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THINGM



ThingM-LC Stop-Motion Camera Control Instruction Manual

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1. Introduction

1.1 About ThingM

Thank you for buying a ThingM Stop-Motion Camera Control.

ThingM (pronounced exactly like it looks) is a “single-axis motion control system in a box” which is specifically adapted for stop-motion camera drives. ThingM operates a stepper motor to rotate a camera’s 1:1 drive shaft at variable single-frame speeds, exposure times, and lapse time intervals. ThingM’s motion-controlled acceleration and deceleration results in smooth handling of film shot single-frame style, without the hard starts and stops produced by conventional AC motors or constant-speed DC motors.

ThingM was originally designed and built by Dave Milici, while studying filmmaking and engineering at the University of Illinois in the early 1980s. After relocating to the San Francisco Bay Area, DaveM built motion control systems for various animators and visual effects cameramen. Eventually, ThingM evolved with versatile exposure features which were otherwise custom programmed for computer-based motion control systems. By the 1990s, ThingM was chosen as the standard stop-motion camera control on such commercial animation productions as “*The Nightmare Before Christmas*” and “*Bump in the Night*”.

1.2 Contact Info

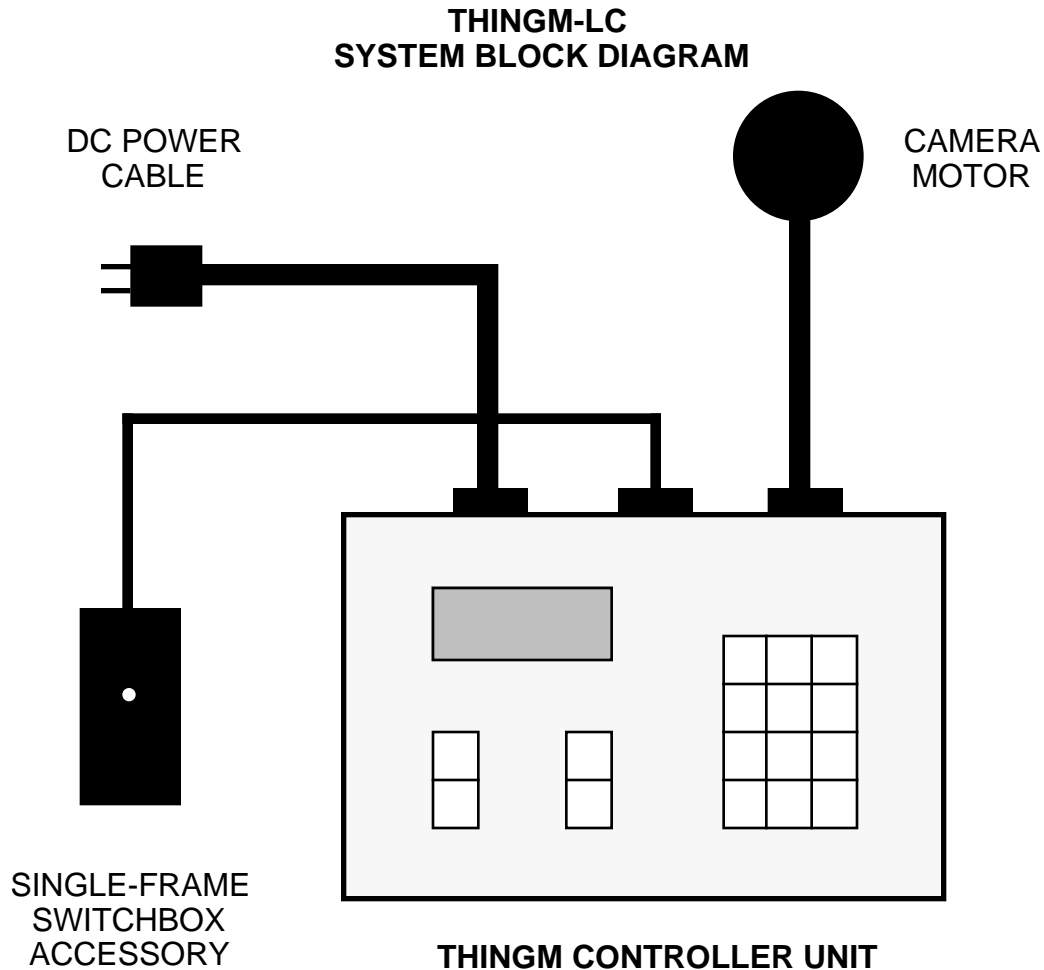
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2. Features

2.1 Hardware Configuration:



ThingM-LC Controller Unit:

- Integrated Controller and Driver in single Aluminum case;
- Controller with 16-key keypad input and 8-character LCD display output;
- Half-stepping Motor Driver providing for 1.0 to 2.5 Amps per phase at full power, reduced to 0% power at standstill;
- Power connector for external 12-Volt DC power supply;
- Motor cable connector, with external switch sensing line(s);
- Trigger input / output connector, for external single-frame switch input, and/or optional remote device trigger output.

