F I + Z Lens Control

Rev 1.0

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I. Introduction

A. System. The F I +Z II Lens Control System provides the highest resolution position and velocity control available. The basic hard-wired system consists of the Hand Unit, Motor Driver, and Digital Motors. The addition of the Microwave Link enables complete wireless control of all functions. The F/X unit adds camera speed ramps with iris and/or shutter compensation.

The Hand Unit digitizes focus, iris, and zoom commands to 16 bits of resolution (1 part in 65,536). This data is sent to the 3 Channel Motor Driver either through a cable or the Microwave Link 2. The cable link uses the RS422 standard protocol to transmit data over a single twisted pair of wires. This enables reliable transmission over long distances (1 km).

The Motor Driver (MDR2) supports 3 motor channels, camera run/stop, and camera speed and shutter control. Switches are provided for adjusting Motor Torque and direction.

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

The Microwave Link 2 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. The Direct Sequence type of modulation employed in the link is uniquely suited to real time control applications since it is able to reject both interfering signals as well as signals reflected from the environment. Additionally, its 30 transmission channels provide ample capability for any set.

The Microwave Link 2 consists of the following modules: the Transmitter (for the Hand Unit), Transceiver (for the Motor Driver), a NMH battery pack, a universal fast charger and a set of antennas. This link supports communication between the Motor Driver (MDR2), the Hand Unit and other clients of the system.

The F/X unit is the first client to take advantage of this network; it provides speed/aperture/shutter ramps and reports on the camera speed, shutter angle and footage status in real time.

The Microwave Transceiver module also incorporates a voltage converter that enables operation from 10.5V to 30 VDC

fig1. Hand Unit

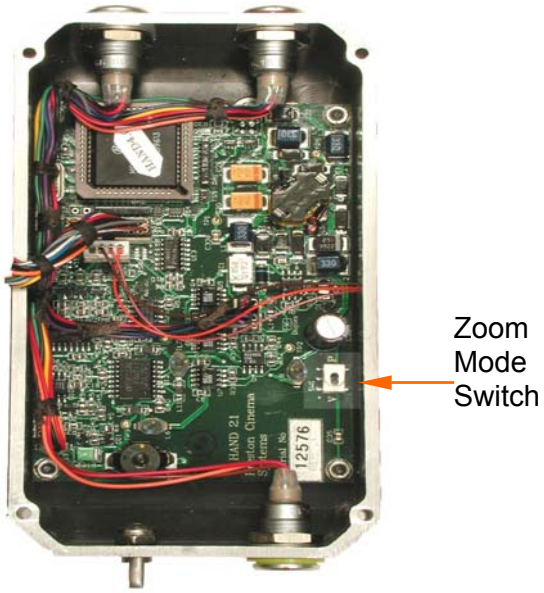


Fig.2 Hand Unit Zoom Mode Switch

B. Hand Unit

The Hand Unit transmits Focus, Iris, and Zoom (when a Micro Force is fitted) data to the MDR2 unit. This digital data can be sent either through a cable connection using the Command cable, or in wireless mode using the ML2 Microwave link.

Power for the Hand unit is provided through the Command cable when a cable link is used or from the NMH battery pack when used in the wireless mode. The Hand Unit will operate over an input voltage range of 10.5 – 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.

A special operating mode is provided to enable the FI+Z to be used to drive the Pan and Horizon axes of the Revolution snorkel lens. The Normal/Snorkel switch is located just above the Focus knob (see fig.1). When the switch is set to Snorkel mode, both lens calibration for the iris and zoom channels and the bargraph display are disabled. The Micro Force Zoom Control drives both the Pan and Horizon axes of the lens, keeping the horizon level. A detailed description is given in Section (xx).

The ergonomic features of the Hand Unit include a large silicone damped focus knob, an iris slider adjustment positioned to enable one hand operation and a bright LED bargraph to indicate zoom position. The replaceable iris scale strip allows for the easy placement of marks.

Zoom command is provided by a Micro Force V + F2 or Digital Micro Force 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 receptacle is provided at the bottom of the Hand Unit. This allows the iris to be controlled by another operator using the Remote Iris Control (p/n 4020).

C. MDR-2

Fig.3 MDR-2 with Microwave Transceiver

The 3 Channel Motor Driver (MDR2) uses a lens calibration sequence to automatically determine the mechanical limits of the zoom, focus, and iris rings of the lens. This sequence is initiated whenever the Reset button on the MDR is pressed, or whenever a motor is connected to the Motor Driver. Lens calibration allows for precise, repeatable marks and also prevents accidental damage to the lens or Digital Motor. An internal memory stores the positions of a calibrated lens for 12 hours without external power.

