

# F I + Z Lens Control

Rev 3.0



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## I. Introduction

**A. System.** The classic FI+Z, wireless lens and camera control system is known worldwide for its combination of precision, simplicity and ruggedness. It consists of the Hand Unit, Motor Driver, a set of Digital Motors, a Micro Force zoom control, and a variety of optional controls including wireless Focus/Iris, Zoom, and F/X units. The FI+Z system controls the complete array of both lens and camera functions

**B. The Hand Unit 3** adds impressive new features and functionality to the system. It integrates its 30 channel 2.4GHz wireless link into a new splash-resistant housing. The built-in microwave antenna is protected from impact. The iris slider uses a unique non contact technology to eliminate the opening required for a conventional sliding seal. The Hand Unit digitizes focus, iris, and zoom commands to 16 bits of resolution (1 part in 65,536). This data is sent to the 3 Channel Motor Driver either through a cable or the Microwave Link. The cable link uses the RS422 standard protocol to transmit data over a single twisted pair of wires. This enables reliable transmission over long distances (1 km).

New software called "Lens Mapping" matches the focus distance marks of a lens to a set of five pre-printed Focus Marking Rings. These rings differ in their minimum focus distance from 9" (.35m) to 6' (2m). Once a lens is calibrated, it can immediately be used with any of the focus rings. The on-board lens library holds data for 150 lenses. Calibration for a lens change only requires the few seconds needed to choose the lens from the library.

A bright, sharp, organic LED display shows camera, lens, and Hand Unit set-up status. Focus distance settings can be displayed digitally for Cooke i-Lenses, or any lens which has been calibrated to the unit. Data from compatible ultrasonic or laser measuring devices (Panatape, Cinetape, Sniper ) can be displayed .

A new focus display mode "Marks" gives an easy to interpret bargraph representation of the difference between the distance set by the focus knob and reference marks entered by the user. Multiple reference marks can be set by entering their position with a "soft key" located below the display.

Ergonomics have been improved with the addition of an integrated hand grip and a molded grip for the focus knob. The focus marking ring is automatically illuminated in low light conditions by a pair of white LED's. The zoom bargraph shows both the zoom lens position as well as user set end limits. End limits are set with Set/ Reset tactile switches arranged in three groups. An LED in each group indicates when limits are active.

The HU3 allows for programming camera speed and shutter angle. Despite all of its additional functionality, the weight of the new hand unit is about 20% less than its predecessor. Power is provided by widely available FM-50 Li-Ion batteries.

**C.** The zoom function is implemented by a **Micro Force** control. It can be directly connected to the Hand Unit using a bracket or operated remotely using a cable. The camera may be started either from the Micro Force or from the Hand Unit.

**D.** The **Remote Iris Box** provides a separate control for the Iris function. It is automatically enabled when plugged into the Iris accessory connector on the Hand Unit.

**E. Optional wireless units** allow various lens and camera control functions to be split off from the Hand Unit functions. The **Focus-Iris** unit is a single channel hand control. When active, it takes over either the focus or iris function from the Hand Unit. The **F/X unit** adds camera speed ramps with iris and/or shutter compensation as well as recording and

playback functions. The **Radio Micro Force** module allows the zoom function to be split off from the Hand Unit.

F. The **Motor Driver (MDR2)** supports 3 motor channels, camera run/stop, and camera speed and shutter control. It provides control over the speed and shutter angle over all of the major film cameras in use today that support external control. The 30 channel transceiver allows the simultaneous operation of both the Hand Unit 3 as well as the **optional wireless hand units** listed previously. An integral voltage booster allows for operation over a voltage range of 11 – 28 VDC. Switches are provided for adjusting Motor Torque and reversing direction.

G. **DM-1X and DM-2** digital motors provide the ultimate in power and reliability. They have proven their toughness under extremes of temperature, humidity and vibration. Their housings are machined from solid magnesium billets and protected by a special ceramic coating before painting. This provides exceptional resistance to salt spray and moisture.

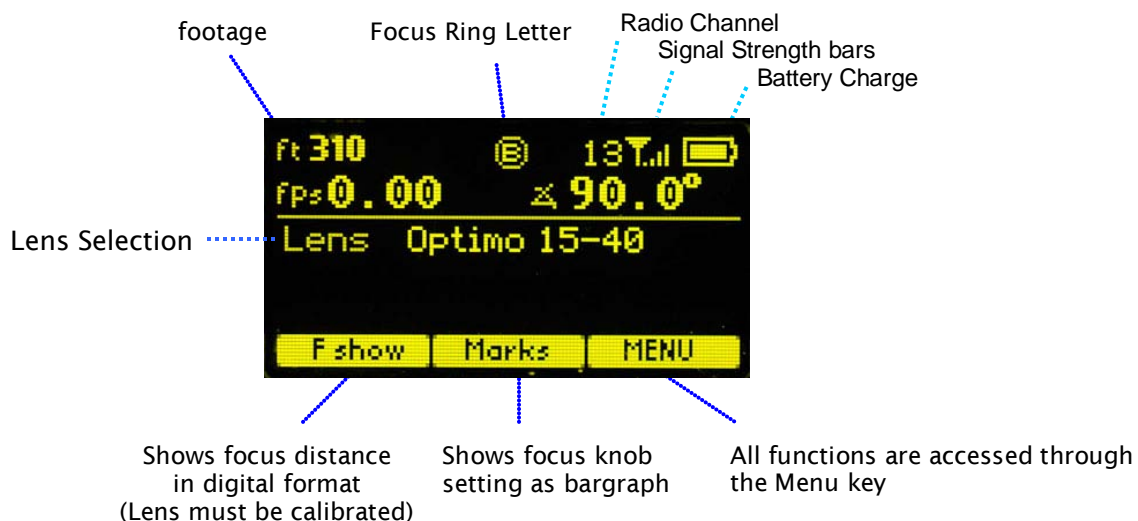
## II. FI+Z Basic Operation Summary.

