# dynamic perception

# Dynamic Perception NMX Motion Controller

## User Guide

Firmware Version .27
Revision Date: February 2015

The NMX Motion Controller is a networkable 3-axis time-lapse and real time digital motion controller with integrated dual camera trigger control. It allows multiple NMX devices to be daisy-chained and synchronized using the open-source MoCoBus™ protocol via widely available Cat5 ethernet cable.  Built to the highest specification with industrial grade components, the NMX is designed to provide years of reliable operation in the field or wherever your creative pursuit takes you.

The NMX has an integrated wireless Bluetooth low energy module which provides intuitive control through Android or iOS apps. Specifying continuous or shoot-move-shoot motion controlled timelapse or video moves is straightforward and fun. Using digital stepper motors you can create three axis editable and repeatable motions.

Auxiliary input and output port allow integration with third party devices, apps and software for more expressive automation in the studio or in the field. MoCoBus™ support allows for future expansion of the firmware to control MoCoBus™ enabled devices without a computer in the field. Camera focus and trigger integration automates control over hundreds of popular camera models.

Powerful, industrial-class motor drives combined with microstepping selectable range allow for smooth and fast control of a wide variety of stepper motors from small to large payloads. Each motor port has an adjustable PowerSave mode to help conserve power consumption in the field.
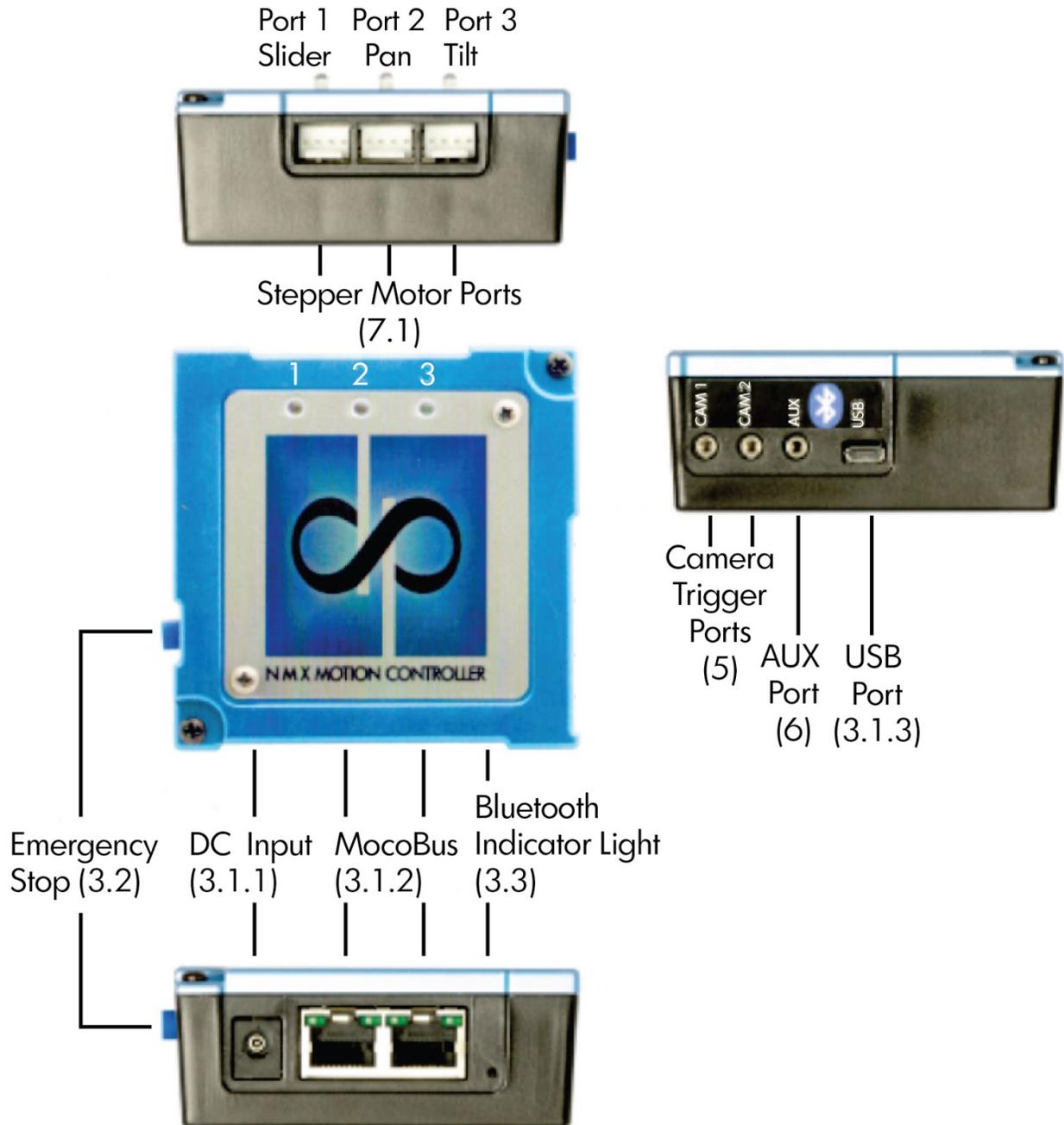
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# 1. Specifications

