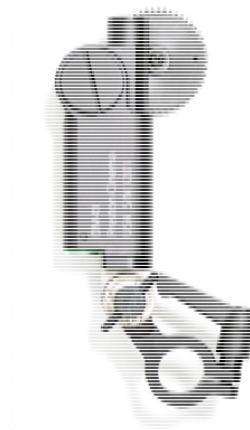# F I + Z Lens Control
DRAFT Rev 4.02

Preston Cinema Systems
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Table of Contents

I. Introduction

A. System. The FI+Z system controls the complete array of both lens and camera functions.
It consists of the Hand Unit HU3, a Motor Driver, a set of Digital Motors, a Micro Force zoom control, and a variety of optional controls including wireless Focus/Iris, and wireless Zoom.

B. The **HU3** gives focus pullers not only a robust and reliable unit but one whose ergonomics allow the focus puller to accurately translate the changing actors' positions on set to a precise movement of the focus knob.

Careful attention has been paid to protecting the unit from impact and environmental damage. The microwave antenna is integrated within a form fitting cover. The iris slider uses a magnetic sensor to eliminate the opening required for a conventional sliding seal. The soft urethane handgrip and focus knob cover not only provide for comfortable all day operation, but also protect the unit from shock.

Generation 4 (G4) transceivers address the challenges brought about by the proliferation of wireless devices using the 2.4 GHz wireless band. Their new architecture results in a greatly improved ability to reject interference from other devices operating in the same band as well as out of band interference. The improvement in performance is quite significant, **typically 10x or better interference rejection than previous transceivers.** The latest "Blue Dot" version of the transceiver (included in all MDR3s) adds channels 30 – 59. These new channels allow FI+Z units to operate in very close proximity (<1m) without interference.

The HU3 and MDR3 can also be connected through a cable link using the main command cable. This provides high reliability communication over long distances (1km).

To address the metadata requirements of CGI, the MDR3 has motor position and camera data, as well as focus, iris and zoom data in conventional units available at the serial port.

Lens Mapping software matches the focus distance marks of a lens to the pre-printed focus marking rings. Five focus rings, labeled A – E, cover focus distances from 9" (.35m) to 6' (2m). The set of focus rings have large, easy to read, distance marks printed on a bright fluorescent background for excellent visibility under all lighting conditions. The rings are automatically illuminated in low light conditions by a pair of white LED's.

Once a lens is calibrated, it can immediately be used with any of the focus rings. The on-board lens library holds data for 255 lenses. Calibration for a lens change only requires the few seconds needed to choose the lens from the library.

A bright, sharp, OLED 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 measuring devices like the Cinetape 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.

The bright zoom bargraph display 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.

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

F. The **Motor Drive**r (MDR3) supports 4 motor channels and camera run/stop. 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, DM-2, and DM4X motors cover requirements from the largest zoom lenses to small prime lenses. They have proven their toughness under extremes of temperature, humidity and vibration. All of them use hardened metal gears with super-hard coating to give very low backlash over thousands of hours of operation.

II. FI+Z Basic Operation Summary.

A. **Set-up the Motor driver (MDR3) and Digital Motors**.

a. 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 MDR3.
b. Use the designated camera cable to connect the MDR3 to the camera accessory receptacle. (See pages 24, 25 for the cable list). Connect the power cable from the MDR to the camera or battery power receptacle. Important: check that camera is capable of supplying sufficient current for the MDR3. This information is usually provided the manufacturer in their specifications.
c. Apply power to the MDR3. Press the reset button. The motors will calibrate themselves to the mechanical span of the lens rings.
d. Select the MDR wireless channel with the channel selection on the top cover or side.