### A. Set-up the Motor driver (MDR2) and Digital Motors.

- Slide the motor brackets onto the matte box support rods. Position the motors and brackets so that the motor gears mesh with the corresponding lens gears. Couple the lens motors to the lens gears. Adjust the motors to have minimum backlash and tighten the handles of the motor brackets. Do not couple the motor to the lens too tightly or binding will result. Check that the motor brackets do not flex or slip on the matte box support rods. For normal lenses, the Torque adjustment switches can be set in the middle position of their range. Connect the motor cables from the motors to the MDR2.
- Use the appropriate camera cable to connect the MDR2 to the camera accessory receptacle. Please note that a special molded “Y” cable is required to control both the speed and/or shutter angles of 24V Arri cameras (p/n #4535) and Panavision Millennium (p/n #4537).
- Connect the power cable from the MDR to the camera or battery power receptacle.
- Apply power to the MDR2. Press the reset button. The motors will calibrate themselves to the mechanical span of the lens rings.
- Select the MDR wireless channel with the channel selection switches on the top cover. Set the slide switch on the MDR2 cover to **Radio**.

### B HU3 Set-up

- Install the FM50 battery.
- Press the Power Switch momentarily. The **main display screen** will appear.



Main Display Screen

To turn off the power to the unit, press the Power Switch for 3 seconds.

- c. If the ft and fps text appear in the upper right corner of the display, the HU3 and MDR are both set to the same wireless channel. If the wireless channels of the HU3 and MDR do not match, the message **No Host!** will appear in the upper left corner of the display replacing the ft and fps text.
- d. Match the HU3 wireless channel to the MDR:



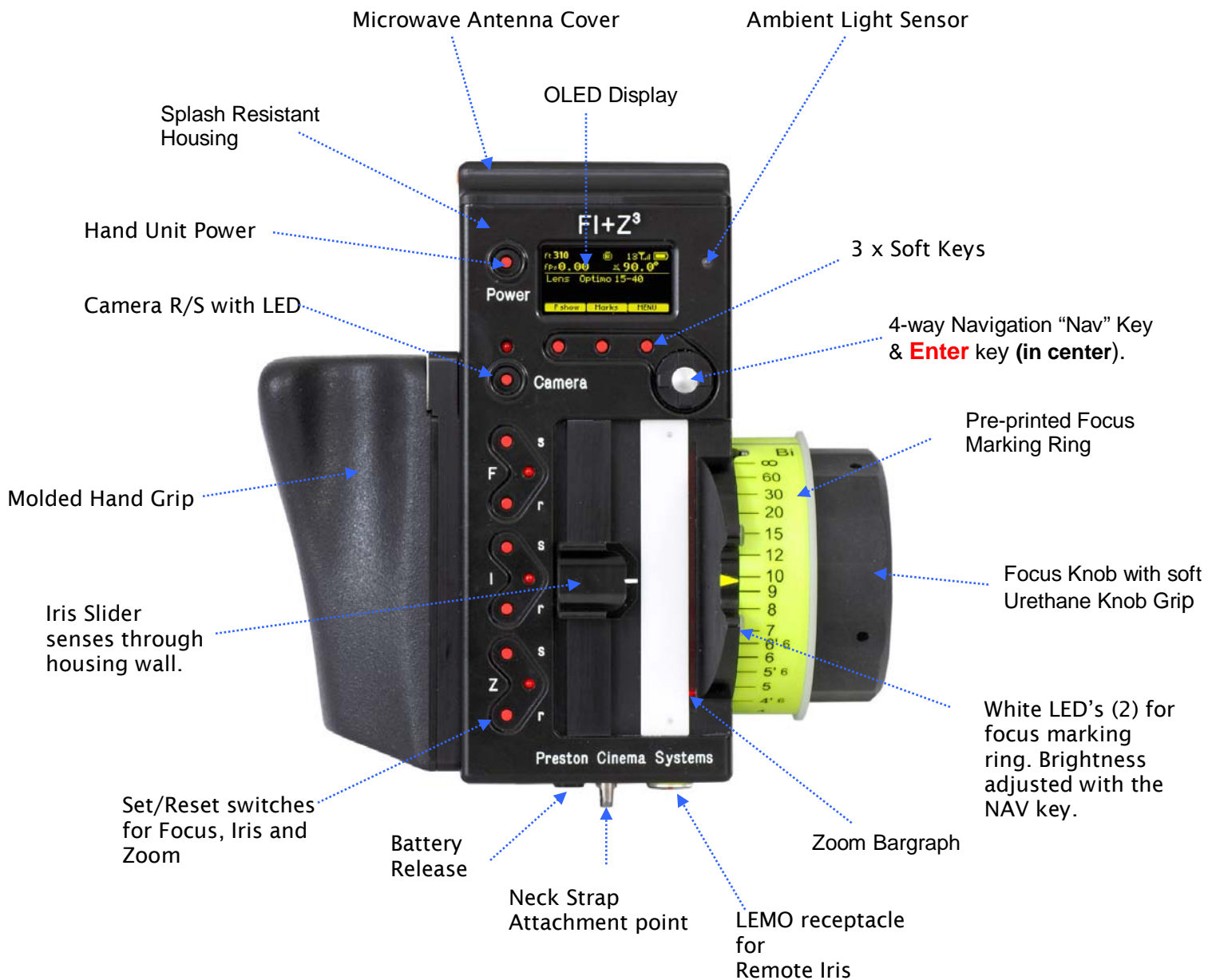
Menu Screen: Channel Selection

- Press the **Menu** soft key. “Channel” will be highlighted. Use the Nav key to move the selection to the right. Change the channel number with the Nav key to match the setting of the MDR.
  - The Signal Strength bars will appear. To return to the main menu, press the Nav key left.
- e. To use a blank focus marking ring, turn off the Focus mapping:



- Press the **Menu key**.
  - Select **Lens**.
  - If the name of a lens appears to the right of “Lens”, press **Fmap OFF**.
  - The HU3 is now ready for basic operation. The blank focus marking ring, and iris marking strip can be used to mark lens calibrations.
- f. **Focus mapping** eliminates the need to manually mark separate rings for each lens. Data from the lens library is matched to pre-printed focus marking rings. This makes process of lens changing quick and efficient. A detailed description of this function showing the display screens is given in section III. To calibrate the focus marking ring to a lens in the library:
    - Press the Menu key.
    - Use the Nav key to select Lens.
    - Press Choose.
    - Select the lens location (All lenses, My List A.....)
    - Select the lens and press **OK** or the Enter key (**the center of the Nav key**).
    - Set the lens to infinity (as directed) and Enter.
    - Return to the Lens selection in the Menu.
    - Press Ring and choose a focus ring with the desired near focus.
    - Install the same focus ring on the focus knob.

