F I + Z Lens Control

Rev 5.2

Preston Cinema Systems
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Table of Contents

I. Introduction

A. System. The FI+Z system controls the complete array of lens and camera functions. It consists of the Hand Unit HU3, one or more Motor Drivers, a set of Digital Motors, a Micro Force zoom control, and a variety of optional controls including wireless Focus/Iris, Zoom, and the Light Ranger 2 focus assist.

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 changes in 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, <u>typically 10x or better interference rejection than previous transceivers.</u>

The HU3 and MDR3 can also be connected through a cable link using the 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 available at the serial port for incorporation into a metadata stream.

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 (Panatape, Cinetape) can be displayed.

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. The Light Ranger 2 is a high-precision focus assist which generates a graphics overlay indicating the direction and amount the focus knob must be turned to bring a subject into focus.
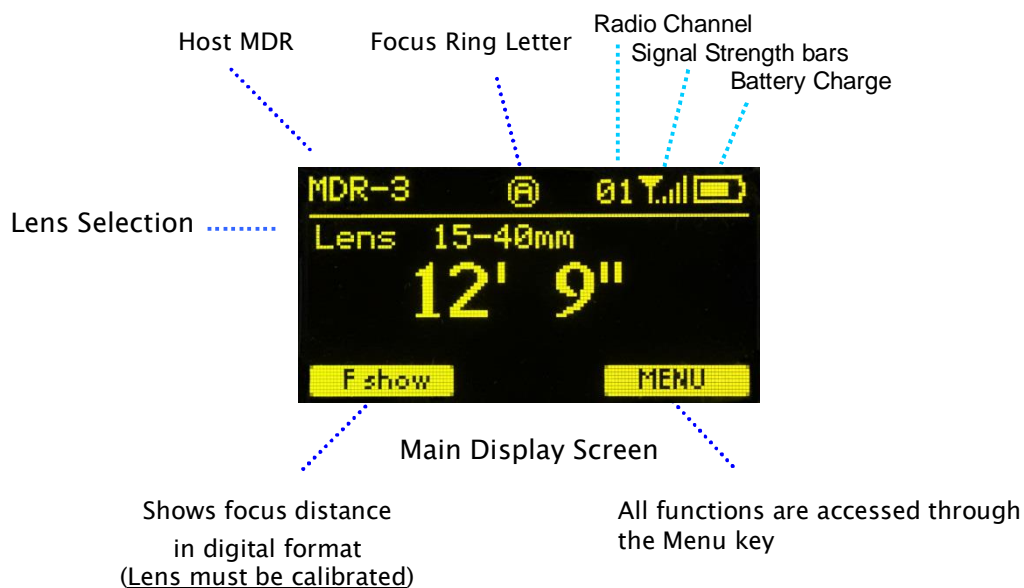
F. The Motor Driver (MDR3) supports 4 motor channels and camera run/stop. The 30 channel transceiver allows the simultaneous operation of both the Hand Unit 3 as well as the optional wireless hand units listed previously. An integral voltage booster allows for operation over a voltage range of 11 – 28 VDC. Switches are provided for adjusting Motor Torque and reversing direction.

G. DM1X, DM2, and DM5 digital motors cover drive 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 coatings to give very low backlash over thousands of hours of operation.

H. The DXL Module is a wireless 3-channel motor driver for the Panavision DXL camera.

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 motor positions relative to the lens 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 MDR3 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 camera manufacturer in their specifications. A conservative estimate of the maximum MDR3 current requirement is 1A per motor at 24VDC or 2A/motor at 12VDC.

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 switches either on the top cover or the side channel display.

