

FI+Z Lens Control

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INTRODUCTION

The F I +Z Lens Control System provides the highest resolution position and velocity control available. The F I +Z Hand Control 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 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 very long distances (1 km) even in the presence of electrical noise and radio frequency emissions. Position and velocity information are updated at 6 millisecond intervals to provide the feel of truly realtime response.

The Microwave Link operates in the 2.4 GHz band and uses spread spectrum modulation to achieve a highly reliable link even in the presence of interfering signals. Additionally, its multiple channel capability enables several units to operate simultaneously at the same location without interference.

The Micro Wave receiver module also incorporates a voltage converter which enables operation from 10.5V to 30 VDC.

The Hand Control incorporates a method for quickly adjusting the scale relationship between the movement of the iris and focus control knobs and the motor rotation. By holding the iris or focus switches in the "set" position, the operator can make any part of the lens scale equal to the full range of the iris or focus controls. This operation effectively expands the lens scale and allows end limits to be set. In the same way, the zoom set switch allows the operator to pre-set zoom limits. Pressing the switch(es) into the "reset" position instantly restores full scale operation.

Zoom command is provided by a Micro Force V + F zoom control. Zoom offsets can be immediately canceled by pressing the Zoom Calibration Switch. Camera operation can be initiated from either the F I + Z hand unit or from the Micro Force control. A remote Iris connection is provided in the event that control of this function is to be done by another operator.

The 3 Channel Motor Driver (MDR) uses a microprocessor to automatically determine the mechanical limits of the zoom, focus, and iris rings of the lens during the auto-calibration sequence. This sequence is initiated whenever the MDR is powered up (the Reset button on the MDR is pressed), or whenever a motor is connected to the Driver.

After these limits are determined, the microprocessor increases the safe area by a few degrees to prevent the motor from impacting the stops. To further protect the lens and driver electronics, the motors are electronically torque limited. Separate torque adjustments are provided for each channel. Direction reversing switches are provided adjacent to each of the motor connectors.

Camera control signals are provided at the LEMO socket labeled "Camera". Signals are available for cameras requiring either continuous voltage levels or momentary pulses,

either active high or active low. In addition, the signals required for VTR start and internal zoom drive for Canon and Fujinon lenses are available from the Camera Lemo receptacle.

SET-UP

1. Couple the lens motors to the lens gears. Adjust the motors to have minimum backlash. Do not couple the motor to the lens too tightly or binding will result.
2. Connect the appropriate camera control cable.
3. Apply power to the system through the LEMO four pin connector on the 3 Channel Motor Driver Box. The system requires 24 VDC (2A peak typical). If the Micro Wave receiver module is fitted, its internal voltage converter enables operation from 10.5V to 30 VDC. The quiescent current with the Micro Force connected is 0.24A and 0.20A without. After power is applied, the motors will find both mechanical end stops of the lens and then come to rest.
4. Check that the direction of motor rotation relative to the Hand Unit is correct. Use the Direction Reversing switches on the Motor Driver Box as required.
5. Plug the Micro Force Zoom Control into the F I + Z Hand unit using the adapter cable provided. Set the maximum zoom speed using the 10 turn adjustment potentiometer at the bottom of the control.
6. With the zoom control in its normal operating position, and no pressure applied to the zoom button, momentarily press the "Zoom Cal" button on the FIZ control. This automatically removes any zoom offset which could cause "creep".

LENS SCALE SET - UP

For normal operation, the full range of the Iris and Focus knobs corresponds to the mechanical end stops of the lens. In many situations it is desirable to **expand** a portion of the lens travel into the full range of the control knob. For example, there may be a sequence with a critical focus pull between 3 ft and 11 ft. That portion of lens focus may be expanded to the full rotation of the focus knob. In this way, there is no danger of the focus puller missing his marks during filming. In addition, the increased resolution allows much finer control of the lens.

The procedure for expanding the range is to position the lens to the first point which you want to make an end stop. While holding the corresponding set/reset switch in the set position move the lens to the position where you want the second end stop and release the switch.

The same procedure is also used for the Focus and Zoom channels.

ZOOM BARGRAPH DISPLAY

The Zoom Bargraph display is off until the Zoom Button on the Micro Force is first pressed. In this way battery power is minimized.