ThingM-LC Accessories:

- External 12-Volt DC power supply or 12-Volt battery pack supply;
- Power cable for external power supply;
- Motor cable for camera motor assembly;
- Single-frame switch and cable for trigger port.

35mm Camera Motor Assembly:

- Size 34 stepping motor (3-3/8 inch diameter), in either 2.9 Amp low-current rating (recommended), or 4.9 Amp high-current rating (alternate for compatibility with existing motors and drivers);
- Motor mount for 1:1 drive shaft coupling on 35mm Mitchell or Bell&Howell camera capable of single-frame operation;
- Position sensing switch for Shutter-Home position;

16mm Camera Motor Assembly:

- Size 23 stepping motor (2-1/4 inch diameter), in either 1.0 Amp low-current rating (recommended), or 3.9 Amp high-current rating (alternate for compatibility with existing motors and drivers);
- Motor mount for 1:1 drive shaft coupling on 16mm Mitchell or Bolex camera capable of single-frame operation;
- Position sensing switch for Shutter-Home position;

2.2 Software Features:

Standard ThingM Features:

- Frame Count and Direction to +/-32000 frames;
- Exposure Times from 0.12 to 100 seconds;
- Lapse Times from 0.01 to 100 seconds;
- Film Speeds from approximately 1 to 4 frames per second;
- Adjustable motor speed and ramping characteristics;
- Exposure Times linked to Film Speeds;
- Input Trigger for single-frame operation;
- Output Trigger for individual exposure status;
- Output Trigger Time Delay prior to shooting exposures.

Additional ThingM-LC Features:

- Variable Exposure Time Sequences;
- Variable Lapse Time Sequences;

3. Operation

3.1 Quick Start

The following “quick-start” instructions are intended for more technically experienced users, or anyone who is just plain anxious to see ThingM do something immediately. More complete instructions are described further on (in excruciating detail...).

Hint: Try ThingM on a test bench, before attempting to mount the camera motor. You might want to see how the camera motor operates without being attached to anything.

- (1) Connect motor and power cables.

All the cable connectors are physically distinct, so you can't mix them up.

- (2) Turn external power supply on.

ThingM should show signs of life in its LCD display, first with a “***THINGM***” greeting, then with an “**OK+**” prompt.

- (3) Press the **RUN** key.

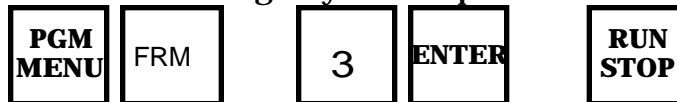


ThingM should run the camera motor 1 complete revolution, equivalent to a single exposure.

These first 3 steps should confirm ThingM's basic single-frame operation. If you have a problem getting these simple results, stop and check your work for the obvious. Refer to the **Troubleshooting** section for more information.

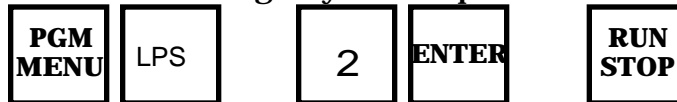
Otherwise you're ready to try programming a few simple commands.

- (4) Press the following keys in sequence: **PGM FRM 3 ENTER**.



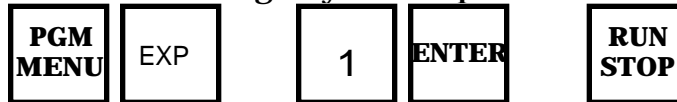
Pressing the **RUN** key will shoot 3 consecutive exposures.

- (5) Press the following keys in sequence: **PGM LPS 2 ENTER**.



Pressing the **RUN** key will shoot 3 exposures in lapse intervals 2 seconds apart.

(6) Press the following keys in sequence: **PGM EXP 1 ENTER.**



Pressing the **RUN** key will shoot 3 time-exposures 1 second long, at the previous lapse intervals 2 seconds apart. Note that the camera motor pauses at an intermediary rotational position for each exposure time, before completing its 360-degree revolution.

By this point you should have been able to program and run these 3 simple commands. If you don't quite get it, read on for further detailed explanations. You might also want to refer to the **Function Keys** section to identify your ThingM keypad's layout.

3.2 Operation Overview

Reset Sequence:

When ThingM is first powered on, it automatically resets itself and all of its internal memory. You should see the LCD display the “***THINGM***” initialization message momentarily, then change to the “**OK+**” prompt. If you don't see this sign-on message sequence, press the **RESET** pushbutton on the back panel.

You might have occasion to reset ThingM manually (with the **RESET** pushbutton) if you discover you have programmed some nonsensical value, like a very long Exposure Time or very fast Film Speed.

