OLYMPUS

i-SPEED


# INSTRUCTIONS

## High Speed Video Camera System

# Contents

# *Important Information — Please Read Before Use*

## *Instruction manual*

This instruction manual contains information for both the standard *i-SPEED* and the G-rated *i-SPEED HG*. For clarity, the term *i-SPEED* refers to both *i-SPEED* and *i-SPEED HG.* The term *i-SPEED HG* will be used only when describing functionality relating to the G-rated variant.

This instruction manual contains essential information on using this equipment safely and effectively. Before use, thoroughly review this manual and the manuals of all equipment which will be used during the procedure and use the equipment as instructed.
Keep this and all related instruction manuals in a safe, accessible location.

If you have any questions or comments about any information in this manual, please contact Olympus.

## *Repair and modification*

The camera has a replaceable fuse on the rear panel and does not contain any other user-serviceable parts. Do not disassemble, modify or attempt to repair, user injury and/or equipment damage can result. Please contact Olympus for service/repair.

## *Signal words*

The following signal words are used throughout this manual:

**CAUTION**
Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices or potential equipment damage.

NOTE
Indicates additional helpful information.

## *Operating precautions*

Olympus will only be considered responsible for the safety, reliability and performance of the system if the following precautions are strictly adhered to:

1. Do not operate the equipment in the presence of combustible gases or vapours.
2. If in any doubt about the operating environment, contact Olympus.
3. The standard *i-SPEED* must not be used for high-g applications as detachment of the camera, camera parts, accessories or connectors may result.
4. The CDU and RCP are not G-rated but can be detached and reattached without affecting the *i-SPEED HG* camera.
5. The equipment has no resistance to fluid ingress - do not use the equipment where ingress of fluid is likely, or already suspected.
6. Do not operate the equipment in live electrical or moving machinery as electric shock or physical injury to the user may result.
7. Do not operate the equipment when connected to a borescope/fiberscope which is in contact with live electrical or moving machinery as electric shock or physical injury to the user may result.
8. When a recorded image is frozen on the display, take care not to touch subject equipment which may still be moving.
9. Do not connect the equipment to a vehicle battery while the vehicle is running as the power supply may rise to 15V and cause damage to equipment.
10. Ensure all equipment is earthed (grounded) to the same potential as the camera prior to operation. Failure to earth equipment may result in electric shock.

11. The measurement suite is intended to give a good indication of relative object distance, speed and angle. However, due to the number of variable factors involved, no guarantee of measurement accuracy can be given.
12. The power supply provided must be connected to a suitably grounded AC outlet.
13. Avoid subjecting the unit to heavy knocks or shock loadings, as these will reduce the effective life and reliability of the components within the unit.
14. Before operating the unit, check that cooling vents are not blocked or obstructed.

## *General notes*

- The *i-SPEED* software runs on Microsoft Windows 2000 or Windows XP. For the basic operating procedures of these operating systems, refer to the operating system manual.
- Microsoft, Windows, Windows NT and MS-DOS are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.
- Acrobat Reader is either registered trademark or trademark of Adobe Corporation in the United States and/or other countries.
- Quick Time is either registered trademark or trademark of Apple Computer Inc in the United States and/or other countries.

# *End-user license agreement*

NOTE

This license agreement applies to the software supplied on disk with the *i-SPEED* system and not the *i-SPEED* camera itself.

READ THE FOLLOWING TERMS AND CONDITIONS OF THIS AGREEMENT CAREFULLY BEFORE OPENING PACKAGE CONTAINING THE PROGRAM DISKETTES (THE SOFTWARE). BY OPENING THIS PACKAGE CONTAINING THE SOFTWARE YOU ACCEPT AND AGREE TO THE TERMS AND CONDITIONS HEREOF. IF YOU DO NOT AGREE TO BE BOUND BY THE TERMS AND CONDITION OF THIS AGREEMENT, PROMPTLY RETURN THIS PRODUCT UNOPENED AND YOUR MONEY WILL BE REFUNDED. THIS LICENSE AGREEMENT REPRESENTS THE ENTIRE AGREEMENT CONCERNING THE SOFTWARE BETWEEN YOU AND OLYMPUS CORPORATION. ("OLYMPUS").

1. **LICENSE**. In consideration of payment of the Licensee fee, Olympus grants to you, as the End User, and you accept, a nonexclusive, nontransferable sublicense to use the Software for internal use, and not as a service bureau or for the benefit of a third party, in accordance with the terms hereof on one hardware system at a time. If you want to use the Software on more than one hardware system at a time you must obtain separate licenses for each system.

2. **OWNERSHIP OF THE SOFTWARE**. Olympus or its suppliers own and will retain all title, copyright, trademark and other proprietary rights in and to the Software. This sublicense is NOT a sale of the Software or a sale of any copy of the Software. This Agreement does not convey to you an interest in or to the Software but only a limited right of use the Software, as is provided herein, revocable in accordance with the terms of the Agreement. You agree as follows:

a. You may NOT make any copies of all or any part of the Software except for archival copies and reasonable backups of the Software as may be permitted by the United States Copyright Act.

b. You may NOT reverse compile, reverse assemble, reverse engineer, modify, incorporate in whole or in part in any other product or create derivative work based on all or any part of the Software

c. You may NOT remove any copyright, trademark, proprietary rights, disclaimer or warning notice included on or embedded in any part of the Software

d. You may NOT sell, license, sublicense or otherwise transfer the Software without the prior written consent of the Olympus to function as an Appointed Distributor with respect to the Software. Any Appointed Distributor shall ensure that the End User is not located in a state or territory for which export restrictions exist under US, UK or other applicable laws and shall assist Olympus as requested in documenting compliance.

3. **COPYRIGHT; RESTRICTED USE**. This Software is the property of Olympus or its suppliers and protected by United States copyright laws and international treaty provisions. Therefore, you must treat the Software like any other copyrighted material.

This product and documentation are provided on a RESTRICTED basis. Use, duplication, or disclosure by the US Government is subject to restrictions set forth in Subparagraphs (c) (1) and (2) of the Commercial Computer Software Restricted Rights at 48 CFR 52.227-19, as applicable.

4. **LIMITED WARRANTY**. Olympus warrants, for your benefit alone, for a period of sixty (60) days after receipt by you, that the Software will conform in all material respects to the user documentation furnished to you by Olympus. The sole responsibility of Olympus under this warranty will be, at its option, (1) to use reasonable efforts to correct documented errors in the Software that are reported to it within the forgoing warranty period or (2) to refund the License fee paid. Olympus and its suppliers do not warrant that the Software will be error free, nor that all program errors will be corrected. This limited warranty does not apply insofar as: (a) the Software is subjected to misuse, neglect, accident or exposure to environmental conditions beyond those specified by Olympus and its suppliers; (b) claims resulting from acts or omissions caused by persons other than Olympus or its suppliers or from products, material or software not provided by Olympus or its suppliers; or (c) you use Software that does not include all updates available from Olympus or its suppliers.

THIS IS THE ONLY WARRANTY GIVEN WITH THE SOFTWARE; OLYMPUS AND ITS SUPPLIERS MAKE NO OTHER WARRANTIES, EXPRESS, IMPLIED, OR ARISING BY CUSTOM OR TRADE USAGE, AND SPECIFICALLY DISCLAIM THE IMPLIED WARRANTIES OR NON-INFRINGEMENT, MERCHANTABILITY OR OF FITNESS FOR ANY PARTICULAR PURPOSE. THIS EXPRESS WARRANTY SHALL NOT BE ENLARGED OR OTHERWISE AFFECTED BY OLYMPUS'S RENDERING OF TECHNICAL OR OTHER ADVICE OF SERVICE IN CONNECTION WITH THE SOFTWARE. KEYMED AND ITS SUPPLIERS SHALL NOT BE HELD RESPONSIBLE FOR THE PERFORMANCE OF OR OUTPUT OBTAINED FROM THE SOFTWARE NOR ANY LIABILITY TO ANY PARTY ARISING OUT OF USE OF THE SOFTWARE OR USE OF ITEMS DESIGNED WITH THE SOFTWARE

5. **HIGH RISK USE UNAUTHORIZED**. The Software are not designed, manufactured, or intended for use in hazardous, medical, or other environments requiring fail-safe performance where the failure of the Software could lead directly to death, personal injury, or significant physical or environmental damage. Use of the Software in such a manner is not authorized.

**6.LIMITATION OF LIABILITY**. The cumulative liability of Olympus and its suppliers to you or any other party for an loss of damages resulting from any claims, demands, or actions arising out or in connection with the Software, or arising out of in connection with or relating to this License Agreement shall not exceed the License fee paid to Olympus by you for the Software. In no event shall Olympus or its suppliers be liable for any indirect, incidental, special, exemplary, or consequential damages (including any damages resulting from loss of use, loss of data, loss of profits or loss of business), or lost profits, even if Olympus has been advised of the possibility of such damages.

7. **MISCELLANEOUS**. This Agreement shall be construed and governed in accordance with the laws of England, and shall be construed as an instrument under seal. Should any term of this Agreement be declared void or unenforceable by any court or competent jurisdiction, such declaration shall have no effect on the remaining terms hereof. The failure of either party to enforce any rights granted hereunder or take action against the other party in the event of any breach hereunder shall not be deemed a waiver by that party as to subsequent enforcement of rights or subsequent actions in the event of future breaches. The provisions of this Agreement may be enforced not only by Olympus, but by its suppliers, each of which is an intended third party beneficiary of this Agreement.

# Chapter 1 Introduction

The Olympus *i-SPEED* is a self-contained high speed video camera. This means that it contains all the functionality required to obtain high speed video and does not require the presence of a PC, although PC connection is possible if required. The camera has been designed to be used in three ways as follows:

## Remote Control Pad

The Remote Control Pad (RCP) is supplied with the camera as part of the standard set. It is left to the user to provide a display device, and this may be a PC monitor or a TV monitor (NTSC or PAL). A menu system is provided specifically for the RCP, making use of the ▲ ▼ ◀ ▶ nature of the RCP buttons. The RCP menu operates in a lower resolution suitable for TV monitor display, although the SVGA output still contains full resolution video. RCP operation of the camera is described in Chapter 7 of this manual.

## Controller Display Unit

The Controller Display Unit (CDU) is available as an optional accessory for the Olympus *i-SPEED* . This product displays the image from the camera in real-time and permits the most flexible use of the camera, by using a series of buttons around the outside of the screen. The bottom seven buttons are used as “soft keys”, that is the function of each button is dependant on the text written above to it on the screen. The four buttons on the right hand side have dedicated functions and these are Text, Back, Up and Down. The menu system has been specially constructed to take maximum advantage of this layout. CDU operation of the camera is described in detail in Chapter 6 of this manual.

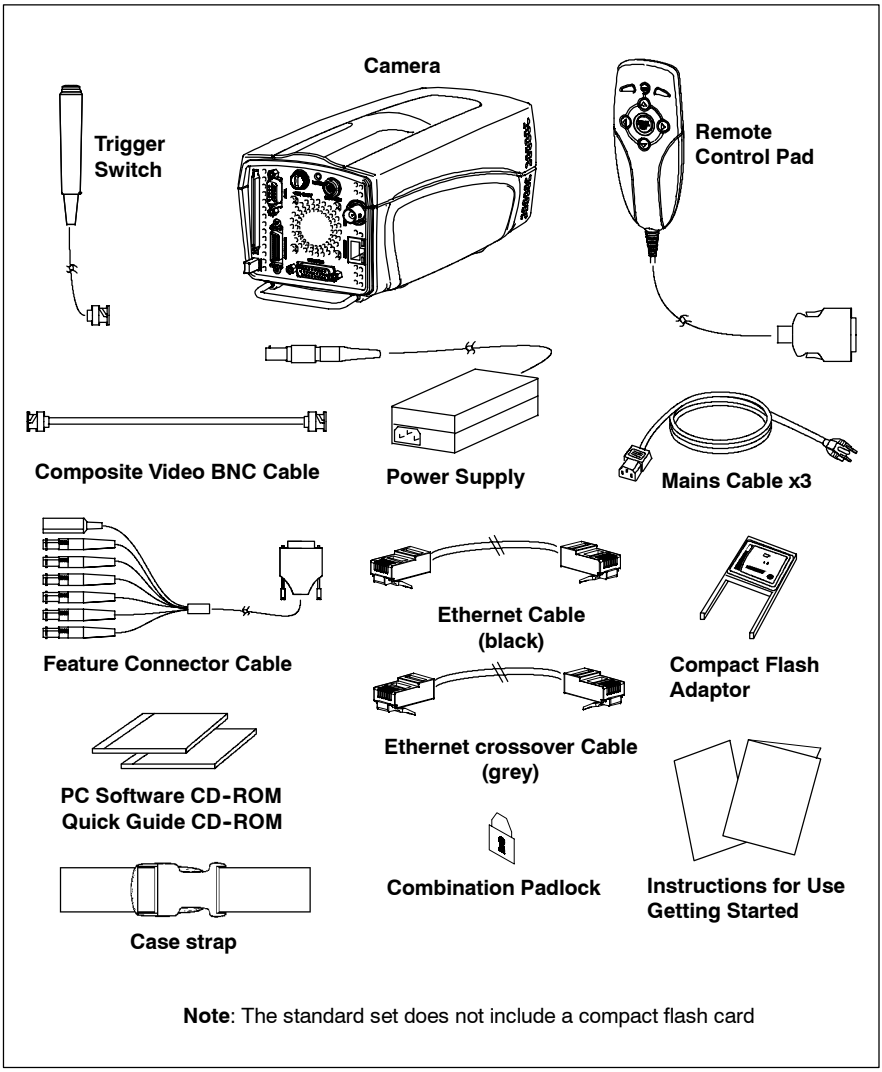
## PC/Laptop Connection

The Olympus *i-SPEED* may be connected to a PC or laptop via the Ethernet connector and an appropriate Ethernet network. In this case, the unit is controlled from the PC / laptop and the image is visible on the PC screen. This requires the PC to be running the basic control program which is supplied on a CD ROM with the camera. Upgrade options are available for the supplied software and these provide additional functionality. Details of the upgrades are available from Olympus representatives. In Ethernet mode, all the functions of the camera are available, but they are presented and controlled by the PC software.

For details of the operation of this software, reference should be made to the documentation supplied with the software. Information regarding the camera, however, is contained in the Reference sections of this manual.

# Chapter 2 Checking the Package Contents

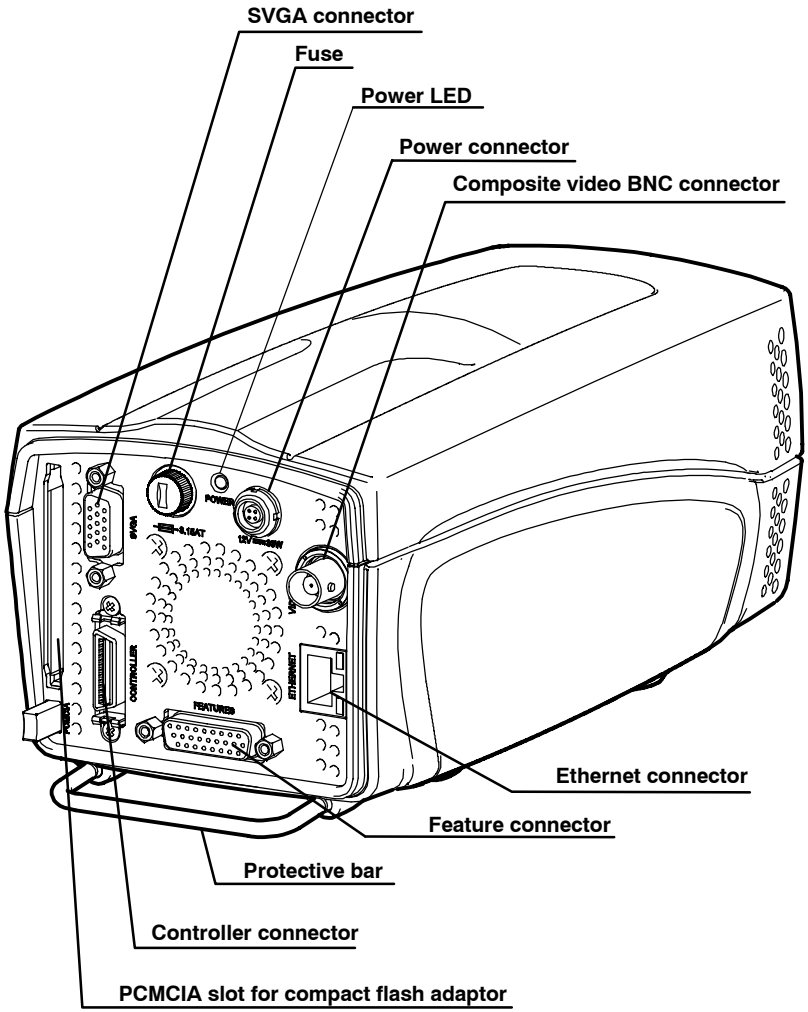
Remove the transit sleeve and open the *i-SPEED* system case. Match all items in the case with the items shown below. If any item is missing or damaged contact Olympus.




**Note**: The standard set does not include a compact flash card

# Chapter 3 Nomenclature and Functions

## 3.1 Camera



1. **Power Connector**
   The rear panel Power connector is used to take power into the camera, nominally 12V DC. This power is used to operate the camera, but is also used to operate the CDU or RCP. The power input is protected against reverse polarity connection and this will normally result in a blown fuse.

2. **Power LED**
   The power LED will illuminate when 12V is applied and the fuse is operating correctly.

3. **Fuse**
   The fuse is replaceable by the user and is accessed by unscrewing the fuse holder. Care must be taken to replace the fuse with one of the correct size, type and rating.

4. **Composite Video BNC Connector**
   This connector provides an industry standard PAL or NTSC composite colour video to a video monitor unit. BNC is an industry standard connection for this type of signal, and a BNC composite video cable is provided. The video available from the connector may be switched between NTSC and PAL via the menu system in the CDU.

   Composite video signals are designed to be driven into a terminated connector, so care must be taken to ensure that the last piece of equipment in the BNC cable chain is set to terminate with 75 Ohms.

5. **Controller Connector**
   This connector is used to connect either the CDU or the RCP to the camera. It carries power from the camera to the RCP or CDU, video from the camera to the CDU and receives button press information from the RCP or CDU.

   Although this connector conforms to the LVDS industry standard, it is recommended that only cables supplied by Olympus are used and it is imperative that no equipment other than the CDU or RCP is attached to this connector.

**6. Ethernet Connector**

This connector is a standard RJ45 connector with two integral LEDs. The signal standard is the Ethernet 10-T or Ethernet 100-T and the Olympus *i-SPEED* will automatically switch as appropriate. The Ethernet cable must be connected to an Ethernet switch, although direct connection to a PC / laptop is possible if the crossover cable is used. It is strongly recommended that all the components in the Ethernet network are compatible with 100-T as this will enable the camera's network controller to operate at this higher speed. The LEDs are included in the ethernet connector for diagnostic purposes and they illuminate as follows:

| | |
|---|---|
| LED nearest top of camera . . . . . | 100Mbps connection |
| LED nearest bottom of camera | 10Mbps connection |
| Red colour . . . . . | Half duplex communication |
| Green colour . . . . . | Full duplex communication |
| Steady . . . . . | Electrical connection made |
| Flashing . . . . . | Data transfer in progress |

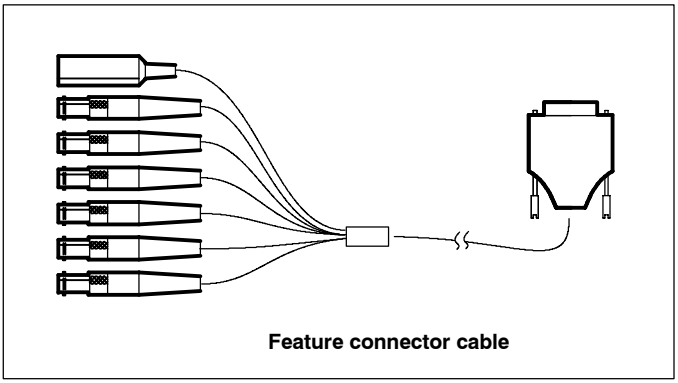
**7. SVGA Connector**

This connector provides a SVGA signal which contains the video image and overlay graphics. When the CDU is being used, this signal is a copy of the CDU image. The output standard is the 60Hz SVGA PC video signal and the connector conforms to the PC video 15 pin D-sub standard. As a result, this signal may be fed directly to a PC monitor, (CRT or LCD) and provides the best quality live analogue video signal available from the camera.