DRIVING A VIDEO ZOOM

The FI+Z can directly drive the analog motor in a video zoom lens. However in this case, the Hand Unit must be switched to operate in the zoom-velocity mode rather than in its default zoom position mode. The change in zoom mode is made by a switch located on the Hand Unit PCB. See the corresponding drawing in this manual.

When the Hand Unit is operated in the zoom-velocity mode, zoom position information isn't available and the zoom bargraph will remain dark.

HAND UNIT FUNCTIONS

The Hand Unit control provides both Iris and Focus capabilities with its integral control knobs, and zoom capability with an external Micro Force zoom control plugged into the zoom socket. Camera control is implemented by the Camera Run push-button. When the Camera Run command is active, the normally green LED indicator flashes red. The Camera Run function may also be activated by the switch on the Micro Force control.

Any Micro Force used with the FIZ must have a MF5 circuit board installed. This is the case for all units manufactured during or after 1992. In addition, the Video Command line coming from the MF5 circuit board must be wired to the 10 pin Lemo socket.

The Zoom Cal button provides automatic adjustment for electrical offsets in the zoom control (i.e. the control is out of adjustment). If any creep of the zoom is observed, the Micro Force should be held in its normal operating position without any force applied to the red joystick knob, and the Zoom Cal button depressed momentarily.

A socket is provided at the bottom of the FIZ control for an external Iris control. When the external iris control is connected, it is automatically enabled and the slide control on the FIZ will be disabled.

MOTOR DRIVER FUNCTIONS

The Motor Driver (MDR) is responsible for driving the motors. Its microprocessor sequences the automatic lens calibration whenever power is first applied to the unit or when a motor is freshly connected. During this sequence, the motors find the mechanical end stops of the lens. The lens end stops are then defined to be the full

travel allowed the motors, and also represent the full scale range of the Focus and Iris controls on the Hand Unit.

The direction of any of the motors may be reversed by the three direction switches located just above the three motor sockets.

The maximum torque output of each motor may be adjusted by means of the three trim pots located on the MDR-1 PCB. Adjusting the maximum torque running torque of the motor also proportionately changes the calibration torque. The adjustment pots have a ten turn adjustment range. Turn the adjustment screw clockwise to increase the maximum motor torque. The adjustments can be done in full turn steps.

The motor currents for calibration and running may be measured with a peak recording current meter (Fluke 87 or equivalent) . A motor driver cable can be modified to make current measurements for the lead going to pin 1 of the LEMO 7 pin connector.

The calibration and run currents for the 3 channels are:

IRIS: 650mA/900 mA
FOCUS: 900 mA/ 1.2 A
ZOOM: 800mA/1.2A

Keep in mind that these are typical settings and may be adjusted per user requirements so long as the peak currents are kept below the current ratings of the fuse(s) installed.

To protect the motor from overheating due to a sustained stall condition, the processor will shut down motor drive if a motor is stalled for more than approximately 5 seconds. The system can be reset by either removing power momentarily or by unplugging and re-plugging the LEMO connector going to the motor.

Each motor driver is separately fused with a 1.5A Picofuse Slo-Blo type (Littlefuse type 473 01.5). Note that if the maximum motor torque is set to a level corresponding to a current greater than the 1.5A fuse rating, the fuse will blow. If the unit is to be operated with extremely stiff lenses requiring very high torques, the 1.5A fuse may be replaced with a 2A Slo Blo fuse (Littlefuse type 473 002).

A separate analog command channel is provided to allow video lenses to be driven from the Camera output of the MDR Unit.

WIRELESS OPERATION

The Micro Wave Link enables wireless operation without any sacrifice in system resolution or response. The transmitter module accepts a 12V NiMH battery pack which powers both the FIZ hand unit as well as a Micro Force . The battery pack typically provides 7 hours of continuous operating time with the FIZ, and 5.5 hours with both the FIZ and Micro Force.

The dual color LED adjacent to the transmitter power switch glows green when the unit is powered and changes to red when the battery is operating on the last 15% of its charge.

The receiver is installed on motor driver unit. To operate the MDR in its wireless mode, move the slide switch to the "Radio" position. The voltage converter within the receiver allows operation of the MDR over the voltage range 10.5 - 30 VDC. The LED located on the receiver will glow green so long as its input voltage is within normal range. As the input drops below 10.5V the light will blink RED. When the input voltage drops below 10V, the light will glow red continuously and the unit will be disabled. To reset the unit replace the depleted battery with a fresh unit.