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

The Direction Reversing and three-level motor Torque switches are located adjacent to each of the three motor connectors, as shown in fig3.

Camera control signals are provided at the “Camera" receptacle of the MDR2. Signals are available both for run/stop as well as for controlling both the camera speed and shutter angle. This receptacle also accepts real-time speed, shutter angle and run/stop status data from the camera and transmits it to the F/X box through the Microwave Link. In addition, the camera receptacle provides the signals required for VTR start and internal zoom drive for Sony cameras as well as Canon and Fujinon lenses.
The Microwave Transceiver mounts directly on top of the MDR-2 unit. It provides wireless bi-directional communication between the MDR, Hand Unit, F/X unit and other clients in the wireless network. In addition, it contains a voltage booster enabling MDR operation over an input voltage range from 11 to 30 volts.

The software controlling the MDR-2 is updated through the “Serial” receptacle and the Serial-PC cable that connects the MDR to the serial “D” connector of a PC. Software updates are available either as a CD or download from our web site: www.prestoncinema.com.
To initiate the update, open the MRD2 update program on your PC. The program CD and a serial cable is included with the MDR2. Remove power from the MDR2. Connect the serial cable between the PC and MDR2 serial receptacle. Open the MDR2 update program. While holding the reset button down, apply power to the MDR2. Release the reset button. The

program should now report that it has found a connection to the MDR2 and asks whether you want to proceed with the update. Choose yes. After the program has completed the update, you can remove the serial cable from the MDR2.

II. SET-UP

A. Cable Operation

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. 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.

2. Use the appropriate camera cable to connect the MDR2 to the camera accessory receptacle. Please note that a special molded “Y” cable is required to control both the speed and/or shutter angles of 24V Arri cameras (p/n #4510).

3. Connect The Hand Unit to the MDR using the Command Cable.

4. Apply power to the FI+Z system through one of the Power Cables (red strain relief). The system requires 24V – 30 VDC (2A peak typical). If the Micro Wave receiver module is fitted, its internal voltage converter enables operation from 11V to 30 VDC.

5. Press the Reset button to start the calibration sequence. The motors will find the mechanical end stops of the lens and then come to rest. If the Hand Unit is linked to the MDR either through a cable connection or through the Microwave Link unit, the motor will immediately move to the positions corresponding to the current Iris and Focus settings on the Hand Unit.

6. Check that the direction of motor rotation relative to the Hand Unit is correct by changing the positions of the knobs in the Hand Unit and observing the lens. Use the Direction Reversing switches on the Motor Driver Box as required.

7. 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.

8. It the zoom motor rotates without any pressure applied to the joystick, momentarily press the “Zoom Cal” button on the FIZ control. This automatically removes any zoom offset, which could cause “creep”.

B. Wireless Operation

9. Determine whether there are any other FIZ wireless units operating in the vicinity. If there are, determine what channel(s) are being used, and choose a different operating channel.
10. Plug the Transmitter module into the Hand Unit. Be sure that the Velcro pads and the Transmitter and Hand Unit are mated together.
11. Screw the transmitter Antenna onto the connector on the top of the unit.

12. Slide a charged battery into the rear of the Transmitter. The Battery Release will prevent the battery from being accidentally released.
13. Set the Channel Switches on the Transmitter and Transceiver to the same channel. There are 30 channels available (00 – 29). Channels above 30 simply repeat the same channels (i.e. Channel 30 is the same as Channel 00).
14. Screw the antenna for the Transceiver into its receptacle. Observe the labels on the antennas since the Transmitter and Transceiver antennas are polarized differently.