**8. PCMCIA Slot**

The camera is able to operate a PCMCIA flash memory. The standard used is the ATA FLASH standard and the card may be either 3V3 or 5V. It is also possible to use a Compact Flash card with the supplied PCMCIA adapter and this is recommended if larger memory sizes are required. Once the card is inserted it must be pressed firmly in place and may be ejected by pressing the button at the bottom of the slot. It is not necessary to switch power on and off as the card is inserted and removed, but care must be taken not to remove the card while writing, deleting or formatting is in progress.

***9.*** **Feature Connector** / **Feature Connector Cable**
This connector contains a number of signals. They are gathered together in one connector to reduce the size of the camera's back panel and thereby permit the manufacture of the smallest possible unit. In order to gain access to the signals in this connector, a feature connector cable is supplied and this terminates in a series of connectors, labelled as follows:



**Feature connector cable**

**Trigger Input** / **Trigger Switch**: This connector (and the supplied trigger switch if required) are used to trigger the camera while recording is in progress. Further details are provided in Chapter 8 "Understanding the Olympus *i-SPEED*".

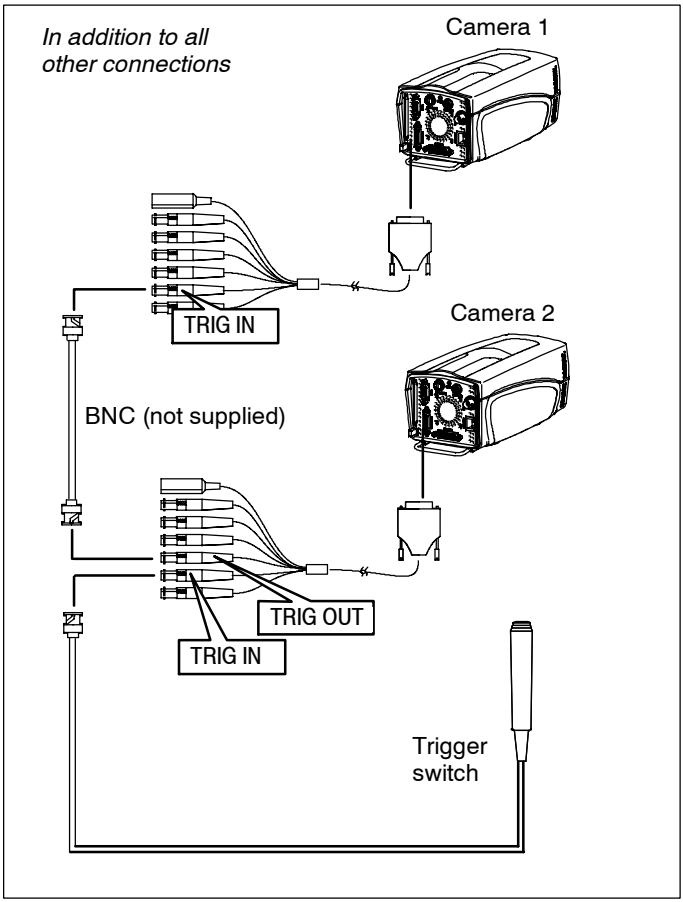
When the trigger is set to 0%, the trigger counter is set to the length of the memory, so that the trigger point appears at the beginning (0%) of the final video clip. A setting of 100% will cause the recording to stop immediately, placing the trigger event at the end of the video clip.

The signal is TTL level and the user may select rising edge or falling edge trigger options.

The trigger input contains a "pull-up" resistor to enable the supplied trigger switch to be used without further electronics. It should be noted that the trigger switch provides a falling edge. In practice, the trigger switch also produces a rising edge because of switch bounce, but this cannot be guaranteed.

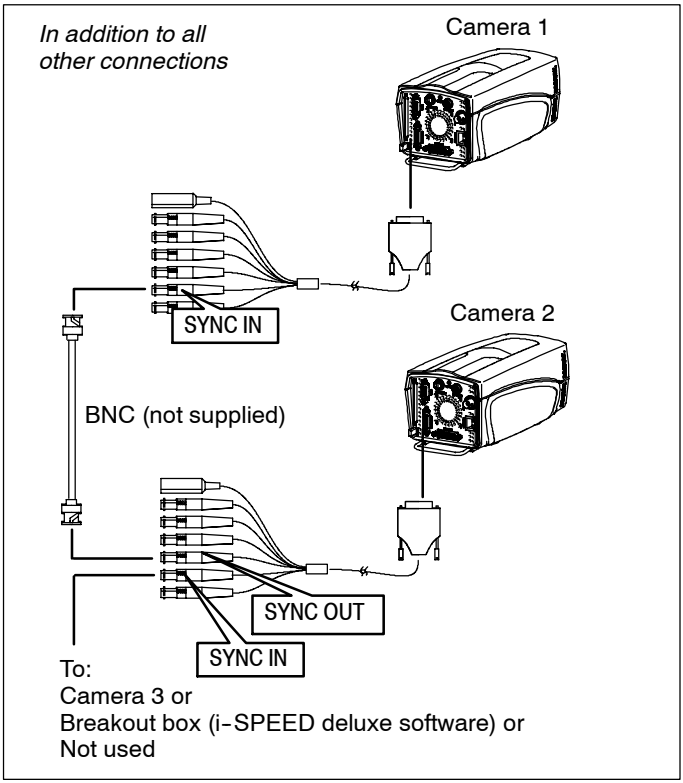
**Trigger Output**: This output is TTL compatible and gives a 1 microsecond wide active high pulse. The rising edge signifies the start of the first integration period of the sensor to occur after recording has stopped. This connector may be used to cause another camera to trigger after the end of this camera's recording. In this way a series of cameras may work in a daisy-chain.

When daisy chain operation is used, the first camera's trigger point may be selected by the user, but it is recommended that the second camera's trigger position is set to 0%.



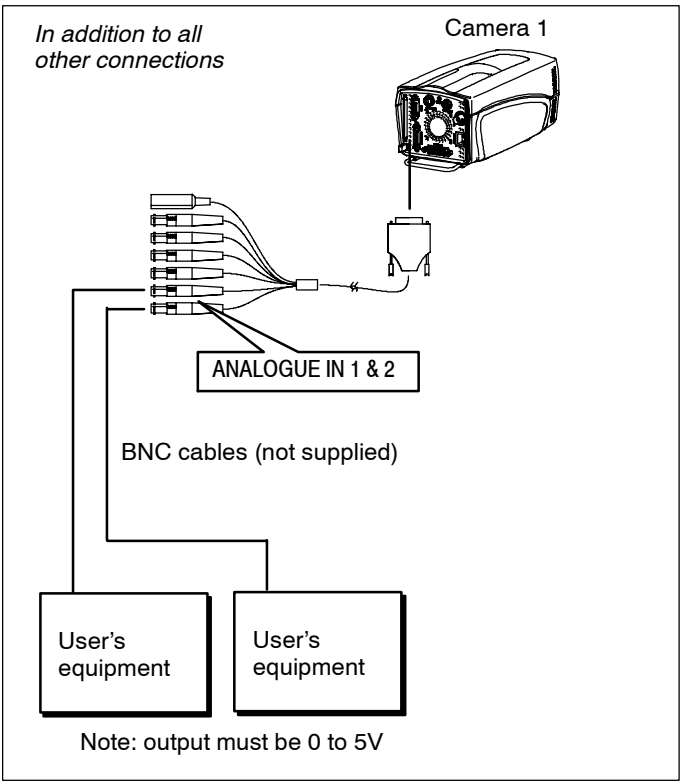
**Sync Input**: The camera's frame rate may be determined by an external signal source, typically another camera. In this case, the camera would not only lock its frame rate to that of the other camera, but the exact moment at which each frame is captured would also be locked to the other camera (+/– 25ns). In this way, it is possible to have multiple cameras viewing one event and taking images simultaneously. The input is TTL compatible and requires an active high pulse, in which the rising edge signifies the start of the integration period.

The camera constantly monitors this input and will notify the user when an incoming sync is detected. When this occurs, the camera will measure the speed of the incoming signal and offer the user the opportunity of automatically configuring for synchronised operation.

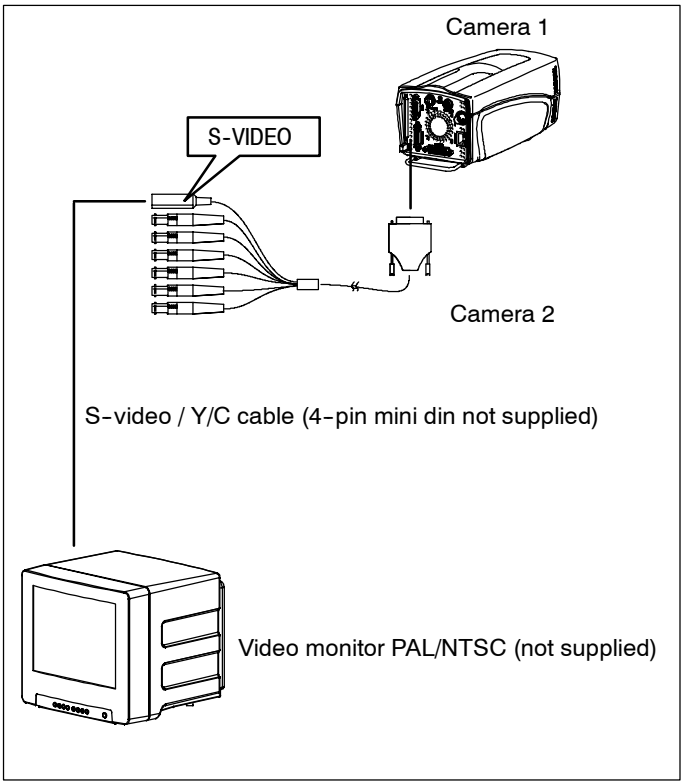


**Sync Output**: This TTL signal is a 1 microsecond wide active high pulse in which the rising edge signifies the start of the integration period. It is used to synchronise other *i-SPEED* cameras as mentioned above.

**Analogue Input 1 and 2**: As well as recording video, the Olympus *i-SPEED* is able to record two analogue signals. These are digitised to 8 bits and saved in the internal memory buffer along with the video. The signals may be displayed on the CDU or PC screen as required. The signals are sampled at a speed related to the frame rate and this may be set from a menu. The sample rate is variable from 1 sample per frame to 100 per frame, subject to a maximum of 100,000 samples per second.



**S-Video Output**: This output is a copy of the composite video (BNC) output, but in the S-Video (sometimes called Y/C) format. Due to the nature of the S-Video standard, this signal is slightly higher quality than the more popular composite video signal.



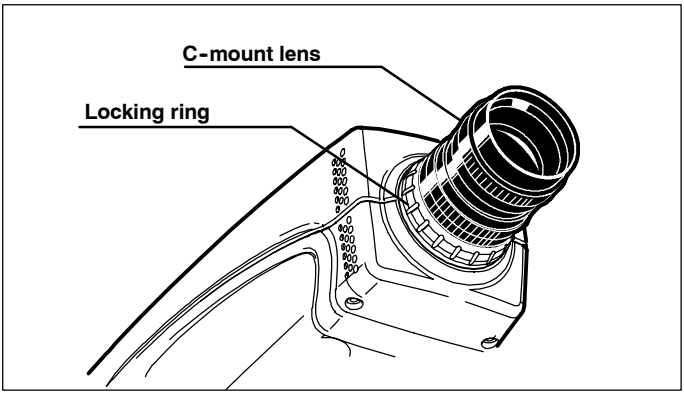

***10.*** **Cooling Holes**

The rear panel has a number of cooling holes, and more are located on the sides of the casework at the front of the unit. The outer holes on the rear panel and the holes at the front of the unit are air inlets and the holes in a circular pattern on the rear are air outlets. The primary reason for including forced air cooling has been to eliminate localised hot spots within the electronics and care should be taken to ensure that the cooling holes are kept clear at all times as described in Chapter 9 "Maintenance".

***11.*** **Back Focus Control**

It is sometimes necessary to adjust the distance between the C-mount face and the image sensor to accommodate lenses from different manufacturers and lenses with different optical tolerances. The Olympus *i-SPEED* has a back focus assembly located in the front of the unit to permit this adjustment.

To adjust the back focus, screw a C-mount lens into the C-mount in the normal way. Turn the locking ring anticlockwise (when viewed from the front) to unlock the C-mount thread ring then rotate the lens to adjust the back focus as required - a series of 'click' positions will be felt. When complete, the adjustment should be left in one of these 'click' positions and the locking ring rotated clockwise to lock the C-mount thread ring in position.

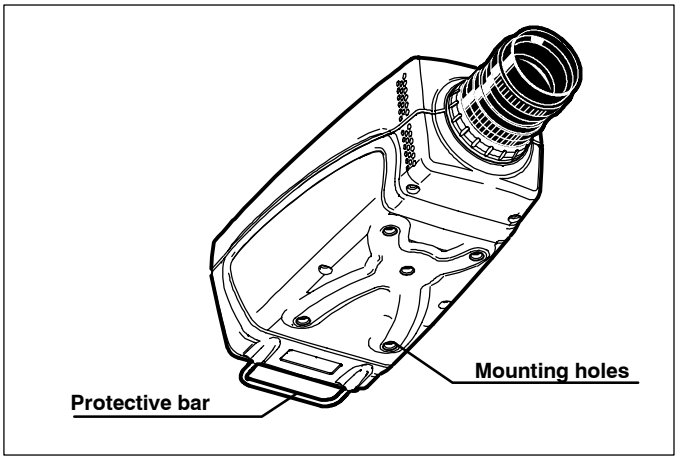



As a guide, the correct setting of back focus is obtained by pointing the camera at an object at a known distance from the lens, preferably an "infinite" distance. The scale on the lens is then used to set the focus ring to this distance. The back focus is then adjusted to obtain the best image.

***12.*** **Mounting Holes**

The base of the unit is fitted with 5 standard mounting holes. It is recommended that the central hole is used for mounting the camera (e.g. to a tripod) and the other holes may then be used to mount light-weight accessories to the camera.

It is important that the *i-SPEED HG* camera is mounted using the four outer mounting holes when used in high-G applications.




***13.*** **Protective Bar**

The back of the unit is fitted with a protective bar. The purpose of this is to protect the connectors from damage if the unit is placed on a shelf and pushed back against a wall. In spite of this, the bar may also be used as a handle to carry the camera or to support light-weight items when the camera is mounted on a tripod.

***14.*** **Protective Glass**

The image sensor is located at the front of the camera inside the C-mount aperture. A protective glass is fitted to this aperture to shield the sensor from dust and damage. It is recommended that the glass is kept clean as detailed in Chapter 9 "Maintenance".

***15.*** **Battery Memory**

The Olympus *i-SPEED* contains a battery powered clock and memory. This is used to keep track of the time and date while the camera is switched off. The memory is also used to store some of the user controls, such as the TCP/IP address, the camera's ID, the TV monitor standard and the language setting. The battery is a non-replaceable lithium cell which should last for approximately 10 years. In the event of battery failure, default values will be used at each switch-on.

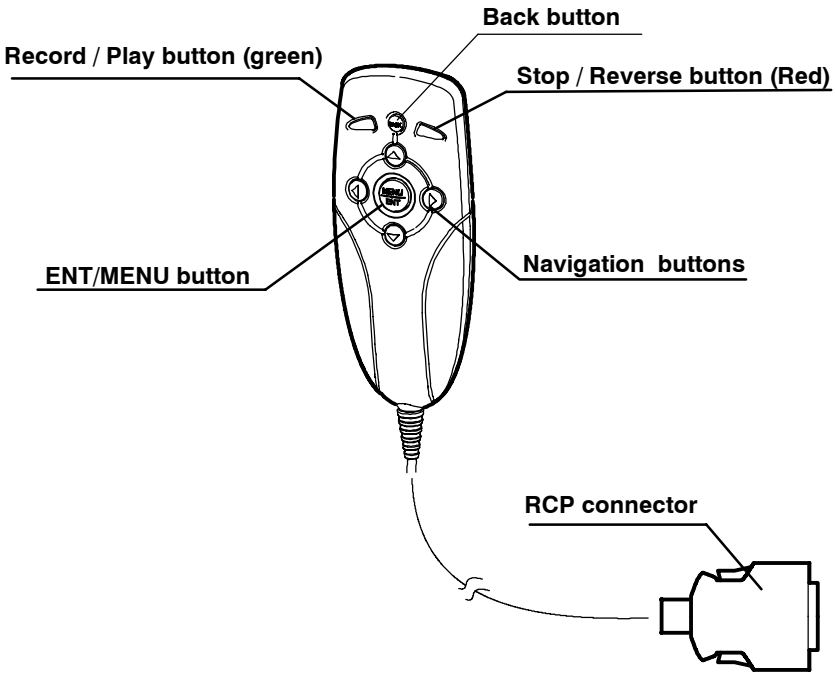
## 3.2 Remote Control Pad (RCP)

This hand held unit is connected to the camera's Controller connector and is powered by the camera. The camera is able to recognise the presence of the RCP and operates a specialised menu system which is displayed on the PC monitor or TV monitor. The RCP is used to navigate the menu system.

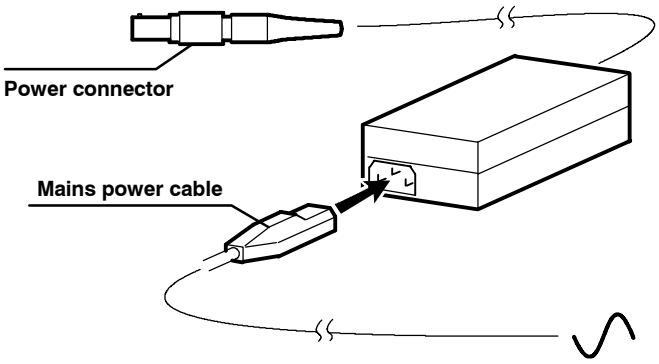
When changing from RCP to CDU and vice-versa, the power should be switched OFF and ON again.

**CAUTION** The RCP must not be connected to any equipment other than the Olympus *i-SPEED* camera, otherwise equipment damage will result.

The RCP is not high-G rated. The RCP can be detached and reattached without switching the camera off.



## 3.3 Power Supply/Mains cable



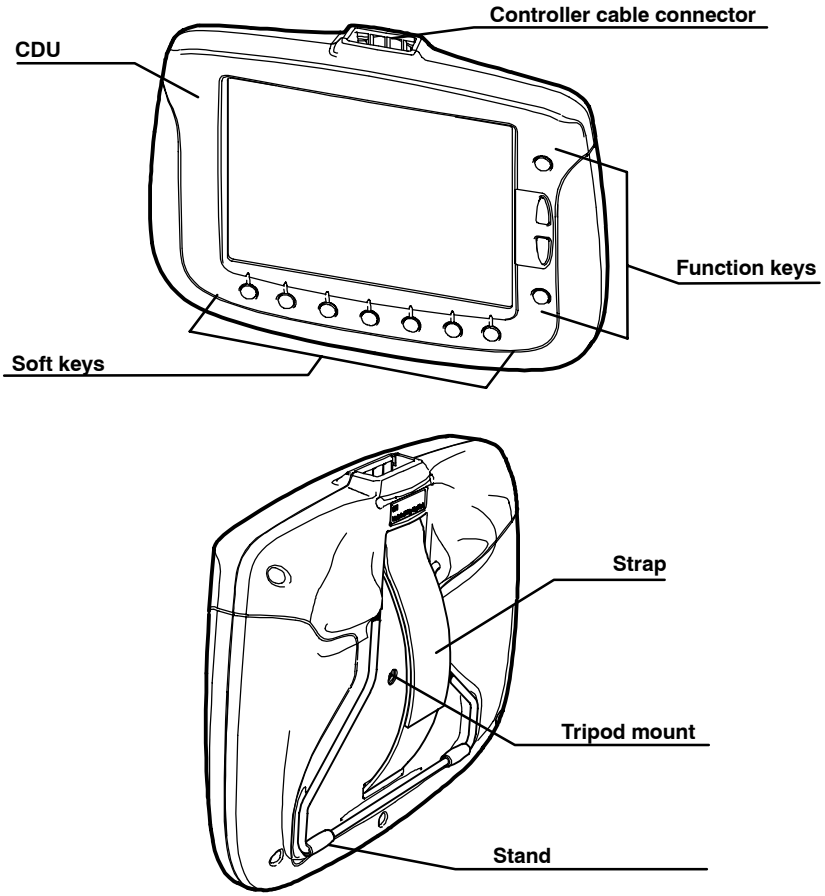

*1.* **ON-OFF switch**
The 12VDC Power supply is supplied with the appropriate AC mains power cable. The power supply unit MUST be earthed and it is recommended that the mains power cable supplied is used to maintain standards compliance.

