

# Tesselator™

## **Tesselator Instruction Manual**

The **Tesselator** (*tessellate – to make up from many small pieces*) automates simple pan and tilt needs for shooting tiles. A camera controller is included, which can be used with any stepper driven camera or switch-operated still camera. The system uses step and direction outputs for pan, tilt, and camera, which allows the system to be configured for any mechanical setup. All parameters are saved on an easy-to-use PC card. The system is run from a hand held jogbox with a LCD screen and a simple keypad.

The system is battery powered, uses only 2 watts, and can be powered with 7 to 63 volts DC, or 120VAC.

### **Tesselator Grids**

In the **Tesselator** system, a grid is set up using the pan and tilt axes on a camera head. The system automatically moves the head to each position on that grid and shoots film. The film can either be a wedge on a film camera, or a shot bracket on a still camera.

The grid is set up using the field of view of the camera to calculate grid size. The following variables can be modified from their defaults:

The focal length of the lens being used.

Actual film horizontal and vertical aperture.

Desired overlap (as a % of field of view).

Landscape/portrait camera orientation (horizontal / vertical)

Pan and tilt start positions (in degrees).

-The start positions define either the center or one corner of the grid.

Number of tiles for pan and tilt.

-If the tile number is negative, the direction for that axis is reversed.

-This allows the 'move' to start from any corner of the grid.



These items determine the grid. See the menu descriptions for more. There is a built-in \_ second delay after the head moves to a grid position before film is shot, to allow the mechanical system to settle.

## **Shooting Film**

There are 2 possibilities for shooting film at each position on the grid, a still camera or a stepper driven film camera.

Still camera (Canon EOS mode):

Film is shot using 1 or 2 dry-contact relay outputs as switch closures. There are two outputs for each relay, so the outputs are isolated. When a frame is shot, two things happen. The first relay closes, and a user-defined delay is started. After the delay time, the second relay closes. The user can enter any time duration for both relay closures. The idea is that the first switch is used to set (power) up a digital camera, and the second switch takes the frame (or a bracket). The first switch then continues to hold for as long as necessary to load the image.

Stepper driven film camera (Vista mode):

A film wedge needs to be shot at each grid position. The user defines the ramp-up and ramp-down accelerations separately, along with the maximum FPS of the camera. These three parameters determine the number of frames in the wedge.

The system records the frame number at every change in FPS. This allows exposure selection using frame numbers when editing. The system stores this information (in ascii format) along with a move when the move is saved on a PC card.

There is a shoot switch input on the system to trigger moves or slates.

A built-in camera controller allows slates to be shot. The user enters the number of frames to shoot (positive or negative), and the desired FPS. The bloop light triggers at the top speed of the camera ramp for all slate shots. The 'slate' bloop frame is displayed on the LCD screen and is saved to the card with a move. If you shoot another slate, the new bloop frame is displayed and overwrites the old one.



The bloop light is also triggered at the top of the camera ramp on every wedge, so the user can position the bloop light anywhere in a scene. The 'wedge' bloop frame information is also saved in the move.

There is a preview mode built in to the 'go to grid' page. This can also be used for 'manual' shooting of a move. Just advance the camera head grid by grid in any direction with one button press, inspect the frame, and jog the head if you like to remove any flares. Then just press a button or the shoot switch to shoot a frame.

## **Pan and Tilt**

The pan and tilt axes can be jogged with the arrow buttons on the jogbox, or with any 2 encoder wheels. The encoder inputs can be configured for response, smoothing and deadband. The jog buttons can be configured for top speed and smoothing.

User units are stored for both axes, in terms of pulses per 45 degrees. This allows the jogbox screen to display degrees for pan and tilt. Negative user units reverse the motor direction. Soft limits (in degrees) are configurable for both axes.

The user can send pan and tilt to any grid number or position required. The system is set up also to easily go to the start of a grid move, or to zero position. The user can easily set zero or any position for pan and tilt.

There are also 6 user-defined positions available. Just set a desired position in memory, then send the pan and tilt to that position, each operation requires just 2 button presses.