Fig 4a
Transmitter
Front view

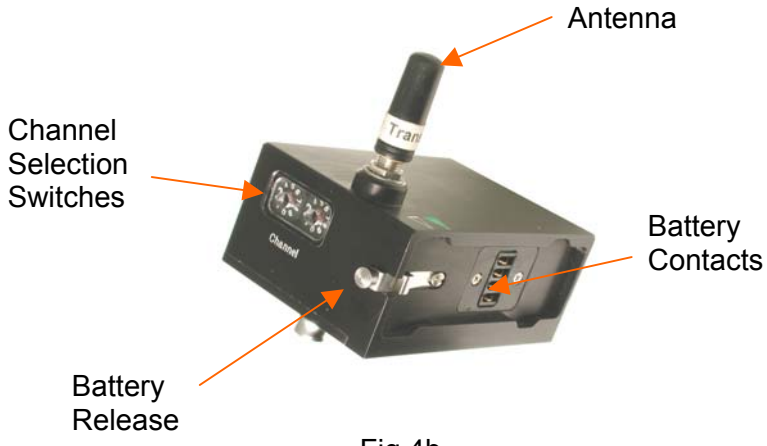


Fig 4b
Transmitter
Rear View

15. Switch on the power. The Power LED should be green during normal operation. The NMH battery pack will last approximately 6 – 8 hours. When the battery is down to the last 10% of its charge, the LED will flash RED and the battery should be replaced with a freshly charged unit.
16. A solid red LED – or no light at all - indicates that the battery is completely depleted. The Transmitter will not operate in this state.
17. When operating in rain, use a rain cover. If the battery contacts become wetted, dry them off immediately with warm air from a hair dryer to prevent corrosion and potential failure.

III. Hand Unit Operation

A. General Description

The Hand Unit control provides both Iris and Focus capabilities. The addition of a Micro Force zoom control provides zoom functionality. The Micro Force control may be attached to the Hand unit with the bracket p/n 4336.

All MF6 and Digital Micro Force units can be used to control the Zoom function. Earlier Micro Forces must have both an MF5 circuit board installed and be wired for use in the Video Command Mode to work with the FI+Z.

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, momentarily press the Zoom Cal button while holding the Micro Force in its normal operating position without any force applied to the red joystick knob

The Camera Run push-button switch allows control of cameras requiring either momentary pulses (Arri 24V cameras, Sony video cameras) or those requiring a constant control voltage (Panavision, Aaton, Arri 12V cameras). When the Camera Run command is active, the normally green LED indicator flashes red.

The Camera Run function may also be activated by the three position switch on the Micro Force control. Note that leaving the Micro Force Camera Run switch in the RUN position will over-ride the Camera Run push-button on the Hand Unit.

B. Scale Expansion

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. Just that portion of lens focus –from 3ft to 11 ft - 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 with the focus knob to the first point that you want to make an end stop (3 ft). While holding the corresponding set/reset switch in the set position move the lens to the position where you want the second end stop (11 ft) and release the switch. Now the full range of the control is between the limits you have set. To restore the full range, momentarily push the set/reset switch to the reset position.

The identical procedure is used for the Iris and Zoom channels. Note that the set/reset switch for the zoom channel is marked ZS/ZR.

C. Zoom Bargraph Display

The Zoom Bargraph display provides a remote indicator of zoom motor position. It remains off until the Zoom Button on the Micro Force is first pressed. In this way battery power is minimized.

The Zoom bargraph is also disabled in Snorkel mode operation.

D. Driving a Video Lens

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 zoom mode switch is located on the Hand Unit PCB. For normal operation, the switch should be in the “P” position. For driving the internal motor of a video lens, put the switch in the “V” position. See fig.2 for the location of the switch.

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

E. Remote Iris Unit

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

Fig5. Remote Iris Box p/n 4020

IV. MOTOR DRIVER FUNCTIONS

The Motor Driver 2 (MDR2) is responsible for driving the motors, providing control signals to the camera, and transferring camera operating data to the wireless network through the transceiver module.

Automatic lens calibration begins whenever the Reset button is pressed or when a motor is initially connected (assuming the MDR is powered). 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 (see fig.3).

The maximum torque output of each motor may be adjusted by means of the three position slide switches also located just below the motor receptacles. Adjusting the maximum running torque of the motor also proportionately changes the calibration torque.

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

Power is provided to the MDR-2 through the 4-pin Lemo connector (see fig. 3). The MDR-2 operates over a voltage range of 22 – 30 VDC. The power source should be capable of 3A current. The Microwave Transceiver unit incorporates a voltage booster unit. This unit allows MDR-2 operation from 11V to 30V. When operated from 12V, the power source should have 6A current capability (for a three motor installation).

The Serial receptacle is used both for updating MDR software as well as providing communication with future accessories. The procedure for updating firmware is as follows:

1. Load the installation files provided on the Firmware Upgrade Installation Program CD to the PC. The update files will be installed in the folder C:\Program Files\Preston
2. Open the file containing the Firmware update. The PC screen will show the message: “Connect MDR to a serial port”
3. Disconnect the Power connection to the MDR. Connect the serial cable from the PC to the Serial LEMO receptacle of the MDR. While holding the Reset button in, connect power to the MDR and release the Reset button.
4. When the PC screen shows that the firmware upgrade has been completed, remove the serial cable.

V. Digital Motors

DM-1

DM-2

DM-3

Fig6. Digital Motors

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

The DM-1 is a general-purpose motor capable of providing high power output over long periods of time. It is recommended for driving even the stiffest lenses under all extremes of temperature, vibration and humidity.