Note that resetting ThingM manually a 2nd time (or more) will re-synchronize the controller electronics only, but will not affect the data values which are stored in memory for that particular shooting session. For example, if you have already programmed Exposure Time and Lapse Time information, then pressing the **RESET** button will allow these values to remain in memory instead of re-initializing them to the power-on default values. Only by turning the power off, then back on again, will the default values be programmed into memory from scratch.

Keypad Operations:

The ThingM keypad allows basically 2 modes of operation: Programming and Running. Programming may take a few keystrokes to complete (typically beginning with the **PGM/MENU** key), while Running is as simple as pressing the **RUN/STOP** key. In fact if all you want to do is shoot a single frame at a time, ThingM is already programmed to run 1 Preset Frame Count at power-on time.

For Programming mode, the **PGM/MENU** key is used in 1 of 2 different

ways. One method is to access each data selection individually, where the **PGM/MENU** key is used like a prefix to some other key. The other method is to access all data selections sequentially, where the **PGM/MENU** key is repeatedly pressed to “scroll” through a whole menu of selections.

With the first method, each data selection is associated with one of the number keys, such as **FRM**, **EXP**, **LPS**, etc being located under the 1, 2, or 3 keys. (Refer to the *Function Keys* section for the particular keypad layout, or better yet, just look at the keypad legends on your own ThingM.) Once you have become familiar with the orientation of the menu selection keys, you will find that you can access them directly in a single key stroke without using the **PGM/MENU** key first. (This is like “hot-keying” in computer applications.) The only difference between whether a number key is used as a menu selection or as a data value is when the cursor on the display is flashing.

Data Displays:

Any time a data key is pressed, a flashing cursor will appear to prompt for the clearing, updating, or entering of data. You have the option for pressing the **CLEAR** key, or entering a new value with a sequence of number keys, or leaving the data entry alone. Once the data value on display is acceptable, press the **ENTER** key to accept it. (If you are familiar with IBM PCs or Apple Macintosh computers, this is like pressing the RETURN key or clicking the OK button in an application program.)

If for some reason you do not want the data entry, and you cannot remember what the original entry in memory was, you can hit the **PGM/MENU** key instead. This will allow you to start the data entry process all over. (This is like pressing the ESCAPE key or clicking the CANCEL button in a PC or Mac computer application.)

In either case, the cursor should stop flashing on the display, and return to the OK prompt with the current Counter Total. This is true whether the data was actually updated or not. If you are not sure, then just check the menu selection again.

Running Sequences:

Once all applicable data has been programmed into ThingM, the sequence may be run by pressing the **RUN/STOP** key. If only 1 Preset Frame Count is programmed, the camera motor will run only 1 revolution. If more than 1 Preset Frame Count is programmed, the motor will run continuously as long as there are no time exposures or time lapse intervals. If a Lapse Time is programmed, the motor will pause after each full revolution. If an Exposure Time is programmed, the motor will also pause in the middle of each revolution at the the shutter-open position.

If you wish to pause the running sequence, press the **RUN/STOP** key again. The current exposure should complete its revolution cycle, and a **HLD** prompt should appear to flash on the display, indicating a run-time Hold state. Pressing the **RUN/STOP** key once more will allow the running sequence to complete its Preset Frame Count. Otherwise any other key, such as **CLEAR** or **PGM/MENU**, will stop the whole sequence altogether.

Motor Operation:

In any of the above cases, the camera motor will always run some multiple of a full revolution. Each motor revolution is motion controlled with acceleration and deceleration ramping. Only after the final deceleration ramp does the ThingM controller logic sense for the camera Home switch. Normally the motor locates the Home switch position exactly at the end of the revolution. Otherwise the motor continues to run at its lowest speed until it reaches Home. (This would happen in cases where the motor had stalled or slipped if there was not enough torque available at the desired Speed and Ramp. This may also happen with the first exposure after the motor assembly was mounted on the camera.)

3.3 Operation Details

Set-Up Configuration:

WARNING: Make sure the DC Power is OFF before plugging or unplugging cables, especially the motor cable.

The power cable connects between the external DC power supply or battery pack and the 4-pin male Amp connector labeled **POWER** on ThingM's back panel.

The motor cable connects between the motor and the 8-pin female Amp connector labeled **MOTOR** on ThingM's back panel.

The optional rack-over switch connects to an extension wiring pair at the motor end of the motor cable. (Custom wiring option.)

The optional single-frame switch connects to the 4-pin female Amp connector labeled **TRIGGER** on ThingM's back panel.

The optional relay trigger cable connects to this same **TRIGGER** connector. (This means that the remote switch accessory and relay trigger accessory may not be used at the same time, unless with an adaptor.)

Power-On Sequence:

Turning on the external power will reset all of the ThingM unit's controller and driver electronics. The controller LCD display will momentarily say "***THINGM***" and then prompt "**OK+ 0**". The driver will initially reset without energizing the motor, so you may turn it freely before firing the first exposure.