B. HU3 Set-up

a. Install the FM50/FM500H battery.

b. Press the Power Switch momentarily. The **main display screen** will appear.

footage   Focus Ring Letter   Radio Channel
                                        Signal Strength bars
                                            Battery Charge

Lens Selection

Shows focus distance   Shows focus knob   All functions are accessed through
    in digital format   setting as bargraph   the Menu key
(Lens must be calibrated)
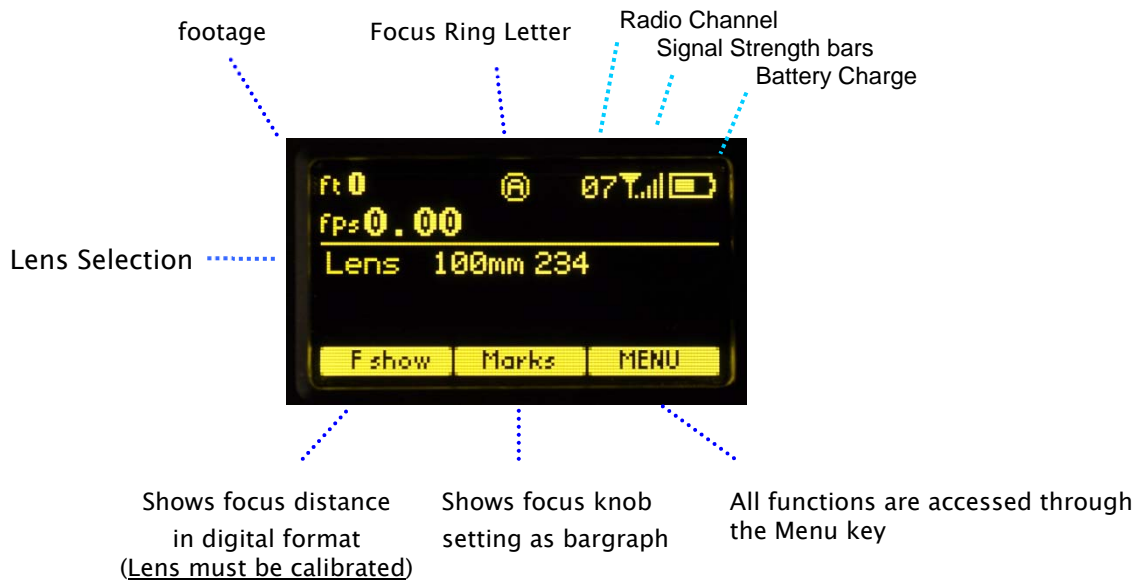
Main Display Screen

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.
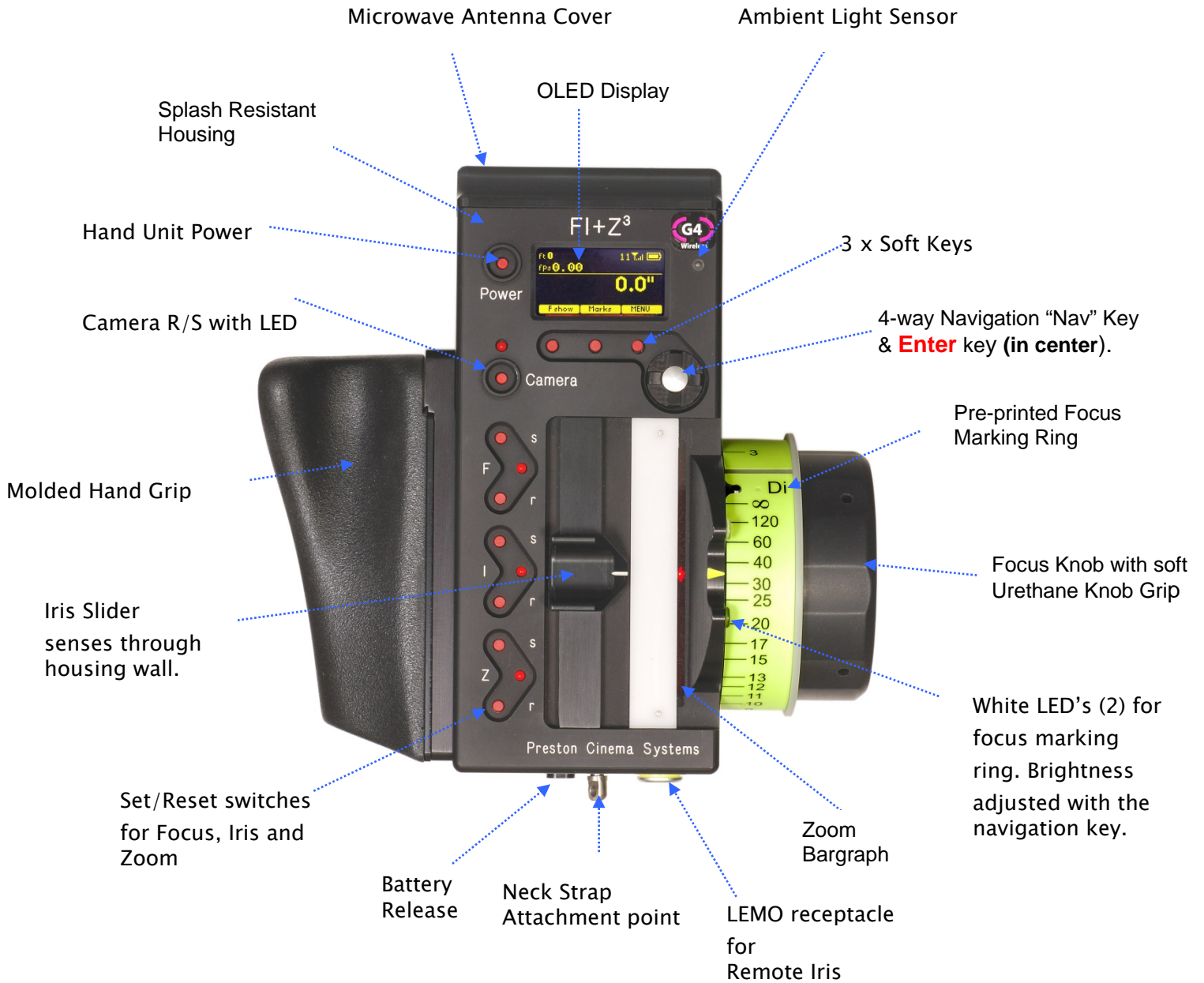
- The Signal Strength bars will appear. To return to the main menu, press the Nav key left.