The DM-2 is a smaller and lighter weight motor. It can be used on all but the stiffest cinema lenses.

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

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

VI. CAMERA & LENS INSTALLATION

The FI+Z system includes bracket kits to provide robust support when used in conjunction with industry standard cameras. These brackets have been designed to for maximum rigidity and lens positioning accuracy.

4304 15mm Arri Bridge
4311 Panavision Bridge

Fig.7 Motor Brackets

1.15mm Arri rod system. When the FI+Z motors are installed on a camera equipped with 15mm matte box support rods, an Arriflex Bridge adapter is required. This adapter slides over the rods, and has two integral 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.

The 19mm Arriflex rods are very rigid and don't require a bridge.

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 and accurate positioning 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.

Fig.8 NMH Battery Pack

Fig.9 Charger

VII. BATTERY PACKS AND CHARGER

Nickel Metal Hydride (NMH) battery packs (fig.8) are used to power the Microwave Transmitter and Hand Unit. The packs provide 12V at 1.5 AH. They incorporate an internal temperature sensor to protect the cells from either overcharging or from being charged below freezing temperatures. They will operate the Transmitter/ Hand Unit combination for 6 – 7 hours continuously. These cells do not exhibit any “memory” effect and therefore they do not need to be completely depleted before being recharged.

The Fast Charger (fig.9) 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 – 80 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.

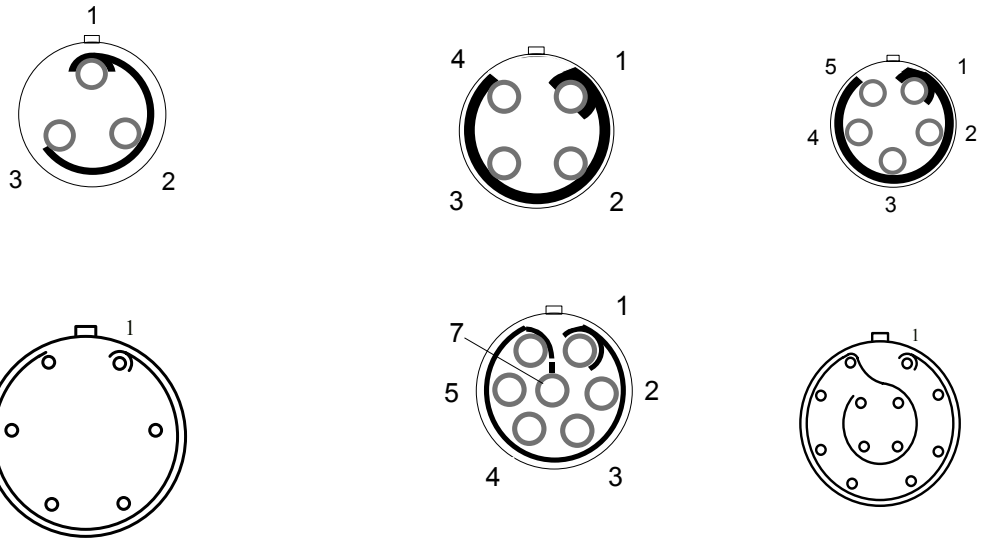
The charger will not allow a fully depleted battery to begin the quick charge mode until the pack reaches a minimum voltage in trickle mode and a minimum temperature of 10°C. When the battery pack temperature is below 10°C, the CHARGE LED will
blink for a few minutes until the cell voltage rises to where 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).

VIII. TECHNICAL INFORMATION

I. Connector Pin-outs

a. Receptacle Views – Solder Side



b. Motor Driver Connectors

i. Power

1. Gnd.
2. +24V
3. +12V
4. n/c

ii. Camera

1. Gnd
2. External Control
3. Run (30mA max. @ 12V)
4. $\overline{\text{Run}}$
5. Momentary Run
6. Clock Out +5V
7. Clock Out +12V
8. Camera Encoder Input
9. RS232(A) out
10. RS232(B) in
11. Zoom Reference Voltage Input
12. Analog Zoom command output