At this point you may begin programming selections like Frame Counts, **FRM**, and Exposure Times, **EXP**, from the keypad. Or you may just

start shooting by pressing the single-frame button.

Standby Motor Torque:

Whenever ThingM runs the motor, the driver is operating at full power for maximum torque. When the motor comes to a standstill after a complete revolution, the driver will remain operating at full power for a short time interval. If the motor is not intended to run again, the driver will automatically reduce its power to a standby level for the rest of the time. (Refer to **TRQ** data selection.)

In the case of ThingM-LC, the standby power is reduced completely to zero, for efficient field use of battery power.

Input Trigger Operation:

A remote switch may be plugged into the **TRIGGER** connector for single frame operation. One single exposure will only occur after the switch is released. This type of operation guarantees single-framing, and prevents accidental double-framing.

Output Trigger Operation:

ThingM's output trigger is normally active throughout the duration of any exposure. This is typically used to cue an external device prior to shooting an exposure. When a trigger time is programmed, a delay will occur before each single frame exposure, or before the first continuous frame sequence, in order to fire the output trigger. Refer to **TRG** for details.

Program Menu Selections:

The ThingM keypad is organized with the common program selections available with either 1 or 2 keystrokes.

The most commonly used program selections may be directly "hot-keyed" by a single keystroke on the number keypad:

- Frame Count;
- Direction;
- Exposure Time;
- Lapse Time;
- Trigger Delay Time;

The less commonly used internal data selections must always be accessed by a 3-keystroke sequence, beginning with the **PGM/MENU** key, followed by the "." (**INT**) key, then a particular number key.

- Film Speed;
- Speed Ramp;
- Motor Torque Time-out;
- plus lots of others.

Refer to the various **Function Keys** section for complete details.

Running Film Frames:

Shooting single frame exposures may be accomplished directly from

the manual switch plugged into the **TRIGGER** port. Intentionally shooting more than one exposure at a time must be done by programming a preset Frame Count. The Frame Count selection is more often used for running continuous frames of film, such as advancing or rewinding. The direction of travel may optionally be toggled via the **DIR** direction key.

As an alternative to running film by relative Frame Counts, an End Frame feature is also available. This is useful for rewinding film to a particular frame number for repeat pass shots. The End Frame feature will only alter the Direction for the duration of that programmed sequence. Once through running, the original Frame Count and Direction are restored. Refer to **FRM**, **DIR**, and **END**.

Exposure Times:

ThingM automatically adjusts the motor speed operation to shoot a particularly selected Exposure Time. For short Exposure Times, the motor will rotate in continuous motion by a proportional speed. For long Exposure Times, the motor will pause in the middle of the rotation at the Shutter-Open position for time exposures. The camera motor will run at a separately selected speed for these long time exposures, called the “whip-open” speed, **WSP**.

For a motion picture camera shutter opening of 180 degrees, the exposure time is half of the motor revolution time. So the following equivalent exposure times would select these corresponding film speeds.

0.12 sec (1/8) exposure time <--> 4 frames per sec speed;

0.25 sec (1/4) exposure time <--> 2 frames per sec speed;

0.50 sec (1/2) exposure time <--> 1 frame per sec speed;

Actual motion picture cameras have shutter openings which are less than 180 degrees, so this table may only be used for approximate values. ThingM will compute the speed for the selected exposure time at a specific Variable Shutter Angle, which is programmed as internal setting **SHR**.

In order to make ThingM run the camera motor reliably without stalling, practical minimum and maximum speed values are set, usually in the range of 1 to 4 revolutions per second. The Minimum Speed is directly programmed as internal setting **MSP**. The maximum speed is determined by internal setting for Minimum Exposure Time, **MEX**. (The **MEX** setting is a convenient way to specify a non-zero Exposure Time when the user clears the **EXP** value to 0. That is, if **MEX** = 0.12 seconds, then any time **EXP** data entry of “0” becomes a minimum value of “0.12” seconds instead.)

In very special cases it may be desirable to override the computed motor speed with an alternate speed. Explicitly selecting Film Speed after Exposure Time would accomplish this. Refer to **EXP**, **SPD**, **MEX**, and **MSP** for details.

4. Examples

Example #1: Run a single frame exposure.

RUN.

Example #2: Advance 120 frames in the camera.

PGM + FRM + 1 2 0 + ENTER.
RUN.

Example #3: Clear the camera cumulative total counter to 0.

PGM + CTR + CLEAR + ENTER.

Example #4: Change the exposure time to 0.25 seconds, and then shoot 48 exposures.

PGM + EXP + 0 . 2 5 + ENTER.
PGM + FRM + 4 8 + ENTER.
RUN.

Example #5: Rewind the camera film to frame number 0.

PGM + EXP + CLEAR + ENTER.
PGM + END + 0 + ENTER.
RUN.

Example #6: Change the exposure time to 1.00 seconds, and then shoot until frame # 240.