B. HU3 Set-up
a. Install the FM500 battery.
b. Press the Power Switch momentarily. The main display screen will appear.

Host MDR   Focus Ring Letter   Radio Channel
                                  Signal Strength bars
                                  Battery Charge

Lens Selection

Main Display Screen

Shows focus distance
in digital format
(Lens must be calibrated)

All functions are accessed through
the Menu key

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

c. If MDR3 appears in the upper right corner of the display, the HU3 and MDR3 are both set to the same wireless channel. If the wireless channels of the HU3 and MDR3 do not match, the message No Host! will appear in the upper left corner of the display.

d. Match the HU3 wireless channel to the MDR3:

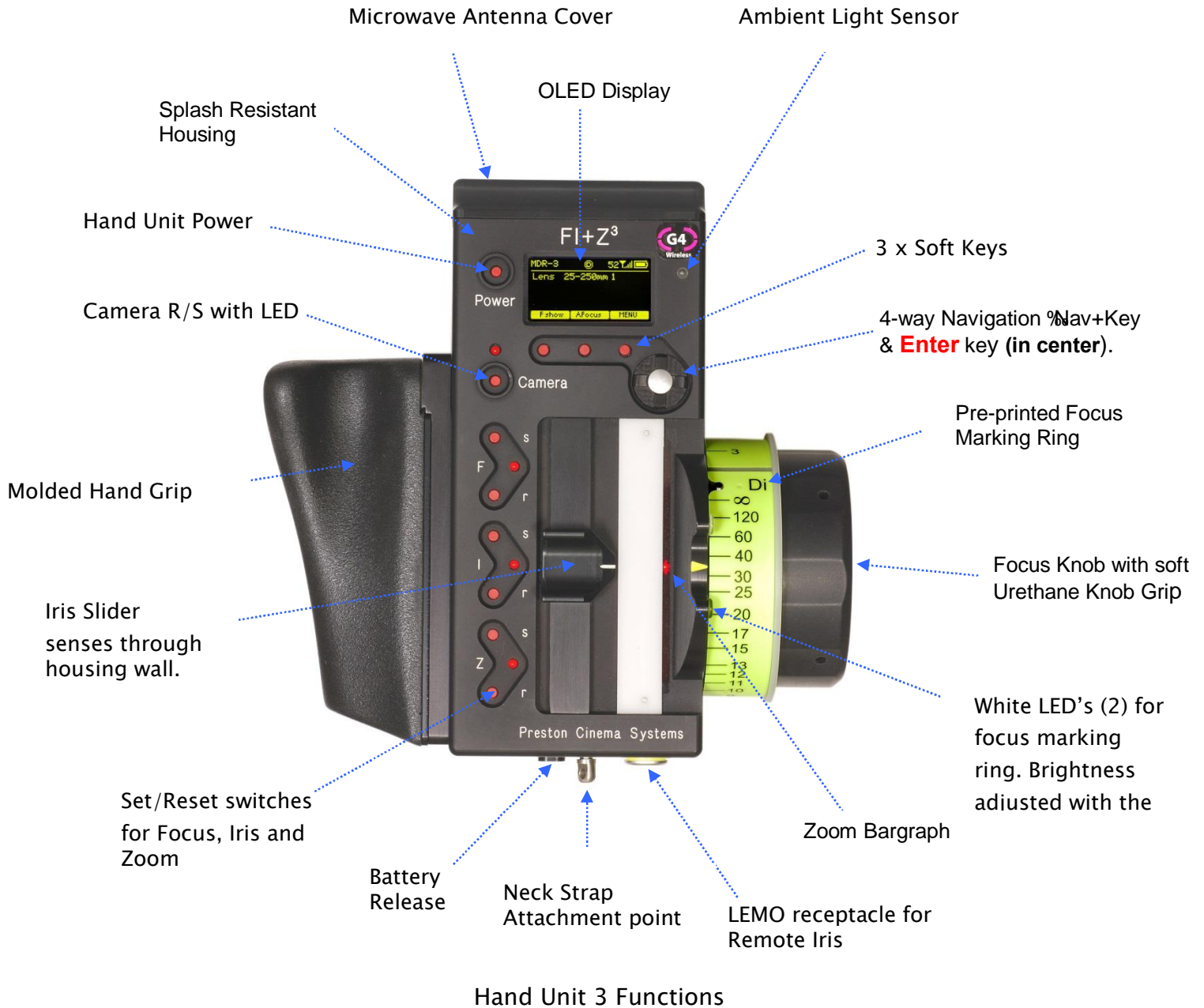Menu Screen: Channel Selection

- 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 MDR3.
- 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 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 manually 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.