iii. Command

1. Gnd
2. +24V
3. Serial
4. $\overline{\text{Serial}}$
5. Playback trigger
   Bloop light trigger

iii. Motor

1. Motor (+)
2. Motor(-)
3. Encoder A
4. +5V
5. GND
6. Encoder
7. Motor Plugged/ ID

i. Serial

1. RS232 in
2. Gnd
3. RS232 out

a. Hand Unit Connectors

i. Command

1. Gnd
2. +24VDC
3. Serial
4. Serial
5. n/c

i. Zoom

1. +12V
2. Gnd
3. Run On/Off
4. Run Momentary
5. Vref (6.2V)
6. Zoom Command

i. Remote iris

1. +3V
2. Wiper
3. –3V

2. Transmitter Channels and Frequencies

Channel	GHz	Channel	GHz
0	2.412	15	2.4405
1	2.4139	16	2.4424
2	2.4158	17	2.4443
3	2.4177	18	2.4462
4	2.4196	19	2.4481
5	2.4215	20	2.45
6	2.4234	21	2.4519
7	2.4253	22	2.4538
8	2.4272	23	2.4557
9	2.4291	24	2.4576
10	2.431	25	2.4595
11	2.4329	26	2.4614
12	2.4348	27	2.4633
13	2.4367	28	2.4652
14	2.4386	29	2.4671

3. Compliance Information

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)

4. Power Requirements

a. Hand Unit: 11 - 30 VDC input. Current requirement are 80 mA at 12V input.

a. Motor Driver:

i. Without the Microwave Transceiver: the input range is 22 -30 VDC. The quiescent current requirement is 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 (for 24V Power Input) are 1.2A peak for Focus, and .6 - .9A for Iris and Zoom. Maximum driver output is 2A per channel. Make certain that the power source is capable of supplying the maximum required current!

ii. With the Microwave Transceiver, the input range is 11 - 30 VDC.

5. Service and Troubleshooting Information

a. MDR Motor Current Settings. 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

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. If the motor consistently stalls due to excessive load, do not reconnect the motor until the mechanical problem is resolved.

If the motor housing is greater than 60°C (140°F), allow the unit to cool until the housing is less than 40°(100°F). Otherwise permanent motor damage can occur.

b. **Troubleshooting Guide**

Symptom	**Check**
1. Motor doesn't turn	Power light on MDR and Hand Units If motor calibrates, check communication with Hand Unit: i. Press the Reset switches on the Hand Unit ii. If in wireless mode, check that the Transmitter and Transceiver are set to the same channel. Check that the correct antennas are installed. Make sure that the Transmitter has a green light – if not replace the battery with a fully charged unit. Check that the Cable/Radio switch on the Transceiver is in the Radio position. iii. Try operating in the Cable mode. Remove the Transmitter from the Hand Unit, and use a command cable to connect the Hand Unit to the MDR. Set the Cable/Radio switch to Cable.
2. Motor rotation isn't smooth.	Observe the motor rotation when it isn't coupled to the lens. If it turns smoothly, check that the lens gear turns smoothly. Examine the teeth on both the lens and motor for damage. If the motor doesn't turn smoothly when it isn't driving the lens, substitute another motor. If the same symptom persists with the other motor, operate in the Cable Mode as described above. If the symptom disappears with the new motor, the original unit should be sent in for service. If the motor turns smoothly in cable mode, check the antennas for damage. See if the symptoms change as the distance between the Transmitter and MDR change. If the roughness goes away as the separation distance becomes smaller, the problem could be due to a bad antenna or a damaged component in the Transceiver.
3. Transmitter LED is RED	Replace the battery pack with a freshly charged unit.

	If the unit is working normally with the red LED, the microprocessor may not be making good contact with its socket. The processor contacts require cleaning with an anti-oxidant (Pro-Gold). This procedure requires careful disassembly and should be left to our Service Department.
4. Transceiver LED is RED	The supply voltage is < 11.0V. Possible causes include: depleted batteries, defective batteries or units with excessively high internal resistance, power cables with excessively high resistance.
5. Lens doesn't return to mark.	Check that the motor brackets aren't flexing during either calibration or operation. Inspect the motor for backlash. Apply light rotational force to the output gear. There should only be a slight amount of play (< 10mils). If the play is excessive, return the motor for service. Make sure that the 15mm motor mounting post is secured by the 10-32 flathead screw. Rotate the lens gear by hand. Check that it isn't binding or have rough spots.
6. No power to the MDR	Check that the proper cable is being used to connect power to the MDR. Note that Arri and Panavision 24V batteries have opposite polarities so be sure the correct cable is used.
7. Charge LED doesn't come on	Battery may be defective. Try another battery. If Charge LED blinks slowly, the fast charge cycle may be delayed until either the battery voltage rises to within normal limits or the battery temperature fall within the safe range 10°C - 50°C.
8. Short Wireless Range	Check antennas for mechanical damage. Make sure transmitter and Transceiver antennas aren't interchanged.
9. No Wireless Operation	Check that the Transmitter and Transceiver are set to the same channels. Check that the switch on the Transceiver is set to Radio. The LED on the transmitter should be green. If not, check with a fresh battery. Otherwise the Transmitter and MDR/Transceiver will have to be returned for service.