- g. **Programming the Camera Speed and Shutter angle.** Use the Nav key to select **Camera** from the Menu screen.
- Press **Choose** to select camera type.
  - **Set-up** shows the camera speed and shutter angle menu.
  - To enable HU3 control of camera speed and shutter, select **Yes** for Speed, Shutter.
  - Use the Nav key to select the Speed, and edit the value on the right.
  - Common speeds and shutter angles are available from lists. The **List** soft key appears when the Nav key selects either the speed or shutter angle value for editing.
  - Programming the camera speed and shutter angle is described in detail in section III. The camera speed and shutter angle are displayed in real time in the upper right corner of the display.



**Hand Unit 3 Functions**

### III. Hand Unit 3. Detailed Description

#### A. Grip Configurations.

1. The Hand Unit can be set-up with a molded Hand Grip for Focus and Iris control or with the Hand Grip replaced by a flat cover to accommodate a bracket and Micro Force zoom control.



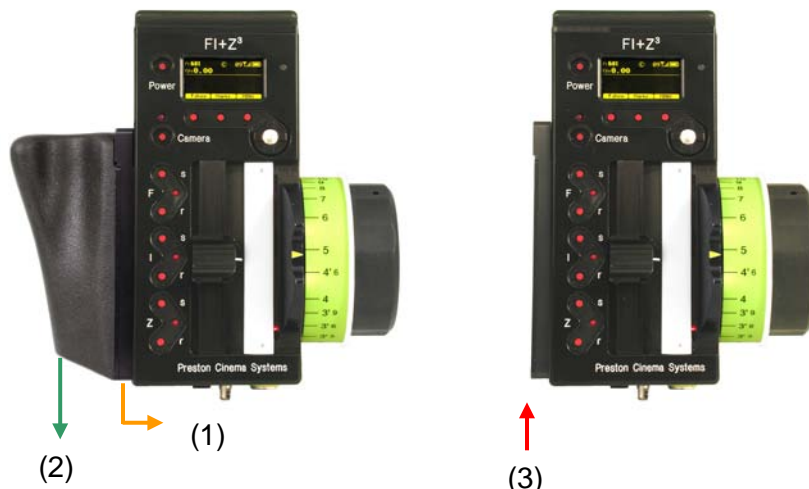
HU3 with Hand Grip and Quick Release Plate



HU3 with Micro Force and bracket 4336

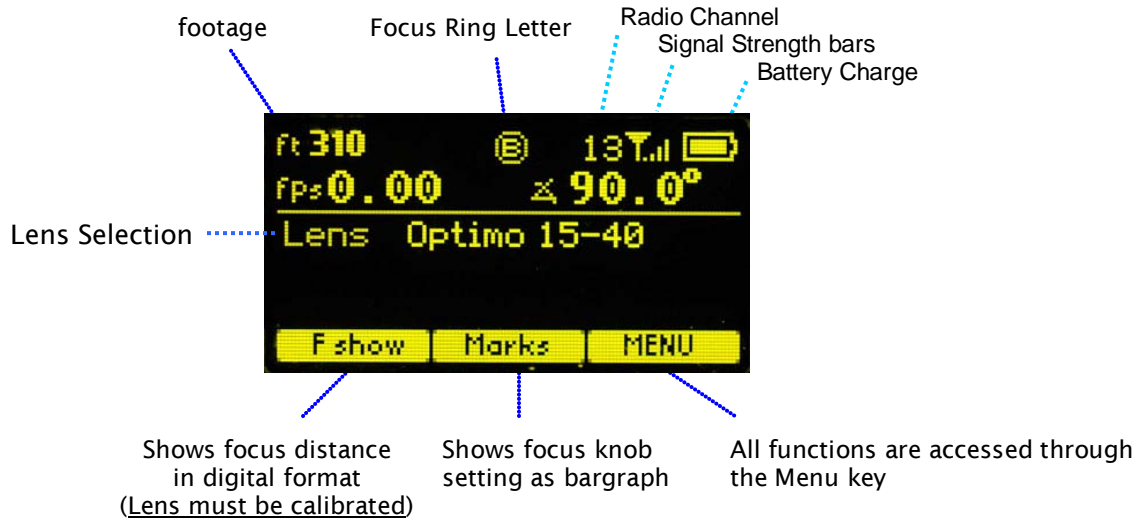
2. **Removing the Hand Grip.** The Handgrip is removed to allow the bracket for the Micro Force to be installed.

- Press the Grip Release toward the HU3 housing (1).
- Slide the Grip downward (2)
- Replace the Grip with the cover (3).
- Install the Micro Force bracket using the threaded hole at the rear of the HU3.



**B. Set-Up and Operation**

- 1. Main Display Screen.** Press the Power Switch momentarily. The OLED display will show the Main Display Screen :



**Main Display Screen**

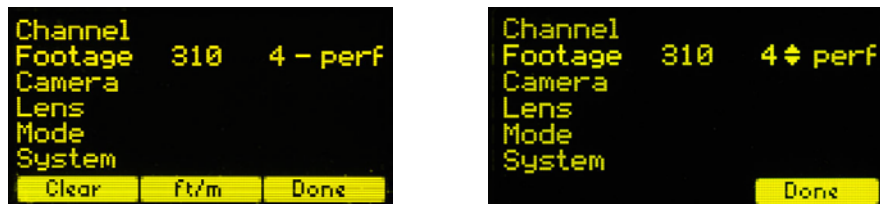
- 2. Menu Screen Options.** Press the **MENU** soft-key; the MENU screen appears:
- 3. Select a radio Channel** to match that of the Motor Drive:



**Menu Screen: Channel Selection**

Press the right side of the NAV key to highlight the Channel number. Change to the desired channel by pressing the top and bottom pads of the Nav key. The antenna icon and bars indicate the presence and signal strength of MDR2 units on that channel.