*2.* **Power connector**
Connects to the 'power' socket of the camera and provides power to the camera and its controller units

**CAUTION** The user must ensure that only the power supply unit supplied with the Olympus *i-SPEED* is used and that this unit is only used to power the camera.

The memory in the camera will be erased if power is lost.

## 3.4 Controller Display Unit (CDU)




**CAUTION** The CDU is not high-G rated. The CDU can be detached and reattached without switching the camera off.

1. **CDU**

   The CDU displays the image from the camera in real-time and permits the most flexible use of the camera, by using a series of buttons around the outside of the screen. The CDU is connected to the camera's Controller connector via a 3m controller cable (a 10m cable is available as an optional accessory). The CDU takes power and video from the camera and requires no batteries or further connections.

   The camera is able to recognise the presence of the CDU and operates a specialised menu system. When changing from RCP to CDU and vice-versa, the power should switched OFF and ON again.

   **LCD Panel, Viewing Angle**: At the time of design and writing this manual, the LCD panel used in the CDU is the best available LCD panel of this size and resolution. Even this market leading panel, however, has a restricted viewing angle in the vertical direction and the user is advised to experiment with the CDU to find the optimum angle at which to view the image.

   **Protective Screen**: Although the CDU LCD screen is protected by a tough plastic sheet, it is still recommended that care is exercised when handling this unit. It is also important to keep this screen clean to preserve its anti-glare properties and this is detailed in Chapter 9 "Maintenance".

2. **Soft keys**

   The bottom seven buttons on the CDU are used as "soft keys", that is the function of each button is dependant on the text written above to it on the screen.

3. **Function keys**

   The four buttons on the right hand side of the CDU are dedicated function buttons, these are Text, Back, Up and Down. The menu system has been specially constructed to take maximum advantage of this layout.

4. **Stand**

   The CDU is equipped with a stand which may be set to a number of 'click-stop' positions to allow standing on a flat surface at various angles or hanging from a convenient hook. The stand may also be folded flat for storage or when the strap is used.

***5.*** **Strap**

The back of CDU has an adjustable strap which may be used to allow the unit to be conveniently held with a single hand.

***6.*** **Tripod Mount**

The CDU contains a tripod mounting hole with the industry standard thread and is located under the strap.

**CAUTION** The CDU must not be connected to any equipment other than the Olympus *i-SPEED* camera, otherwise equipment damage will occur.

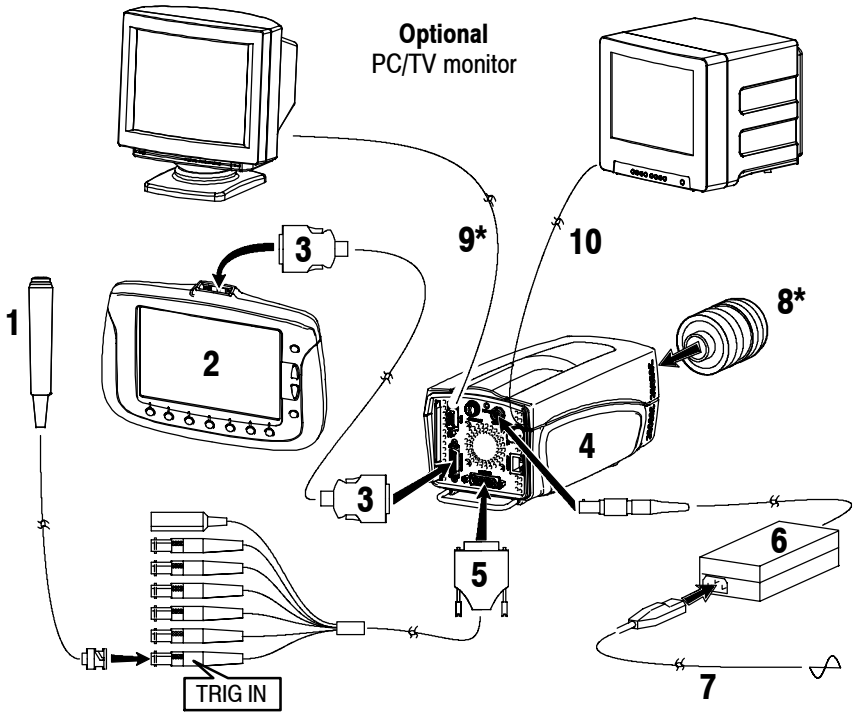
NOTE To maintain standards compliance, it is recommended that only cables supplied by Olympus are used.

# Chapter 4 System Connection

As described in Chapter 1, the *i-SPEED* camera system can be configured in three ways using a Remote Control Pad (RCP), Controller Display Unit (CDU) or Ethernet via connection to a PC or Laptop.

Refer to the connection diagrams shown below and connect the system as appropriate.

## 4.1 Controller Display Unit (CDU)

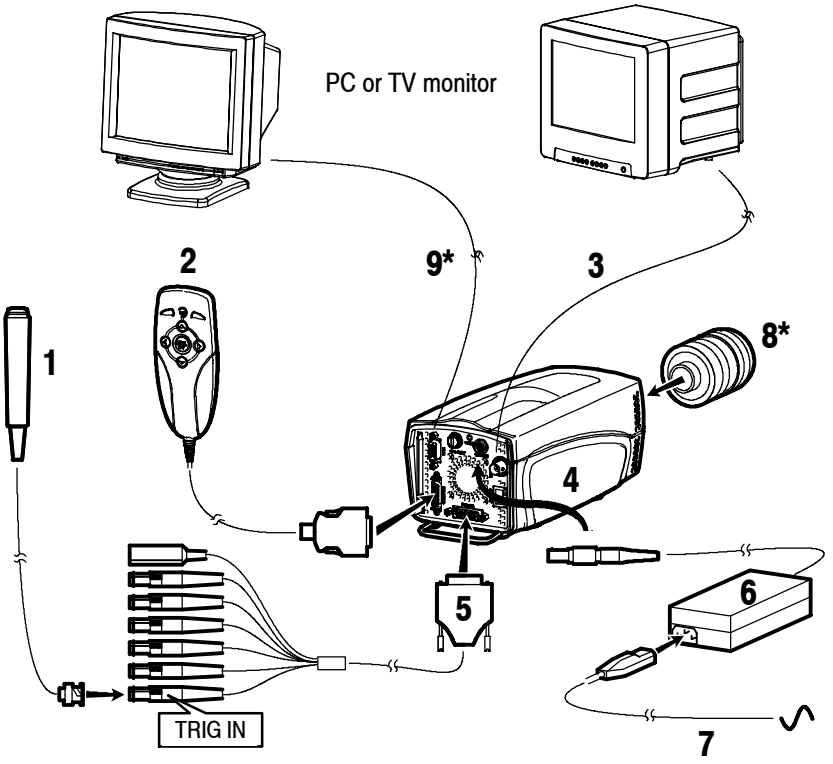



**Key**

| | | | |
|---|---|---|---|
| 1 | Trigger switch | 6 | Power supply unit (PSU) |
| 2 | CDU (Controller Display Unit) | 7 | Mains power cable |
| 3 | Controller cable | 8 | C-Mount lens* |
| 4 | Camera | 9 | VGA cable * |
| 5 | Feature connector cable | 10 | Composite video BNC cable |

*not supplied in the standard set

## 4.2 Remote Contol Pad (RCP)

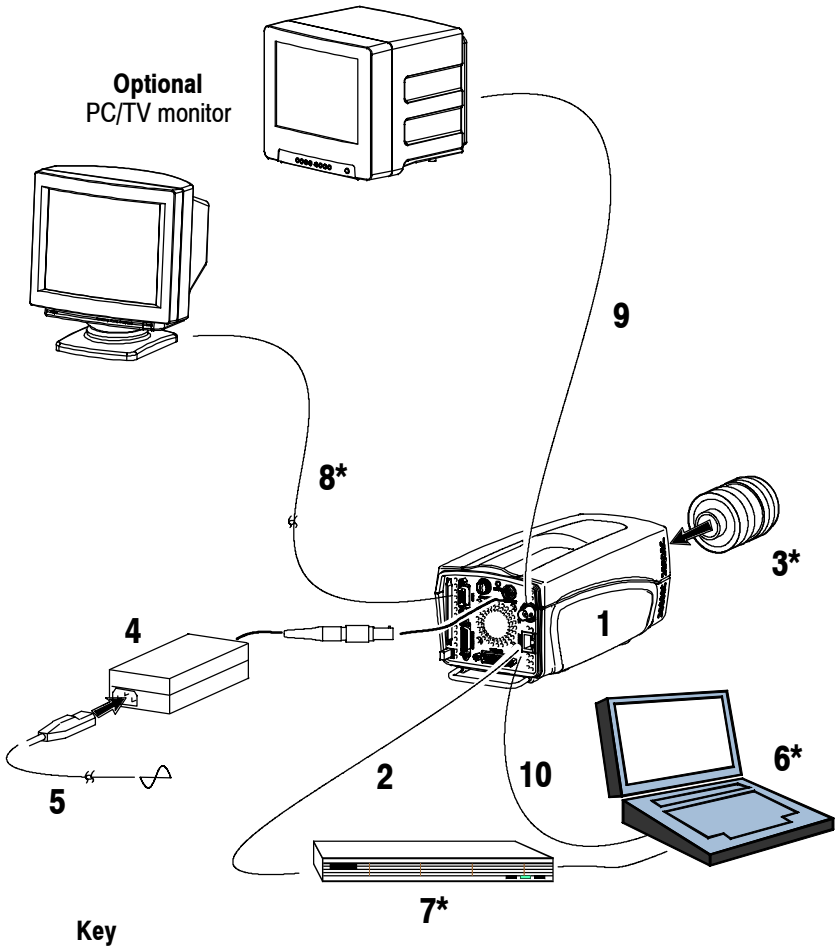



**Key**

| | | | |
|---|---|---|---|
| 1 | Trigger switch | 5 | Feature connector cable |
| 2 | RCP (Remote Control Pad) | 6 | Power supply unit (PSU) |
| 3 | Composite video BNC cable | 7 | Mains power cable |
| 4 | Camera | 8 | C-Mount lens * |
| | | 9 | VGA cable * |

*Items not supplied in standard set

## 4.3 PC/Laptop connection




**Key**

| | | | |
|---|---|---|---|
| 1 | Camera | 6 | Laptop (or PC)* |
| 2 | Ethernet cable (black) | 7 | Network switch * |
| 3 | C-Mount lens * | 8 | VGA cable * |
| 4 | Power supply unit (PSU) | 9 | Composite video BNC cable |
| 5 | Mains power cable | 10 | Ethernet crossover cable (grey) |

* not supplied

# Chapter 5 Getting Started

This section provides a functional description followed by the basic steps required to start using the *i-SPEED* camera system.

## 5.1 Functional Description

Assuming the system has been connected as described in Chapter 4, the typical sequence of events is as follows:

The frame speed and shutter settings are chosen, the lighting and lens are adjusted appropriately and the camera is placed in record mode.

The camera then takes video at high frame rates and stores it in the built-in memory. This memory is configured in a circle so that, once the memory is full, each new frame replaces the oldest stored frame. In this way, the camera keeps a rolling history of the scene it views and this process can continue indefinitely. Once the desired event has occurred, the camera is stopped or triggered.
During the entire set-up and record process, the CDU and any monitor attached will display the live image in full colour and in real time.

Once the required video clip is stored in memory, it may be viewed by using the player function. In this mode, video may be played forwards or backwards at a range of speeds. A convenient bookmark system is provided (CDU only) for easy navigation between sections of interest.

The memory in the camera will be erased without power, so if it is necessary to preserve the captured video after power off, it may recorded onto a PCMCIA memory card, which is inserted into the card slot provided. The internal memory is much bigger than any card currently available, so only a subsection of video may be stored. High speed video clips generally contain a large amount of “dead time” and a relatively small amount of useful motion, in recognition of this, the Olympus *i-SPEED* has a clip select function which allows a precise choice of the video to be saved.

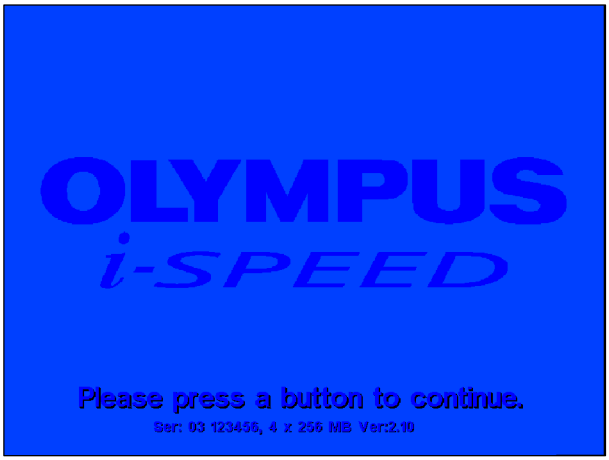
Further to these functions, it is sometimes necessary to measure a feature of the recorded motion and the Olympus *i-SPEED* contains an advanced measurement suite.

## 5.2 Use with the CDU

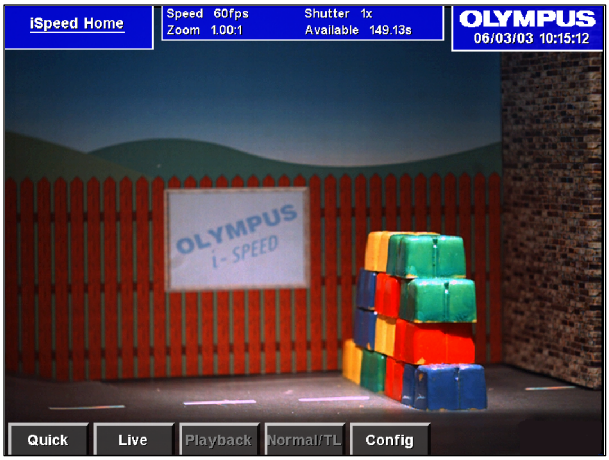
This section describes the basic steps required to start using the *i-SPEED* camera system with the CDU. Additional information regarding functionality of the CDU can be found in Chapter 6.

1. Connect the system as described in Chapter 4, then connect the mains power cable to a suitable AC wall outlet and switch the power ON – the *i-SPEED* splash screen is displayed on the CDU.

   NOTE When using the *i-SPEED HG*, the lens must be completely covered (eg with a lens cap) from power on until the splash screen appears.




2. Press any key, a live video image is displayed on the CDU. Adjust the lens focus and iris as required to achieve a sharp, bright image.



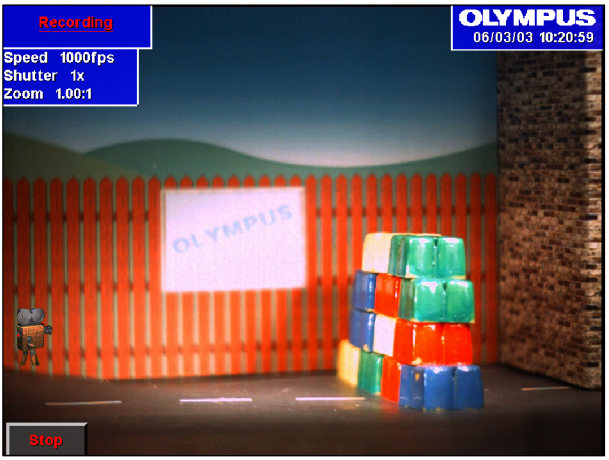

3. Depress the Quick button to enter the Quick menu

4. Depress the Speed and Shutter buttons to select the desired frame speed (def: 60fps) and shutter speed (def: x1). You may need to re-adjust the lens focus and iris to achieve a sharp, bright image.


5. Depress the Record button, a camera icon is displayed and the camera records video into its circular buffer until the Stop button is depressed or the trigger button is pressed.

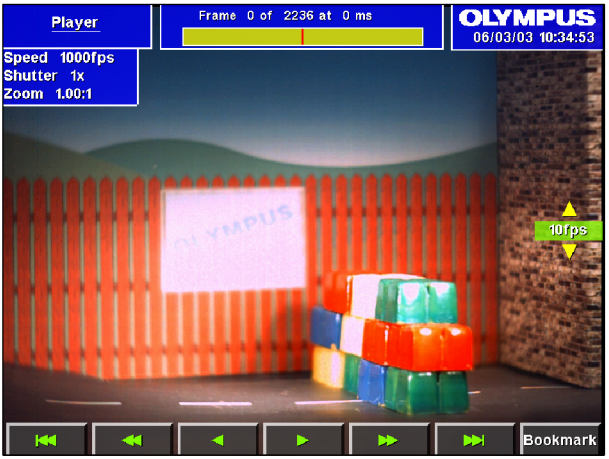
NOTE If the trigger is used, recording will stop after a delay. This delay depends on memory size, the trigger position setting and frame speed.

NOTE When using the *i-SPEED HG* for high-G tests, disconnect the CDU from the camera. When recording has stopped, reconnect the CDU.




When recording has stopped, whether by trigger or STOP button, the camera will present the Playback Menu. Press the Player button to enter Player menu and display the first recorded image in the memory.

6. Player controls are: jump back, rewind, play backwards, play forwards, wind forwards, jump forward (to bookmark). Each button when pressed changes to a Stop button



The Bookmark control is used to set bookmarks at points of interest and are displayed as white vertical lines in the progress bar at the top of the screen. When the Trigger is used, an automatic bookmark is displayed as a Red vertical line.

7. Use the up/down buttons on the right hand side of the CDU to adjust playback speed.

8. If the video clip is to be saved, insert a PCMCIA memory card into PCMCIA slot in the camera.

9. Depress Back to return to Playback menu and press Clip select. Use the control buttons to move to the start frame and press Clip start, move to end frame and press Clip end.

   Frame and memory status is displayed top right.

   NOTE Note that Clip select will not be available until a card is inserted.


10. Depress Save.

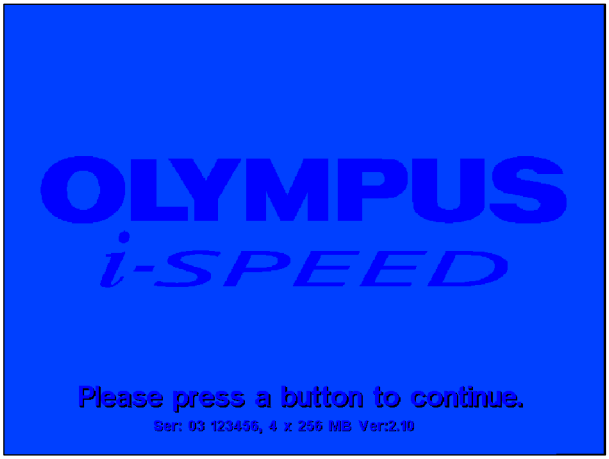
11. Depress BACK as required to return to the Home menu.

## 5.3 Use with the RCP

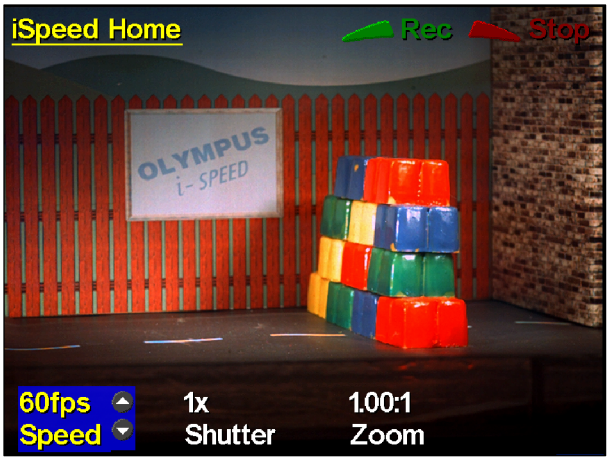
This section describes the basic steps required to start using the *i-SPEED* camera system with the RCP. Additional information regarding functionality of the RCP can be found in Chapter 7.