e. To use a blank focus marking ring, turn off the <u>Focus mapping</u>:

- Press the **Menu key**.
- Select **Lens.**
- If the focal length and serial number 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 load focus data for a lens and select a focus ring:
- 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/Next.
- Press **Ring** and choose a focus ring with the desired near focus.
- Install the same focus ring on the focus knob.

Hand Unit 3 Functions

Microwave Antenna Cover

Ambient Light Sensor

OLED Display

Splash Resistant
Housing

Hand Unit Power

FI+Z³

3 x Soft Keys

Power

4-way Navigation "Nav" Key
& **Enter** key **(in center)**.

Camera R/S with LED

Camera

Pre-printed Focus
Marking Ring

Molded Hand Grip

Focus Knob with soft
Urethane Knob Grip

Iris Slider
senses through
housing wall.

White LED's (2) for
focus marking
ring. Brightness
adjusted with the
navigation key.

Set/Reset switches
for Focus, Iris and
Zoom

Preston Cinema Systems

Zoom
Bargraph

Battery
Release

Neck Strap
Attachment point

LEMO receptacle
for
Remote Iris

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).
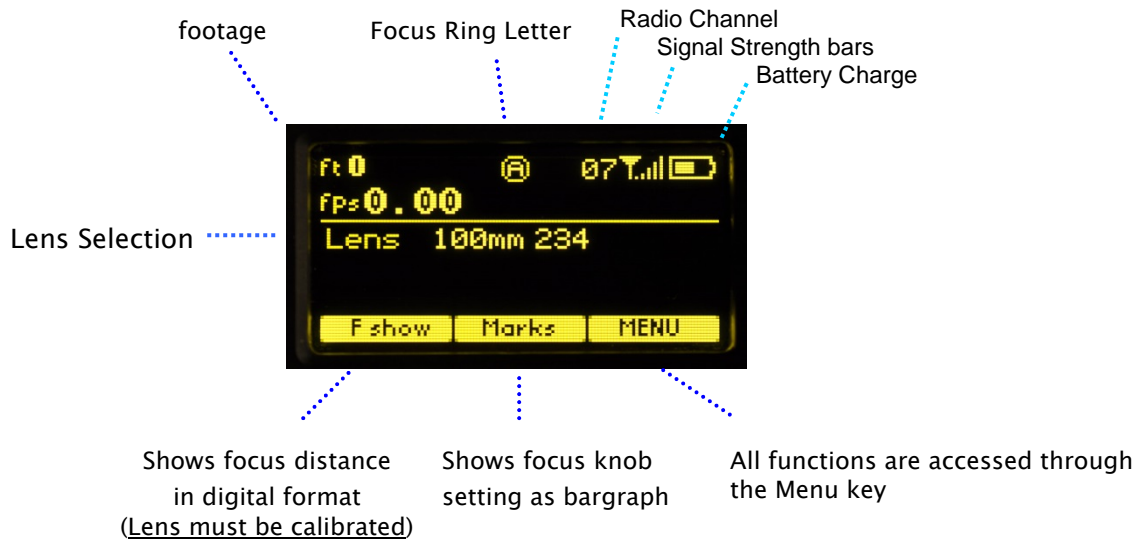- Install the Micro Force bracket using the threaded hole at the rear of the HU3.

