FI+Z F/X
Manual
V1.1

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F/X Manual

1. **Overview**. The F/X unit works in conjunction with the MDR2 to provide camera Speed Ramps with automatic iris and/or shutter angle compensation. (Shutter angle compensation is currently available only for the Arri 24V cameras with variable electronic shutters (435ES, 535)). Camera Speed ramps may be controlled either manually – through the slider control - or through the programmed Auto mode using the arrow keys. Supported cameras include both those requiring an analog clock input for speed control (Arri3, Aaton, Panavision…) and those requiring digital interface (Arri 453, 435ES, 535 SR3…).

   An integral Microwave transceiver provides bi-directional communication between the F/X unit and the camera through the MDR-2. This allows the real time display of the camera speed, shutter angle, footage, and running status. The large graphic screen shows all relevant camera, lens, and system status information.

   Lens data is stored internally in a **Lens Library**. The Library is split into 2 parts; the **Standard** list that can only be edited with a password, and the **User** list that may be edited without a password. Both linear and non-linear lenses are accepted in the library. These libraries allow lens changes to be made without having to go through the calibration procedure. In addition, the base "T" stop may be changed "on the fly", even during the speed ramp by simply using the Iris control knob.

   The **Home** menu displays the list of functions. A function is chosen by using the arrow keys to scroll through the list and then pressing **Enter**. The **System Info** entry allows the user to select the microwave channel for wireless communication (0 – 29). This must match the channel selected on both the Motor Driver MDR2 and Hand Unit transmitter. The **ft/m** soft key toggles the film footage units between English and Metric. The current camera and lens are stated along with calibration information. The firmware version is shown at the bottom of the screen. Firmware updates may be downloaded from the **www.prestoncinema.com** web site.

   The Li-Ion battery operates the unit continuously for approximately 5 hours. The re-charge time is 4 hours.

2. **Graphic Screen**. The Graphics screen is divided into four parts (see fig 1).

   A. The upper part of the screen shows the following status information:
      a. Camera Status
         i. Shutter Angle
         ii. footage
         iii. fps
      b. System Status
         i. Signal Strength
         ii. Battery charge
      c. Record/Playback mode active. (icon with tape reels).
      d. Warnings
         i. Broken link – no communication with the MDR2.
         ii. Iris motor not calibrated. (motor icon with ?)
         iii. Snorkel Mode indication (when enabled from the Hand Unit).
         iv. Keyboard locked.
         v. Uncompensated: existing lens or camera setting will not provide correct exposure compensation. This occurs in two situations: in the Speed

Shutter mode where the user has manually entered a shutter angle – overriding the settings computed by the F/X unit, or in the Speed/Aperture/Shutter mode where the user has set the T-stop in a position too close to a mechanical limit to allow proper exposure compensation.

vi. Iris Off icon. This will appear if the automatic Iris exposure function is not active. For example, when the Speed/Shutter function is chosen, the Iris Off icon appears, indicating that all exposure compensation is done with only the shutter. This warning will also appear if you have chosen a lens from the Library that has not had its iris calibrated.

B. The middle part of the display shows the programmed camera speeds, shutter angles, ramp times, and (for the speed/shutter mode) T-stops.

C. The bottom part of the display shows the softkeys.

3. **Controls Description**. Keys functions will use **blue** text. See fig.2.

2. Keyboard Functions
    a. Numeric keys are used for data entry.
    b. **Arrow** keys are used for cuing speed changes in auto mode or selecting an entry from a list (i.e camera or lens list).
    c. The **Home** key brings up the list of available functions. The first entry, System Info shows the current radio channel, camera and lens selection, motor calibration status and firmware version. A **shortcut** for changing radio channels can be taken by pressing the Shift key (momentarily) and then the **Home** key. Change to the desired channel and press C (clear) to return to the previous screen.
    d. The **Camera** key shows the list of supported cameras.
    e. The **Lens** list shows all entries in the lens library. It also allows the user to add new lenses to the library and to edit existing lens data.
    f. The **Shift** key is used to access functions in yellow text above the keys (clear footage etc). The keyboard **LOCK** function prevents accidental data entry, camera or lens changes. This is accessed by Shift "0".
    g. The Record/Playback setup screen is accessed by pressing **Shift** + 5. Record/Playback functions are selected by **Shift** +1, 2, 3, or 6,
    h. The **Camera Run** key is used to start and stop the camera. Its backlight indicates the actual running status of the camera. If the camera does not respond to the start command, the backlight will turn off after 2s.
    i. The four **softkeys** have functions defined by the graphic screen just above them.
    j. The Keyboard can be **locked and unlocked** by **Shift** + 0. This prevents accidental data entry during a shot.