1. Connect the system as described in Chapter 4, then connect the mains power cable to a suitable AC wall outlet and switch the power ON - the *i-SPEED* splash screen is displayed on the PC/TV monitor.

   NOTE When using the *i-SPEED HG*, the lens must be completely covered (eg with a lens cap) from power on until the splash screen appears.




2. Press any key, a live video image is displayed. Adjust the lens focus and iris as required to achieve a sharp, bright image.




This is the top level or home screen of the RCP menu system which provides rapid access to the most commonly used functions. This screen may be accessed by pressing the Back button repeatedly from any position in the menu system.

3. Use the arrow buttons on the RCP to select the desired frame speed (def: 60fps) shutter speed (def: x1) and zoom (if required). You may need to re-adjust the lens focus and iris to achieve a sharp, bright image.

4. Depress the Green button on the RCP, a camera icon is displayed and the camera records video into its circular buffer until the Red button is depressed or the trigger button is pressed.

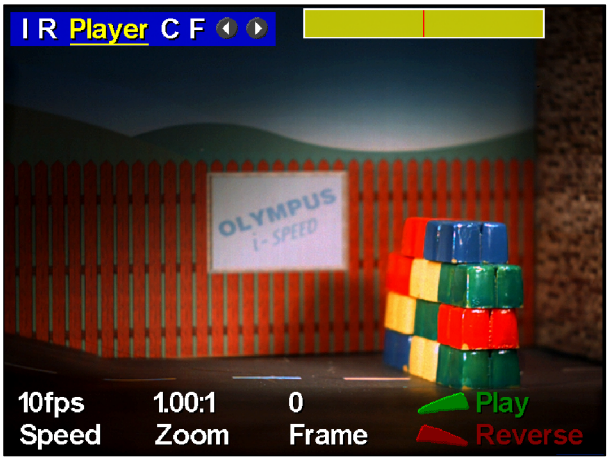
   When recording has stopped, whether by the trigger or the STOP control, the camera will automatically present the Player Menu and thereby display the first recorded image in the memory.

   NOTE

   If the trigger is used, recording will stop after a delay.

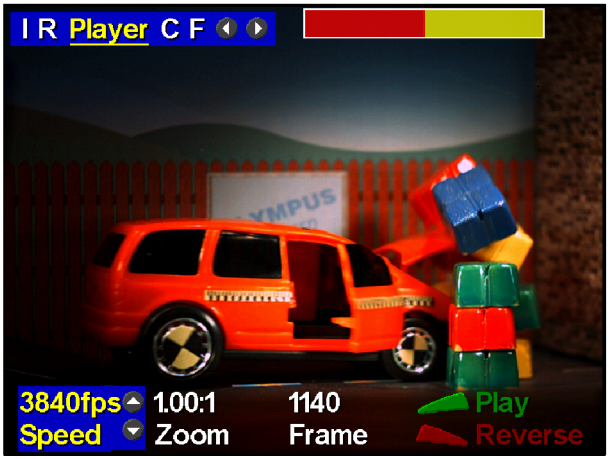
   This delay depends on memory size, the trigger position setting and frame speed.

   When using the *i-SPEED HG* for high-G tests, disconnect the RCP from the camera. When recording has stopped, reconnect the RCP.




5. Use the Green or Red buttons to view the recorded scene (the button pressed changes to Stop), progress is displayed in the bar at the top of the screen to indicate the relative position within the circular buffer of the currently displayed frame. This bar is also used to display a bookmark which is generated when the trigger is used.

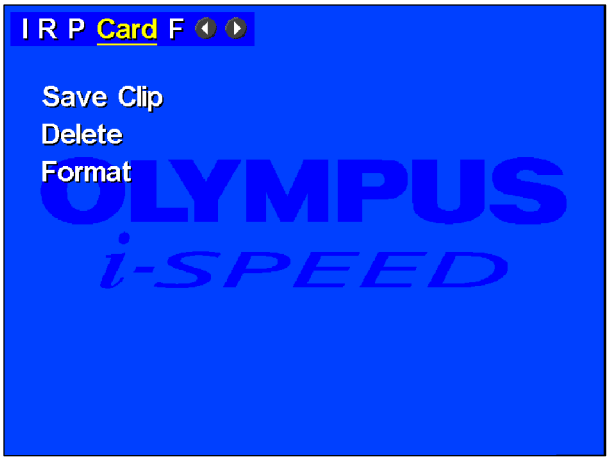
NOTE There is no control to “jump” to the bookmark, therefore the point of interest may take some time to reach. In this case, increase the frame speed and play forwards to the bookmark (see Figure below), then reduce the frame speed.



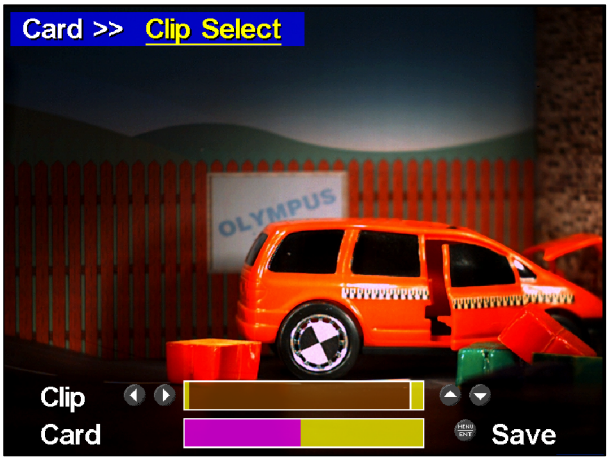
6. If the video clip is to be saved, insert a PCMCIA memory card into PCMCIA slot in the camera.

7. Press ENT/MENU on the RCP and use the right arrow button to display the Card Menu. Use the down button to select Save Clip and press ENT/MENU button, the clip select screen is displayed.

NOTE Note that Clip select will not be available until a card is inserted.




8. Use the left and right arrow buttons to move along the progress bar from the left to the first frame to be saved. Use the up and down buttons to move along the progress bar from the right to the last frame to be saved. The available card memory is displayed on the lower bar. Press MENU/ENT to save the clip or BACK to return to the card menu.




If the start and end frames are selected as the same frame, the save control will cause the camera to save a single bitmap (BMP) image to the card. If more than one frame is chosen, the camera will save a movie (AVI) file to the card.

9. Depress BACK as required to return to the Home menu.

## 5.4 Use with a PC/Laptop

For detailed use with a PC/Laptop, refer to the instruction manual provided with the software.

# Chapter 6 Embedded Software Reference (CDU)

## Introduction

This reference section describes the camera's embedded software and its user interface from the viewpoint of the CDU. In this section, items which are printed *like this* signify the name of a sub menu, controls are described whenever they appear in a menu.

## Operation of the CDU menus

To navigate through the menu system, the button nearest the desired selection is pressed.

When a control is selected, the desired value may be chosen by using the ▲ and ▼ buttons on the right hand side of the screen. Repeatedly pressing or to press and hold the control button will cycle through the available values. The current value is displayed above the control button and also next to the ▲ ▼ buttons.

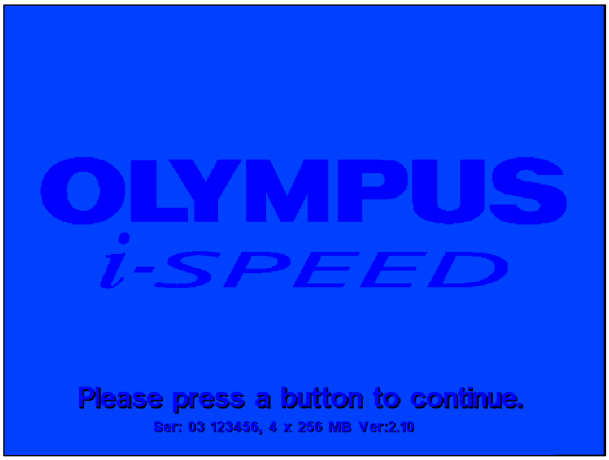
To return to a higher menu, the Back button is pressed. If there is a requirement for a text free screen, the Text button is used to cycle the on-screen text through full, time/date only and off options.

**CAUTION** The CDU is not high-G rated.

# 6.1 Menu Screens

1. OLYMPUS *i-SPEED* Splash Screen

This screen is displayed while the camera starts up and configures the internal software. It contains data on the memory configuration of the camera, the serial number and the software version number. To exit this screen, the user must press a button on the RCP or CDU.



## 2. *i-SPEED* Home Menu

This is the top level or home screen of the menu system. It may be accessed by pressing the Back button repeatedly from any position in the menu system.

**Options**: *Quick* *Live* *Playback* Timelapse *Config*


- The CDU will display a *live* image

### Time Lapse Control

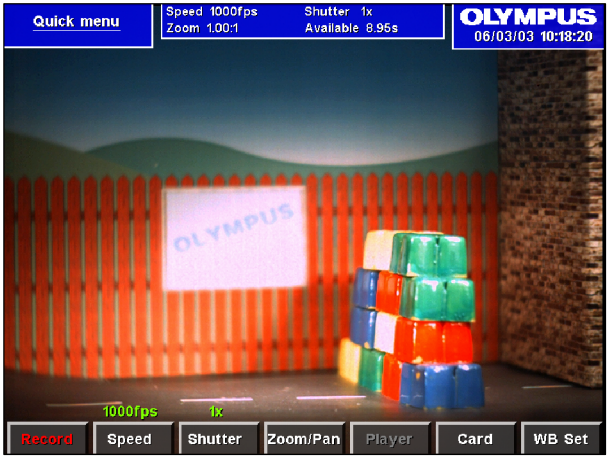
This control allows the user to change the operating mode of the camera into a timelapse camera. This mode is described later in Section 16.

### 3. Quick Menu

This menu provides rapid access to the most commonly used functions. All items available through the Quick menu are accessible elsewhere.

**Access**: *i-SPEED* Home ➧ Quick

**Options**: *Record* Speed Shutter *Zoom/Pan* *Player* *Card* WB Set




- The CDU will display the live image

#### Speed Control

This control allows the user to set the frame speed of the camera. The lowest speed available is 60 frames per second as this is almost equal to the SVGA display specification. The maximum speed is fixed to 33,000fps by the design of the sensor and electronics in the camera.

As described in Chapter 8 “Understanding the Olympus *i-SPEED* ”, the user will normally need to open the iris of the lens and/or add more light as the speed is increased. Further, the image will appear to zoom in as the frame speed is increased above 1,000 frames per second.

### Shutter Control

It is sometimes desirable to reduce the time during which the sensor gathers light (called “exposure time”, “integration time” or “shutter time”) in order to reduce motion blur and “freeze” the motion in each frame. The default shutter time is equal to the frame time, but this may be reduced by this control. The shutter time is measured as the ratio between frame time and shutter time, e.g. x10 means that the shutter is open for 1/10 of the frame period. The shutter period may range from the frame period (x1) to 1/200 of the frame period (x200), but is subject to a 5 microsecond lower limit and a 1 second upper limit.

The user should note that as the shutter ratio is increased, the camera will require more light.

### WB Set Control

This control activates the automatic white balance function. Before pressing this control, the user must place a pure white reference (sheet of paper etc.) if front of the camera, completely filling the field of view. This must not be removed until the white balance is complete. An on screen message shows the status of the white balance process.

Please refer to Chapter 8 “Understanding the Olympus *i-SPEED*” for a further description.

The control is only available if the white balance mode is set to automatic.

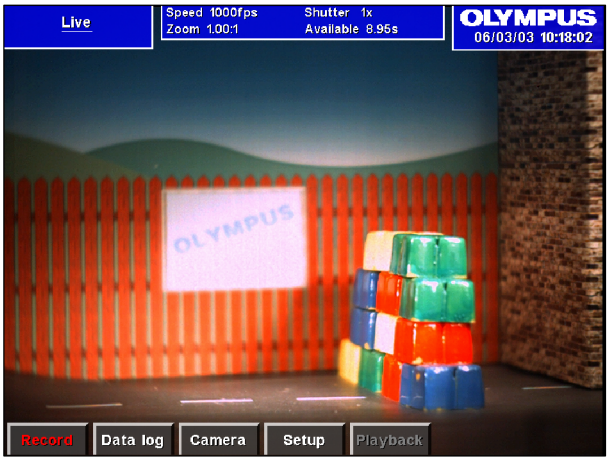
NOTE Once this is set, the white balance setting is stored in the camera’s internal memory.

## 4. Live Menu

This menu makes available all the sub menus items which relate to the live view systems of the camera.

**Access**: *i-SPEED* Home ⏵ Live
*i-SPEED* Home ⏵ Playback ⏵ Live

**Options**: *Record* *Data Log* *Camera* *Setup* *Playback*




- The CDU will display the live image

## 5. Playback Menu

This menu makes available all the items which relate to the playback view systems of the camera. The menu is not available until a recording has been made.

**Access**: *i-SPEED* Home ⏵ Playback
*i-SPEED* Home ⏵ Live ⏵ Playback

**Options**: Enhance *Data Log* *Measure* *Zoom/Pan* *Clip Select* *Player* *Live*


- Automatically appears after recording has stopped and displays the playback image.

### Enhance Control

The Olympus *i-SPEED* is able to digitally enhance the on-screen image. This enhancement is based on two-pole, two-dimensional edge detection and is carefully phase matched to the video signal. This control adjusts the quantity of enhancement added.

## 6. Config Menu

This menu makes available all the items which relate to the configuration of the camera.

**Access**: *i-SPEED* Home ➧ Config Menu

**Options**: Time/Date Language Camera ID TV Monitor Calibrate Sensor Ethernet


- The CDU will display the splash screen logo

### Language Control

This control permits the user to set the language in which the menus are displayed. The language of the information tiles and control value display is not changed.

### Camera ID control

The Olympus *i-SPEED* camera is capable of connection to an Ethernet network. It is possible to connect more than one camera and, whilst the cameras are uniquely identified by their TCP/IP address, it is sometimes useful to have a simple user settable ID tag which is kept with the downloaded video. This control allows the setting of this tag.

### TV Monitor Control

The composite video output connector (BNC) is able to provides either NTSC or PAL and this selection is made by this control.

### Calibrate Sensor Control

In common with all CMOS sensor chips, the Olympus *i-SPEED* sensor requires a calibration system to remove fixed pattern noise. The standard Olympus *i-SPEED* provides a fully automatic off-chip calibration system which operates in under a second. This system includes a mechanical shutter which removes the requirement for the user to manually cover the lens as is found on less capable cameras. The shutter gives a characteristic click sound when it operates. Manual operation of the system is not usually necessary, but may be required in very high ambient temperatures. Further discussion may be found in Chapter 8 “Understanding the Olympus *i-SPEED* ”.

This control allows the user to manually trigger the calibration system.

NOTE To calibrate the *i-SPEED HG* the lens cap should be fitted before depressing Calibrate sensor.

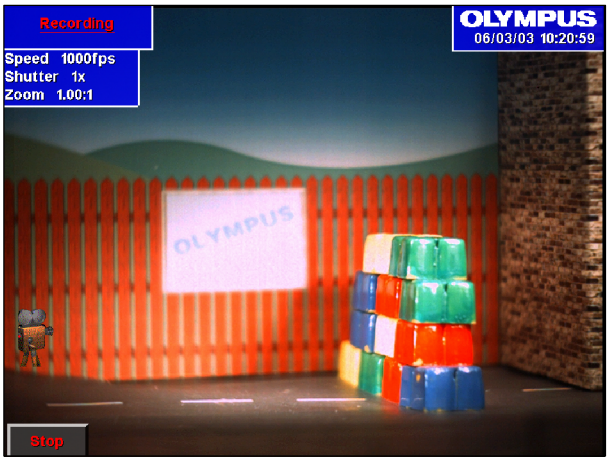
## 7. Recording Menu

When this menu is displayed, the Olympus *i-SPEED* is recording video into its circular buffer. The record action is confirmed by the presence of a small animated camera icon. When a trigger signal is received and the camera is working through the length of its trigger counter, the animation is supplemented by a 'stop watch' icon.

When recording has stopped, whether by the trigger or the STOP control, the camera will automatically present the Playback Menu and thereby display the first recorded image in the memory.

**Access**: *i-SPEED* Home ⏵ Quick ⏵ Record
*i-SPEED* Home ⏵ Live ⏵ Record

**Options**: STOP




- The CDU will display the live image

### STOP Control

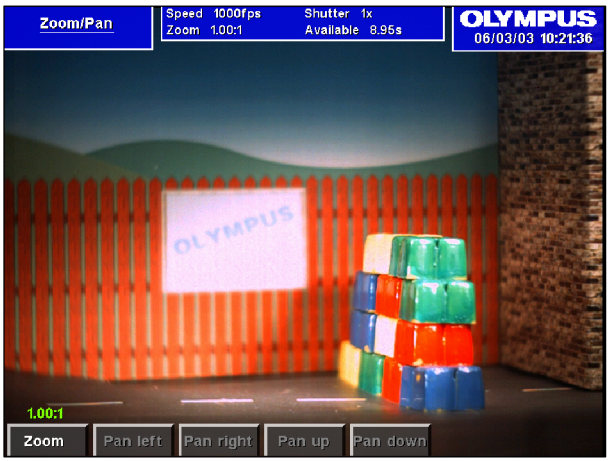
This control will cause the camera to stop recording immediately, regardless of the setting of the trigger position.

## 8. Zoom / Pan Menu

This menu provides access to the controls of the built-in zoom engine.

**Access**: *i-SPEED* Home ⏵ Quick ⏵ Zoom
*i-SPEED* Home ⏵ Playback ⏵ Zoom
*i-SPEED* Home ⏵ Live ⏵ Playback ⏵ Zoom
*i-SPEED* Home ⏵ Live ⏵ Camera ⏵ Zoom

**Options**: Zoom Pan Left Pan Right Pan Up Pan Down




- The CDU will display the live or playback image depending on the route taken to activate the menu

### Zoom Control

The Olympus *i-SPEED* camera has a built-in zoom engine which can electronically magnify the video image by up to 10 times. The user may adjust the level of zoom using the zoom control in this menu.

It should be noted that the zoom engine is automatically operated when high frame rates result in the active area of the sensor being reduced or when the “square” economy mode is selected. In these circumstances, the user may still zoom further into the zoomed image, but the 10 times limit is applied to the total zoom employed.

### Pan Control

For the convenience of the user, pan controls are also provided. These are individually disabled when the limit of the pan in a given direction is reached, and all are disabled when the zoom engine is turned off (1:1).

## 9. Card Management Menu

This menu makes available the items which relate to the management of the PCMCIA removable memory card, both ATA and Compact FLASH.

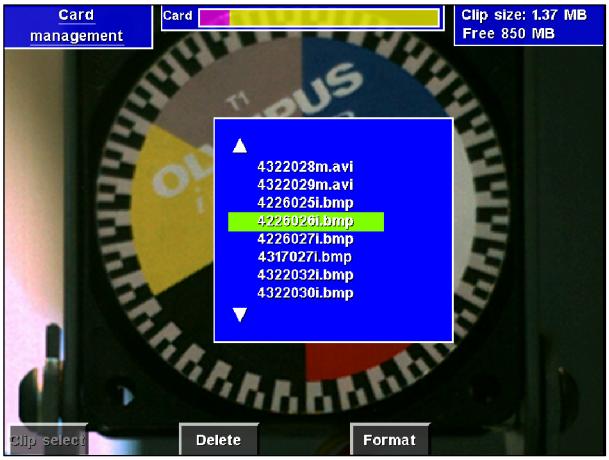
The screen includes a list of the files on the card and one of these will be highlighted by a selection bar.

Automatically appears after saving a file

**Access**: *i-SPEED* Home ⏵ Quick ⏵ Card

**Options**: Delete Format

The CDU will display the splash screen logo and card directory.