## **PC Card**

Moves are saved on an SRAM PC card (PCMCIA card). All data is saved in a move.

The user can load, save and delete moves on the card, and format a new card. Cards are hot-swappable; you can insert and remove them while the system is on.



When the camera is stepper based, ASCII data is included for every wedge shot. This includes the latest slate bloop frame, number of frames in the wedge, and the frame number for every change in FPS for the last wedge shot. There is a bloop frame at the top of every wedge, which is recorded also. The ASCII data is readable by any computer with a PC card slot. This data can also be read on the LCD screen.

## LCD Menus

This section describes each LCD menu screen.

The main menu displays the pan and tilt positions (in degrees) on the top line of the display. Pan is on the left and tilt on the right. The current camera frame is displayed on the bottom right.

The numbers to the left of the screen headings are shortcuts to that heading. For instance, press '1' to display the 'GO TO' screen.

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Go to:

Start:

Sends pan and tilt to their start positions as defined on the Tess page. This defaults to zero for each axis on power-up.

Grid#:

This is the move preview page.

The head can be sent to any selected grid number. Enter a grid number for both pan and tilt, when you press 3, both pan and tilt will go to that grid position. Press 4, and the head will immediately move to the previous grid number. 5 will move the head to the next grid position. 8 will shoot a camera frame.

The arrow buttons will also move the head 1 grid at a time, in all 4 directions.

So you can 'walk' or browse through a move, shooting film only if required.

Pos:

Sends pan or tilt to the selected position. Enter a position in degrees for pan or tilt and that axis will move to that position.

Zero:

Sends both pan and tilt to position '0.00'.



**Preset:**

Each number from 4 through 9 refers to a preset position for both pan and tilt. Just press any number and both pan and tilt will slew to that position. See below (Set Preset).

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**Set:**

**Start:**

Sets the current position for both pan and tilt as the start position for the tiling move. This refers to 1 corner of the grid if the grid is Corner based, or the center grid if Center based. See below (More Tesselator Config).

**Position:**

Resets the current position for pan or tilt to any number.

**Zero:**

Resets both pan and tilt to position '0.00'.

**Preset:**

Each number from 4 through 9 refers to a preset position for both pan and tilt. Just press any number and that memory location will store the current position for pan and tilt. These positions are saved with a move.

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**Tess: (Tesselator Configuration)**

- 1. Pan start    2. Tilt start
- 4. Pan tiles    5. Tilt tiles
- 7. Wedge FPS    8. More Tesselator Config

**Pan and Tilt Start:**

Enter the desired start position for pan or tilt, in degrees.

**Pan and Tilt Tiles:**

Enter the number of tiles, or grids, for each axis.

If you enter a 1, there is only one camera shot taken on that axis.

A 2 means that there will be 2 camera shots.

A negative tile number means that the grid will be in the negative direction for that axis.

**Wedge FPS: (Vista mode only)**

Enter the maximum FPS for the camera during wedge shots.



## More Tesselator Config:

### Focal Length:

Enter the focal length (in millimeters) for the current camera lens.

### % Overlap:

Enter the amount you wish the grid to overlap the field of view. This is entered as a percentage of the total field of view, as defined by the focal length and the film aperture. If you enter 20%, 20% of the field of view will be overlapped on each side.

### L/P:

This button toggles the Landscape / Portrait mode. If the mode is Landscape, the horizontal aperture is applied to the field of view calculations for Pan. If the mode is Portrait, the vertical aperture is applied to the field of view calculations for Pan.

### Aperture:

#### Horizontal:

Enter horizontal film aperture in millimeters.

#### Vertical:

Enter vertical film aperture in millimeters.

### Corner/Center:

This button toggles Corner / Center mode.

#### Corner:

The move start position refers to 1 corner of the grid. Change corners by inverting tile numbers on the 'Tess' page.

#### Center:

The start position refers to the center of the grid. If there is an odd number of grids, they will be evenly centered around the start grid. If there is an even number, the last grid will be on the positive side of the center.