PGM + EXP + 1 . 0 0 + ENTER.
PGM + END + 2 4 0 + ENTER.
RUN.

Example #7: Shoot lapse time intervals at 5 second intervals for 1000 frames.

PGM + LPS + 5 . 0 0 + ENTER.
PGM + FRM + 1 0 0 0 + ENTER.
RUN.

5. Troubleshooting

No Power?

Check the power supply and cable connections to **POWER** connector.

Weak power?

If you have a Volt-meter, check for 10-14 Volts DC input to **POWER** connector, and 5 Volts DC output from the **TRIGGER** connector.

Unintelligible display at power-on?

Press the **RESET** pushbutton on the back panel.

Motor does not run?

Check motor and cable connections to **MOTOR** connector.

Motor runs more than 1 revolution on first exposure?

If motor assembly includes a Shutter-Home sensing switch, the motor may not have been initially located at the Home position.

Motor runs continuously with only 1 exposure programmed?

Shutter-Home sensing switch may not be switching from “Normally-Open” position properly.

Motor stops after only part of a revolution for first exposure?

Check if a very long Exposure Time has been programmed, by pressing the **EXP** key. Note that if this is the case, you should press the **RESET** button to re-program it instead of the **RUN/STOP** key. Otherwise ThingM will wait for the rest of the long Exposure Time before returning to the OK prompt. If not, check if the Steps per Revolution setting, **STP**, has been changed.

Motor only runs 1 frame when a Lapse Time is programmed?

Check that you also programmed a Frame Count, **FRM**.

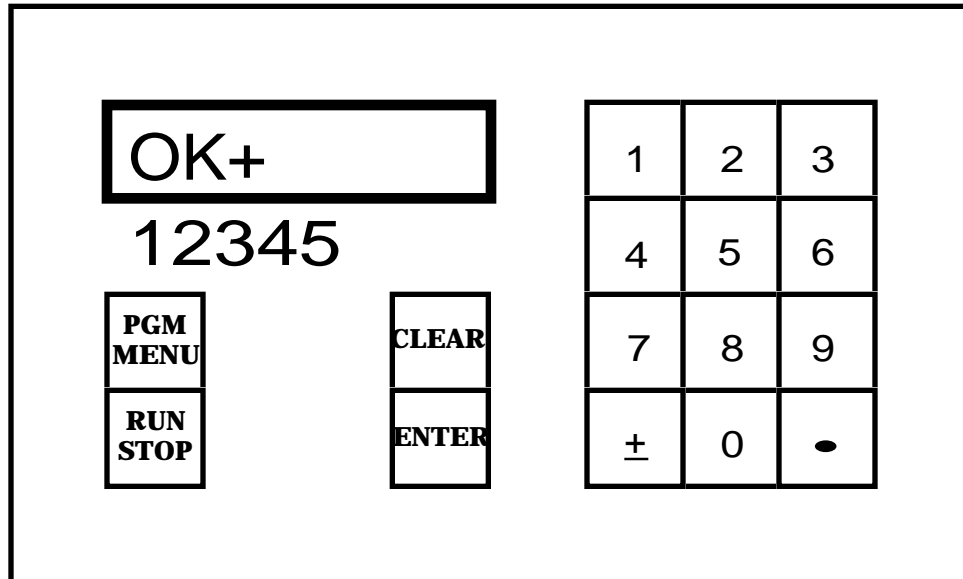
Motor slips or stalls when running?

Check for mechanical friction, possibly from improperly threaded film! If you are running fast Exposure Times, try lowering the Film Speed, **SPD**, or lengthening the Ramp Count, **RMP**.

6. Function Keys

ThingM-LC Version 2.70

(Note: Your ThingM may have a later software revision EPROM inside. Check your keypad layout for matching ThingM functions to number keys.)



Keypad Identification:



PGM/MENU For programming data selections. **PGM/MENU** key pressed repeatedly will sequence through all available data selections, such as Frame Count, Direction, Counter Total, Exposure Time, Lapse Time, and Trigger Time. **PGM/MENU** pressed as prefix to **1** through **9** keys will access these data selections individually, as an alternative to sequencing through the entire menu.



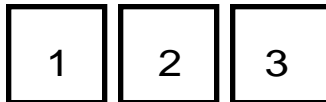
RUN/STOP For running and stopping programmed exposures. **RUN/STOP** key works like a toggle switch: If the camera motor is at a standstill, then the next exposure will run. If the motor is already running then it will stop the motor after the next completed exposure, and hold shooting the rest of the sequence. That is, **RUN/STOP** pressed the 1st time will begin running program, **RUN/STOP** pressed a 2nd time will hold the running program, and **RUN/STOP** pressed a 3rd time will continue the paused program.



ENTER For entering all data values at program prompts, as denoted by a flashing cursor on the display.



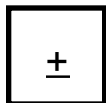
CLEAR For clearing data to zero values at program prompts. (You still need to use the **ENTER** key in order to accept the zeroed value.)