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- 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.

Microwave Antenna Cover
Ambient Light Sensor
OLED Display
Splash Resistant Housing
Hand Unit Power
3 x Soft Keys
Camera R/S with LED
4-way Navigation % Nav+Key & **Enter** key **(in center)**.
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 adiusted with the
Set/Reset switches for Focus, Iris and Zoom
Zoom Bargraph
Battery Release
Neck Strap Attachment point
LEMO receptacle for Remote Iris

FI+Z³
G4 Wireless
MDR-3 52
Lens 25-250mm 1
F:show AFocus MENU
Power
Camera
F
I
Z
s
r
s
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r
Preston Cinema Systems
Di
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12
11
3

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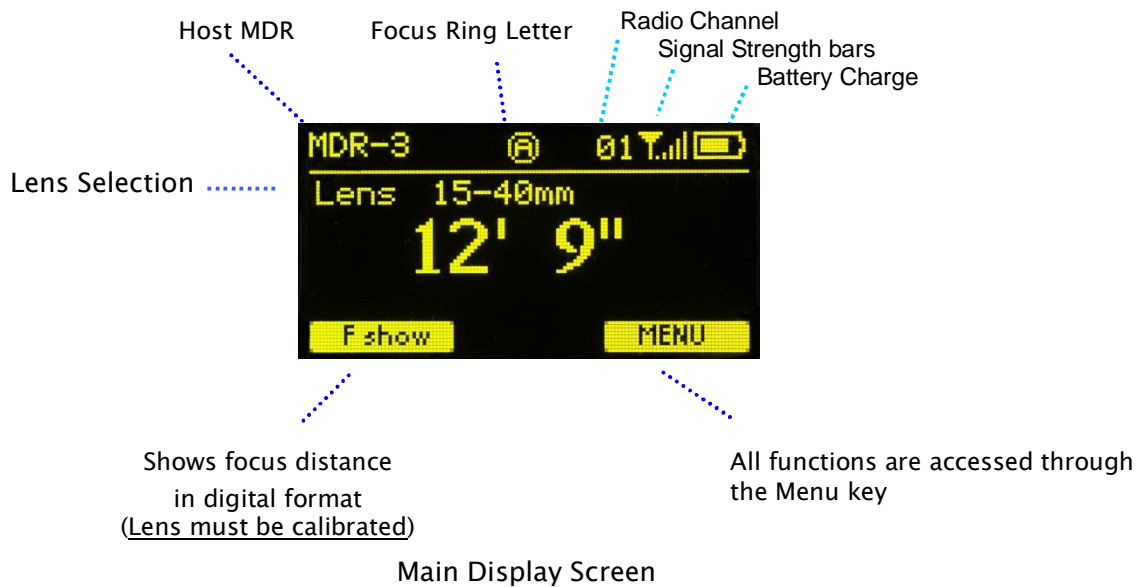
- Press the Grip Release toward the HU3 housing (1).
- Slide the Grip downward (2)
- Replace the Grip with the cover (3).
- Install the Micro Force bracket using the threaded hole at the rear of the HU3.

(1)

(2)

(3)
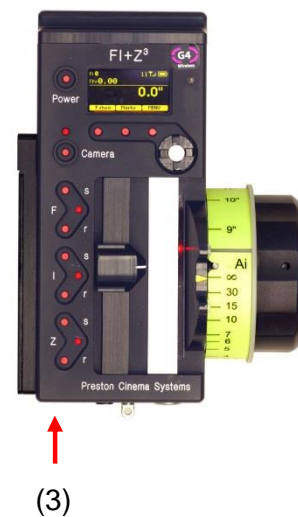
B.   Set-Up and Operation

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

Host MDR   Focus Ring Letter   Radio Channel
                                              Signal Strength bars
                                                 Battery Charge

Lens Selection ·········

Shows focus distance   All functions are accessed through
   in digital format   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 MDR2 units on that channel.