### Delete Control

This control is used to delete the selected file from the card. The user is protected from error by a confirmation question.

### Format Control

The user is able to format the card. This will delete all the data on the card and also prepare a new card for its first use. The user is protected from error by a confirmation question.

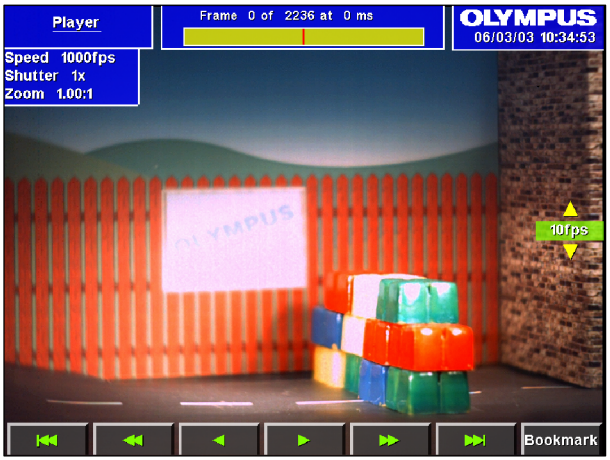
## 10. Player Menu

This specialised screen allows the user to play back and interact with the video stored in the circular buffer memory.

**Access**: *i-SPEED* Home ⏵ Playback ⏵ Player
*i-SPEED* Home ⏵ Live ⏵ Playback ⏵ Player

NOTE Also accessed from the measurement system

**Options**:  Bookmark




- The CDU will display the playback images required by the player controls

### Player Controls

The controls should be familiar to most users: jump back, rewind, play backwards, play forwards wind forwards, jump forward.

The jump controls will cause the player to immediately move either to the next bookmark or to the beginning/end of the memory.

The speed of playback is controlled by the ▲ ▼ buttons on the right hand side of the CDU. The chosen playback speed is indicated in a label next to these buttons.

### Bookmark Control

This control is used to set bookmarks at points of interest. Pressing the button when already on a marked frame will remove the bookmark. Bookmarks are displayed in the progress bar at the top of the screen. For the convenience of the user, the trigger frame is automatically given its own bookmark, and this is coloured differently for clarity.

### On Screen Information

The player provides a progress bar at the top of the screen to indicate the relative position within the circular buffer of the currently displayed frame. This bar is also used to display bookmarks. In the same display panel as the progress bar is a numerical description of the frame number, the total number of frames in memory and the time of the current frame relative to the start of the memory.

## 11. Data Log Menu

NOTE This menu is not available in timelapse mode.

This menu makes available all the items which relate to the analogue input signal data logger and data display.

**Access**: *i-SPEED* Home ⏵ Live ⏵ Data Log
*i-SPEED* Home ⏵ Playback ⏵ Data Log
*i-SPEED* Home ⏵ Live ⏵ Playback ⏵ Data Log

**Options**: Display 1 Display 2 Sample


- The CDU will display the live or playback image depending on the route taken to activate the menu

### Sample Control

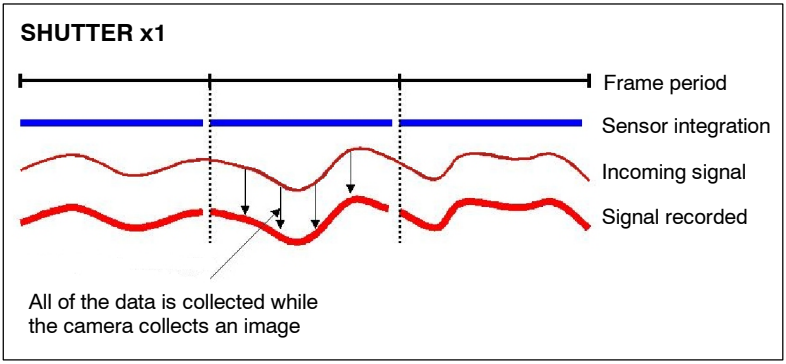
The sample rate of the user data logger may be adjusted by this control. The sampling rate is expressed in terms of samples per frame and the available range is from 1 to 100, but there is an upper limit of 100,000 samples per second.

### Display 1 and 2 Controls

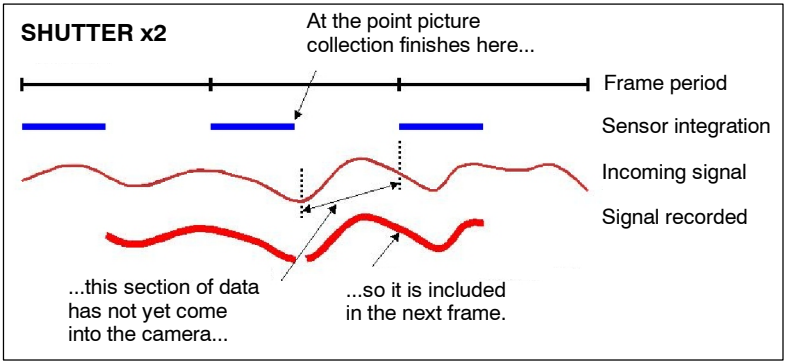
The analogue signal data which is sampled by the user data logger may be displayed in graphical format on the CDU screen and these controls allow the channels to be individually switched on and off.

## Data Logger Timing – an explanation

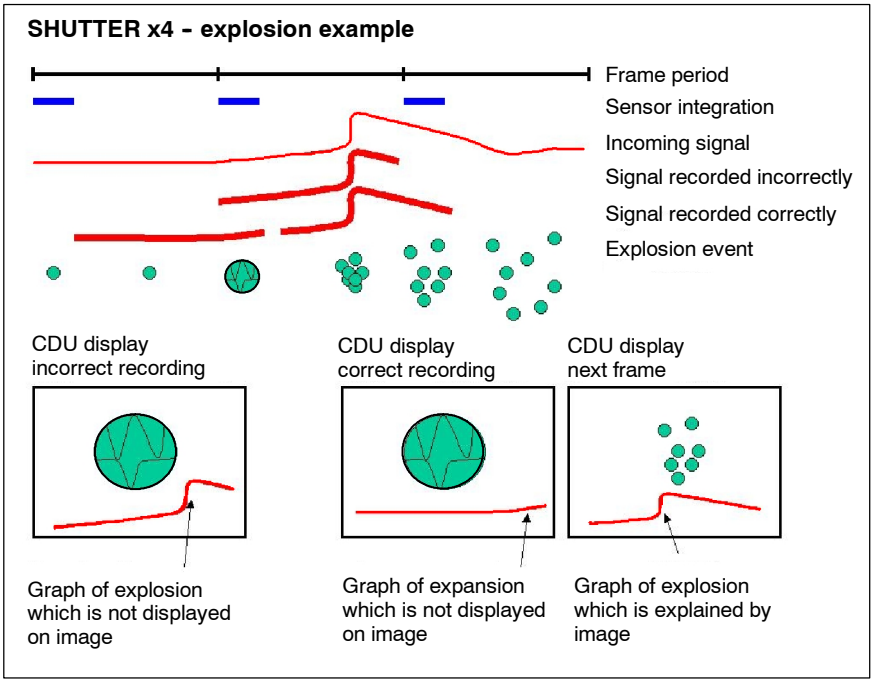
The data logger records data for the entirety of each frame period regardless of the shutter setting. This feature is included so that the user is able to detect events which happen faster than the frame period and which may be blurred, missed by the video recording (or missed if a short shutter time is used).
When a short shutter time is employed, a question arises as to what data should be logged. The diagram below shows the action of the data logger with a shutter setting of x1. In this example, it can be seen that the sensor gathers an image for the whole frame period and the data logger gathers data for the same period. In this way, the data and the image are correlated.



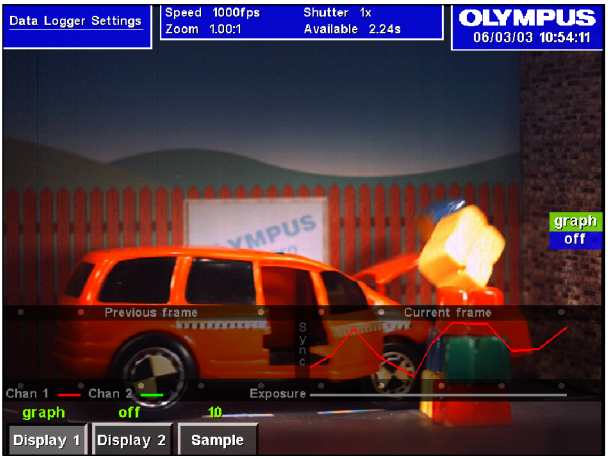

If the shutter is now increased to x2, the i-SPEED still gathers data for an entire frame period, but it only gathers the image for half the frame period. It should be noted that the i-SPEED records data from the time in the preceding frame when the shutter closes through to the time in the current frame when the shutter closes.



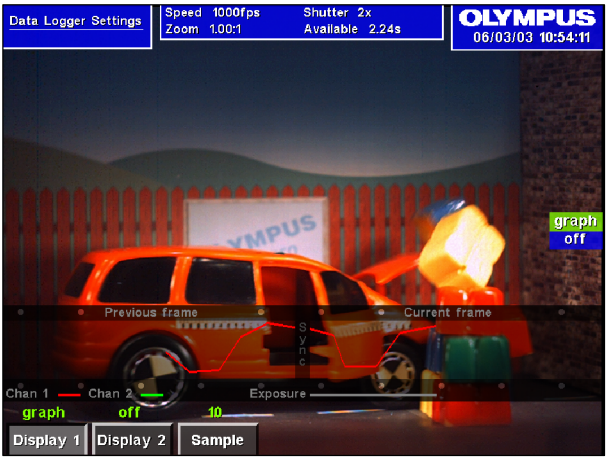
It may be wondered why the data is not recorded over the current frame period. This is because this action would lead to the display of data which occurred after the sensor had collected an image. An example is given of an explosion. In the first CDU image, the display shows the ball expanding and cracking, but the data shows an explosion. This is incorrect, because the data is not explained by the image. In the second CDU image, the data shows the ball expanding and cracking and this is supported by the data beginning to rise . The next CDU image correctly shows the ball after the explosion and the data from the explosion is displayed in this frame.



This point is somewhat esoteric but is none the less very important. In order to fully explain the timing of the data logging, the data display is presented on the CDU along with a reference frame diagram. The diagram shows the previous frame, the current frame and the exposure period. The data log is also shown and it is drawn in the position from which the data was collected. Thus it will be seen that a shutter of x1 causes collection from the current frame,




while a shutter of x2 causes collection from the previous as well as the current frame.



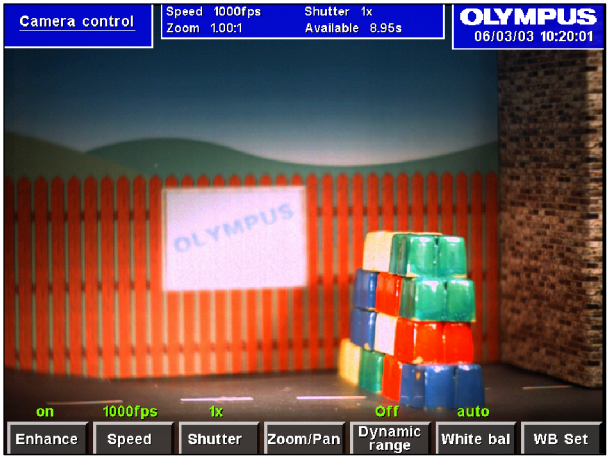

Since the end of data collection is synchronised with the end of the exposure period, it will be understood that a shutter of x200 causes collection of almost all the data from the previous frame.

## 12. Camera Menu

This menu makes available all the items which relate to the detailed control of the video processing chain of the camera.

**Access**: *i-SPEED* Home ⏵ Live ⏵ Camera

**Options**: Enhance Speed Shutter *Zoom/Pan* Dynamic Range White Bal WB Set




- The CDU will display the live image

### Enhance Control

The Olympus *i-SPEED* is able to digitally enhance the on-screen image. This enhancement is based on two-pole, two-dimensional edge detection and is carefully phase matched to the video signal. This control adjusts the quantity of enhancement added.

### Speed Control

This control allows the user to set the frame speed of the camera. The lowest speed available is 60 frames per second as this is almost equal to the SVGA display specification. The maximum speed is fixed to 33,000fps by the design of the sensor and electronics in the camera.

As described in Chapter 8 “Understanding the Olympus *i-SPEED*” the user will normally need to open the iris of the lens and/or add more light as the speed is increased. Further, the image will appear to zoom in as the frame speed is increased above 1,000 frames per second.

### Shutter Control

It is sometimes desirable to reduce the time during which the sensor gathers light (called “exposure time”, “integration time” or “shutter time”) in order to reduce motion blur and “freeze” the motion in each frame. The default shutter time is equal to the frame time, but this may be reduced by this control. The shutter time is measured as the ratio between frame time and shutter time, e.g. x10 means that the shutter is open for 1/10 of the frame period.

The shutter period may range from the frame period (x1) to 1/200 of the frame period (x200), but is subject to a 5 microsecond lower limit and a 1 second upper limit.

The user should note that as the shutter ratio is increased, the camera will require more light.

### Dynamic Range Control

The *i-SPEED* ’s image sensor is capable of detecting light in a non-linear fashion, which permits each pixel to individually reduce its sensitivity with increasing light. This effect allows the sensor to “see” in very bright and dark areas simultaneously and this is known as “dynamic range extension”. There are several levels of dynamic range extension. Further discussion may be found in Chapter 8 “Understanding the Olympus *i-SPEED*”.

### White Bal Control

The Olympus *i-SPEED* provides two types of white balance, pre-set and automatic. Several pre-set white balance settings are provided, based on light source technologies found in the Olympus range of industrial light sources.

The automatic function relies on the user placing a pure white reference (sheet of paper etc.) if front of the camera, completely filling the field of view and then pressing the WB Set button. This paper must not be removed until the white balance is complete. An on screen message shows the status of the white balance process.

The balance achieved is remembered by the camera while switched off.

NOTE This control is not available in monochrome cameras.

### WB Set Control

This control activates the automatic white balance function. Before pressing this control, the user must place a pure white reference (sheet of paper etc.) if front of the camera, completely filling the field of view. This must not be removed until the white balance is complete. An on screen message shows the status of the white balance process.

Please refer to Chapter 8 “Understanding the Olympus i-SPEED” for a further description.

NOTE The control is only available if the white balance mode is set to automatic.

Once set, the white balance values will be stored in non-volatile memory. Thus if camera power is removed, the camera will return to the user set white balance values.

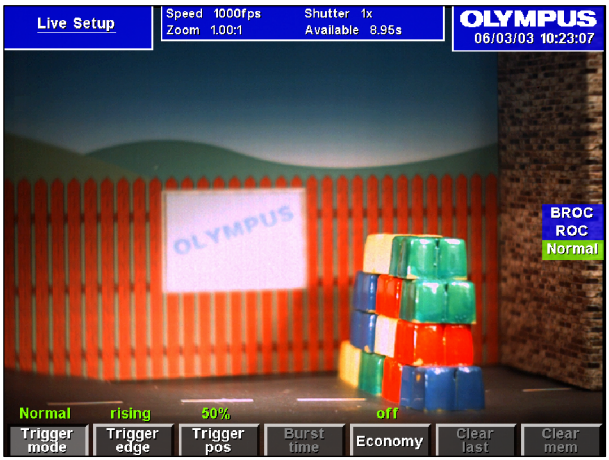
## 13. Live Setup Menu

This menu makes available all the items which relate to the live view systems of the camera. It would be of benefit to read Chapter 8 “Understanding the Olympus *i-SPEED* ” for further descriptions on several of the terms and phrases used in this section.

NOTE This menu is not available in Timelapse mode.

**Access**: *i-SPEED* Home ➧ Live ➧ Live Setup
*i-SPEED* Home ➧ Playback ➧ Live ➧ Live Setup

**Options**: Trig Mode Trig Edge Trig Pos Burst Time
Economy Clear Last Clear Mem




- The CDU will display the live image

### Trigger Mode Control

This control is used to change the camera into Record On Command (ROC) mode or Burst Record On Command (BROC) mode.

### Trigger Edge Control

This control sets the trigger detection system to wait for a rising edge or a falling edge on the trigger input connection.

NOTE This control is not available in ROC mode, since ROC is not edge triggered.

This value is stored in non-volatile memory. After a power cycle, it will be set to the last used position.

### Trigger Position Control

This control sets the length of the trigger delay, so that the trigger point will appear at a user-settable position in the recorded video clip. With the trigger position at 0%, the trigger delay is equal to the length of the circular buffer and the trigger point will appear at the beginning of the video clip. With the trigger position at 100%, the trigger counter is set to zero and the recording will stop immediately the trigger is activated, thus the trigger point will appear at the end of the video clip. There are a number of options available in between 0% and 100%.

NOTE This control is not available in ROC and BROC modes.

### Burst Time Control

This sets the length of the bursts recorded when the trigger is activated in BROC mode.

NOTE This control is not available in normal trigger or ROC modes.

### Economy Control

It will be noted that many high speed events are primarily horizontal or vertical in nature and so the edges of the screen often contain no useful video information. It is also sometimes desired to have a longer record time than that given by the available memory option. This control addresses both of these issues by causing the camera to use a central subsection of the sensor, rather than the maximum available area. This has the effect of reducing the number of pixels recorded in each frame and so effectively increasing the record time available.

Where possible, the zoom engine will return the image to full screen.

### Clear Last Control

Pressing this control deletes the last burst recorded in ROC or BROC mode.

NOTE This control is not available in normal trigger mode, or if no burst is available for deletion.

### Clear Mem Control

Pressing this control deletes the entire contents of the memory, permitting further use of the ROC or BROC modes.

NOTE This control is not available in normal trigger mode, or if no burst is available for deletion.

## 14. Clip Select Menu

This menu makes available all the items which relate to selecting the video clip to be saved on the PCMCIA card.

**Access**: *i-SPEED* Home ⏵ Playback ⏵ Clip Select
*i-SPEED* Home ⏵ Live ⏵ Playback ⏵ Clip Select

**Options**: Clip start Clip end Player Save


- The CDU will display the playback images required by the clip select controls

### Player Controls

The controls should be familiar to most users: jump back, rewind, play backwards, play forwards wind forwards, jump forward.

The jump controls will cause the player to immediately move either to the next bookmark or to the beginning/end of the memory.

### Clip Start and Clip End Controls

The player controls are used to locate the start and end of the desired video clip and the Clip Start and Clip End controls are used to mark the chosen frames.

### Save Control

If the start and end frames are selected as the same frame, the save control will cause the camera to save a single bitmap (BMP) image to the card. If more than one frame is chosen, the camera will save a movie (AVI) file to the card.

### On Screen Information

The Clip Select menu provides a progress bar to indicate the position in the buffer memory of the currently displayed frame as well as the start and end frame markers. This bar is also used to display bookmarks.

In the same display panel as the progress bar is a graphical representation of the available memory in the card, the total memory in the card and the quantity of memory required for the currently selected clip.

In a separate display panel is a numerical description of start frame number relative to the start of the camera's memory, the number of frames selected, the size of the chosen clip and the available free memory in the card.

*15.* Time / Date Setting Menu

This menu permits the setting of the time and date of the on-board clock of the camera.

When the appropriate time and date have been set, the OK button should be pressed.

**Access**: *i-SPEED* Home ➧ Config ➧ Time/Date

**Options**: Year Month Day Hour Minute Second OK


- The CDU will display the splash screen logo

### OK Control

This control confirms the numerical entry just made and also returns to the previous menu.

## 16. Ethernet Menu

**Access**: *i-SPEED* Home ➧ Config ➧ Ethernet

These controls permit the setting of the TCP/IP address of the on-board Ethernet controller of the camera. The choice of address is dependant on the individual network being used and should be chosen by the network administrator. When the appropriate address has been set, the OK button should be pressed.

NOTE The camera contains a DHCP client. If upon switch on, a DHCP server is detected on the network, the TCP/IP address will be set automatically. In this case, the TCP/IP buttons will be disabled and the automatically assigned TCP/IP address will be displayed.