3. User Controls
    a. The Iris knob is used to set the base **T-Stop relative to 24fps**.
    b. The Slider is used to change camera speed in the manual mode. It also controls the shutter angle in the shutter/iris mode.
    c. The Power Switch is located just above the slider knob.

4. Indicators and Sensors
    a. The Out of Range Window (fig2) glows red if the Iris motor is at the mechanical limit of the lens. If this glows during a speed change, the base T-stop will have to be changed to allow for proper exposure compensation.
    b. The light sensor (fig2) for the backlight is located just above the home key.

c. The Battery Charge indicator (fig1) shows five bars to indicate full charge. When only a single bar remains there will be 15 – 30 minutes of operating time remaining.
d. The Signal Strength indicator (fig1) provides a relative indication of the signal strength received from the MDR2.

4. Lens Calibration. Lens data on up to 150 lenses may be stored in the F/X. The lens library is organized by manufacturer. To display the manufacturers list, press the **Lens** key and then **mfr. list** softkey. See fig. 3a.

Lenses may be entered as either **Standard Lenses** or **User Lenses**. A password is required to enter or edit lenses in the Standard lens list. The Standard list is useful for storing a large number of lenses in a permanent inventory.

User lenses may be entered and edited without a password. All user lenses entered into the lens library are prefaced by the letter "**u**". User lenses may be purged from the library as follows: Press **Home**, **system** (softkey), enter the password, move the cursor to "Remove User Lenses", **Enter**, move the cursor to **Yes** and **Enter**.

Lens data entry is done in two steps: first entering the lenses' name and second calibrating the lens.

a. To name a lens, Press **Lens**, **new**, and then choose Standard or User using the arrow keys, then **Next** (softkey). If the lens is a zoom enter the zoom ratio (i.e. 5:1, 11:1 etc.) Next, choose the manufacturers' name to determine the page on which the lens data will appear. Figure 3b.shows a lens page. The letters "I" to the far right show which lenses have their iris' calibrated. Finally name the lens using the lens editing screen (fig. 3c.). Scroll through the alphanumeric characters using the ► and ◄ characters. The softkeys << and >> move the cursor through the text line to enter or overwrite characters. When done press **Enter**.
b. To Calibrate a lens, go to the lens manufacturers' page which contains the lens, place the cursor opposite the lens' entry and choose **edit**. Keep the default Calibrate choice and press **Next**. Leave the cursor on Iris (the default) and press **Next**. Indicate whether the lens has uniform spacing between T-stops and press **Next**. Enter the maximum and minimum T-stops. Use the Iris Knob to position the lens to the T-stops indicated on the display and press **Next.** The display will return to the last operating mode (Speed/Aperture etc.) before the lens was calibrated.

5. Operating Instructions.

A. Install the MDR2 and its motor drives. Couple the motor drives to the corresponding lens gears. Check that the MDR2 and Hand Unit Transmitter are set to the same channel – between 0 and 29. Apply power to the MDR2 and Hand Unit. The motors will go through their calibration cycle unless the memory function is active (the motors haven't been unplugged since the last calibration). When changing lenses always remember to press the reset button on the MDR2 to calibrate the new lens. Check that the Hand Unit controls the motors. The Normal/Snorkel switch on the Hand Unit should be in the Normal position, otherwise the Snorkel Icon and the Iris Off warning will appear in the F/X display.
B. Insert a fully charged Li-Ion battery into the compartment at the rear of the F/X unit. Power up the unit. The first screen confirms communication with the MDR2 (Radio detected, MDR found). If the screen shows "MDR not found", communication has not

been established with the MDR. The next screen will indicate this with the broken link icon. See fig1. The F/X channel should be checked to match that of the MDR. Press the **Home** key, place the cursor will be on System Info and press **Enter**. If the channel doesn't match that of the MDR change it by pressing the soft key **chann**. Use the numeric keys to select the correct channel and then press **exit**. The broken link icon should disappear indicating that the link to the MDR2 is established. The display then shows the last screen before the unit was shut down.