4. 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 (Fig. 6.1) 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 6.4).

To use a lens from the library, choose a lens folder shown Fig 6.5. 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 as shown in Fig 6.8 and press NEXT/ENTER. The lens name now appears on the main screen (Fig. 6.9).
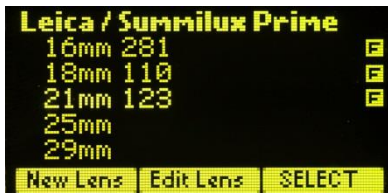

Fig 6.4

Fig 6.5

Fig 6.6

Fig 6.7

Fig. 6.8

Fig. 6.9

To calibrate a new lens:
- Name the lens 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 6.2), select All lenses (Fig 6.2), 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 15). Note that the lenses are automatically sorted in ascending values of the focal length.
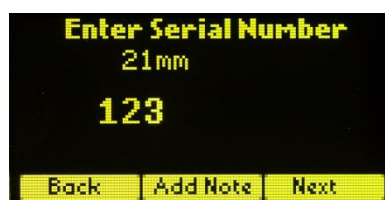
To calibrate the lens press Edit (Fig 6.12). Select Calibrate Focus with the Nav key (Fig 6.13), and press OK or ENTER).

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 (FIG 6.15). 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).
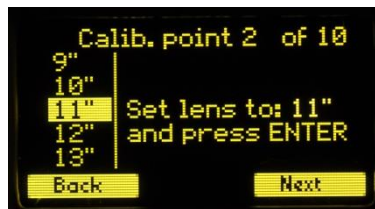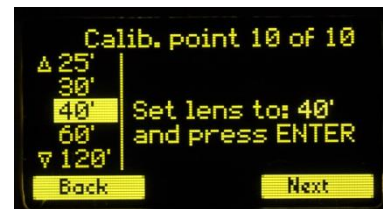

Fig 6.15   Fig 6.16   Fig 6.17

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

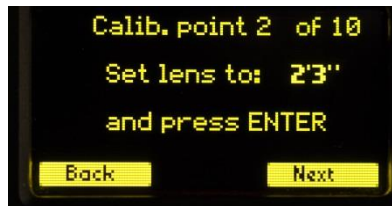Fig 6.18   Fig 6.19   Fig 6.20

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 "F" to the right of the lens description indicates that the lens focus has been calibrated. The main screen (Fig. 6.22) shows the lens information.

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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 in Fig. 6.24 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.
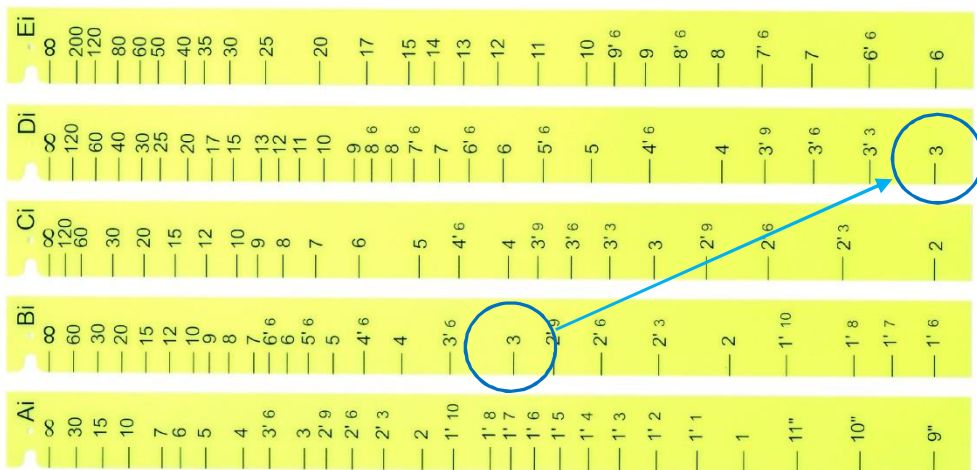

Fig.6.24 Increasing the "throw" of the focus knob by choosing focus ring minimum focus.