(1)

(2)

(3)

B.   Set-Up and Operation

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

footage   Focus Ring Letter   Radio Channel
                                                     Signal Strength bars
                                                        Battery Charge

Lens Selection

Shows focus distance   Shows focus knob   All functions are accessed through
in digital format   setting as bargraph   the Menu key
(Lens must be calibrated)

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 Driver:

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 MDR3 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

==Film camera fps and shutter angle control are not supported with the MDR3, and the corresponding menu items will not be active when the HU3 detects connection to an MDR3 unit.==

5. The Camera selection (Fig 5.1) provides for control of both camera speed and shutter angle for those cameras supporting remote operation (==MDR2 only==). Pressing Choose brings up the Manufacturers folders (Fig 5.2). Pressing Choose again brings up the list of supported cameras (Fig 5.3).

Fig 5.1   Fig 5.2   Fig 5.3

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 5.4). 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 5.5, Fig 5.6).

Fig 5.4   Fig 5.5   Fig 5.6

6. Selecting Lens with the Nav key (Fig. 6.1) 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 6.1) is used to match the installed focus ring letter (A – E).

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The Choose key brings up the list of folders containing lens data (Fig 6.2). The *All lenses* folder contains data on all of the lenses stored in the HU3 lens library. The Library stores up to 255 lenses. Next brings up the contents of the selected folder (Fig 6.3).

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 6.3).
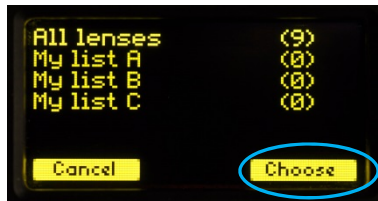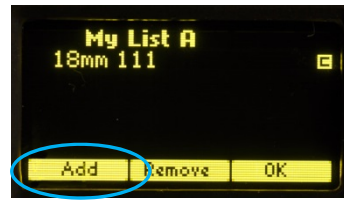

| Fig 6.1 | Fig 6.2 | Fig 6.3 |

To **use a lens from the library**, choose a lens folder shown Fig 6.4. Using the Nav key select the manufacturer (fig.6.5, the lens type (fig.6.6), and the lens (fig 6.7) and press either OK or ENTER. Use the focus knob to set the lens to infinity, Fig 6.8, and press NEXT/ENTER. The lens name now appears on the main screen (Fig. 6.9).
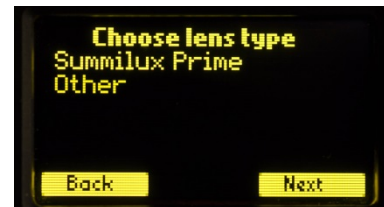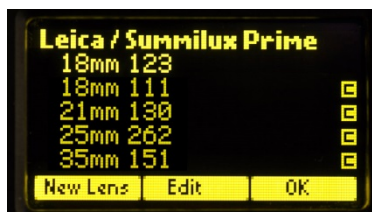

| Fig 6.4 | Fig 6.5 | Fig 6.6 |

| Fig 6.7 | Fig. 6.8 | Fig. 6.9 |

To **calibrate** a new lens:
- Name the lens (focal length and serial number) and store it in the lens library.
- Use the Edit function to calibrate the lens.

To **name the lens**, go to the Lens selection screen (FIG 6.1), press Choose, select All lenses (Fig 6.4), select a manufacturer's folder (Fig 6.5), and Lens Type (Fig 6.6).