C. Press the **Camera** key. Select the camera type and press **Enter**

6. **Operating Modes.**

Speed Ramp Functions. There are three speed ramping functions available: Speed/Aperture, Speed/Shutter, and Speed/Shutter/Aperture. Press the **Home** key and then use the ↓ and ↑ keys to select the Speed Ramp function and **Enter**

A. **The Speed Aperture** (Auto mode) screen is shown in fig.4a. S1 – S4 represent user-programmed speeds. Press the **speed** softkey and use the arrow cursor to choose the speed to edit. Key in the desired speed. The arrow key can be used to edit another speed on the screen. When finished, press **Enter**.

Press the **time** softkey and using the arrow keys to choose which transition time to edit. The F/X unit automatically calculates the speed ramp to match the programmed **screen times**. Press **Enter** to complete.

The rate of speed change is automatically limited to the capability of the camera being used. If the user attempts to enter too short a transition time, the F/X unit will substitute the minimum possible transition time.

To operate the camera in the Speed Aperture mode, put the cursor opposite the beginning speed (S1). Use the Iris knob on the F/X unit to set the base T-stop. **(This is the stop referenced to 24fps**). Press the **Camera Run** key to start the camera. The fps indicator on the screen will indicate the actual running speed (S1). Start the speed ramp by pressing the arrow key to move the cursor to the next speed (S2). The iris will automatically compensate for the speed change. Additional speed changes can be made by stepping the cursor with the arrow keys.

To change the speed manually with iris compensation, press the **manual** softkey (fig.4b). Program Smax and Smin, the maximum and minimum speeds, with the respective softkeys. These speeds correspond to the end positions of the slider. Set the base T-stop with the Iris knob. After starting the camera with the **Camera Run** key, the speed may be changed with the slider between the programmed limits Smax, Smin. As in the Auto mode, the F/X unit limits the rate of speed change to conform to the cameras capabilities.

B. Speed/Shutter Ramp functions. This function supports cameras with electronic shutters (currently Arri 435ES, 535). One of these cameras must be selected to enable this function. Press the **Home** key and then use the ↓ and ↑ keys to select the Speed/Shutter function and **Ente**r. The manual and auto Speed/Shutter screens are shown in figures 4c, 4d. This function allows speed compensation with only the shutter angle. Use the **speed** softkey to program both the speeds. The correct shutter angles are automatically calculated for correct compensation and shown to the right of the speed entries. The shutter angles may also be entered manually using the **shuttr** softkey. If a shutter angle entered manually doesn't provide exposure

compensation the warning **UNCOMPENSATED** will appear in the display. To restore exposure compensation, press the **shuttr** and then **auto** softkey. Exposure compensation can also be restored by re-entering a speed.

A special option allows flicker free speed ramps in the Speed/Shutter mode. This option is selected by pressing the **shuttr** and then either the **50Hz** or **60Hz** soft keys. The F/X unit forces the exposure time to be 1/100s or 1/120s for 50Hz or 60Hz respectively. The maximum camera speed will correspondingly be limited to 50fps or 60fps

C. **Speed/Shutter/Aperture** Ramp functions. This function allows the user compensate a speed ramp with a combination of the shutter angle and iris. The F/X unit will automatically calculate the shutter angle and the T-Stop change to maintain constant exposure.

Auto Mode: If the **Iris Off** icon appears, press **Shift + 9** to go into automatic iris mode. The screen is shown in fig. 5a. Enter the desired beginning and ending speeds and the unit will calculate the required shutter angle change for correct exposure. At this point the exposure compensation is done entirely by the shutter. Manually enter the desired shutter angles and the unit will calculate the required T-Stop change. Note that the T-Stop information is displayed just below the speeds with ¼ stop resolution.

Manual Mode. The screen is shown in fig. 5b. Enter the speeds using the **Smin** and **Smax** softkeys. Enter the desired shutter angles with the **shutt**r softkey and the up/ down arrow keys ↓and ↑. The slider allows manual control of the camera speeds.