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 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 any focus ring can be used with any calibrated lens.

7. The Operating Mode allows the user to change which hand control axis, focus, iris, or zoom, controls which motor. Pressing the Set-Up key (FIG. 7.1) brings up the screen for allocating the 4-motor axes in the MDR3.

Fig 7.2 shows the focus axis selected. To re-allocate the focus axis, tap the right side of the Nav key to highlight "Focus", Fig. 7.3. The north/south sides of the Nav key are then used to cycle the axes: Focus→Iris→Zoom→Off. The "Off" selection is used when one of the HU3 axes is being over-ridden by either a Focus/Iris or Radio Microforce hand unit. The Off selection prevents the selected motor axis (focus for this example) from taking its position command from the HU3 if the wireless signal from the Focus/Iris unit drops out. This option is commonly used when the Iris function is being remotely controlled from "Video Village" with a Focus/Iris unit.

The mode selection is also used to set-up the source for the AUX motor axis of the MDR4. Selecting "AUX" allows the Nav key to cycle through all available hand controls: HU3 Focus, HU3 Iris, HU3 Zoom, F/I Focus, F/I iris, Analog Focus, Analog Iris, and Analog zoom. The Analog controls refer to units plugged into the analog port of the MDR3.

Zoom Mode Set-Up

The "Normal" zoom mode allows the HU3 zoom bargraph to indicate the lens zoom position when the MDR3 is driving a zoom motor. When a Video lens with an internal servo drive is used in conjunction with the MDR3, the required analog control signal is made available by selecting the Video option. When this option is active, the zoom bargraph will indicate the velocity of the zoom motor rather than its position, and limits on the zoom range cannot be set.

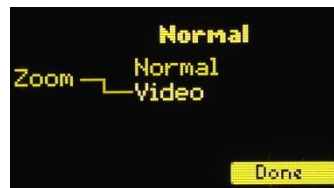

Fig. 7.4   Fig. 7.5

8. The System Menu displays 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).
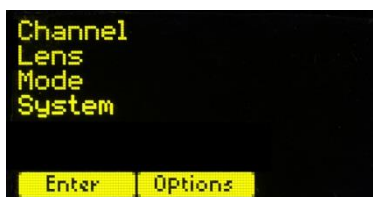

Fig. 8.1   Fig. 8.2   Fig. 8.3

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Select Menu →System + Enter to see the System Info screen (Fig. 8.1). Pressing the NETWORK key (Fig. 8.2) initiates a scan of all HU3 channels. The Occupied Channels screen (Fig. 8.3) lists the channels in use and their signal strength. The Region key adjusts the output power of the microwave link to comply with local regulations

The Network scan function (Fig. 8.2) 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 (Fig. 8.5) 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.

The OPTIONS (Fig. 8.4) selections consist of selecting distance units, and focus knob/iris slider direction. Use the Navigation key to select the desired function. The default knob direction is CW and slider direction is maximum aperture UP. 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 is used. The zoom bargraph indicates the lens limits as described in the next section.

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.
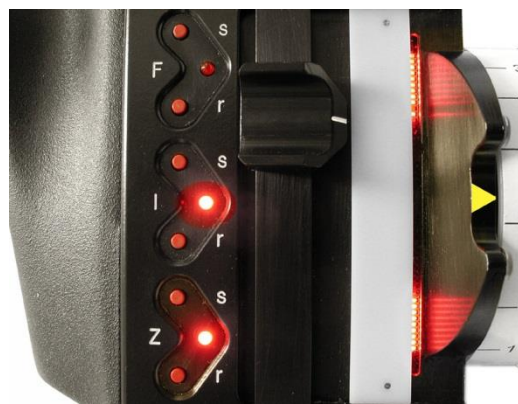

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Fig. 10.1

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. Panatape and Cine Tape Interfaces.