| Operating Parameters | | |
|---|---|---|
| | Temperature Range (stable bluetooth) | -12C - 80C (10F - 176F) |
| | Maximum Relative Humidity | 90% non-condensing |
| Wireless Control | | |
| | Bluetooth Low Energy (Smart or 4.0) | 30 feet line of sight |
| Ports | | |
| | Camera Trigger | **2x** 3/32" (2.5mm) TRS |
| | Auxiliary | 3/32" (2.5mm) TRS |
| | DC Input (center positive) | 2.1 x 5.5mm DC barrel (+)- |
| | Motor Output | **3x** Molex 22-01-3047 |
| | USB | USB Micro B |
| | MoCoBus™ | **2x** RJ-45 Female |
| Electrical Characteristics | | |
| | Input Voltage (DC Jack) | 9VDC - 24VDC |
| | Input Voltage (USB) | 5VDC |
| | Input Voltage (MoCoBus™) | 12VDC - 24VDC |
| | Maximum Current (DC Jack) | 5A |
| | Maximum Current (USB) | 500mA |
| | Maximum Current (MoCoBus™) | 1A |
| 3X Motor Outputs | | |
| | Supported Motor Type | Bi-polar 4 wire stepper |
| | Voltage and Amperage | Recommended maximum 6V rating Recommended maximum 1A rating |
| License | | |
| | Firmware | GPLv3 |
| | Schematics and Board Design | Creative Commons Attribution Share-Alike 3.0 |

# 2. NMX Diagram



Port 1 Slider  Port 2 Pan  Port 3 Tilt

Stepper Motor Ports (7.1)

1   2   3

N M X MOTION CONTROLLER

Camera Trigger Ports (5)  AUX Port (6)  USB Port (3.1.3)

Emergency Stop (3.2)   DC Input (3.1.1)   MocoBus (3.1.2)   Bluetooth Indicator Light (3.3)

# 3. Basic Operation

The NMX has three primary connection options for control;
**Bluetooth Low Energy compatible devices (Android/iOS mobile smartphones & tablets), MicroUSB (Windows & OSX) or MoCoBus compatible devices.**

## 3.1. Powering the NMX

The NMX can accept three power inputs; DC input jack, MoCoBus port or USB connector. **For most use-cases the DC input jack should be used to power controller and up to 3 attached stepper motors (see 7 for specs)**.

### 3.1.1. DC Input Jack

The DC input jack is the primary power source for most motion control operations. **This is the only power supply that will allow use of the Stepper motor drivers.** Typically a battery or AC adapter using the standard 2.1mm x 5.5mm DC barrel connector can be used to supply power. **The DC input jack can be supplied from 9VDC to 24VDC**.