- 4. To reset the Footage counter** use the Nav key to highlight Footage, and press **Clear**. Units are changed with the **ft/m** soft key. Change the movement type by pressing the right side of the Nav key; 4, 3, and 2 perforation pull down are supported.



**Footage Counter menu**

**Movement Selection**



5. The **Camera** selection (Fig 1) provides for control of both camera speed and shutter angle for those cameras supporting remote operation. Pressing **Choose** brings up the Manufacturers folders (Fig 2). Pressing **Choose** again brings up the list of supported cameras (Fig 3).



Fig 1



Fig 2



Fig 3

Press the left pad of the Nav key to return back to the **Camera** selection. Press the **Set-Up** key to bring up the camera Control menu (Fig 4). Use the Nav key to select and then modify the camera speed and shutter angle. The **List** key appears when editing either a camera speed or shutter angle. Pressing this key brings up tables containing commonly used camera speeds and shutter angles (Fig 5, Fig 6).

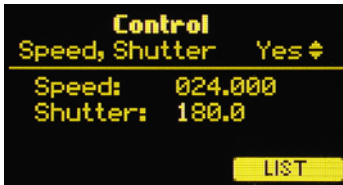


Fig 4



Fig 5

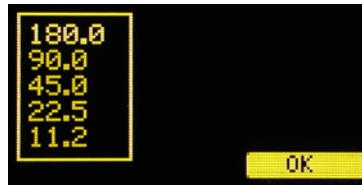


Fig 6

6. Selecting **Lens** with the Nav key allows lenses to be calibrated and their data to be stored in the on-board library. The Focus Mapping software matches the witness marks of calibrated lenses to the printed scales on the lens rings. The **Ring** key (Fig 7) is used to match the installed focus ring letter (A – E). The screen shown in figure 7 indicates that the HU3 is calibrated for a 21 mm T2 lens.

The **Choose** key brings up the list of folders containing lens data (Fig 8). The **All lenses** folder contains data on all of the lenses stored in the HU3 lens library. The Library stores up to 150 lenses. **Next** brings up the contents of the selected folder (Fig 10).

The folders **My list A**, **B**, and **C** are used to store up to 15 lenses (3 screens) so that they can be accessed quickly without having to scroll through the complete list. Pressing **Add** allows a lens to be copied from the lens library to the **My list** folder (fig 12).



Fig 7



Fig 8



Fig 9

To use a lens from the library, choose one of the folders shown in Fig 8, select the manufacturer (fig.9, and the lens (fig.10) using the Nav key and press either **OK** or **ENTER**. Use the focus knob to set the lens to infinity as shown in Fig 11 and press **ENTER**.



Fig 10

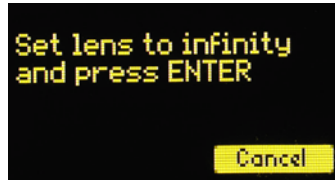


Fig 11



Fig 12

To **calibrate** a new lens:

- Name the lens
- Use the Edit function to enter the lens focus data.

To **name the lens**, go to the Lens selection screen (FIG 7), press **Choose**, select **All lenses** (Fig 8), and select a manufacturer's folder to store the lens data (Fig 9).

Press the **New Lens** key (Fig 10) and you will be asked to select the lens name (Fig 13 ). The lens name is entered by using the Nav key to select the characters in the table (Fig 14), and shifting the character places with the arrow keys (▶ ◀). When finished, press **Enter** and the lens name (Test) appears in the selected manufacturer's folder (Fig 15).



Fig 13



Fig 14



Fig 15

To complete calibrating the lens named "Test", press **Edit** (Fig 15). Select **Calibrate** with the Nav key (Fig 16), and press **OK** or **ENTER**). The close focus distance for the lens is entered in Fig 17 by using the Nav key to scroll through the list shown on the left of the screen, setting the lens to the same distance with the focus knob, and pressing **Enter**. If the close focus distance mark of the lens is not listed, choose the next greater distance that is on the list. For example if a lens has focus markings at 8", 9", 10"...choose 9" as the close focus, since this is the next greater distance which appears on the list.



Fig 16



Fig 17

Note: When calibrating a close-focus lens, choose a close focus mark approximately one full turn of the lens ring (or less) from the infinity mark, rather than the minimum focus of the lens. The six calibration points provide excellent accuracy for a single turn of the lens. Using a larger span can diminish this accuracy.

Press **Next** and continue entering the remaining focus distances (a total of six distances plus infinity). Pressing the Nav Key left allows re-entering previous distance calibrations.

When this procedure has been completed, an icon with the letter c appears on the right hand side of the lens name, indicating that the lens has been calibrated (Fig 10).

Return to the Menu Screen (fig 7), and press **Ring** to select a ring (A - E) for metric and Ai - Ei for imperial) to match the close focus of the lens. The tables below show the near focus distances for both the rings calibrated in imperial and metric units.

Ring	Ai	Bi	Ci	Di	Ei
Near Focus	9"	18"	24"	36"	72"

Ring	A	B	C	D	E
Near Focus	.25m	.50m	.70m	1.0m	3.0m

Note that any focus ring can be used with any lens. The ring can be chosen to best use the mechanical range of the focus knob. For example, if the closest subject distance is 6' while the lens has a close focus of 18", the Ei ring would allow maximum focus knob travel - covering infinity to 6', while the Bi ring would allow focus down to 18". In the latter case, the focus knob movement from 6' to 18' would not be used.



7. The **Operating Mode** is changed by using the Nav key to select Mode and then pressing **Choose**. The four modes are:

- Normal
- Snorkel
- Custom
- 3D

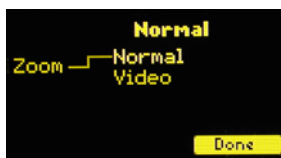
The **Normal** mode is defined by having each of the motor channels controlled by the corresponding channel of the Hand Unit. Within this mode there are two ways the zoom control can operate, Normal and Video.

The **Normal Zoom mode** means that the Hand Unit controls the position of the zoom motor and this position is shown on the zoom bargraph display. Limits can be set to the zoom range using the Set/Reset keys.