Press the New Lens key (Fig 6.7) and you will be asked to select the focal length (Fig 6.10), and Serial Number (Fig 6.11). When finished, press Next and the lens name (18mm s/n 123) appears in the lens type folder (Fig 6.12). Note that the lenses are automatically sorted in ascending values of the focal length.

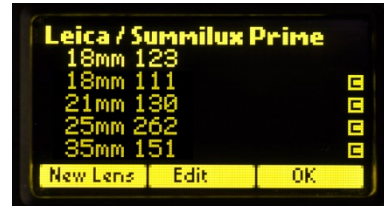Fig 6.10   Fig 6.11   Fig 6.12

To calibrate the lens press Edit (Fig 6.12). Select Calibrate with the Nav key (Fig 6.13), and press OK or ENTER).

Fig 6.13   Fig 6.14

After the lens focus ring is set to infinity (Fig 6.14), the display indicates the first of ten calibration distances- close focus. There are two versions of this display screen, one for lenses with linear focus mechanisms, and a second for lenses with non-linear focus. Choosing a lens type automatically brings up the corresponding display screen.

 The display screen for lenses with linear focus mechanisms allow the user to scroll up and down with the Nav key (Fig 6.15, and 6.16).

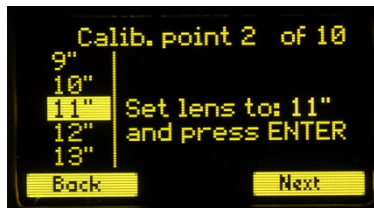Fig 6.15   Fig 6.16   Fig 6.17
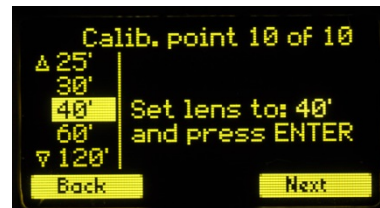
The display screens for non-linear lenses show fixed distances for each calibration point as shown in Fig. 6.18 – 6.20.

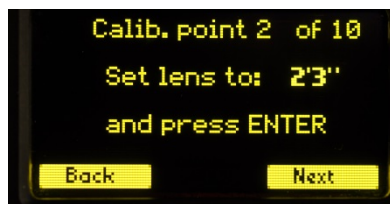Fig 6.18   Fig 6.19   Fig 6.20

After the tenth point is entered (Fig. 6.17, 6.20), the lens description is shown to the right of the Lens entry of the Menu (Fig. 6.21). The letter "c" to the right of the lens description indicates that the lens has been calibrated. The main screen (Fig. 6.22) shows the lens information.

| Fig. 6.21 | Fig. 6.22 | Fig. 6.23 |

To select the focus ring, →Menu (Fig 6.22) → Ring (FIG 6.21) and use the Navigation key ↕ to select either a ring (A – E) for metric or (Ai – Ei for imperial) (Fig. 6.23. 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

The printed labels Ai – Ei are pictured below. Note that the midpoint of each scale is about twice the minimum focus distance. Although the ring can be chosen to cover the entire focus range of the lens, it is often advantageous to choose the ring which covers the minimum focus required for the actual shooting.
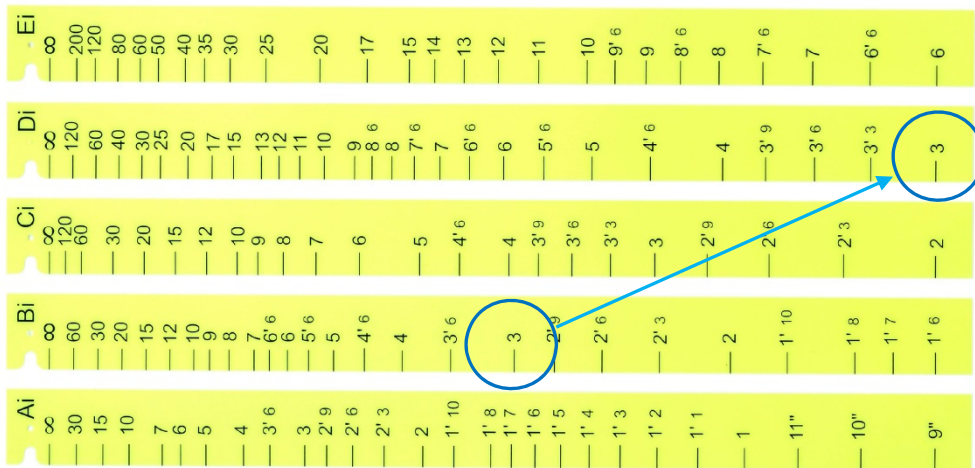

Fig.23 Increasing the "throw" of the focus knob by choosing focus ring minimum focus.