The voltage converter must be connected to its power source through a low resistance lead. *If the source resistance is too high, the converter will emit a whining sound.*

Both the transmitter and receiver have a pair of channel selection switches. They must be set to the same channel for the units to function.

The transmitter and receiver modules are provided with short dipole antennas. The transmitter and receiver antennas are NOT COMPATIBLE. The SMA type connectors are polarized in opposite ways as required by the US F.C.C. regulation. Please note the labels provided on each antenna and install accordingly.

The receiver module includes a pair of wedge shaped antenna guards. These are designed to protect the receiver SMA connector and the SMA right angle adapter in case of impact. The orientation of the antenna may be changed 90° by removing the guards and turning the right angle adapter.

FCC COMPLIANCE STATEMENT

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

1. This device must not cause harmful interference and
2. This device must accept any interference received including interference that may cause undesired operation.

The FI+Z Microwave Link has been tested and found to comply with the limits for a class B digital device. 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 properly installed and used in accordance with 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 on and off, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or re-locate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Consult the dealer or an experienced radio/TV technician for help.

INDUSTRY CANADA STATEMENT

This Class B digital apparatus meets all requirements of the Canadian Interference - Causing Equipment Regulations. (ICES-003 Issue 2)

BATTERY CHARGER

The Fast Charger has been specifically designed to safely charge the NiMH battery packs at high currents. The unit accepts universal mains voltage 110 - 240 VAC 50/60 Hz. It will fully charge a depleted battery pack in approximately 60 minutes.

The LED marked CHARGE will glow red continuously when in its fast charge mode. After the unit has completed the fast charge phase, the LED will blink, indicating it is operating in the trickle mode. The battery can be left on the trickle mode indefinitely without damage.

The charger will not allow a fully depleted battery to begin the quick charge mode until the pack reaches a minimum voltage in trickle mode. Therefore, the CHARGE LED will blink for a few minutes until the cell voltage rises to where the fast charge can begin safely.

The TEMP LED will glow if attempting to fast charge a battery pack outside safe temperature limits. The minimum and maximum temperatures for fast charging are 10°C (50°F) and 50°C (122°F).

CIRCUIT PROTECTION

The following fuses are used to protect the various elements of the system:
All of the fuses listed are the slow blow type. Fast blow fuses will not work; when power is applied to the circuit the inrush current will cause them to blow immediately.

UNIT

FUSE(S)

Hand Unit	Resettable poly fuse
Motor Driver	Resettable poly fuse (logic power + LED) 1.5A Pico Fuse Iris and Zoom channels 2.0A Pico Fuse Focus channel Littlefuse 473 01.5 1.5A or Littlefuse 473 002 2.0A
Charger	1.25A slow blow (5 x 20 mm) Littlefuse type 218

The motor fuse locations are shown in the drawing of the MDR-1 PCB . They may be replaced by gripping the fuse bodies with needle nosed pliers and pulling them free of their sockets. Bend the leads of the replacement fuses to match the spacing of the sockets, trim their length to the fuses being replaced and push their leads into the sockets.

The Battery Charger fuse is located on the circuit board and retained by a clip. **Remove mains power before replacing!**

CAMERA & LENS INSTALLATION

The FI+Z system includes bracket kits to provide robust support when used in conjunction with industry standard cameras.

1. 15mm Arri rod system. When the FI+Z motors are installed on a camera equipped with 15mm matte box support rods, a Arriflex Bridge adapter is required. This adapter slides over the rods, and includes 2 x 19mm bushings over which the motor swing arms are installed. The adapter provides very rigid mounting points for the motor, and prevents motor torque from twisting the rods .

Once the 15mm rods are stabilized by the Arriflex Bridge adapter (p/n 4304), a third motor may be installed on the 15mm rods using the 19mm motor swing arm and a 15mm/19mm adapter bushing. In addition, a 19mm rod adapter is provided for use with the Arri handle.

2. 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 are provided for use with the upper and lower rod. A bushing adapter is provided to allow the 19mm swing arm to clamp to the .625" rod.

The motor output gears are .80m. They are available in .25" and .50" face widths. All gears are designed to accept "step-up" gears installed over the normal output gears. These step up gears are provided for : Panavision Zoom (48 DP 20 degree PA),

Panavision Iris (64 DP 20 degree PA), Panavision Focus (32 DP, 14.5 degree PA.),
.60m, .70m .