0...9 keys For entering numeric values for data like conventional keypad, whenever display cursor is flashing. Also used for individually selecting program functions (no cursor flashing), when used as function keys **PGM/MENU 1** through **PGM/MENU 9**.



• key Decimal point for data values, such as Exposure Time, Lapse Time, and Film Speed. Also used to access internal data selections, when used as **INT** function keys **PGM/MENU •**.



+/- key Plus sign for positive numbers, or Minus sign for negative numbers, such as Frame Counts and Counter Totals. Also used for toggling direction of motor rotation, forward or reverse, when used as **DIR** function keys **PGM/MENU +/-**.

Program Menu Data Entries:



FRM: Preset Frame Count = the number of camera exposures per run-time sequence. Typically set for many continuous frames or time-lapse operation. A negative Frame Count, denoted by a number with a Minus sign, will set the direction in Reverse. Otherwise positive Frame Counts default to the Forward direction. Initialized = 1 Frame for single frame operation.



DIR: Direction = direction of film travel, selected to either +FOR or -REV according to toggle of Minus (-) key. That is, each

press of the Minus key will flip the direction back and forth between Forward or Reverse. This selection must be quit by using the ENTER key, as in the rest of the data selection procedures. Once the direction is selected, the OK prompt will denote the direction with a + or - character following it: as OK+ or OK-.

Note: Once the direction is set, the sign of the Preset Frame Count is updated in memory. Particularly, if you select the Reverse direction, the Preset Frame Count will be turned into a negative number, and will display a Minus sign the next time you look at it. If you are used to using frame counters which never bothered with negative numbers, it is advisable that you always select your Preset Frame Count first, and then set the film Direction after that.

Initialized = +FOR for Forward film travel.

PGM MENU	2
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CTR: Counter Total = cumulative count of exposed frames. May be preset to any value. Typically may be used for assigning a counter frame number according to a cue sheet. Usually used just for clearing the Counter to 0. Counts up when camera running forward, and down when running reverse. Initialized = 0 frames.

PGM MENU	3
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END: End Frame = destination frame number to go to. Provided as an *alternate method* to using the preset Frame Count. Computes the difference between the current Counter Total and the specified End Frame destination, and updates the Frame Count and Direction data entries to run. Sets the direction to Reverse if lower than the current Counter Total, or leaves the direction Forward if higher. Always defaults to the current Counter frame + preset Frame Count whenever selected. Note: Entering an End Frame equal to the Counter Total frame will compute a Frame Count = 0, which will not Run at all.

PGM MENU	4
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EXP: Exposure Time = actual exposure time for camera motor to either run a continuous revolution or stop at the shutter-open position. May be specified with 0, or 1, or 2 decimal places in seconds. Exposure times automatically affect film speeds directly. Short exposure times will compute fast film speeds down to a minimum exposure time. Long exposure times will compute slow film speeds down to a minimum film speed. Only longer exposure times will use the time-exposure mode for stopping at the shutter-open position after running constant speed at the slowest film speed.

(The minimum exposure time, minimum film speed, and variable shutter angle may be changed as Internal data selections.) Initialized = 0.12

seconds for default exposure.

Special remote controlled exposure mode is selected by entering a negative value for the Exposure Time, such as "-1.00". When this exposure mode is entered, a time exposure is run for as long as the Input Trigger line is active. (This is like the "Bulb" exposure mode on still cameras.)



LPS: Lapse Time = time for camera motor to stop inbetween exposures. May be specified with 0, 1, or 2 decimal places in seconds. Small lapse times less than the rotational time of the motor are ignored. Exposure times are likewise compensated for in running of lapse times. Initialized = 0.00 seconds for no lapse timing.



TRG: Trigger Time = time delay between output trigger and camera exposure. When set to a value greater than 0, the trigger line will fire first, so there will be a delay before the next exposure. In single-frame mode, there is always a delay before the exposure. In continuous mode, there is only one delay before the first exposure. In time lapse mode, there is a time delay between exposures which is accounted by the lapse time intervals. May be specified with 0, or 1, or 2 decimal places in seconds, as in exposure time or lapse time. Initialized = 0.01 seconds minimum additional time.



VEX: Variable Exposure Time = sequence for camera exposures to change from present Exposure Time value to some adjusted value over the course of so many Frames. This sequence is set up with two successive data entries. The first, **VEX**, sets the destination Variable Exposure Time. The second, **+FR**, defines the number of frames the change between the initial and final exposures. Initialized = 0.00 seconds for no Variable Exposures.

Note this feature must be set up in advance of shooting the sequence. Also you will find that the number of frames for changing the time intervals does not necessarily have to equal the preset Frame Count.