For example the Summilux 18mm lens has an 18" near focus, matching the Bi ring. However if the closest distance required is 3', only half of the knobs rotation would be

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used. Choosing the Di ring instead would make the entire rotation of the focus knob available and double the spread of distances, dramatically improving the precision.

Note that <u>any focus ring can be used with any calibrated lens.</u>

7. The **Mode** (Fig. 7.1) has two functions. The first allows the four MDR motor channels, focus, iris, zoom and auxiliary to be assigned to user-designated Hand Unit controls.

Fig. 7.1   Fig. 7.2

For example, in a multi-camera set-up, the focus knob of a single hand unit can be assigned to focus, iris and zoom, allowing the focus knob to control the focus rings of up to three separate lenses simultaneously.

The AUX channel of the MDR3 can be set-up to track the setting of the HU3 focus, iris, or zoom, or the Focus/Iris control focus or iris, or the Radio Micro Force zoom. Use the Navigation key to scroll down to AUX. Press the right side of the NAV key and a select the source for the AUX channel to track. Figure 7.3 shows the AUX tracking the HU3 iris.

Fig. 7.3   Fig. 7.4

The second function of Custom Mode is to turn off one or more of the HU3 control channels focus, iris, zoom or auxiliary. This is useful when using the HU3 in combination with the Focus/Iris or Radio Microforce single channel units. Turning off the HU3 channel will prevent the motor from changing from the setting of the single channel hand unit to the setting of the HU3 if the signal from the single channel unit is lost.

Figure 7.4 shows the HU3 zoom channel set to Off, so if the signal from the Radio Micro Force is lost, the motor will not revert back to the zoom setting of the HU3.

==In situations where the lens setting must be controlled only by the single function hand unit and not the HU3, the corresponding HU3 channel should be set to "Off".==

Zoom Mode Set-Up

| Fig. 7.5 | Fig 7.6 | Fig. 7.7 |

(==Zoom modes are only supported for the MDR2==) To choose a **Zoom Mode** press the Set-Up key (Fig. 7.5). The **Normal Zoom mode** (Fig. 7.6) 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** (Fig 7.7) is used when driving the internal motor of a video lens using the analog zoom signal available at the ==MDR2== camera receptacle. In this mode, the Hand Unit controls the velocity of the zoom motor, and the zoom bargraph shows the velocity of the zoom, not its position.

8. The **System Menu** (Fig. 8.1) 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).
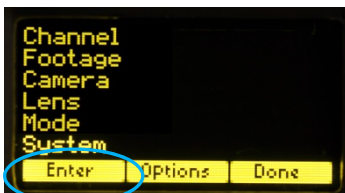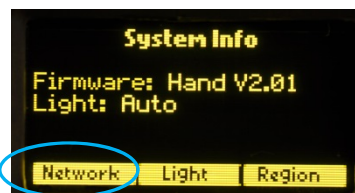

| Fig. 8.1 | Fig. 8.2 | Fig. 8.3 |

Press the Enter key (Fig.1) to see the System Info screen (Fig. 8.2). Pressing the NETWORK key initiates a scan of all HU3 channels. The Occupied Channels screen (Fig. 8.3) lists the channels in use and their signal strength.

The Network scan function will only detect G4 devices; it will not detect Wi-Fi, Bluetooth, frequency hopping devices, etc.

Press the Light soft key (Fig.8.2) to display the options for illuminating the focus ring. 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.