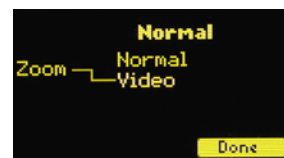
The **Video Zoom mode** allows the MDR to control the internal motor of video lenses. Instead of displaying the position of the zoom motor, in this mode, the zoom bargraph display indicates the velocity of the zoom motor. Therefore limits on the zoom range cannot be set. A video zoom cable is required to connect the MDR2 to the video lens.



Normal Mode



Normal Zoom  
with digital motor



Video Zoom

The **Snorkel mode** is used to implement the pan and horizon functions of the Revolution snorkel (or similar lenses) that require synchronizing horizon rotation to the pan rotation with a ratio of 1:2. This mode is indicated by the letter **S** in the main screen to the left of the radio channel indication. When the system is in this mode, neither the iris nor the zoom motor will calibrate. This is because the Snorkel lens doesn't have mechanical stops on the pan and horizon axes.

The **Custom mode** has two functions. The first allows the three MDR motor channels, focus, iris, and zoom to be assigned to user designated Hand Unit controls. For example, the focus knob of a single hand unit can control the focus rings of three separate lenses simultaneously. This mode is indicated by the icon **C** in the main screen.



Custom Mode



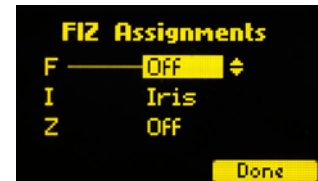
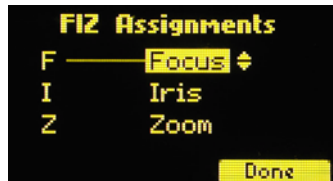
Snorkel Icon



Custom Icon

The **Custom mode** is configured by pressing **Set-Up**. The Assignment screen appears in the left figure below. The letters F, I, Z on the left column represent motor channels of the MDR and the column on the right hand unit functions. The display indicates that the Iris channel of the Hand Unit will control both the Focus and Iris motors, while the zoom motor is controlled by the Micro Force zoom control.

To change the assignments of a hand unit control, use the Nav key to select and change a Hand Unit control function in the right column. The middle figure below shows the Focus function selected.



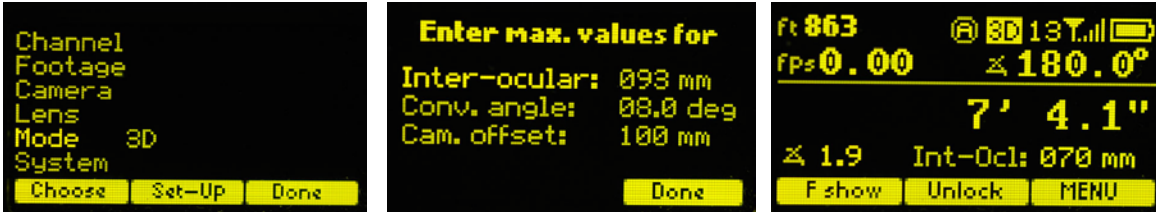
A hand unit function can also be turned off as shown in the figure above, right. This choice is used when a single function hand unit (Focus/Iris or Radio Micro Force zoom) is used to exclusively split off a function from the HU3. In the "Normal" mode of operation, when the MDR detects the presence of a single function hand unit, the MDR will respond to it rather than to the HU3. When the single function unit is no longer detected, control will automatically revert back the HU3. The corresponding lens position will therefore change back and forth between the setting of the HU3 and the other hand unit.

In situations where the lens setting must be controlled only by the single function hand unit, the corresponding HU3 channel should be set to "Off".

The **3D mode** is used in conjunction with user supplied 3D rigs which have motorized control of both the camera convergence angle and inter-ocular camera separation. After the user sets the convergence distance, the inter-ocular distance can be changed "on the fly" and the convergence angle will automatically change to maintain the correct convergence distance.

The 3D mode display (left, below) has a Set-Up soft key. Pressing this key allows the user to input the **maximum values** for Inter-ocular separation and Convergence angle. The camera offset value is the distance from the pivot point of the convergence axis to the lens nodal point. Please refer to the reference drawing for 3D rigs on page 21.

Returning to the main display screen, pressing the Fshow soft-key shows the Convergence Distance, Convergence Angle and Inter-ocular distance.



3D Mode selection

3D Set-Up

Main Display for 3D Mode

8. The **System Menu** reports the installed firmware version, scans for other FI+Z systems operating in the vicinity, sets-up the operating mode for the LED's that illuminate the focus rings, and specifies the focus distance units ( imperial/metric).



Fig.1

Fig. 2

Fig. 3

Press the **ENTER** key (fig.1) to see the System Info screen (fig. 2). Press Units (fig.1) to change between imperial and metric units (fig.3).

The **System Info** (fig.2) menu provides the Network scanning function and the **Light** set-up for the focus ring.

Press the **Network** soft key (fig.2) to display a list of active FIZ systems in the vicinity. The Occupied Channels list shows both the Occupied Channels and their signal strengths.

Press the **Light** soft key (fig.2) to display the options for the focus ring (fig.5). The **Auto** option turns on the light automatically under dim conditions. The options may be selected by using the Nav key to highlight the desired choice.



Fig.4

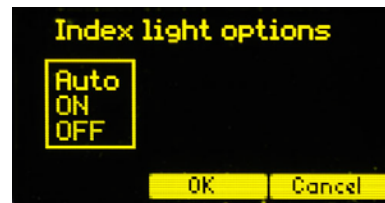


Fig.5



9. **Lens Limits** can be set using the three groups of set/reset (s/r) keys. To set a limit, move the motor to the first limit and press the set (s) key. While keeping the s key pressed, move the motor to the second limit and release the s key. The limit is now set and indicated by a lit LED.

To remove a limit, press the reset key r.

The Zoom bargraph indicates the off-limits areas of the zoom range by two lit strips of LED's. The span of the allowed travel corresponds to the length of the un-lit LED's.