**Options**: TCP/IP(1) TCP/IP(2) TCP/IP(3) TCP/IP(4) OK


- The CDU will display the splash screen logo

### OK Control

This control confirms the numerical entry just made and also returns to the previous menu.

### TIMELAPSE MODE

In addition to its normal function as a high speed video camera, the Olympus *i-SPEED* is able to operate as a timelapse camera. In timelapse mode, operation is similar to normal mode, with a few necessary exceptions.

The normal trigger functions, ROC, BROC and the data logger functions are not available, so the Live Set-up menu is deleted.

The speed is expressed either as frames per second or seconds per frame, depending on the speed chosen. The shutter is expressed in time, rather than shutter ratio. Speed and angular velocity measurement are not available.

## 6.2 Measurement system

The Olympus *i-SPEED* camera has a built-in measurement system which is based on the principle of comparative measurement whereby measurement is achieved by entering the size of a known object in the image and then comparing this with the size to be measured.

The measurement suite is intended to give a good indication of relative object distance, speed and angle. However, due to the number of variable factors involved, no guarantee of measurement accuracy can be given.

**IMPORTANT**: The entire reference measurement and the entire measurement of interest must be coplanar, in a plane orthogonal to the axis of the camera.

This means that for distance and speed measurements, the scene must contain an object whose size is accurately known. Also, this object must be the same distance from the lens as the object being measured.

Furthermore, the start and end points of the known measurement and the start and end points of the measurement of interest must all be the same distance from the camera. For angle and angular velocity measurements, the origin, start and end points of the measurement must all be the same distance from the camera.

The accuracy of measurement depends on the conditions above being fulfilled and on the skill of the operator in placing the on screen cursors accurately.

## 1. Measure Menu

This is the home or start-up screen of the measurement system. Before the system is used, the Set up menu must be accessed to set the units of measurement and to calibrate the system by measuring an object of known dimensions.

**Access**: *i-SPEED* Home ⏵ Playback ⏵ Measure
*i-SPEED* Home ⏵ Live ⏵ Playback ⏵ Measure

**Options**: *Speed & Dist* *Ang & Ang Vel* *Player* *Setup*


- The CDU will display the playback image

## 2. Measure Speed & Distance Menu

**Access**: Measure ➧ Measure Speed & Distance

**Options**: Start Clear Player Save Image ◄ ► ▲ ▼


- The CDU will display the playback image

### Start Control

This control marks the start of the measurement or calibration.

### Clear Control

This control clears all the currently marked points, to allow another measurement to be taken. The control is disabled if there are no marked points to clear.

### Player Control

The player is presented here to allow the measurement of speed and angular velocity, by permitting the user to move to a different frame for the end point of the measurement.

### Save Image

This control causes an image to be saved to the PCMCIA card. After an image is saved, the Card Management menu automatically appears. Pressing the Back button from the Card Management menu will cause the CDU to return to the Measure Speed & Distance Menu.

### ◄ ► ▲ ▼

These controls allow the user to move the measurement cursor.

*3.* Measure Angular Velocity and Angle Menu

**Access**: Measure ➧ Measure Angular Velocity and Angle

**Controls**: Start Origin Clear Player Save Image ◄ ► ▲ ▼


- The CDU will display the playback image

### Start Control

This control marks the start of the measurement or calibration.

### Origin Control

This control marks the origin or axis of rotation for the measurement of angle and angular velocity.

### Clear Control

This control clears all the currently marked points, to allow another measurement to be taken. The control is disabled if there are no marked points to clear.

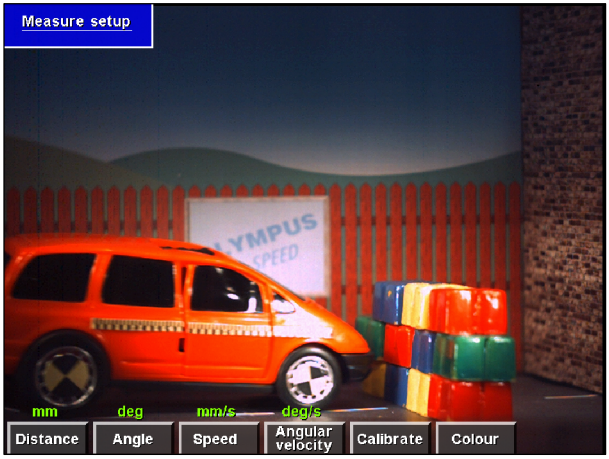
### ◄ ► ▲ ▼

These controls allow the user to move the measurement cursor.

4. Measure Setup Menu

**Access**: Measure ➧ Measure Setup

**Controls**: Distance Angle Speed Ang Vel *Calibrate* *Colour*




- The CDU will display the playback image

### Distance, Angle, Speed, Ang Vel Controls

These controls allow the user to choose the most appropriate units for the measurement to be taken.

## 5. Measure Calibration Menu

**Access**: Measure ➧ Measure Setup ➧ Measure Calibrate

**Controls**: Start End Clear *Calibrate* ◄ ► ▲ ▼


- The CDU will display the playback image

### Start Control

This control marks the start of the measurement or calibration.

### End Control

This control marks the end of the known distance which is used in the calibration process.

### Clear Control

This control clears all the currently marked points, to allow another measurement to be taken. The control is disabled if there are no marked points to clear.

### ◄ ► ▲ ▼

These controls allow the user to move the measurement cursor.

## 6. Enter Calibration Menu

**Access**: Measure ➧ Measure Setup ➧ Measure Calibrate ➧ Enter Calibration

**Controls**: 1000 100 10 1 0.1 0.01 OK


- The CDU will display the playback image

### Numerical Controls

In conjunction with the ▲▼ buttons, these controls allow the entry of the calibration value, which must be the accurately known distance between the points just marked as “start” and “end”.

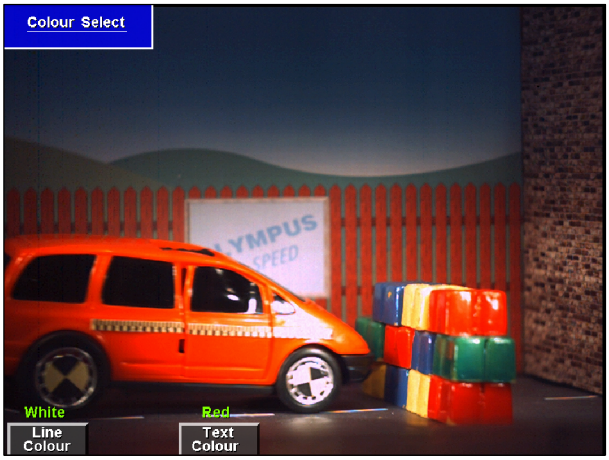
### OK Control

This control confirms the numerical entry just made and also returns to the previous menu. This control is not available until calibration value is non-zero.

## 7. Colour Menu

**Access**: Measure ⏵ Measure Setup ⏵ Colour

**Controls**: Line Colour  Text Colour




- The CDU will display the playback image

### Colour Controls

The colour controls are used to select the colours of the on-screen cursor and text to improve legibility against different backgrounds.

# Chapter 7 Embedded Software Reference (RCP)

## Introduction

This reference section describes the camera's embedded software and its user interface from the viewpoint of the RCP.

## Operation of the RCP menus

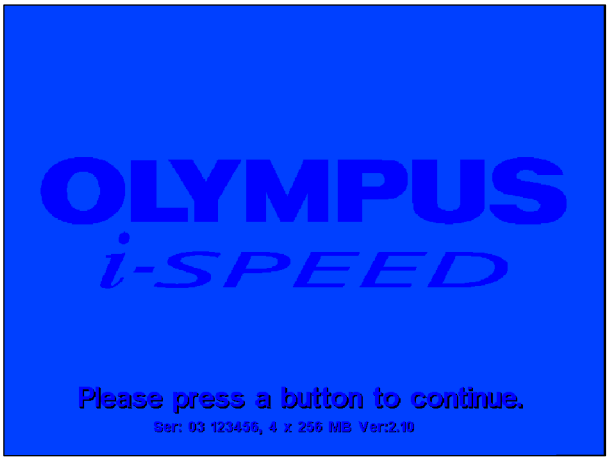
Control menus within the RCP software are accessed by pressing the MENU/ENT button on the RCP.

The ◀ ▶ ▲ ▼ buttons are used to move within the menu screens to highlight the various options, an icon is displayed next to the selection prompting the user to press MENU/ENT to select the option – press BACK to abort selection or return to a higher menu.

# 7.1 Menu Screens

1. OLYMPUS *i-SPEED* Splash Screen

This screen is displayed while the camera starts up and configures the internal software. It contains data on the memory configuration of the camera, the serial number and the software version number. To exit this screen, the user must press a button on the RCP or CDU.

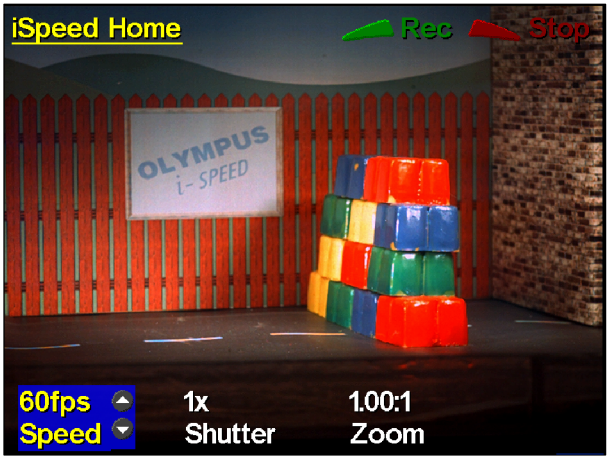


## 2. *i-SPEED* Home Menu

This is the top level or home screen of the RCP menu system which provides rapid access to the most commonly used functions. This screen may be accessed by pressing the Back button repeatedly from any position in the menu system.

The current frame speed, shutter and zoom settings are displayed at the bottom of the screen and can changed quickly using the arrow buttons on the RCP before pressing Record.

Pressing the MENU/ENT button will access the RCP menu options which are described in the following Sections.




- The display will show a *live* image

### Rec Control

When this button is pressed, the Olympus *i-SPEED* is recording video into its circular buffer. The record action is confirmed by the presence of a small animated camera icon. When a trigger signal is received and the camera is working through the length of its trigger counter, the animation is supplemented by a 'stop watch' icon.

When recording has stopped, whether by the trigger or the STOP control, the camera will automatically present the Player Menu and thereby display the first recorded image in the memory.

### STOP Control

This control will cause the camera to stop recording immediately, regardless of the setting of the trigger position.

### Speed Control

This control allows the user to set the frame speed of the camera. The lowest speed available is 60 frames per second as this is almost equal to the SVGA display specification. The maximum speed is fixed to 33,000fps by the design of the sensor and electronics in the camera.

As described in Chapter 8 “Understanding the Olympus *i-SPEED*”, the user will normally need to open the iris of the lens and/or add more light as the speed is increased. Further, the image will appear to zoom in as the frame speed is increased above 1,000 frames per second.

### Shutter Control

It is sometimes desirable to reduce the time during which the sensor gathers light (called “exposure time”, “integration time” or “shutter time”) in order to reduce motion blur and “freeze” the motion in each frame. The default shutter time is equal to the frame time, but this may be reduced by this control. The shutter time is measured as the ratio between frame time and shutter time, e.g. x10 means that the shutter is open for 1/10 of the frame period. The shutter period may range from the frame period (x1) to 1/200 of the frame period (x200), but is subject to a 5 microsecond lower limit and a 1 second upper limit.

The user should note that as the shutter ratio is increased, the camera will require more light.

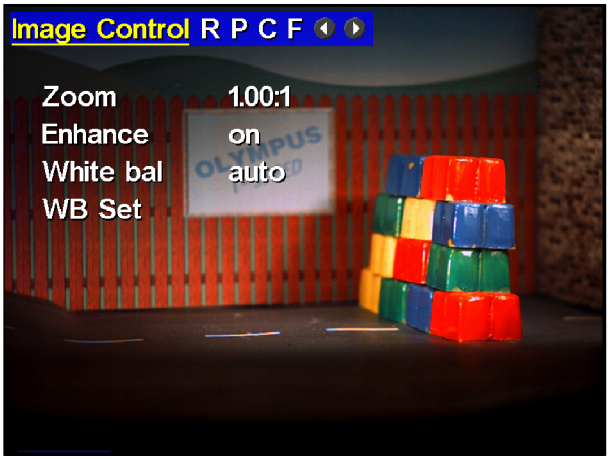
### Zoom Control

The Olympus *i-SPEED* camera has a built-in zoom engine which can electronically magnify the video image by up to 10 times. The user may adjust the level of zoom using the arrow keys on the RCP.

It should be noted that the zoom engine is automatically operated when high frame rates result in the active area of the sensor being reduced or when the “square” economy mode is selected. In these circumstances, the user may still zoom further into the zoomed image, but the 10 times limit is applied to the total zoom employed.

### 3. *i-SPEED* Image Control Menu

This menu makes available the zoom, image enhancement and white balance controls.




- The CDU will display a *live* image

#### Zoom Control

The Olympus *i-SPEED* camera has a built-in zoom engine which can electronically magnify the video image by up to 10 times. The user may adjust the level of zoom using the arrow keys on the RCP.

#### Enhance Control

The Olympus *i-SPEED* is able to digitally enhance the on-screen image. This enhancement is based on two-pole, two-dimensional edge detection and is carefully phase matched to the video signal. This control adjusts the quantity of enhancement added.

### White Bal Control

The Olympus *i-SPEED* provides two types of white balance, pre-set and automatic. Several pre-set white balance settings are provided, based on light source technologies found in the Olympus range of industrial light sources.

The automatic function relies on the user placing a pure white reference (sheet of paper etc.) if front of the camera, completely filling the field of view and then pressing the WB Set button. This paper must not be removed until the white balance is complete. An on screen message shows the status of the white balance process.

The balance achieved is remembered by the camera while switched off.

NOTE This control is not available in monochrome cameras.

### WB Set Control

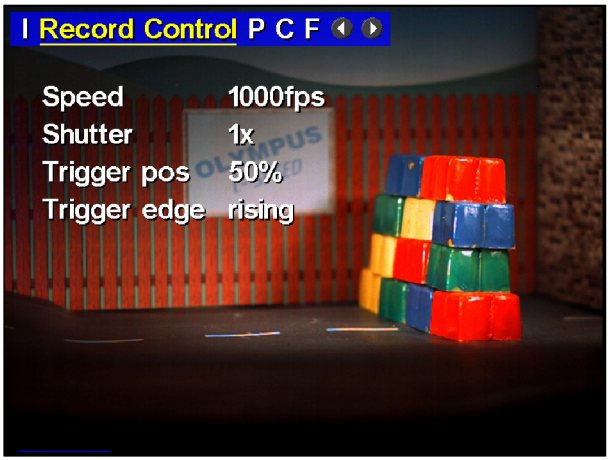
This control activates the automatic white balance function. Before pressing this control, the user must place a pure white reference (sheet of paper etc.) if front of the camera, completely filling the field of view. This must not be removed until the white balance is complete. An on screen message shows the status of the white balance process.

Please refer to Chapter 8 “Understanding the Olympus *i-SPEED*” for further information.

NOTE The control is only available if the white balance mode is set to automatic.

## 4. *i-SPEED* Record Control Menu

The frame speed, shutter and trigger settings may be adjusted from this menu using the RCP.




- The CDU will display a *live* image

### Speed and Shutter Controls

Speed and shutter settings are described in Section 2.

### Trigger Position Control

This control sets the length of the trigger delay, so that the trigger point will appear at a user-settable position in the recorded video clip. With the trigger position at 0%, the trigger delay is equal to the length of the circular buffer and the trigger point will appear at the beginning of the video clip. With the trigger position at 100%, the trigger counter is set to zero and the recording will stop immediately the trigger is activated, thus the trigger point will appear at the end of the video clip. There are a number of options available in between 0% and 100%.

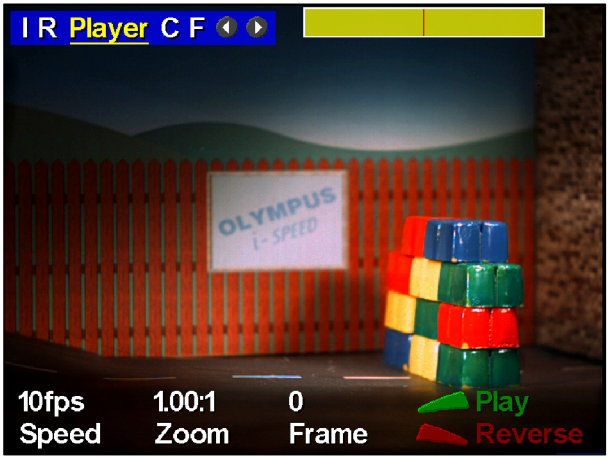
### Trigger Edge Control

This control sets the trigger detection system to wait for a rising edge or a falling edge on the trigger input connection.

## 5. *i-SPEED* Player Menu

This menu makes available all the items which relate to the playback of the recorded scene stored in the camera.

NOTE This menu is not available until a recording has been made.




- Automatically appears after recording has stopped and displays the playback image.

### Speed Control

The speed of playback is controlled by the ▲ and ▼ buttons on the RCP.

Depending on the playback frame speed, the point of interest may take some time to reach. In this case, increase the frame speed and play forwards (see Figure below), then reduce the frame speed.


### Zoom Control

The Olympus *i-SPEED* camera has a built-in zoom engine which can electronically magnify the video image by up to 10 times. The user may adjust the level of zoom using the arrow keys on the RCP.

### Frame Control

The frame number of the image is displayed on screen. Using the arrow buttons on the RCP, the user can navigate the forwards and backwards through the recorded scene.

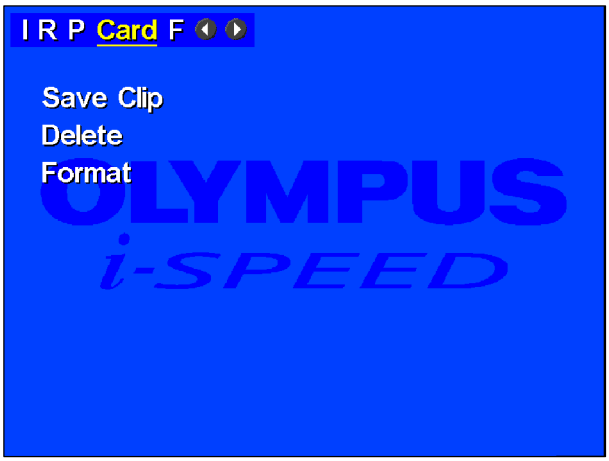
### Play-stop / Reverse-stop Controls

When pressed, the recorded scene is played forwards or in reverse and the button pressed changes to Stop - progress is displayed in the bar at the top of the screen to indicate the relative position within the circular buffer of the currently displayed frame.

This bar is also used to display a bookmark which is generated when the trigger is used.

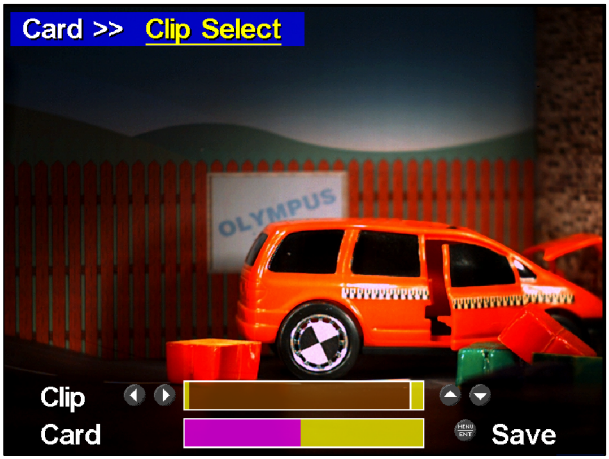
## 6. *i-SPEED* Card Menu

This menu makes available the items which relate to the management of the PCMCIA removable memory card, both ATA and Compact FLASH.