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The **Region** key (fig.3, 4) adjusts the output power of the microwave link to comply with local regulations.
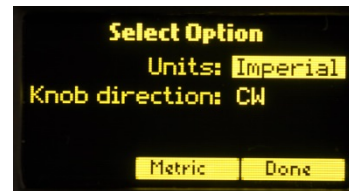

Fig. 8.4	Fig.8.5	Fig. 8.6

The **OPTION** (Fig. 8.6) selections consist of selecting distance units and knob direction. Use the Navigation key to select the desired function. The default knob direction is CW. Optional labels for the focus rings are available for CCW direction use.

9.   The **Zoom Bargraph** indicates the position of the zoom when the zoom is in Normal mode (See section 7. Operating Modes.) Note that the bargraph of the Digital Microforce is not active when connected to the HU3, as the zoom position is only available when a digital motor and Y cable are used. The zoom bargraph indicates the lens limits as described in the next section.

Fig. 10.1

10. **Lens Limits** (Fig. 10.1) 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 limits are now set and indicated by a lit LED in the corresponding group.

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.

Lens limits can be used to <u>lock a motor</u> to a given position. This is done by setting a <u>zero-span</u>, 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.

11. **CineTape Interface**

CineTape units can be used to provide a distance reading that is displayed by the HU3 main display screen.

The CineTape interface (p/n 4742) connects the Remote Lemo receptacle of the CineTape to the 4-pin Serial receptacle of the MDR3.

The CineTape data is displayed as soon as the interface is connected to the MDR3(Fig. 11.1).

Pressing the Fshow button switches the display from the remote distance measuring device (Fig. 11.1) to a dual display (Fig 11.2) and finally to the default display (Fig. 11.3).

Fig 11.1   Fig. 11.2   Fig. 11.3

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 downloads page.
- Make sure that the Hand Unit is not powered.
- Connect the serial cable 4538 (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 receptacle is provided on the bottom of the HU3 for an external, cable connected, iris control. When the external iris control is connected, the slide control on the FIZ will be disabled.

Fig. 12.1 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. MDR3. Detailed Description

MDR3: Torque and Direction Switches   Input/Output Connectors

MDR3: Channel Display & Switches – Top   Channel Display & Switches – Side

The four channel Motor Driver (MDR3) 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 MDR3 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 settings 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 four channels. This insures that even in the event of improper calibration, the motors will remain protected from overheating.

The LED status displays for motor torque and direction are activated by pressing any of the red buttons. Change the Torque and Direction setting of a motor by pressing the button adjacent to the corresponding connector. The bottom row of buttons controls the torque and the upper row controls the direction.

- At each press of the torque button, the LED color changes to indicate the maximum torque level: blue minimum, green mid-level, red maximum.
- Pressing the direction button changes the motor direction to correspond with the Hand unit. The white LED indicates the status.
- After approximately 4s from the last button press, the display will turn off.

Camera control signals are provided at the "Camera" receptacle of the MDR3.

The Microwave Transceiver is located in the lid of the MDR3. It provides wireless bi-directional communication between the MDR3, Hand Unit, Focus/Iris units and other clients in the wireless network. The lid also contains a voltage booster enabling MDR operation over an input voltage range from 11 to 30 volts.

The wireless channels are selected by pressing the up/down channel switches located on both the MDR3 top cover and side. There are 30 channels numbered 0 – 29 and are backwards compatible with the MDR2 G4 units. Channels 30 – 59 use enhanced data encoding and eliminate interference between closely spaced units.

The software controlling the MDR3 is updated through the USB receptacle and the USB cable that connects the MDR to the USB receptacle of a PC or MAC (OS 10.5 or later). Software updates are available either as a CD or download from our web site: http://www.prestoncinema.com/downloads.html.

To initiate the update, open the MRD3 update program on your computer. The program CD and a USB cable are included with the MDR3. Remove power from the MDR3. Connect the USB cable between the computer and MDR3 USB receptacle. Open the MDR3 update program. While holding the reset button down, apply power to the MDR3. Release the reset button. The program should now report that it has found a connection to the MDR3.

V. Digital Motors

DM-1X	DM-1X	DM2	DM4X
p/n 4205	p/n 4205A	p/n 4201A	p/n 4207
	(integral bracket)	(integral bracket)	

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-1X and DM-2 are available with an integral bracket (the "A" version). This bracket provides for simplified mounting and also allows the motors to be positioned very close to one another. A rosette gear securely locks the swing arm in position.