Iris and Zoom LED's show limits set

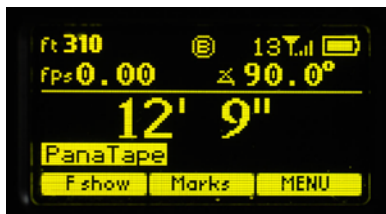
Lens limits can be used to lock a motor to a given position. This is done by setting a zero-span, where the beginning and end of the range are the same point. To lock a motor, position the motor to the desired point and press the set button twice.

#### 10. Panatape and Cine Tape Interfaces.

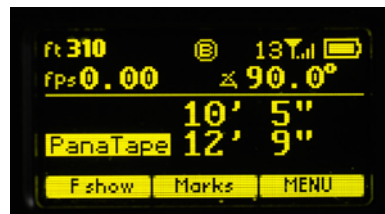
The Panatape and Cinetape units can be used to provide a distance reference that is displayed by the HU3 main display screen.

The Panatape interface p/n 4534 connects the data receptacle (5-pin Lemo) on the Panatape to the 4-pin Serial receptacle on the MDR2. MDR2 units with the 3-pin Lemo receptacles require a hardware update.

The Cine Tape interface (p/n 4542) connects the Remote Lemo receptacle of the Cine Tape to the 4-pin Serial receptacle of the MDR2.



Default with Panatape



**Fshow display options**  
Dual display with Panatape



Default display, lens name

The Panatape/ Cine Tape data will be displayed as soon as the interface is connected to the MDR2. Pressing the Fshow button switches the display from the remote distance measuring device to a dual display and finally to the default display showing the selected lens as shown in the three figures above.

11. **Software updates** can be downloaded from the website <http://www.prestoncinema.com/downloads.html>. To load an update into the HU3:

- Install the boot loader program from the CD which is shipped with the FI+Z system to a PC.
- Make sure that the Hand Unit is not powered.
- Connect the serial cable 4651 (serial connector to 4-pin Lemo) between the serial port of the pc and the Serial receptacle on the rear cover of the HU3.
- For laptops without a serial connector, use a USB to serial adapter.
- To initiate the update, open the HU3 update program on your PC. While holding the iris set button down, press the Power button of the HU3. Release all buttons.
- The HU3 display will show the message "Ready to load".
- The display on the PC should now report that it has found a connection to the HU3 and ask whether you want to proceed with the update. Choose yes. After the program has completed the update, you can remove the serial cable from the HU3.

## 12. Remote Iris Unit

A socket is provided on the bottom of the HU3 for an external Iris control. When the external iris control is connected, the slide control on the FIZ will be disabled.



Remote Iris Box p/n 4020

13. **Focus Ring Light**. Under low light conditions, two white LED's will automatically illuminate the Focus Ring.

To **Change the brightness of the LED's**: tap the top/ bottom of the Nav key to increase/decrease the brightness level.

## IV. MDR. Detailed Description



MDR2 with 15mm rod bracket p/n 4335 and swing arm p/n 4302



MDR2: Torque and Direction Switches



Channel Selector Switches

The three channel Motor Driver (MDR2) is responsible for driving the motors, providing control signals to the camera, and transferring camera operating data to the wireless network through the transceiver module.

The MDR2 uses a lens calibration sequence to determine the mechanical limits of the zoom, focus, and iris rings of the lens. This sequence is initiated whenever the Reset button on the MDR is pressed, or whenever a motor is connected to the Motor Driver. Lens calibration allows for precise, repeatable marks and also prevents accidental damage to the lens or Digital Motor. An internal memory stores the positions of a calibrated lens for 12 hours without external power.

To further protect the lens and driver electronics, the motors are electronically torque limited and electronic motor stall protection is provided. In addition, self-resetting thermal fuses protect all three channels. This insures that even in the event of improper calibration, the motors will remain protected from overheating.

The Direction Reversing and three-level motor torque switches are located adjacent to each of the three motor connectors.

Camera control signals are provided at the "Camera" receptacle of the MDR2. Signals are available both for run/stop as well as for controlling the camera speed and shutter angle. This receptacle also accepts real-time speed, shutter angle and run/stop status data from the camera and transmits it via the Microwave Link to the HU3 as well as all the other wireless units set to the same channel. In addition, the camera receptacle provides the signals required for VTR start and internal zoom drive for Sony cameras as well as Canon and Fujinon video style lenses with integral zoom drives.

The Microwave Transceiver is located in the lid of the MDR2. It provides wireless bi-directional communication between the MDR2, Hand Unit, F/X unit and other clients in the wireless network. In addition, it contains a voltage booster enabling MDR operation over an input voltage range from 11 to 30 volts.

The wireless channels are selected by turning the two channel switches located on the MDR2 top cover. There are 30 channels numbered 0 – 29. Channels above 29 repeat the sequence, so that channel 30 is the same as channel 0, and so on.

A slide switch on the cover selects between Cable and Radio operation.

The software controlling the MDR-2 is updated through the "Serial" receptacle and the Serial-PC cable that connects the MDR to the serial "D" connector of a PC. Software updates are available either as a CD or download from our web site: [www.prestoncinema.com](http://www.prestoncinema.com).



To initiate the update, open the MRD2 update program on your PC. The program CD and a serial cable is included with the MDR2. Remove power from the MDR2. Connect the serial cable between the PC and MDR2 serial receptacle. Open the MDR2 update program. While holding the reset button down, apply power to the MDR2. Release the reset button. The program should now report that it has found a connection to the MDR2 and asks whether you want to proceed with the update. Choose yes. After the program has completed the update, you can remove the serial cable from the MDR2.

The serial receptacle is used for additional purposes:

- It can accept motion control commands from an external computer using RS-232 data.
- It can accept data from the Panatape device using the Panatape interface cable p/n 4534. The distance data is displayed on the Main Display screen.

## V. Digital Motors



DM-1X



DM-2



DM-3

There are three types of digital motors used in the FI+Z system. All of the motors use digital encoders to provide positional feedback to the MDR unit. Digital encoders are highly reliable and do not suffer from wear.

The DM-1X is a high speed and high power motor. It is specifically recommended for driving the focus ring of cinema lenses.

The DM-2 is a smaller and lighter weight motor. It is recommended for driving the zoom and iris of all lenses, and the focus for all but very stiff lenses .