3. A lightweight bracket for Panavision cameras is available (p/n 4341. It is secured to the post adjacent to the lens mount, and allows up to two motors to be rigidly supported with short swing arms. See illustration at the rear of this manual.

Correct operation of the unit depends on the motor supports being rigid. Excessive flexure can cause the motors to not recognize the end limits of the lens. The motor will remain stalled for a few seconds until the system shuts down that channel.

This problem can also be caused when the lens mount on the camera shifts during calibration (as on the Arri BL). Stopping the motor by hand just before the end limit of the lens is reached will enable normal operation.

POWER REQUIREMENTS

1. Hand Unit: 10 - 28 VDC input. Current requirement 80 mA at 12V input.

2. Motor Driver:

- a. Without the Micro Wave receiver: the input range is 19 -28 VDC. Quiescent current requirement 135 mA at 24V input (without motors connected). Each motor draws an additional 20 mA each for optical encoder power.

Peak current requirements are dependent on the current limit settings. Typical settings are 1.2A peak for Focus, and .6 - .9A for Iris and Zoom. Maximum driver output is 2A per channel.

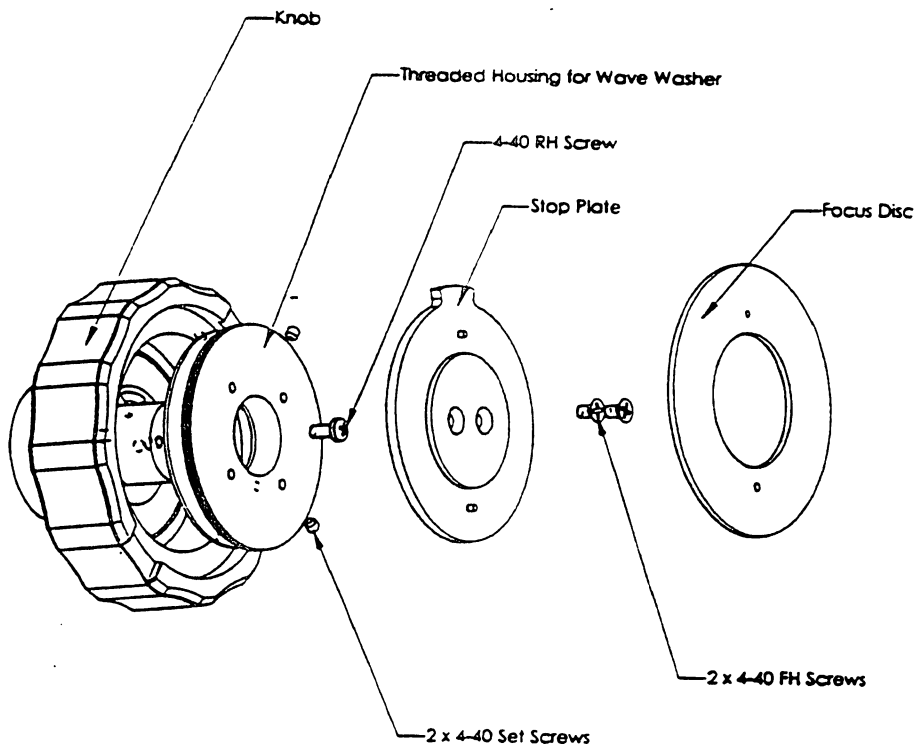
- b. With the Micro Wave receiver, the input range is 10.5 - 30 VDC.

Focus Knob Adjustment

Procedure for removing excess "play" in the Focus Knob
(Please refer to drawing "Focus Knob Assembly".)

1. Remove the plastic Focus Disc from the knob.
2. Remove the 2 x 4-40 flat head screws, which hold the Stop Plate.
3. Lift the Stop Plate clear from the knob. Note that the stop is positioned toward the top of the Hand Unit.
4. Loosen the 2 x 4-40 set screws in the knob. These screws prevent rotation of the Wave Washer Housing.
5. Hold the knob in one hand and use a tool with a round tip to rotate the Wave Washer Housing clockwise in approximately 30° increments until any play is removed.
6. Tighten the two 4-40 set screws and re-assemble the Stop Plate with its tab facing upwards, toward the top of the hand Unit.
7. Replace the 2 x 4-40 flat head screws and replace the plastic Focus Disc.

Caution: Do not loosen the Wave Washer Housing by turning it counterclockwise. This will allow the Pressure Washer to leave the pins, which retain it in place.



Focus Knob Assembly