The Panatape and Cinetape units can be used to provide a distance reading that is displayed by the HU3 main display screen. The MDR3 serial port accepts data directly from Panatape/Cinetape units while the MDR2 requires interface units 4534/4542 respectively.

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 |

12. Light Ranger 2 (LR2)

The LR2 (Fig. 12.1) provides focus assist information in the form of graphics which overlay the camera image (Fig. 12.2). In the Manual mode of operation, the overlay graphics indicate the direction and amount the focus knob must be turned to bring a subject into sharp focus. In the autofocus mode, the focus will track a subject selected from the 16 measurement zones. The HU3 display (Fig. 12.3) shows the distance selected in the target area. http://www.prestoncinema.com/products_LR2_2014.html
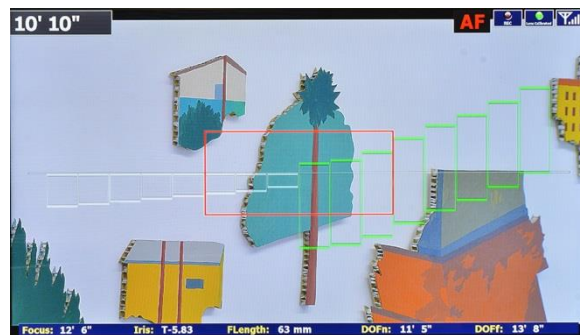
13. Software updates can be downloaded from the website
http://www.prestoncinema.com/downloads.html. To load an update into the HU3:

- 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.

14. Remote Iris Unit

A socket 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. 14.1 Remote Iris Box p/n 4020

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

IV. MDR3. Detailed Description

MDR3: Torque and Direction Switches   Input/Output Connectors

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

The four channel MDR3 Motor Driver controls up to four motors, providing control signals to the camera, and transfers 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 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 protected from overheating during stall.

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. In addition, the camera receptacle also provides:

- Serial control signals for controlling the internal servos of Fujinon Cabrio lenses.
- The signals required for VTR start for Sony cameras as well as internal zoom drive for Canon and Fujinon video style lenses with integral zoom drives.

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 MDR3 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 29 – 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 MDRs 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, 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 and asks whether you want to proceed with the update. Choose yes. After the program has completed the update, you can remove the USB cable from the MDR3.

The serial receptacle functions:

- Accepts motion control commands from an external computer using RS-232 data.
- Accepts distance data from the Panatape or Cinetape devices using the Panatape interface cable p/n 4534 or Cinetape cable p/n 4542. It can also

take data from the Cooke i-Lens using cable p/n 4544. The distance data is shown on the HU3 display.

- It can send motor position and camera data to an external device.

Time Code

A. Jamming TC with a Clockit device. After connecting the Clockit to the MDR3 with cable 4731, the HU3 will indicate that its TC is synced (see picture below). This feature requires that the HU3 is running firmware version 2.14 or later.

B. MDR3 time code accuracy and stability. The MDR3 real-time clock is tuned at the factory to better than 1 ppm accuracy at ambient temperature of 20C. To maintain 1 frame accuracy at 24fps or 30 fps, the MDR3 should be jammed at 8 hour intervals or less, at ambient 20C.

D. Genlock Input. The TC connector has an input for genlock. When a genlock signal is detected the lens metadata will be stored synchronously. The connector pinout is shown from the termination side of the plug:

Pin #	Function
1	Gnd
2	TC in
3	
4	Genlock in
5	
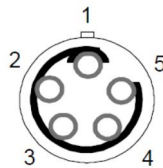
VII. Analog Input functions. When an analog control unit is detected at the Analog receptacle, the corresponding motor channel(s) will be controlled.