### Save clip Control

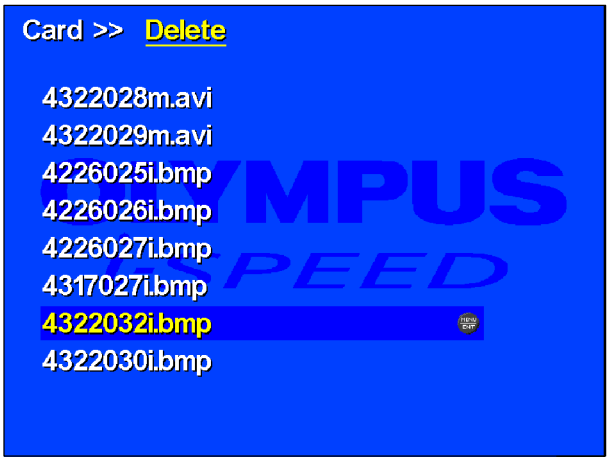
When selected, the clip select screen is displayed. Use the ◀ and ▶ arrow buttons to move from the left along the progress bar to the first frame to be saved. Use the ▲ and ▼ buttons to move from the right along the progress bar to the last frame to be saved. The available card memory is displayed on the lower bar. Press MENU/ENT to save the clip or BACK to return to the card menu.



If the start and end frames are selected as the same frame, the save control will cause the camera to save a single bitmap (BMP) image to the card. If more than one frame is chosen, the camera will save a movie (AVI) file to the card.

### Delete Control

This control is used to delete the selected file from the card. The contents of the card are displayed for individual selection or select ALL. The user is protected from error by a confirmation question.

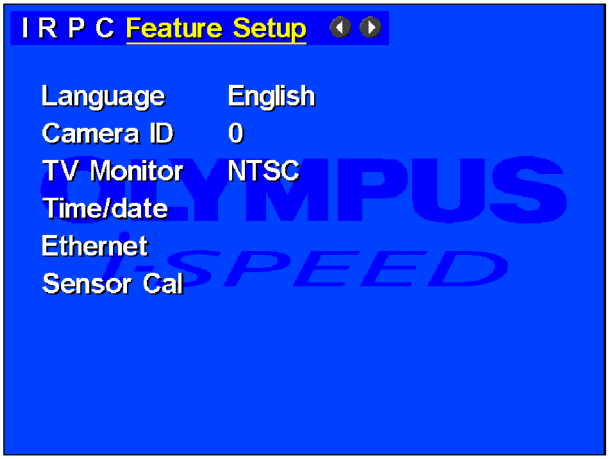



### Format Control

The user is able to format the card. This will delete all the data on the card and also prepare a new card for its first use. The user is protected from error by a confirmation question.

## 7. *i-SPEED* Feature Setup Menu

This menu makes available all the items which relate to the configuration of the camera.




- The CDU will display a *live* image

### Language Control

This control permits the user to set the language in which the menus are displayed. The language of the information tiles and control value display is not changed.

### Camera ID control

The Olympus *i-SPEED* camera is capable of connection to an Ethernet network. It is possible to connect more than one camera and, whilst the cameras are uniquely identified by their TCP/IP address, it is sometimes useful to have a simple user settable ID tag which is kept with the downloaded video. This control allows the setting of this tag.

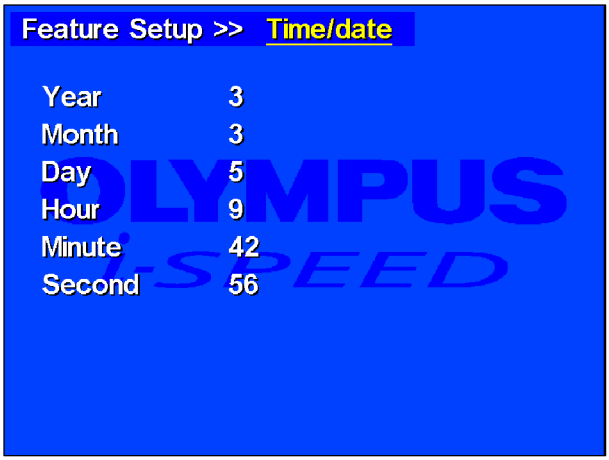
### TV Monitor Control

The composite video output connector (BNC) is able to provide either NTSC or PAL and this selection is made by this control.

### Time/date Control

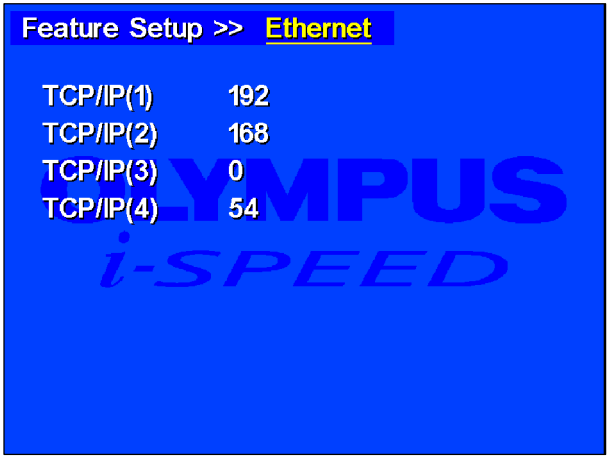
This menu permits the setting of the time and date of the on-board clock of the camera.

When the appropriate time and date have been set, the MENU/ENT button should be pressed.




### Ethernet Control

These controls permit the setting of the TCP/IP address of the on-board Ethernet controller of the camera. The choice of address is dependant on the individual network being used and should be chosen by the network administrator or configured automatically via a DHCP server located on the network. When the appropriate address has been set, the MENU/ENT button should be pressed.



## Sensor Cal Control

In common with all CMOS sensor chips, the Olympus *i-SPEED* sensor requires a calibration system to remove fixed pattern noise. The standard Olympus *i-SPEED* provides a fully automatic off-chip calibration system which operates in under a second. This system includes a mechanical shutter which removes the requirement for the user to manually cover the lens as is found on less capable cameras. The shutter gives a characteristic click sound when it operates. Manual operation of the system is not usually necessary, but may be required in very high ambient temperatures. Further discussion may be found in Chapter 8 "Understanding the Olympus *i-SPEED*".

This control allows the user to manually trigger the calibration system.

NOTE To calibrate the *i-SPEED HG* the lens cap should be fitted before depressing Sensor Cal.

# Chapter 8 Understanding the Olympus i-SPEED

The Olympus *i-SPEED* has been designed with ease of use in mind and all the functions of the camera are accessed via clear and descriptive menus. Every effort has been made to ensure that the menus are intuitive.

High speed video, however is a complex subject in itself and several of the functions of the Olympus *i-SPEED* are necessarily complex. Reading the following section will provide the user with sufficient knowledge of these areas to begin to understand the menus themselves. A detailed description of the menus is given later.

## Speed, Resolution, Record Time, Economy Modes

In order for the Olympus *i-SPEED* to capture frames of video at high speeds, a specialised sensor is used. In spite of this, there is a limit to the number of pixels the sensor can process per second, and this sets a limit on the frame speed of 1,000 frames per second (fps).

If faster operation is required, the number of pixels per frame must be reduced, and this is accomplished by reducing the active area of the sensor. This function is called windowing and can increase the maximum frame speed of the Olympus *i-SPEED* to 33,000fps. The on-board zoom engine is used to automatically compensate for the reduction in image size.

The camera contains electronic memory to hold the video images as they are captured and this has a specific size, which is dependant on the model chosen. The memory is therefore capable of holding a fixed number of full resolution images and there is a clearly defined maximum recording time at 1,000fps.

If the frame rate is reduced below 1,000fps, the available record time will increase because the images are arriving less frequently. If the frame rate is increased above 1,000fps, the available record time will not change much because, although the images are arriving more often, the image size is reduced and the two effects tend to offset each other.

Under some circumstances, it is desirable to record for a longer time than the memory permits. It will be noted, however, that some high speed events are primarily horizontal or vertical in nature and so it is sometimes found that the edges of the screen contain no useful video information. This fact is used by the economy modes, which reduce the active area of the sensor below the size suggested by the frame speed. This reduced image size increases the number of images which may be stored in the memory and thereby the record time is increased.

Several economy modes are available. Wide modes remove the top and bottom edges of the image, tall modes remove the left and right edges and square modes remove the top, bottom, left and right edges of the image. In square mode, the internal zoom engine is again used to compensate for the reduced image size.

There is a further trade-off associated with frame speed and this is discussed below.

## Shutter, Speed, Sensitivity

The sensor operates by capturing light, converting it to an electronic facsimile of the optical image and supplying the memory with the image while the cycle begins to repeat. The period during which light is captured is called the “integration time”, “exposure time” or “shutter time”. The shutter time is normally equal to the maximum time available during the frame, called the “frame period”.

If the scene contains a very fast moving object, the object may move an appreciable distance during the frame period and this will cause the object to appear blurred. This “motion blur” is sometimes undesirable, so the Olympus *i-SPEED* is able to reduce the shutter time to a fraction of the frame period and this causes the object to be “frozen” in each frame. The shutter time is usually measured as the ratio between frame period and shutter time, e.g. 10x means that the shutter is open for 1/10 of the frame period.

Reducing the shutter time however, reduces the amount of time the camera spends gathering light and the image will become dimmer. For this reason, increasing the shutter setting will normally require the addition of extra light to the scene.

A similar effect is found when the frame speed is increased. The available shutter time is reduced because the frame period is reduced - the faster the frames are taken, the less time is spent on each one. As a result of this, increasing frame speed will normally require the addition of extra light to the scene.

## Dynamic Range

The human eye has an extraordinary ability to see dark and bright objects simultaneously. The classical illustration of this is a plant on a windowsill. The eye can see the plant and the view through the window simultaneously. Ordinary video cameras are less capable and can only produce images of one or the other. Either the plant will be a featureless black silhouette and the view through the window will be visible or the plant will be visible and the view through the window will be a featureless white sheet.

The level of ability to see light and dark simultaneously is called dynamic range.

The *i-SPEED* 's image sensor is capable of increasing its dynamic range by detecting light in a non-linear fashion. This permits each pixel to individually reduce its sensitivity with increasing light. This effect allows the sensor to gather image features in very bright and dark areas simultaneously and this process is known as “dynamic range extension”.

## Internal Memory, Circular buffer

When in record mode, the camera continuously stores frames in its internal memory. That memory is configured in a circle so that, once the memory is full, each new frame replaces the oldest stored frame. In this way, the camera keeps a rolling history of the scene it views and this process can continue indefinitely. This configuration of the memory is called a “circular buffer”.

Once the desired event has occurred, the camera may be stopped by pressing a menu button or raising a trigger event as discussed below.

## Trigger

As mentioned above, the Olympus *i-SPEED* records video in a circular buffer and can do so indefinitely. At some point, however, it is necessary to stop the recording process in order to preserve the data in the memory.

The method of stopping the camera is highly important as it is this which guarantees the capture of the event in question. There are two methods of stopping the Olympus *i-SPEED* . The first is a button press in the menu system and this immediately stops the record process, so that the memory contains the history prior to the button press.

The second method is to use an external electrical trigger, which causes the camera to stop after a user-settable delay. By permitting the camera to record for a brief time after the trigger, some history before the trigger and also some future after the trigger are preserved in the memory. In this way, the trigger may occur in the middle of the event of interest and yet the camera can still capture the whole event.

The delay between the trigger event and the cessation of recording is controlled by a frame counter known as the trigger counter. The length of this count is controlled by the menu system and is expressed as a percentage of the total available record time of the camera's memory.

The counter value is described from the viewpoint of the final recorded video clip, so that a setting of 0% sets the counter to delay for the entire length of the circular buffer. In this way, the trigger event will appear at the beginning of the video clip. Similarly, a setting of 100% will cause the camera to stop immediately a trigger is received, and this will place the trigger event at the end of the recorded video clip.

Since the trigger is an electrical signal, the Olympus *i-SPEED* may be set to wait for either the rising or the falling edge of the trigger pulse.

The Olympus *i-SPEED* has two extensions to the normal trigger operation described above. These are called Record On Command (ROC) and Burst Record On Command (BROC) and a description of these follows.

## ROC, BROC

Record On Command (ROC) and Burst Record On Command (BROC) are extensions of the normal trigger function of the Olympus *i-SPEED* . Once Recording mode is selected in ROC mode, the camera only records video into the memory while the trigger signal is true (active low). By judicious use of the trigger connection (e.g. dextrous use of the supplied trigger switch) the camera may record several short bursts of video into the memory buffer.

For the purposes of ROC and BROC, the memory is not treated as a circle, but is regarded as a straight line with a defined start and end. When the memory is full, no further recording is possible. A progress indicator is provided.

A facility is provided to erase video bursts from the memory in case an error is made in the use of the trigger switch. A further facility is provided to erase the entire memory.

BROC is an extension of ROC, in that a trigger edge (rather than an active level) will cause the camera to record video for a pre-defined time. The length of time that the trigger signal is active is ignored. This function is especially useful for unattended operation when several short events are likely to occur. The burst time is settable in the menu system.

## Sensor, FPN, FPN Calibration

The image sensor used in the Olympus *i-SPEED* camera is a CMOS chip and, like all CMOS imagers, it has the property of introducing fixed pattern noise (FPN) onto the image. Most HSVC manufacturers provide some form of correction to remove the FPN and the Olympus *i-SPEED* provides a fully automatic off-chip calibration system which operates in under a second.

NOTE When using the *i-SPEED HG*, the lens must be completely covered (eg with a lens cap) from power on until the splash screen appears.

This system includes a mechanical shutter which removes the requirement for the user to manually cover the lens as is found on less capable cameras. The shutter gives a characteristic click sound when it operates.

The system operates automatically on start-up and also after a few moments of operation and this should normally be sufficient. Under extreme circumstances, however, especially in high temperature environments, the calibration system may need to be manually operated some time after switch-on. This is indicated by the presence of FPN on the image. FPN will give the image a gritty appearance, almost as though the picture has been printed onto sandpaper, and may also produce thin vertical stripes.

The control to manually trigger the calibration is found in the menu system.

## White Balance

The human eye automatically adjusts its colour processing in order to make white objects look “white” in spite of varying ambient lighting colour. When viewing video on a monitor, however, the eye judges white based on the ambient around the monitor, not on the ambient around the camera. For this reason, a colour camera must also adjust its processing to compensate for the ambient lighting and configure its output to produce the electronic version of pure white (red = green = blue) when a white object is viewed. In this way, the camera can render white objects as white on the monitor, in spite of ambient light coloration. This function is called white balance.

The Olympus *i-SPEED* provides two types of white balance, pre-set and automatic. Several pre-set white balance settings are provided, based on light source technologies found in the Olympus range of industrial light sources.
The automatic function relies on the user placing a pure white reference (sheet of paper etc.) if front of the camera, completely filling the field of view and then pressing the WB Set button. When this is done, the camera will sample the reference and reconfigure its processing electronics to render this as pure white. The reference must not be removed until the white balance is complete, so an on screen message shows the status of the white balance process.

## Lighting

The Olympus *i-SPEED* has been designed to remove most of the difficulty associated with taking high speed video shots, but two areas of critical importance still remain, lenses and lighting. In many cases, most of the time taken when working with the Olympus *i-SPEED* will be used in setting up the lighting, framing the shot and choosing the correct lens.

Earlier sections of this document have described how the shutter time and speed setting of the camera dramatically increase the requirement for light. The result of this is that most high speed video applications require a large amount of lighting and this is a common theme in the high speed video industry. As a rough guide, most indoor shots require 500 to 2,000 watts of additional lighting. This is traditionally provided by shining a few high power spot lights on the target scene but, for smaller targets, the Olympus range of industrial light sources and light guides provide ideal illumination.

Simply providing a large wattage of light is not suitable for most applications. It is usually necessary to carefully focus and target the light, so general purpose floodlights are not normally useful in HSV work.

An illustration is given from the experience of the *i-SPEED* development team. A car parts manufacturer wished to view a rapid movement in the mechanism of a prototype seatbelt reel. The scene was illuminated with several 1,000 watt garden floodlights, but this was sufficient for only a few hundred frames per second. The lighting was removed and replaced by a single specialised 500 watt spotlight and this permitted operation at 1,000 fps. When faster operation was required, the spotlight was augmented by an Olympus Industrial light source and liquid light guide and this increased the operating speed to 4,000fps.

This example is included to show that the quantity of light is significantly less important than the concentration of light. Olympus representatives are able to supply specialised lighting which has been selected to be suitable for most high speed video applications.

## View Finder

In contrast with some inferior products, the Olympus *i-SPEED* camera presents the live image on the CDU or monitor screen at all possible times. Some menus do require the image to be obscured and the splash screen logo is used for this purpose. Also, the playback screen is used to display the contents of the memory buffer, rather than a live image. During the live view and the record process, however, the screen will display a live, colour, real time image, updated at 60 frames per second.

## Lenses

The choice of lens can make a dramatic difference to the video images obtained.

Choosing the lens must begin with the focal length, which is expressed in mm. A lens with a large focal length would normally be chosen when a small area is to be viewed or the camera is to be a long distance away from the scene, because a longer focal length means a greater magnification. This type of lens has the disadvantage of reducing the apparent distance between objects which are arranged axially with the camera. This is called foreshortening. Lenses with long focal lengths also tend to have a smaller maximum iris setting (higher f number) and are therefore dimmer than long focal length lenses.

A lens with a short focal length is chosen when a wide area is to be viewed, or the camera is to be placed near to the scene. Lenses with a very short focal length have the disadvantage of distorting the perspective of the image and this is called barrel distortion.

Normal lenses have a controllable iris or aperture. The iris controls the amount of light available to the camera. The higher the f number, the less light the lens transmits. Increasing the number by 1.4 times (e.g. from f/4 to f/5.6), is called 1 stop and halves the light throughput.

There is a secondary effect of reducing the iris (increasing the f number) and this is an increase in the depth of field. This means that the lens is more able to focus on close and distant objects simultaneously, so a small iris setting is advantageous.

This is in conflict with the normal HSV requirement for as much light as possible, especially at high speeds and fast shutter times.

Probably the greatest art in lens set-up is striking a balance between getting all objects in the scene into focus and having a bright enough image. It is advisable in general to operate with a smaller iris (higher f number) and add more light.

It is not possible to specify an ideal lens, because photography is dependant on the object being photographed, but an “average” lens for the Olympus *i-SPEED* would have a focal length of 25mm and an iris range of f/1.4 to f/22.

When purchasing lenses for the Olympus *i-SPEED* , it must be remembered that the CMOS imager is quite large in size, so a 1” format (minimum) lens is required.

# Chapter 9 Maintenance

## 9.1 Cleaning

*To prevent electric shock or damage to equipment, always disconnect from the power supply before attempting to clean.*

### Camera CMOS protective glass and CDU screen

Clean using lens tissues moistened with a solvent solution composed of 70% ether / 30% industrial methylated spirits. DO NOT use hard or abrasive materials.

### Camera cooling holes

Periodically inspect the camera cooling holes to ensure they are not blocked with fluff, dirt etc. Clean as necessary.

### General cleaning

Wipe equipment clean with a soft cloth dampened with a mild detergent solution.

## 9.2 Storage and transportation

### After use

Always pack the product in the kit case after use or for transportation.

### Padlock/Case strap

For security and to prevent inadvertent opening of the case during transportation, it is recommended that the padlock is fitted and the case strap is secured around the case.

## 9.3 Repair

The *i-SPEED* camera contains a user replaceable fuse located in the rear panel. There are no other user repairable components.