D. Record/Playback operation

The F/X unit can record and playback up to 11 minutes of programmed lens and camera moves. Recordings for any channel must be made as a continuous record; they cannot be made as a sequence of segments. Each time a recording is initiated, you will be recording over any existing record. To provide flexibility, you are able to build up records one channel at a time. You can choose to playback any of the 5 channels while recording one or more of the remaining channels.

The Record/Playback setup is accessed by the Shift + 5 key. The setup has the following functions:

1. Enable/Disable recording and playback.
2. Selecting Record, Playback or none for each channel. The channels consist of the 3 lens channels (focus, Iris, and zoom) and two camera channels (speed and shutter).
3. Enabling a countdown prompt for cueing the action. The countdown prompt is 5 seconds long. It is shown on the display (see fig. 6) and can be recorded on film by plugging the bloop light accessory into the command receptacle of the MDR-2. If the countdown is disabled, the recording begins as soon as the Record command key (Shift + 1) is pressed. In this case, the Bloop light will remain lit for 1s.
4. Playback can be triggered via the command receptacle located on the MDR-2. This is useful for synchronizing Lens and Camera recordings with other motion control equipment.

   A 5V pulse applied to pin 5 will start the Playback function 60mS after the leading edge.

The R/P Setup screen is accessed by **Shift** + 5 and shown in figure 7.

1. To enable the Record/Playback functions choose the **enable** soft key. Pressing this key toggles the Status indicator between Enabled and Disabled.
2. Use the up/down arrow keys to point the cursor to the channel you wish to define. A channel can be defined for recording, playback or inactive by pressing the **choose** softkey. This allows channels to be recorded sequentially. If you choose to write over a channel with existing data you will be asked to confirm the overwrite. If you answer Yes, the memory for that channel will be purged of existing data, and the counter will be reset to zero. If you choose No, the Record function will not be enabled for that channel.
3. The countdown function can be enabled by placing the cursor on its line and using the Choose soft key to toggle between Yes and No.

When all of the Setup choices have been made, press the **done** softkey, and the screen will return to its previous menu.

Important! Once the F/X unit programs the MDR-2 for Playback**, any channel that has been chosen for playback cannot be controlled manually.** To enable normal manual control, return to the Record/Playback menu and either **Disable** the Record/Playback function or change the status of the channel in question to either Record or none.

Alternatively, you can restore normal manual control by momentarily removing power to the MDR-2 unit. After power is restored to the MDR-2, the F/X unit will no longer display the Record/Playback icon, confirming that it is operating in the normal manual control mode.

The record time is shown on the display just to the right of the Record/Playback icon.

The Record/ Playback controls are indicated by the familiar icons located above the **1, 2 3**, and **6** number keys corresponding to **Play, Stop**, **Record**, and **Rewind.**

E. Shutter/Aperture operation provides depth of field control with exposure compensation. Program the camera **speed**, **max**imum and **min**imum shutter angles with the soft keys. The slider control controls the shutter angle; the end limits correspond to the programmed angles. Figure 8 shows the Shutter/Aperture screen.

7. **Cable operation**. The F/X unit can be connected to the MDR2 through a standard Command Cable (p/n 4400). Be sure to set the switch on the MDR2 Transceiver to the Cable position. This cable connection allows the MDR2 unit to communicate with only the F/X; the MDR2 cannot be used simultaneously with the Hand Unit in this mode.

8. **System Set Up**. The system set up page allows the user to:
   a. Change the Password
   b. Remove User Lenses. This will purge all user lens data from the Lens library. The Standard lenses will remain unaffected.
   c. Change the backlight threshold.

   The System menu is reached by pressing **Home**, and then the **system** softkey. Be sure to record your password!