The DM4X motor (right) is the smallest member of the family. It comes with an integral bracket and is recommended for either light-weight video lenses or the zoom/iris rings of small zoom or prime lenses.

The integral swing arm has rosettes on two sides. This permits the motor to be mounted horizontally (above, left) or vertically (above, right). The two adjustable handles lock the rosette position and the motor bracket to the matte box support rod.

Important tip: to prevent the motor position from changing as the handles are tightened, first tighten the handle which clamps the motor to the rod and then tighten the rosette handle.

4310   4334   4302   4301   4333

Short Brackets for Panavision   Long Brackets for Horizontal
 Vertical Matte Box Rods   Matte Box Rods

The swing arm clamps to 19mm rods. Step-down bushings accommodate 15mm and 0.635" rods, p/n 4320 and p/n 4321 respectively.

All of the brackets have one 15mm opening for the motor rod and one 19mm opening for a matte box rod. A step-down bushing is required for 0.625" Panavision rods or 15mm Arri rods.

Bracket p/n	Distance between holes	Use
4310	2.2"	PV top rod bracket
4334	1.6"	Clamps to PV Long Rod Support bracket
4302	1.8"	PV bottom rod bracket
4301	3.7"	Arri, Red, general purpose
4333	4.4"	Arri, Moviecam, general purpose

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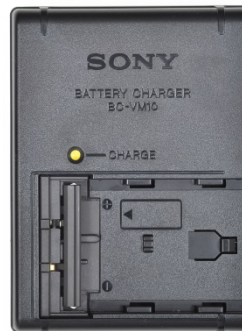
p/n	Motor Gear/Application
4221	0.8m .50" wide
4231	48DP .25" wide PV zoom
4232	64DP .25" wide PV iris
4240	0.5m Canon
4241	0.6m Fuji Focus, Zoom
4242	0.4m Fuji Iris

VI. Battery Packs and Charger

The HU3 uses FM-500H 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 -500H Battery p/n 4040   Charger p/n 4041

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

	Command 5-pin	Serial 4-pin	Zoom 6-pin	Remote Iris 3-pin
1	Gnd	+12V	+PWR	+ Pot
2	+12-24VDC	GND	Gnd	Wiper
3	Serial Data	Serial In	Run	-Pot
4	SerialData	Serial Out	Run (mom)	
5	n/c		Vref	
6			Zoom Cmd.	

2. MDR 3 Connectors

	Command	Serial	Power	Motor	Camera
	6-pin	4-pin	2-pin	7-pin	10-pin
1	GND	+12V	Batt(–)	Motor(+)	Batt(–)
2	24V 0.2A	Gnd	Batt(+)	Motor(–)	Serial
3	Serial 1	Serial In		Encoder A	Serial
4	Serial1	Serial Out		+5V	Batt(+)
5	n/c			Gnd	Camera R/S
6	n/c			Encoder B	Common R/S
7				Motor ID	DSR
8					DTR
9					Camera ID
10					Camera ID rtn

C. MDR3 Camera Cables

p/n	Camera Model	Description	Connector
4721	Alexa, Arri 435/535, Sony F65	R/S	3 pin Fischer
4722	All Panaflex	R/S	10-pin Lemo
4730	Sony, Panasonic, Viper	VTR	12-pin Hirose
4746	RED Epic	R/S	BNC
4755	Sony F5/F55	R/S	4-pin hirose

D. Transmitter Channel frequency allocation and Power (G4 blue dot transceivers)

Blue dot designated units can access 30 additional channels 30–59 with advanced coding. These channels share the same frequencies as channels 0 – 29. (Channel 30 is the same frequency as Channel 0). The advanced data coding allows units to be operated at close proximity to other units (<1m) without interference.

Channel	MHz		Channel	MHz		Channel	MHz
0	2402		10	2424		20	2458
1	2404		11	2428		21	2460
2	2406		12	2432		22	2462
3	2408		13	2436		23	2464
4	2410		14	2440		24	2466
5	2412		15	2444		25	2468
6	2414		16	2448		26	2470
7	2416		17	2452		27	2472
8	2418		18	2454		28	2474
9	2420		19	2456		29	2476

The maximum peak power / average power is 0.10W/0.01W.