VLP: Variable Lapse Time = sequence for camera exposures to change from present Lapse Time value to some adjusted value over the course of so many Frames. This sequence is set up with two successive data entries. The first, **VLP**, sets the destination Variable Lapse Time. The second, **+FR**, defines the number of frames the change between the initial and final lapse time intervals. Initialized = 0.00 seconds for no

Variable Lapse Times.

Note this feature must be set up in advance of shooting the sequence. Also you will find that the number of frames for changing the time intervals does not necessarily have to equal the preset Frame Count.

During Lapse Time intervals, you may view the data selections by pressing any of the corresponding keys. Therefore during Variable Exposure or Variable Lapse Time sequences you may monitor the changes in Exposure Time and Lapse Time values by pressing the **EXP** and **LPS** keys.



TRX: Output Trigger Action = direct override of output trigger line, either On or Off. Normally the output trigger line is active only during exposures, and Off anytime else. This feature allows the camera operator to toggle the trigger line On and Off for testing purposes, or for previewing a scene under shooting light conditions. The next exposure will revert the output trigger line to its normally programmed On-Off pulse, as specified with TRG Trigger Time. Initialized = Off.

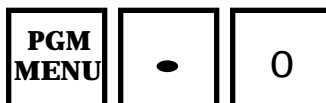


WDG: Variable Exposure Time Wedge = sequence of exposure times, shot in range from minimum exposure value, MEX, to the selected final exposure value, WDG. The available wedge exposure values are pre-set at half-f/stop increments in the range of 0.12, 0.17, 0.25, 0.35, 0.50, 0.70, 1.00, 1.41, 2.00, 2.82, 4.00, 5.64, 8.00, 11.28, 16.00, 22.56, 32.00, 45.12, and 64.00 seconds. May be specified with 0, or 1, or 2 decimal places in seconds, as in default exposure time. Initialized = 0.00 seconds for NO wedge sequence.

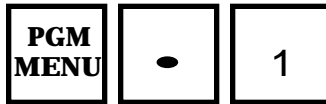
Once the wedge sequence is selected by the PGM key, it will run automatically by the next press of the RUN key. The WDG prompt will appear, and list each exposure time value as the wedge frames are being shot. Once the wedge sequence has run out, it will restore the previously selected Exposure Time and Preset Frame Count as defaults.

Internal Menu Data Entries:

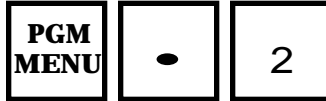
These are internal data settings for re-configuring some of ThingM's features. Normally you will not use these set of key sequences at all. (Note that the organization of the internal data selection keys has been configured to correspond more closely with the pre-labeled data selection keys.)



VER: Version number of ThingM Software, for identification purposes only. This version is VER 2.70, as seen by pressing these 3 keys sequentially: **MENU • 0**.



STP: Steps per Revolution = number of stepper motor pulses defined for 360-degree motor rotation. Initialized = 400 pulses per revolution for conventional DC stepper motors using half-stepping drivers. Accessed by **MENU • 1**.



OPN: Open-Shutter Rotation = fraction of motor rotation defined between Shutter-Closed and Shutter-Open positions, ie, how far the camera motor needs to rotate to pause at the Shutter-Open position for time exposures. (This is not to be confused with variable shutter angle.)

Initialized as follows for these cameras:

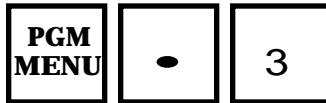
0.50 rev (180 degrees) for 35mm Bell+Howell 2709;

0.50 rev (180 degrees) for 35mm Mitchell standard;

0.35 rev (125 degrees) for 16mm Mitchell;

0.31 rev (110 degrees) for 16mm Bolex reflex;

Accessed by **MENU • 2**.



SHR: Variable Shutter Angle = angle opening of variable shutter defined in terms of degrees. This value is important for determining the correct relationship between exposure times and film speeds. If you ever close down your variable shutter, you must change this value to re-compute the correct relationship between exposure times and film speeds. Initialized as follows for these cameras:

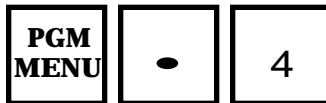
170 degrees for 35mm Bell+Howell 2709;

170 degrees for 35mm Mitchell standard;

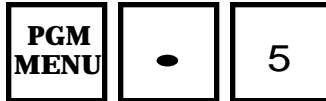
235 degrees for 16mm Mitchell;

100 degrees effective (= 135 degrees * 75%) for 16mm Bolex reflex, including compensation for beam-splitter light loss;

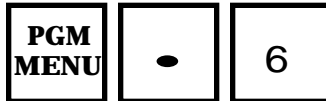
Accessed by **MENU • 3**.



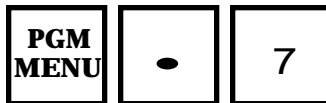
MEX: Minimum Exposure Time = minimum limit to short exposure times. This value is somewhat arbitrarily defined, but is necessary to keep very short exposure times from generating very fast film speeds. This is especially helpful in Variable Exposure Time sequences to keep all exposures shooting at practical single-frame speeds. Initialized = 0.12 seconds. Accessed by **MENU • 4**.