The DM-3 is specifically designed for use with snorkel lenses. It combines very high torque and mechanical stiffness to smoothly drive the Pan and Horizon axes of the Revolution Snorkel lens.

Step-up gears are provided to allow the DM-1X, and DM-2 motors to drive Panavision Zoom and Iris gears as well as the Focus, Iris, and zoom gears of Canon and Fujinon video lenses. Please consult our price list for a complete list of available gears.

## VI. Camera and Lens Installation

The FI+Z system includes bracket kits to provide robust support when used in conjunction with industry standard cameras. These brackets have been designed to for maximum rigidity and lens positioning accuracy. All of the brackets have one 15mm opening for the motor rod and one 19mm opening for a matte box rod or a step-down bushing for use with 0.625" Panavision rods or 15mm Arri rods.



4304 15mm Arri Bridge  
 4311 Panavision Bridge  
 Motor Brackets

**A. 15mm Arri rod system.** When the FI+Z motors are installed on a camera equipped with 15mm matte box support rods, the rods must be prevented from twisting. This can be accomplished with either a matte box, or the Arriflex Bridge adapter (p/n 4304). The adapter slides over the 15mm rods, and has two integral 19mm sleeves which can be used to attach two motor mounting brackets. Additional brackets require 19mm/15mm step-down bushing (p/n4320).

**B. 19mm Arri Rods.** A bridge adapter is not required for cameras using 19mm Arri matte box support rods.

**C. The Panavision Bridge** adapter (p/n 4311) slides over the .625" matte box support rods, and includes a pair of 19mm bushings for mounting the motor swing arms. Swing arms pn 4302 and 4310 are provided for use with the upper and lower rod. A bushing adapter p/n 4321 allows the 19mm swing arm to clamp to the .625" rod.

**D. Standard motor output gears** are .80m. They are available in .25" and .50" face widths. These standard gears are designed to accept additional "step-up" gears for use with lenses having alternate gear pitches.

Motor Gear/Application	p/n
0.8m .25" wide	4220
0.8m .50" wide	4221
32DP .25" wide PV focus	4230
48DP .25" wide PV zoom	4231
64DP .25" wide PV iris	4232
0.5m Canon	4240
0.6m Fuji Focus, Zoom	4241
0.4m Fuji Iris	4242

## VII. Battery Packs and Charger

The HU3 uses FM-50 type LI-Ion Battery Packs. The batteries have a rating of 7.4v @ 1.5 ~ 1.8 AH. They provide a typical run time of 6 hours. The typical charging time is 4 hours.



FM -50 Battery p/n 4025



Charger p/n 4027

## VIII. Technical Information

### A. FCC Statement

This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- \* Reorient or relocate the receiving antenna.
- \* Increase the separation between the equipment and receiver.
- \* Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- \* Consult the dealer or an experienced radio/TV technician for help.

This equipment has been verified to comply with the limits for a class B computing device, pursuant to FCC Rules. Operation with non-approved equipment is likely to result in interference to radio and TV reception.

The user is cautioned that changes and modifications made to the equipment without the approval of manufacturer could void the user's authority to operate this equipment.

This device complies with Part 15 of the FCC Rules.

Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference and

(2) This device must accept any interference received including interference that may cause undesired operation.

### FCC RF EXPOSURE STATEMENT

To satisfy RF exposure requirements, this device and its antenna must operate with a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

## B. Connector pin-outs

### 1. Hand Unit Connectors

<b>Command</b> <b>5-pin Lemo</b>	<b>Serial</b> <b>4-pin Lemo</b>	<b>Zoom</b> <b>6-pin Lemo</b>	<b>Remote Iris</b> <b>3-pin Lemo</b>
1. GND	1. +12V	1. + PWR	1.+Pot
2. +12 - 24 VDC	2. GND	2. Gnd	2. Wiper
3. Serial	3. Serial In	3. Run	3.GND
4. Serial	4. Serial Out	4. Run momentary	
5. n/c		5. Vref	
		6. Zoom Cmd	

### 2. MDR Connectors

<b>Command</b>	<b>Serial</b>	<b>Power</b>	<b>Motor</b>
1. Gnd	1. +12V	1. Gnd	1. Motor (+)
2. +24V	2. GND	2. +24V	2. Motor (-)
3. Serial	3. Serial In	3. +12V	3. Encoder A
4. Serial	4. Serial Out	n/c	4. +5V
5. Playback trigger			5. GND
Bloop Light Trigger			6. Encoder B
			7. Motor ID

### Camera

1. GND
2. Ext. Control
3. Run (30mA max)
4. Run
5. Momentary Run
6. Clock Out +5V
7. Clock Out +12V
8. Camera Encoder In
9. RS232 out
10. RS232 In
11. Zoom Ref In
12. Zoom Command out

## C. MDR2 Camera Cables

### 2. Panavision Cameras

#### 1. Arriflex Cameras

<i>p/n</i>	<i>Camera Model</i>	<i>Description</i>	<i>Connector</i>
4520	Arri3	R/S, fps	11 pin
4521	Arri 235, 435, 535, SR3	R/S	3 pin
4535	Arri 435, SR3	R/S, fps, shutter*	Y-cable; 8 pin, 9 pin
4541	Arricam	R/S, fps, shutter	16 pin

<i>p/n</i>	<i>Camera Model</i>	<i>Description</i>	<i>Connector</i>
4522	All Panaflex	R/S, fps	10-pin
4533	Genesis	VTR	12-pin
4537	Millennium	R/S, fps, shutter	Y-cable

#### 3. Other Film Cameras

<i>p/n</i>	<i>Camera Model</i>	<i>Description</i>	<i>Connector</i>
4519	Moviecam SL	R/S, fps	Y-module: 3-pin, 25 pin
4521	Moviecam (all)	R/S	3-pin
4524	Aaton	R/S	8-pin
4525	Wilcam	R/S	19-pin
4526	Fries	R/S, fps	8-pin

#### 4. Video Cameras

<i>p/n</i>	<i>Camera Model</i>	<i>Description</i>	<i>Connector</i>
4435	Sony, Panasonic, Viper	VTR	12-pin
4543	RED Digital	VTR, Zoom	10-pin