Please Note: When running an automatic move, the first grid to be shot will still be a corner, as defined in Corner mode.



## Cam: (Camera page)

### Canon EOS Mode:

#### Cur Frame:

Displays and sets the current camera frame.

#### SHOOT 1 FRAME:

Shoots 1 EOS frame.

There is a black circle that appears to the right of the frame display while either camera trigger (relay) is active. This tells you that the camera is active or exposing film.

### Vista Mode:

#### Cur Frame:

Displays and sets the current camera frame.

#### Shoot Frames:

Enter the number of frames to shoot, positive or negative.

#### FPS:

Enter the maximum camera speed in frames per second.

#### RUN CAMERA:

Shoots the above number of frames.

The bloop light triggers at the end of the ramp-up. The frame at which this happens will then be displayed on the screen. This overwrites the 'Cur Frame' prompt, but the '1' key still works to change the frame number.

The camera will use the acceleration defined as 'Camera Ramp Up'

for both ramp-up and ramp-down.

While on this page, the 'Pan' jog keys (<->) will run the camera at the FPS rate on this screen. Be careful using this feature, though, because the camera will not stop on frame. If you stop off frame, set the shoot frames to '1' and shoot a frame, the camera will return to a shutter closed position.

To zero the camera motor, jog it to position or manually set the motor to shutter closed. Then set Cur Frame to any frame number. This will set the shutter-closed position.



## Moves:

-This page loads, saves, and deletes moves using a PC card, runs the Tesselator, and displays wedge information. The system detects when a PC card is installed, and will display 'Card Ready' or 'No Card Installed' on the top line.

## Load:

Displays current moves on the card. Use the up and down arrows to move the \* up and down the display to select a move. If you press ENT, the currently selected move is loaded into the system.

## Save:

Saves all current information, including move data and config data, to the PC card. You are requested to enter a name for the move.

### Naming a Move:

A default name is displayed. If you press ENT, that name will be used when saving the move.

If the first key that you hit is a number key, the default name will be erased and that number will appear in the display. Use the left and right arrow keys to move the cursor to a character. Pressing a number key will enter that number, and using the up and down keys changes the character to consecutive letters and special characters. If the first key that you hit is an arrow key, the cursor changes to non-flashing and allows you to modify the default name.

Holding an arrow key down speeds up its operation.

If you press 'CE' when the cursor is over a character, the character will change to a space.

To cancel naming a move after you have started, move the cursor all the way to the right, and hit CE to delete each character one by one.

## Delete:

Displays current moves on the card. Use the up and down arrows to select a move. If you press ENT, the selected move is deleted from the card.



## **RUN TILER:**

Runs a grid move using the current parameters. You are first asked where you want to start the move from. You can run the move starting from the normal pan and tilt start positions, or start from a different grid number. If you want to start from a grid number, the system uses the same grid number as on the 'Go To Grid#' page. First go to that page (enter 22 from the home page) and set up the pan and tilt grid numbers to start from.

The Tiler will move to position before starting a move, the motors do not need to be in the correct position first.

While running a move, the system will display the pan and tilt positions, the current grid number and the current camera frame. The 'exposure' dot is also active, see the Camera page, EOS mode.

## **Show Wdg: (Show Wedge) (Vista Mode Only)**

Displays data from the latest wedge on the LCD screen. This is the same information that is saved with a move. Use the up/down arrows to navigate.

The screen data displays:

- The latest slate bloop frame.

- How many frames in the wedge.

- The frame number for each change in FPS during the wedge.

The frame information is in decimal tenths; .0 means shutter closed.

The code "BF" is used at the top of the ramp to show the bloop frame. The

bloop light is on during the whole frame.

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## **Cfg: (Configuration page)**

### **Jog:**

#### **Pan and Tilt Speed:**

Enter the maximum speed. This value is in terms of degrees per second.

#### **Pan and Tilt Acceleration:**



Enter the ramp-up and ramp-down acceleration. This value is in terms of how long it takes to get to the top speed, and is expressed in seconds (1 second = 1.00).