9. **Firmware Updates**. New Firmware for the F/X can be downloaded from a PC through the 3-pin LEMO connector at the bottom of the unit. A serial cable is provided with the

unit to make the necessary connection. Firmware updates will be made available in both floppy disc form and as downloads from the Web.

a. Firmware Update Procedure.
   i. Load the Installation files provided on the data CD to the PC.
   ii. Open the file containing the Firmware update. The PC screen will show the message" Connect FX to the serial Port. Searching for FX."
   iii. Make sure power to the FX is off. Connect the serial port of the F/X to the PC with the cable provided. While pressing both the **Enter** and the ↑ key on the FX unit turn on the power. The FX screen says "Ready to Load". Release the keys. The PC screen will ask whether you want to update the firmware to the new version. Press **Enter** to begin. When the PC screen shows that the update has been loaded, turn off the power to the FX and remove the serial cable.

10. Warnings Messages and Troubleshooting

#	Message/problem	Description	Checks
1	MDR Not found	No communication with MDR. This only appears on intro screen upon power up.	• All units are set to the same radio channels. • Switch on MDR is in Radio mode.
2	Broken Link Icon	Same as above	Same as above
3	Snorkel Icon	Hand Unit in Snorkel mode	Set Switch on Hand Unit to Normal
4	Radio Signal Strength Icon shows no bars	Low radio signal strength	• Antenna problem on MDR. • Distance between MDR and F/X too great. • Possible transceiver problem
5	Motor icon?	• Iris motor not calibrated • If Broken Link Icon appears, MDR cannot send data to the F/X unit.	• Calibrate the Lens (iris). • If you have chosen a new lens from the Lens Library, check that Iris Calibration Icon is present
6	**Iris Off**	This indicates that the iris is controlled manually and won't automatically perform exposure compensation.	• Press Shift + 9 to change to automatic iris mode. • Message appears if lens iris isn't calibrated. • Message appears in Speed/Shutter mode.
7	fps reads 0	• Camera Stopped • No camera speed data	• If link to MDR is good, possible camera problem. Check with another camera body, • Check cable MDR to camera.
8	uncompensated	• The exposure will not be compensated with the current lens and camera settings.	• In speed/shutter mode, re-enter one of the speeds – the shutter angles will be re-calculated. • Check that the T-Stop setting allows for the required compensation. Change the base stop if necessary.
9	! Playback Mode	• The iris knob is locked out: the iris channel is	• Change the R/P set up (Shift + 5).

		in playback mode. • The camera functions are locked out	
10	One or more camera or lens functions are locked out.	MDR-2 has been set to Playback mode.	• Check of R/P icon is present. Change setup (Shift + 5). • If F/X is unavailable, the MDR-2 can be reset to normal operation by removing and re-applying power. Note that the Reset button on the MDR will not affect the R/P mode.
11	Out of Range lit	Lens is at a limit	Adjust base T-Stop setting.
12	Lock icon	Keyboard is locked.	The arrow keys, camera run and the Iris knob remain active in the locked mode. Unlock the keys with Shift + 0.

11. **Advice for Speed Ramps**
    a. Successful Speed Ramps require that any exposure errors are imperceptible. The purpose of this section is to explain the sources of the most common exposure errors and what steps should be taken to minimize or avoid them. There are trade-offs using either the shutter or iris for exposure compensation. Some of these are discussed next.
    b. Speed Ramps can be exposure compensated either by changing the shutter angle, lens T-Stop, or both in combination. Ramps using the camera shutter provide essentially perfect exposure compensation. The disadvantages to using the shutter are:
        i. Strobing artifacts occur at small shutter angles when either the subject moves rapidly across the frame or if the camera is panned quickly. This is due to the short exposure time diminishing the image blur.
        ii. The minimum ramp speeds using shutter compensation are generally longer than with T-stop compensation (the 435 Advanced will overcome this limitation).
    c. Ramps using the lens iris have significantly higher exposure error than those using the shutter. However, reasonable care in the choice of lenses and ramp speeds will give excellent results. The disadvantages to using the iris for exposure compensation are:
        i. The depth of field will change with the camera speed.
        ii. Accurate exposure compensation will depend on both the iris mechanism and the iris motor being free of mechanical backlash. The result of this backlash will be an exposure "bump" caused by the camera speed changing before the lens iris begins to compensate. Typically, this error would manifest itself as a sudden density change at the beginning of the ramp.
        iii. The delay time inherent in the Iris motor response will cause an exposure error; the shorter the ramp time, the larger this error will be. This type of error will be seen as exposure bumps at both the beginning and end of the ramp.
        iv. A small error (<1%) is caused by the delay in the MDR calculating the actual running speed of the camera from the pulses generated from the camera motor encoder. This delay will also appear as an exposure bumps at the beginning and end of the ramps.
        v. Accurate exposure compensation requires that the T-stop markings on the lens are accurate.