#### 5. Video Lenses

<i>p/n</i>	<i>Lens Model</i>	<i>Description</i>	<i>Connector</i>
4527	Nikon	VTR, zoom	12-pin
4528	Fujinon	VTR, zoom	12-pin
4529	Canon	VTR, zoom	12-pin
4532	Canon HD	VTR, zoom	20-pin

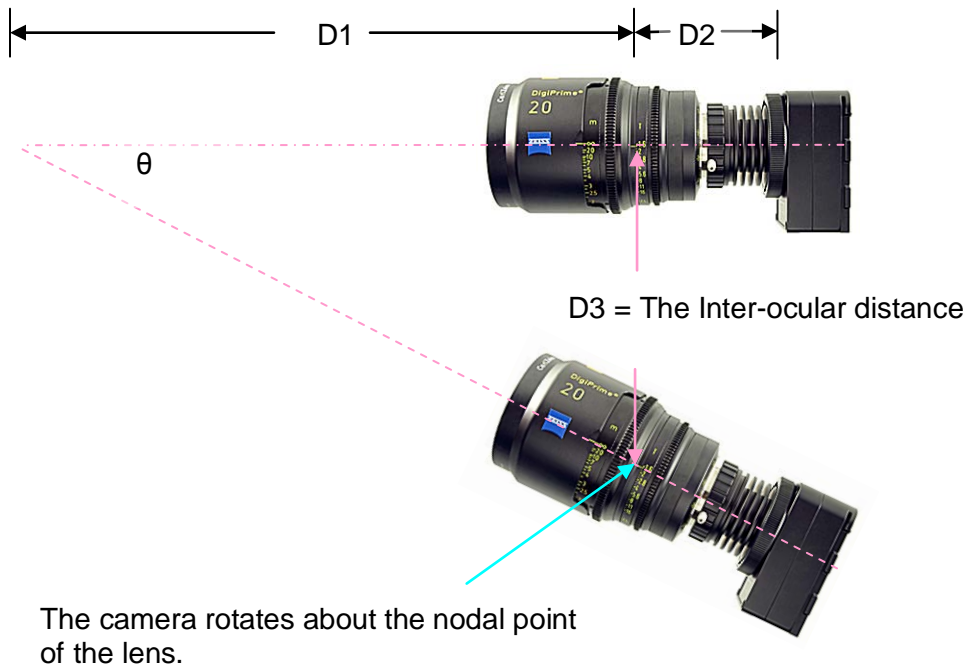
## D. Transmitter Channel frequency allocation.

Channel	MHz	Channel	MHz	Channel	MHz
0	2402	10	2424	20	2460
1	2404	11	2428	21	2462
2	2406	12	2432	22	2464
3	2408	13	2436	23	2466
4	2410	14	2440	24	2468
5	2412	15	2444	25	2470
6	2414	16	2448	26	2472
7	2416	17	2452	27	2474
8	2418	18	2454	28	2476
9	2420	19	2458	29	2478

## E. 3D Reference information

### 3D Rig Geometry

The 3D mode is designed to control the convergence angle and inter-ocular distance for 3D rigs which are configured with the rotation axis about the nodal point of the lens as shown below. The convergence angle is  $\theta$ , and the distance from the subject to the lens nodal point is  $D1$ .  $D2$  is the “Camera Offset” distance, measured from the lens nodal point to the camera focal plane.



### 3D Rig Geometry

The lens nodal point is the point about which the lens may be rotated without causing parallax, the lateral shift of the image. Several good tutorials on the web describe the procedure for finding the lens nodal point: <http://dgrin.smugmug.com/gallery/2114189> and <http://archive.bigben.id.au/tutorials/360/photo/nodal.html>.

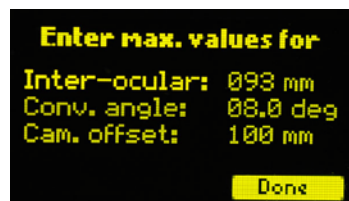
Once the nodal point of a lens is found, its position can be noted, and the distance D2 between the nodal point and the focal plane of the camera should be recorded. This procedure should be followed for all of the lenses to be used in the 3D rig.

### 3D Mode Set-Up on the HU3

The HU3 set-up for 3D operation requires that:

1. One camera is rotated about the entrance pupil of its lens so that its line of sight intersects the line of sight of the second camera at a distance D1, as illustrated in the picture on p-21.
2. The mechanical stops for the motorized adjustment of the inter-ocular distance are set up so that one stop corresponds to where the distance  $D3 = 0$ , and the second stop is the maximum inter-ocular distance.
3. The mechanical stops for the motorized adjustment of the convergence angle are set up so that one stop corresponds to zero convergence angle ( $\theta = 0$ ), where the optical axes of both cameras are parallel, and the second stop corresponds to the maximum angle of convergence.
4. The user input three values:

a. The maximum value of the inter-ocular distance. This distance is entered on the first line labeled Inter-ocular (see figure below left). The navigation key may be used to highlight and change this distance value.



3D Set-up window

- b. The maximum angle of convergence is entered on the second line.  
c. The Camera Offset distance is the distance between the lens nodal point and the camera focal plane and is entered on the third line.

### Checking the 3D Set-Up

This procedure requires using a monitor that can superimpose the outputs of both cameras.

1. After setting up the HU3 for 3D Mode as described in the preceding section, select a focus ring:
  - a. Press the Menu key. Navigate to the Lens selection. Press the **Ring** softkey and select a lettered ring that matches the approximate range of subject distances.

b. Place a subject having a straight vertical line at a convenient distance from the rig. Measure the distance between the subject and the camera focal plane and adjust the focus knob to match.

2. Adjust the inter-ocular distance to maximum. Observe the monitor to see whether the images from both cameras overlap. Make small adjustments in the focus knob setting until the images overlap exactly.

a. If the focus has to be set to a longer distance for exact overlap, decrease the value of the maximum convergence angle in increments of  $0.1^\circ$  until the focus knob setting agrees with the measured distance.

b. If the focus has to be set to a shorter distance for exact overlap, increase the value of the maximum convergence angle in  $0.1^\circ$  increments until the focus knob settings agrees with the measured distance.

c. Check that the images remain overlapped as the inter-ocular distance is changed with the iris slider.