The jog parameters are also used by the system whenever it is moving pan and tilt, except when moving them via the encoder inputs.

#### Encoders:

When you first get to this page, the encoders are disabled. Press '9' to enable them. Pressing '9' again will disable them.

#### Sensitivity:

A higher number will make the motor run faster for a given encoder input. Default is 1000, which means that there is 1 motor step for each encoder pulse. 500 decreases sensitivity, i.e. twice as many encoder pulses are necessary to move the motor the same distance.

#### Smoothing:

A higher number will increase the response time, i.e. more smoothing.

#### Deadband:

Stored as encoder pulses, a higher number will provide a larger deadband.

#### Units:

##### Pan and Tilt:

Enter a signed number for steps per 45 degrees. A negative number will show the opposite polarity on the screen. Camera units are entered as steps per frame on the config camera page.

##### Motor Directions:

Changing these parameters will change each motor's direction.

This includes pan, tilt and camera.

#### Card:

Format the PC card here. In this version, only 64K of any card will be used. All 64K are erased and the card is formatted to the PCMCIA spec as an SRAM PC card.



### Limits:

Enter pan and tilt soft limits in the positive and negative direction. The pan and tilt axes will ramp down to these positions.

They might cross the limit positions by a few pulses, depending on the original motor speed.

### Camera:

Select between a still camera or stepper-driven motion camera here.

#### Still Camera (EOS):

All times are expressed in seconds.

Trig1 Time: Time for relay1 to close

Delay Time: Time from start before Trig2 closes

Trig2 Time: Time for relay2 to close

Both relay1 and the delay are activated at the start of a shot.

Relay2 starts at the end of the delay time.

#### Motion Camera (Vista):

##### Ramp Up:

This is the time it takes for the camera to get from 0 to 24 FPS, no matter what the actual FPS is. It is expressed in terms of the system timebase (1/120 sec). This value is also applied to the ramp down during normal shooting and slewing.

##### Ramp Down:

Using the same units as ramp-up, this ramp is only applied when ramping down during a Tesselator move. This allows longer wedges.

##### Steps/Frame:

Enter the number of steps per frame for the camera.

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## Quick Tips

Pressing '0' from the main page is an emergency stop. The camera, pan and tilt will stop their motion immediately by ramping down to a stop.

The home page can be reached quickly by pressing ENT from anywhere.

Pressing CE/C usually brings you to the previous page.



**Negative Numbers:**

Since the keypad has no '+/-' key, this is simulated.

If there is a zero on the screen or if the first key hasn't been hit yet, hitting '0' will toggle the polarity, and a '-' sign will appear if the polarity is negative.

Enter these numbers from the home page:

**Camera:**

Focal Length ---- 481

Landscape/Port -- 483

Aperture ----- 484

Steps/Frame ----- 884

Still/Motion ---- 881

**Tiler:**

Run Tesselator ----- 74

Show Data ----- 75

Start Position -- 21, 41, 42

Tiles ----- 44, 45

% Overlap ----- 482

**Wedge:**

Ramp Up Accel --- 882

Ramp Down Accel - 883

Max FPS ----- 47

**Pan, Tilt or Camera:**

Motor Direction - 843

Soft Limits ----- 871, 872

Set Position ---- 24, 25, 26, 27, 28, 29

Go to Position -- 14, 15, 16, 17, 18, 19

**Screen:**

Motor Units ----- 841, 842



## **Hardware**

### **Power requirements:**

+7 to +63 volts DC

or

120 volts AC

~2 Watts

### **Ram Card:**

SRAM PC card, size at least 16K, 250nS or faster

### **Input signals:**

Encoders – quadrature, 2 channels

Shoot trigger – opto-coupled edge-based input with 330 ohms in series on board,  
needs 5 or more volts to trigger.

### **Output signals:**

Step and direction signals – 4 channels (1 unused at present).

Still camera controls - 2 relay outputs, 2 lines each.

Bleep light – 1 line, active low.

Ground, +5 volts.