d. Very fast ramps can cause the camera speed to fluctuate (ring) for a short time at the end of the ramp. These speed fluctuations will cause exposure errors with either shutter or iris compensation.
e. Shooting ramps under artificial illumination will cause exposure changes (flicker) if the light output isn't constant and/or the exposure time isn't constant.
f. Things to check during camera prep.
    i. Check for backlash in the lens iris. Close down the lens iris close to the minimum opening. Rotate the iris ring slightly and watch the lens iris to see how much the iris ring must move before the iris opening changes. Do not use a lens with significant backlash (more than 1-2% of a stop).
    ii. If you anticipate doing fast ramps, **do a film test!** The tests should cover ramp times from the fastest allowed to 4x slower in .5s intervals.
    iii. Check that there is no backlash between the iris motor and lens gear.

12. **Specifications**
    a. Size: 5.5" x 8" x 1.5"
    b. Weight: 2.1 lbs (1 kg)
    c. Power Source 7.8V 1.4AH Li-Ion: Moli Energy MCR-1812E
    d. System Requirements: MDR2, Hand Unit2, Transmitter2.
    e. Camera Supported:
        i. Analog Cameras
            1. Arri 12V cameras (Arri3, SR2, BL)
            2. Aaton XPROD
            3. Fries
            4. Panavision (all types for speed/iris ramps)
            5. Moviecam SL
            6. Wilcam
            7. Imax
        ii. Digital Cameras
            1. Arri 435, 435ES, 535
            2. Panavision Millennium, Millenium XL (speed/aperture only)
    f. Microwave Band: 2.412 – 2.469 GHz Typical Range 500m+ line of sight; 50 – 100m through interior walls. Antenna is integral type.
    Channel Allocations:

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

13. **Illustrations**.