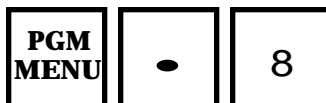
MSP: Minimum Film Speed = minimum motor speed for all speed computations. Also denotes film speed for changing over from continuous-rotation exposures to intermittent-rotation time exposures. Initialized = 0.93 revolutions per second = frames per second on 1:1 drive shaft. Accessed by **MENU • 5**.



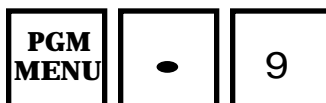
WSP: Whip-open Film Speed = maximum motor speed for use in intermittent-rotation time exposures, also known as "whip-open" exposures. The actual time interval for pausing at the Shutter-Open position is automatically compensated from the selected Exposure Time and this motor speed. Initialized = 2.00 revolutions per second = frames per second on 1:1 drive shaft. Accessed by **MENU • 6**.



SPD: Film Speed (Motor Speed) = rotational motor speed of camera drive in frames per second. Equivalent to revolutions per second on 1:1 camera drive shaft. See the typical relationships above in the Exposure Time section. Initialized = 3.92 frames per second, for default 0.12-second Exposure Time at 170-degree Variable Shutter Angle. May be any practical speed value for DC stepper motor driving 1:1 shaft, from approximately 1.00 to 4.00 frames per second. Accessed by **MENU • 7**.



RMP: Acceleration / Deceleration Ramp = fraction of motor revolution to ramp from starting speed to maximum speed. Initialized = 0.25 rotation for about quarter-revolution ramped speed motor operation. Minimum ramp = 0 for constant speed operation. Maximum usable ramp = 1.00 full revolution, to accommodate both acceleration and deceleration for stop motion modes. Maximum allowable ramp = 2.50 revolutions, which works for continuous motion modes only. Accessed by **MENU • 8**.



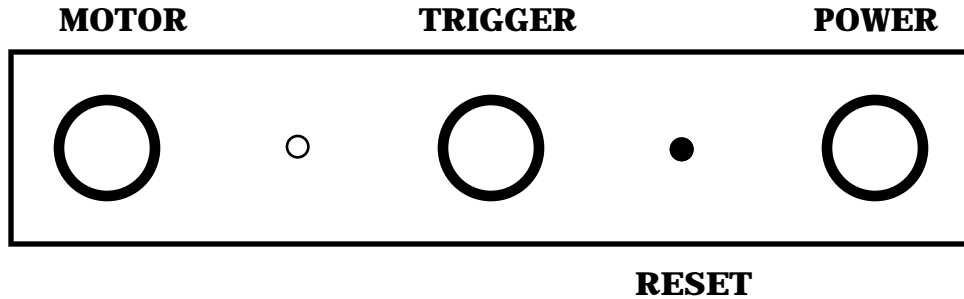
TRQ: Torque Time-out = time duration of motor holding torque at standstill. This time interval controls the length of time that motor is energized to full holding torque after complete camera exposures. After this length of time, the motor reduces to its standby torque instead. This torque time-out insures no additional mechanical motion

between exposures. May be specified with 0, or 1, or 2 decimal places in seconds, as in exposure time or lapse time. Initialized = 0.10 seconds additional energization time before torque reduction at standstill. Accessed by **MENU • 9**.

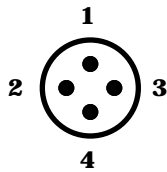
7. Technical Info

7.1 Back Panel Pin-out Diagram

THINGM-LC BACK PANEL LAYOUT

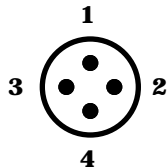


POWER



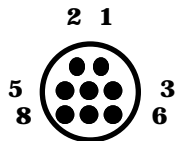
- 1 --- (no connection)
- 2 --- +12 Volt DC Input
- 3 --- (no connection)
- 4 --- Power Ground

TRIGGER



- 1 --- +5 Volt DC Output
- 2 --- Output Trigger
- 3 --- Input Trigger
- 4 --- Logic Ground

MOTOR



- 1 --- Motor Phase A In/Out
- 2 --- Motor Phase C In/Out
- 3 --- Motor Phase AB common
- 4 --- Switch Ground
- 5 --- Motor Phase CD common
- 6 --- Motor Phase B In/Out
- 7 --- Home Switch Input
- 8 --- Motor Phase D In/Out

7.2 Trigger Port Connection Diagram

Note: The following schematic diagram is intended as a reference for experienced electronic technicians. This is only an example of using ThingM's TRIGGER port to connect with two typical external devices. If you have any questions about interfacing input/output trigger devices to ThingM, please contact Ironic Research Labs for assistance.

THINGM TRIGGER INPUT / OUTPUT SCHEMATIC