A. Microforce zoom cables:

1. Digital Microforce, cable 4765.

2. Analog Microforce V+F3, cable 4766.

3. Gimbal Microforce, cable

B. Canon Broadcast Controls: Focus/Zoom splitter 4771.

C. Fujinon Broadcast controls: Focus/Iris/Zoom splitter 4770.

V. Digital Motors

DM-1X	DM-1X	DM2	DM4X
p/n 4505	p/n 4205A (integral bracket)	p/n 4201A (integral bracket)	p/n 4206 & 4206A both have integral brackets

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 DM4X motor (right) is the smallest member of the family. It's recommended for either light-weight video lenses or the zoom/iris rings of small zoom or prime lenses.

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
4220	0.8m .25" wide
4221	0.8m .50" wide
4230	32DP .25" wide PV focus
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

A. Digital Motor Brackets.

The integral bracket ("A" version) 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. See pictures on previous page.

Important tip for integral brackets: 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.

Swing Arm Brackets pictured below have a 19mm opening on one end and a 15mm opening of the other. Step-down bushings accommodate 15mm and 0.635" rods, p/n 4320 and p/n 4321 respectively.

4310   4334   4302

Short Brackets for Panavision
Vertical Matte Box Rods

4301   4333

Long Brackets for Horizontal
Matte Box 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

VI.   MDR3 Brackets
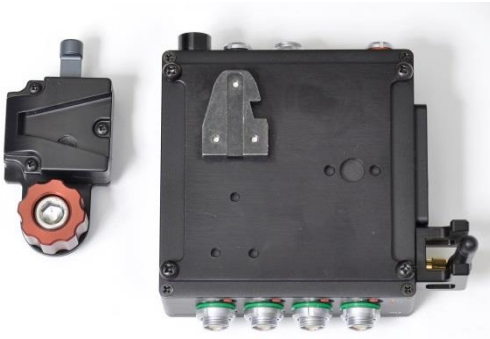
p/n 4790 MDR3 V-lock bracket   MDR3 mounted on F55 with V-lock bracket

A. Third party suppliers of MDR3, MDR4 brackets and accessories:
    a.   www.cleanscamerasupport.com
    b.   www.film-stuff.com/remote-focus-accessories.html
    c.   www.woodencamera.com

VII. Battery Packs and Charger

The HU3 uses FM-500 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 -500 Battery p/n 4025   Charger p/n 4027

VIII. Technical Information

A.   FCC Statement

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.

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.

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 Connectors

	Command 5-pin	Serial 4-pin	Power 4-pin	Motor 7-pin	Camera 12-pin
1	Gnd	+12V	Gnd	Motor(+)	Gnd
2	+24	Gnd	+24	Motor(-)	Ext. Control
3	Serial	Serial In	+12	Encoder A	Run (30mA max)
4	Serial	Serial Out	n/c	+5V	Run
5	Playback Trigger			Gnd	Momen. Run
6				Encoder B	Clock Out +5V
7				Motor ID	Clock Out +12V
8					Camera Encoder In
9					RS232 out
10					RS232 in
11					Zoom Ref In
12					Zoom CMD out

C. MDR3 Camera Cable

1. Arriflex Film Cameras

p/n	Camera Model	Description	Connector
4721	Arri 235, 435, 535, SR3	R/S	3 pin Fischer

2. Panavison Film Cameras

p/n	Camera Model	Description	Connector
4722	All Panaflex	R/S, fps	10-pin Lemo

3. Digital Cinema Cameras

p/n	Camera Model	Description	Connector
4721	Sony F65	R/S	3-pin Fischer
4744	RED One	R/S	10-pin Lemo
4746	RED Epic	R/S	BNC

| 4755 | Sony F55 | R/S | 4-pin Hirose |
| 4757 | Canon C300/500 | R/S | 2.5mm stereo jack |

5. Video Lenses

p/n	Lens Model	Description	Connector
4748	Fujinon	VTR, zoom	12-pin
4749	Canon HD	VTR, zoom	20-pin

D. Transmitter Channel frequency allocation

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