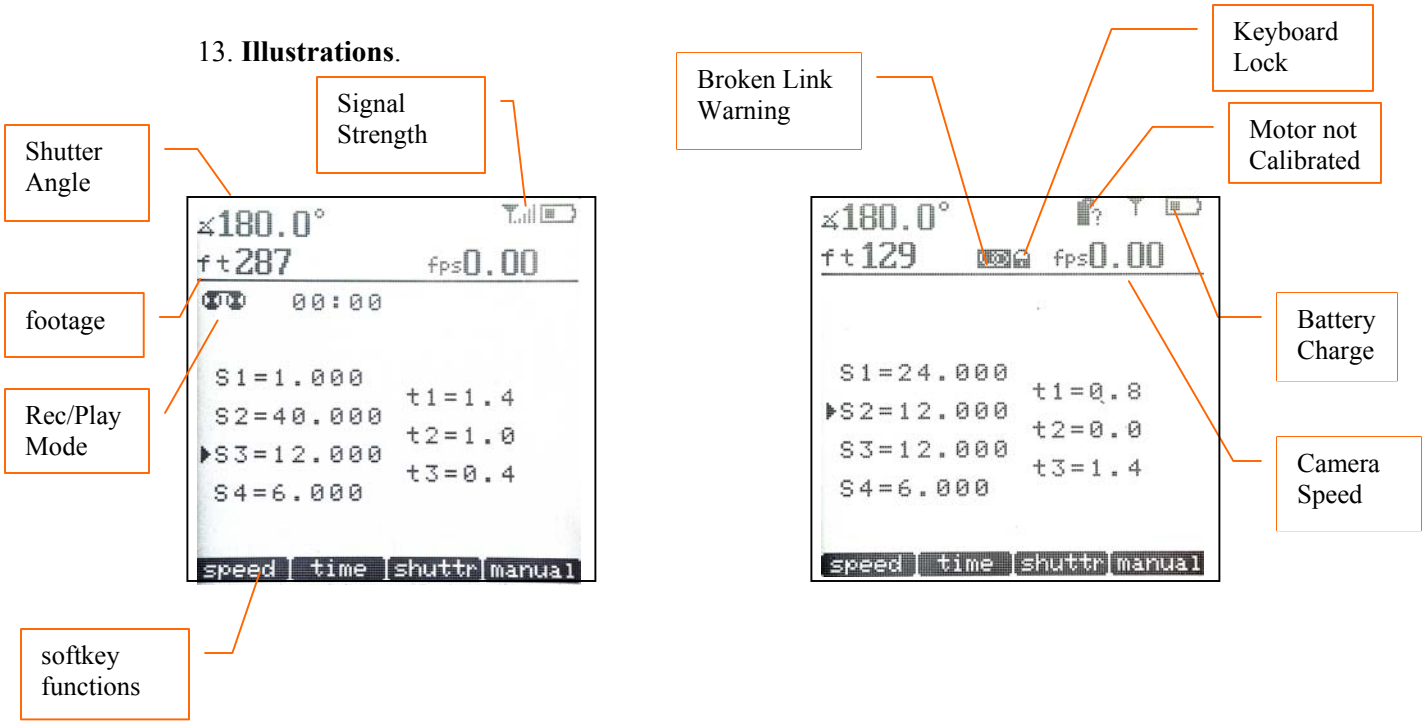

fig 1.

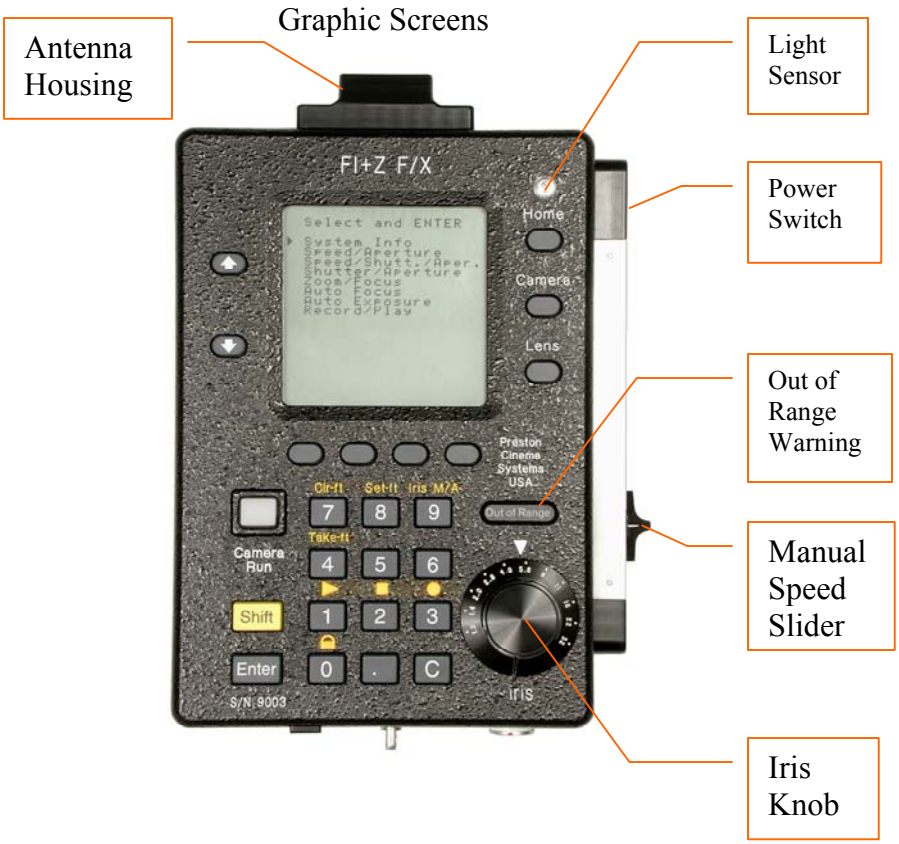

fig. 2 Home Screen

fig. 3a Lens manufacturer List

fig 3b. Lens Page

Fig. 3c. Lens Editing Screen

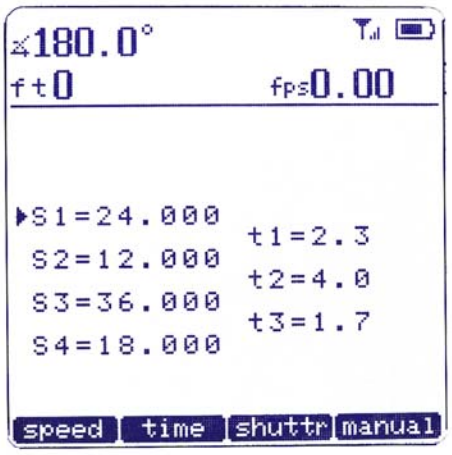

fig. 4a Speed/Aperture Screen (auto)