# Chapter 10 Spares and Accessories

## Spares

| | Part No. |
|---|---|
| Camera – Colour HG, 4Gb | K7506213 |
| Camera – Mono HG, 4Gb | K7506214 |
| Camera – Colour, 2Gb | K7505042 |
| Camera – Colour, 4Gb | K7505043 |
| Camera – Mono, 2Gb | K7505044 |
| Camera – Mono, 4Gb | K7505045 |
| Power Supply | K7505046 |
| Mains Cable – UK | 7145454 |
| Mains Cable – Europe | 7145462 |
| Mains Cable – USA | 7318375 |
| Instructions (English) | K5070384 |
| Get Started Guide | K5070396 |
| Quick Guide CD–ROM | K5070399 |
| Camera fuse (pack of 5) | 7502254 |
| Controller Cable, 3m | K7504982 |
| Remote Control Pad with integral cable | K7505047 |
| Ethernet cable | K7505048 |
| Ethernet crossover cable | K7505372 |
| Composite video cable | K7505049 |
| Feature Connector Cable | K7505050 |
| Trigger Switch | K7505051 |
| PCMCIA Compact Flash Adapter | K7505053 |
| Transit Case with Outer Sleeve | K7505054 |
| Combination Padlock | K7505055 |
| Internal memory upgrade from 2Gb to 4Gb | K7505069 |
| PC Software Security Keytag | K7505297 |
| Breakout Box | K7505308 |
| Case strap | K3931429 |

## Accessories

| | |
|---|---|
| Controller Display Unit | K7504248 |
| Controller Cable, 10m | K7504984 |
| 12V DC input cable | K7504985 |
| Compact Flash Card – 1Gb | 1163123 |

*In addition to the above items, a range of flash cards, tripods, lenses and lighting equipment is also available. Please contact Olympus for further information.*

## Software modules

| | |
|---|---|
| Basic | K7505657 |
| Basic to advanced | K1155430 |
| Basic to deluxe | K1155431 |
| Advanced to deluxe | K1155440 |
| External breakout box (data) | K1155455 |
| GPS/IRIG module | K1155456 |

# Chapter 11 Specifications

## 11.1 i-SPEED Camera

### Camera physical

| Dimensions | |
|---|---|
| Size | W 106mm x H 98mm x L 264mm nominal |
| Weight | 2kg nominal |

| Mechanical connections | |
|---|---|
| Tripod mounting | 1x standard tripod mount (¼" Whitworth thread) |
| Lens mounting | Standard C-mount |
| Back focus | Nominal position 17mm. C-mount can be screwed in 1mm & out 3mm. |
| | Rotary control locks the C-mount in position |
| Accessory mounting | 4x ¼" Whitworth thread fixing holes on the base |

### Electrical connections

| Power input | Lemo EGG.OB.304.CLV | | | |
|---|---|---|---|---|
| Pinout | 1 | Ground | 3 | +12V |
| | 2 | +12V | 4 | Ground |
| Input voltage | 12VDC ±10% | | | |
| Power consumption | Camera: 28W max<br>System: 36W max | | | |

| Fuse | |
|---|---|
| Type | 20 x 5mm cartridge (coin slot screw access) |
| Rating | 3.15AT 250V |

| Controller Connector |
|---|
| Standard LVDS connector, 26 way MDR |

| **Feature connector** | 26 way high density D sub female | | | |
|---|---|---|---|---|
| Pinout | 1 | +12V | 2 | Power ground |
| | 3 | Trigger input | 4 | Trig in ground |
| | 5 | Trigger output | 6 | Trig out ground |
| | 7 | Sync input | 8 | Sync in ground |
| | 9 | Sync output | 10 | No connect |
| | 11 | Analogue signal input 1 | 12 | Analogue in ground 1 |
| | 13 | Analogue signal input 2 | 14 | Analogue in ground 2 |
| | 15 | No connect | 16 | RS-232 ground |
| | 17 | RS-232 Tx (data out of iSPEED, not used) | 18 | Sync out |
| | 19 | RS-232 Rx. (data in to iSPEED, not used) | 20 | RS-232 ground |
| | 21 | No connect | 22 | S-Video Y |
| | 23 | S-Video Y ground | 24 | S-Video C |
| | 25 | S-Video C ground | 26 | No connect |
| Sync in | Level: 5V TTL, 12V maximum<br>Impedance: 10k ohms to ground ±10% | | | |
| Sync out | Level: 5V nominal TTL<br>Impedance: 50 ohms ±10% | | | |
| Trigger in | Level: 5V TTL, 12V maximum<br>Impedance: 10k ohms (pulled to +5V for trigger switch) | | | |
| Trigger out | Level: 5V nominal TTL<br>Impedance: 50 ohms ±10% | | | |
| Analogue signal input 1 and 2 | Level: 0 to 5V analogue<br>Impedance: 10k ohms to ground ±10%<br>Bandwidth: 100KHz minimum | | | |
| S-Video | Industry standard signals, NTSC / PAL as for BNC | | | |
| Power output | 12V @ 10W max | | | |

Note: Further data on Analogue input, sync and trigger can be found in System Performance

| | | | | |
|---|---|---|---|---|
| **Ethernet** | RJ45 | | | |
| Pinout | 1 | TXD1+ | 5 | NC |
| | 2 | TXD1- | 6 | RXD2- |
| | 3 | RXD2+ | 7 | NC |
| | 4 | NC | 8 | NC |
| Ethernet signal | 10 / 100 Base-T, auto switching | | | |
| Link (in RJ45) | Link status is indicated by two bi-colour red-green LED's: | | | |
| | Top red: 100Mb connection, half-duplex link | | | |
| | Top green: 100Mb connection, full-duplex link | | | |
| | Bottom red: 10Mb connection, half-duplex link | | | |
| | Bottom green: 10Mb connection, full-duplex link | | | |
| Activity (in RJ45) | Indicated by flashing of the appropriate LED in the appropriate colour (see above) | | | |
| **SVGA** | 15 way high density D sub female, PC standard | | | |
| Pinout | 1 | Red video | 6 | Red ground |
| | 2 | Green video | 7 | Green ground |
| | 3 | Blue video | 8 | Blue ground |
| | 13 | Horizontal sync | 10 | Sync ground |
| | 14 | Vertical sync | * | Other pins no connection |
| SVGA video output | SVGA (800 x 600) 60Hz | | | |
| **Composite video out** | BNC | | | |
| Standard | NTSC / PAL switchable | | | |
| Level | 1Vp-p | | | |
| Impedance | 75 Ohms | | | |
| **PCMCIA Port** | | | | |
| Standard | PCMCIA "memory card" format<br>ATA specification, Type II | | | |
| Vpp Level | 0V, 5V, auto select | | | |
| Vcc Level | 3V3, 5V, auto select | | | |
| Connection | Hot swappable | | | |

## Performance characteristics

| Resolutions, speeds & record times | |
|---|---|
| Sensor | CMOS |
| Resolution | 800 x 600 active pixels |
| Operating modes | Normal, Timelapse |
| Frame rate | Maximum: 33,000 fps<br>Minimum: 0.0667 fps (4 frames per minute time lapse)<br>Maximum for full resolution: 1,000fps |
| Economy modes | 3 each of Tall, Wide, Square |

**Nominal values of speeds and resolutions**

| Resolution H | Resolution V | Pixels per frame | Zoom ratio | Frame speed | Images in Memory* | Record time* |
|---|---|---|---|---|---|---|
| 800 | 600 | 480000 | 1.00 | 60 | 4473 | 74.55 |
| 800 | 600 | 480000 | 1.00 | 100 | 4473 | 44.73 |
| 800 | 600 | 480000 | 1.00 | 150 | 4473 | 29.82 |
| 800 | 600 | 480000 | 1.00 | 200 | 4473 | 22.37 |
| 800 | 600 | 480000 | 1.00 | 300 | 4473 | 14.91 |
| 800 | 600 | 480000 | 1.00 | 400 | 4473 | 11.18 |
| 800 | 600 | 480000 | 1.00 | 500 | 4473 | 8.95 |
| 800 | 600 | 480000 | 1.00 | 600 | 4473 | 7.46 |
| 800 | 600 | 480000 | 1.00 | 800 | 4473 | 5.59 |
| 800 | 600 | 480000 | 1.00 | 1000 | 4473 | 4.47 |
| 672 | 504 | 338688 | 1.19 | 1500 | 6340 | 4.23 |
| 576 | 432 | 248832 | 1.39 | 2000 | 8630 | 4.32 |
| 448 | 336 | 150528 | 1.79 | 3000 | 14266 | 4.76 |
| 384 | 288 | 110592 | 2.08 | 4000 | 19418 | 4.85 |
| 320 | 240 | 76800 | 2.50 | 5000 | 27962 | 5.59 |
| 288 | 216 | 62208 | 2.78 | 6000 | 34521 | 5.75 |
| 256 | 192 | 49152 | 3.13 | 8000 | 43690 | 5.46 |
| 224 | 168 | 37632 | 3.57 | 10000 | 57065 | 5.71 |
| 160 | 120 | 19200 | 5.00 | 15000 | 111848 | 7.46 |
| 128 | 96 | 12288 | 6.25 | 20000 | 174762 | 8.74 |
| 96 | 72 | 6912 | 8.33 | 30000 | 310689 | 10.35 |
| 96 | 72 | 6912 | 8.33 | 33000 | 310689 | 9.41 |

*Standard internal Memory 2Gb camera

| **Trigger** | |
|---|---|
| Trigger input | Position:<br>User controllable, variable in 10% steps as follows:<br><br>0% (recording stops one full buffer length after the trigger, so video clip starts at trigger moment)<br><br>100% (recording stops immediately, preserving previous video so video clip ends at trigger moment)Edge:<br>Programmable in menu system |
| Trigger output | Edge: Rising edge is trigger<br>Duration: 1μs high period approx.<br>Rise time: < 50ns<br>Missed frames: For synchronised cameras only, daisy chain operation will not cause any missed frames at the hand over point |
| Advanced Trigger modes | Record on command (ROC), Burst record on command (BROC) |

| **Analogue signal input 1 and 2** | |
|---|---|
| Frequency | User selection of sample rate, from frame rate to 100KHz maximum, subject to a further limit of 100 samples per frame |
| Phase | First sample is coincident with beginning of frame period and others are equally spaced thereafter |
| Resolution | Both channels sampled at 8 bits resolution |

| **Synchronisation** | |
|---|---|
| Sync output | Edge: Rising edge signifies start of frame period<br>Frequency: Frequency equals frame rate<br>Duty cycle: 1μs pulse |
| Sync input | Edge: Rising edge signifies start of exposure period<br>Frequency: Frequency equals frame rate |

| **Dynamic range extension** | |
|---|---|
| Type | Built in to CMOS Imager |
| Levels | Off, 1 to 7 |

| **Enhance** | |
|---|---|
| Type | 2 pole, 2 dimensional |
| Levels | Off, On, High, Extra |

| **Zoom** | |
|---|---|
| Type | Type 2 dimensional with smoothing |
| Levels | Continuously variable, (16 pixel granularity) |
| Smoothing | Bilinear interpolation, 4 coefficient |
| Automatic zoom | The image will automatically be zoomed to fill the screen |
| User zoom | The user is able to zoom in on an image in order to see more clearly |
| Zoom application | User zoom may be applied to both recorded and live images, but the image recorded into memory will be taken from the unzoomed area of the sensor chip. The area of the chip used will be determined by the economy mode setting and any windowing caused by frame speed increase |
| User pan | User pan and tilt facilities will be provided |
| Limit | The zoom engine will be limited to the range of 1:1 to 10:1 |

| **Shutter** | |
|---|---|
| Normal mode | Range: Frame time to frame time / 200 (200x), subject to the following limits, 5 μs to 1s |
| Time lapse | Range: 5 μs to 1s, limited to frame time |

| **Video update for Controller Display Unit & SVGA port** | |
|---|---|
| Refresh rate | The LCD will be refreshed at 60Hz, regardless of video or graphics activity |
| Playback rate | Video may be played back at speeds from stop frame up to 3,840Hz |
| Viewfinder mode | At all times, except during playback, video from the sensor will be displayed on the screen at an update rate of 60Hz. In timelapse mode, update rate will be equal to sensor speed |

| **Fixed pattern noise correction** | |
|---|---|
| Resolution | Full resolution of CMOS sensor |
| Effectiveness | Correction to 0.4% |
| Black reference | Automatic mechanical shutter |

| **White balance** | |
|---|---|
| Types | Auto white balance, single shot operation, no time limit on hold, and pre-set options |
| Range | To correct for daylight, fluorescent light, 60W mains tungsten (Anglepoise) and the full range of Olympus light sources. |
| Pre-Set Options | Tungsten, Daylight, Xenon, Metal Halide, UHP |

| **PCMCIA card interface** | |
|---|---|
| File type | The video will be saved in “*.AVI” and “*.BMP” format, non-compressed and with no audio channel, compatible with Windows 95/98/ME/NT/2000/XP |
| Filing system | FAT 32 style system, compatible with windows 95/98/ME/NT/2000/XP |
| Data | The user data and other information will also be saved to the PCMCIA card, locked to the relevant image |
| Card functions | Format, delete file, select clip start and end |

| **Real time clock & settings memory** | |
|---|---|
| Purpose | The system will retain the time of day and date while the power is switched off, along with key user settings |
| Retention time | The battery will power the clock for approx. 10 years |
| Battery type | Lithium coin cell |

### Software facilities

| General | |
|---|---|
| Camera ID | 0 to 20 |
| Languages | English, French, German, Spanish |
| TCP/IP Address | 4 byte, fully settable |
| **Measurement** | |
| Type | Relative to known object in image |
| Resolution | 1 pixel (operator dependent) |
| Measurements | Speed, distance, angle, angular velocity |
| Units | Individually selectable, cross calculations automatically performed |
| Colour | Cursor and text colours are user selectable |

## 11.2 Controller Display Unit (CDU)

| Dimensions | |
|---|---|
| Size | W 273mm x H 214mm x D 51mm nominal |
| Weight | 1.5kg nominal |
| Stand | A flip-out stand with ratchet positions of: -3°, 42°, 87°, 132°, 177°. When in the 177° position, the stand can be used as a hanger |
| **Connector** | |
| Type | Standard LVDS connector, 26 way MDR |
| **Electrical** | |
| Input voltage | 5V ± 10%, 12V ± 10% |
| Input power | <2W, <8W at nominal voltages, derived from camera |
| Resolution | 800 x 600 |
| Brightness | 350 cd/$m^2$ |

## 11.3 Remote Control Pad (RCP)

| **Dimensions** | |
|---|---|
| Size | W 51mm x L 123mm x D 23mm |
| Weight | 100g nominal |
| **Integral Cable Connector** | |
| Cable length | 2.0m nominal |
| Cable type | Round, multicore, screened |
| Connector type | Overmoulded LVDS, 26 way MDR |
| **Electrical** | |
| Input voltage | 5V |
| Input power | <1W derived from camera |

## 11.4 Cables

| **Ethernet cable** | |
|---|---|
| Length | 2m |
| Cable type | UTP, category 5 |
| Connectors | RJ45 |
| **Composite video cable** | |
| Length | 2m |
| Cable type | Coax |
| Impedance | 75 ohm |
| Connectors | BNC |
| **Controller cable (2 sizes)** | |
| Length | 3m (& 10m accessory) |
| Cable type | Multicore, double screened |
| Connectors | Overmoulded LVDS, 26 way MDR |
| **Feature connector cable** | |
| Length | 2.2m overall, bound length 2.0m, tail length 0.2m |
| Cable type | Multiple coaxes in a plastic sheath, with breakout moulding |
| Connectors | Camera: 26 way high density D SUB male<br>Users equipment: 6x BNC jack<br>1x 4-pin mini-DIN socket for S-Video |

| 12V DC cable accessory | | | | |
|---|---|---|---|---|
| Length | 2.2m | | | |
| Cable type | 6 core, round | | | |
| Connectors | Lemo FGG.OB.304.CLAD52Z | | | |
| User equipment connector | XLR-3M | | | |
| Pinout | 1 | +12V | 2 | Ground |
| | 3 | N/C | Body | Braid screen |

## 11.5 Power supply

| Dimensions | |
|---|---|
| Size | 130mm x 58mm x 30mm nominal |
| Weight | 0.4kg nominal |
| **Mains input** | |
| Socket type | IEC |
| Fuse | Internal, not user replaceable |
| **Power output** | |
| Lead length | 2.2m nominal |
| Connector | Lemo FGG.OB.304.CLAD52Z |
| **Electrical** | |
| Input | 100–240VAC ± 10%, 50-60Hz |
| Output | 12VDC, 36W minimum |

## 11.6 Trigger switch

| Dimensions | |
|---|---|
| Size | L 90mm x 20mm diameter nominal |
| Weight | 60g nominal |
| Cable | Integral, black, 2m nominal length, with strain relief |
| Connector | BNC with strain relief |
| Switch | Press to close, momentary |

## 11.7 Internal memory upgrade

*i-SPEED* has a maximum internal memory capacity of 4Gb. An upgrade from 2Gb to 4Gb is available, fitted at Olympus Service Centres.

## 11.8 Regulatory Status

CE

This mark on the *i-SPEED* camera indicates conformity with the requirements of EC Directives 89/336/EEC relating to electromagnetic compatibility and for the 12V DC power supply, compliance with Directive 73/23/EEC, as amended by 93/68/EEC, relating to electrical equipment designed for use within certain limits (Low Voltage Directive). The *i-SPEED* camera has been designed and tested to meet the requirements of the following standards:

| | |
|---|---|
| EN 61000-6-4:2001 | EMC Emissions |
| EN 61000-6-2:2001 | EMC Immunity |
| EN 61000-3-2/3:2000 | |
| EN 60950 | Electrical Safety |

## 11.9 Environmental

| | |
|---|---|
| Temperature | Operation: 0˚C to +40˚C<br>Storage: -20˚C to +60˚C |
| Pressure | 71kPa to 106kPa |
| Relative humidity | 95% at 40˚C non-condensing |
| Fluid ingress | All items: No resistance to fluid ingress |
| Attitude of operation | All items will be capable of operation in any orientation |
| Attitude of storage / transit | All items will be capable of storing / transporting in any orientation |

## 11.10 G-rating

| | |
|---|---|
| *i-SPEED HG* | **Shock test to IEC 68-2-27 Test Ea**<br>Test level: 100G<br>Pulse duration: 11ms |
| *i-SPEED* | Not rated |
| CDU | Not rated |
| RCP | Not rated |

## 11.11 Compatibility

| **Interchangeability** | |
|---|---|
| Any item in the standard set or accessories may be changed for another identical item and the system will still function correctly. | |
| **External compatibility** | |
| Light sources | ALS-150U, KLS-3250, ILH-2 series, ILK-7 series, ILV-C1, ILK-C ILV-2, ILP-1 |
| Borescopes | Series 5 Borescopes, IFxD4 Fiberscopes, IFxC5 Fiberscopes |
| Adaptors | AK2-10C, AK2-5C, AK2-20C, AI-10C, AI-11C, AI-12C |
| Lenses | Standard range of C-mount lenses:<br>12-75mm (2/3" format zoom)<br>6.5mm, 12.5mm, 25mm, 50mm, 75mm (1" format fixed focus) |
| TV monitors | PAL, NTSC and auto selecting video monitors, NTSC LCD monitors |
| PC monitors | Standard PC SVGA compatible monitors |

## 11.12 End of life

The product incorporates batteries and PCB's and must be disposed of in line with current legislation. The camera and accessories should be returned at the end of life to an Olympus Service Centre for disposal.

The Olympus *i-SPEED* is Made in the UK by KeyMed, an Olympus group company.

Issue 5
March 2004

OLYMPUS

## OLYMPUS CORPORATION

Shinjuku Monolith, 3-1 Nishi-Shinjuku 2-chome, Shinjuku-ku, Tokyo 163-0914, Japan
Fax: (03) 6901-4911 Telephone: (03) 6901-4038

## OLYMPUS EUROPA GMBH

(Premises/Goods delivery) Wendenstrasse 14-18, D-20097 Hamburg, Germany
(Letters) Postfach 10 49 08, D-20034 Hamburg, Germany Telephone: (040) 237730

## OLYMPUS INDUSTRIAL AMERICA INC.

One Corporate Drive, Orangburg, N.Y. 10962, U.S.A.
Fax: (800) 233-0697 Telephone: (866) 642-4725

## KEYMED LTD.

KeyMed House, Stock Road, Southend-on-Sea, Essex SS2 5QH, United Kingdom
Fax: (01702) 465677 Telephone: (01702) 616333

## OLYMPUS SINGAPORE PTE LTD.

491B, River Valley Road #12-01/04, Valley Point Office Tower, Singapore 248373
Fax: 834-2438 Telephone: 834-0010

## OLYMPUS MOSCOW LIMITED LIABILITY COMPANY

117071, Moscow, Malaya Kaluzhskaya 19, bld. 1, fl.2, Russia
Fax: (095) 958-2277 Telephone: (095) 958-2245

## OLYMPUS AUSTRALIA PTY. LTD.

31 Gilby Road, Mount Waverley, Victoria 3149, Australia
Fax: (03) 9543-1350 Telephone: (03) 9265-5400