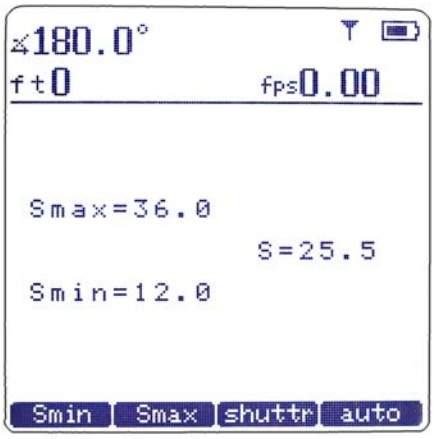

Fig. 4b Speed Aperture (manual)

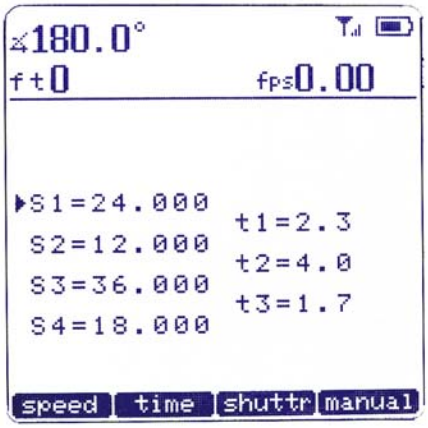

fig. 4c Speed Shutter (auto)

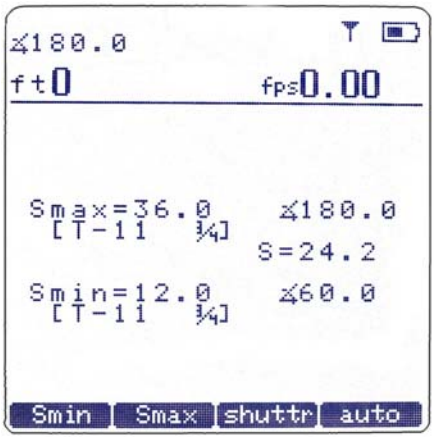

fig.4d Speed Shutter (manual)

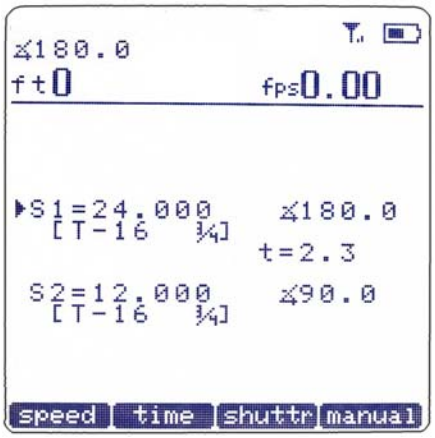

fig. 5a Speed Shutter Aperture (auto)

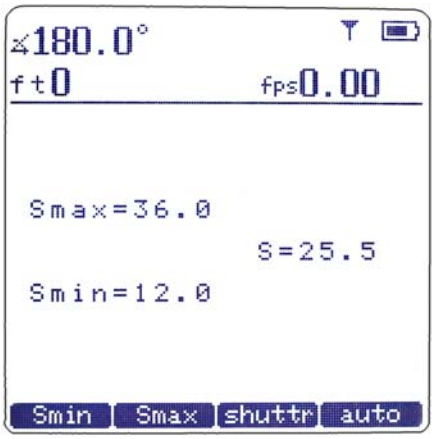

Fig. 5b. Speed Shutter Aperture (manual)

fig. 6 Record/Playback with countdown

fig.7 Record/Playback Setup

fig.8 Shutter Aperture