### 3.1.2. MoCoBus Ports

The NMX can be powered via MoCoBus, this protocol carries data and power through the standard RJ-45 connector but the NMX is of limited use if powered by MoCoBus alone. The motor drivers will be disabled when the only power source is the MoCoBus connector as the MoCoBus does not provide enough amperage to run 3 stepper motors simultaneously. **If you connect multiple NMX controllers through the MoCoBus connector each NMX must be supplied power through the DC Input Jack at the same voltage level.**

### 3.1.3. USB Connector

The USB connector can be used to power the NMX when connecting to a computer or a powered USB hub. Typical use cases are when updating the firmware or used as a camera trigger intervalometer only. **Motors cannot be used with USB power alone, the 5V source is not enough power to drive motors.** The controller will reset if motors are connected and turned on under USB power.

## 3.2. Emergency Stop Button

The NMX has a single 'kill all motors/running programs' button, the button can be used for quick stop of all motor drivers if an unexpected issue arises. It can be pressed to stop all motor movement and any program running at any time.

The button has a few other uses as well. It is also used to put the NMX into 'upload mode' for firmware update (see 13) by holding while connecting to a computer via USB. Additionally, the button can be used to enter 'Slave Mode' via a triple click after booting (see 6)

# 3.3. Bluetooth Indicator & Connecting via Bluetooth

Bluegiga BLE112 *Bluetooth* Smart module is build in targeted for low-power wireless communication within 30 feet line of sight. The NMX can be accessed via Bluetooth through the use of Dynamic Perception purpose built iOS or Android 'NMX Motion' apps (see 4).

- **Important:** Make sure you have the most **up-to-date firmware loaded on the NMX** (see 8) and that you also have the latest version of the **iOS** or **Android** app (see 4)
- The NMX is only able to connect with **Bluetooth Low Energy** compatible devices (also known as 4.0 or 'Smart'). **Android 4.3 or higher. iOS 7.0 or later** (iPhone (6 Plus, 6, 5s, 5c, 5 & 4s), iPad (Air, Mini, 3rd & 4th gen), iPod touch)
- **Make sure your iOS/Android device Bluetooth setting is ON** but **Do Not 'pair' the NMX with your phone/tablet OS through the Bluetooth Device Settings**. Only the NMX Motion app has the ability to communicate properly with the NMX. **If paired, the OS may block the NMX Motion app from connecting!** If you do happen to pair the NMX with your phone/tablet make sure it's completely unpaired before you try to connect with the NMX Motion app, in the worse case your mobile device may automatically re-connect and block you from connecting through the app. The same is true of you are using multiple iOS or Android phones/tablets to connect, **the NMX can only connect with one device/app at a time**.
- Before attempting to connect check the Bluetooth indicator light on the NMX, it should be **OFF**. If the Bluetooth light is **ON** the NMX is connected to another device. It must be disconnected from the first device before it will allow a new connection.
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- Sometimes it takes a little patience, give the app 10-20 seconds to connect but if it hangs for more than 20 seconds try cycling the NMX Motion app and/or NMX controller on/off and try again.. After the first solid connection the app will usually re-connect very quickly but sometimes that initial handshake between app and NMX can be a little finicky.  Many times a simple shutdown/restart of the app will do the

trick. With Apple devices this is done by double clicking the main button at the bottom of the screen, then swipe the app up to close. With Android devices you use the 'app stack' button that looks like a stack of rectangles and swipe left or right on the app to close (Samsung devices you hold the main button to get a display of apps currently running). Strangely, it seems that Android is happier when the NMX is on before the app is launched and Apple is happier when the app is on before powering the NMX.

# 4. NMX Motion App

## 4.1. iOS NMX Motion App for iPhone, iPad & iPod

The NMX Motion app can be found by searching 'NMX Motion' in iTunes or by accessing the direct link below:

**LINK TO NMX Motion on iTUNES**

The NMX is only able to connect with **Bluetooth Low Energy** compatible devices (also known as 4.0 or 'Smart'). **iOS 7.0 or later** (iPhone (6 Plus, 6, 5s, 5c, 5 & 4s), iPad (Air, Mini, 3rd & 4th gen), iPod touch)
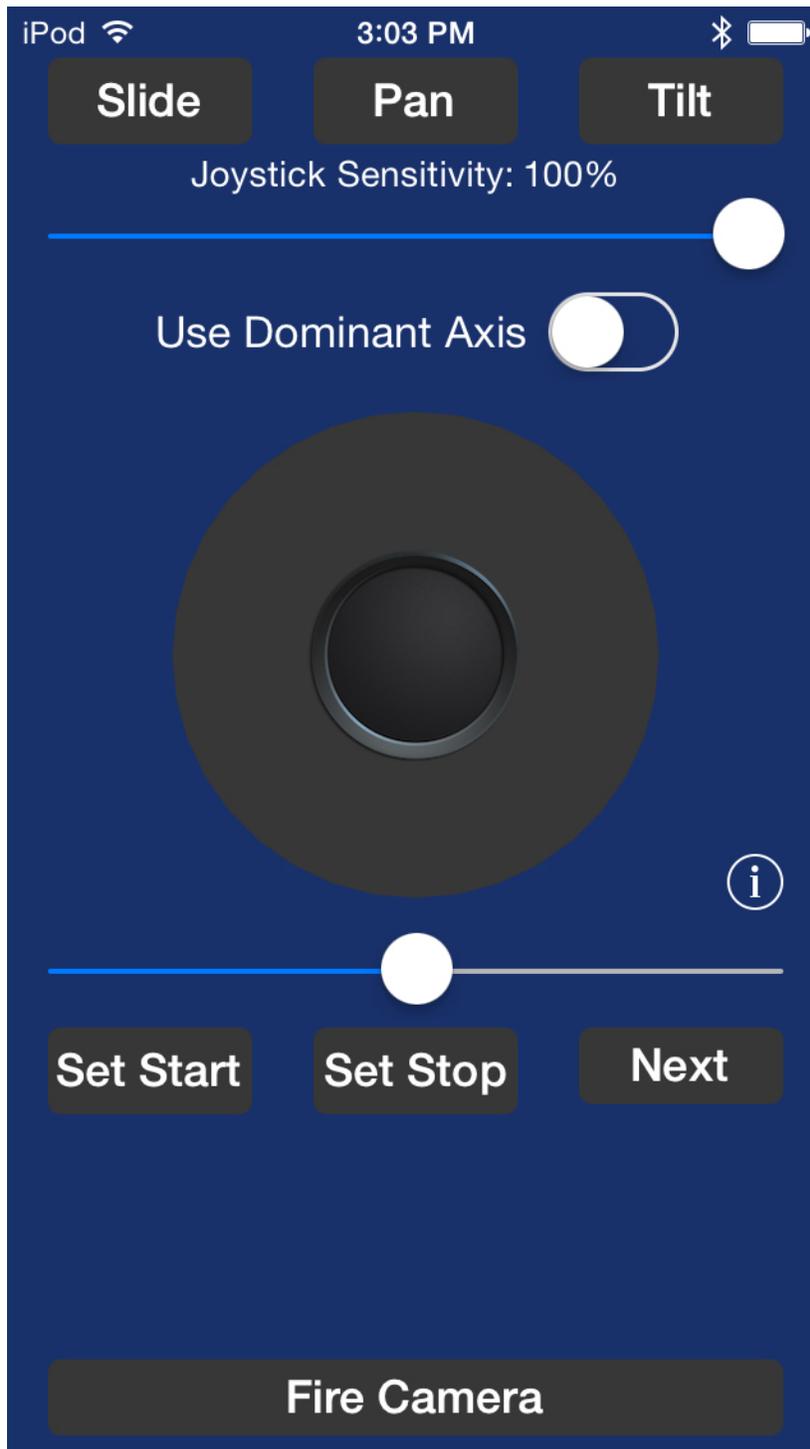
## 4.2. Android NMX Motion App

The NMX Motion app can be found by searching 'NMX Motion' in the Google Play store or by accessing the direct link below:

**LINK TO NMX Motion on GOOGLE PLAY**

The NMX is only able to connect with **Bluetooth Low Energy** compatible devices (also known as 4.0 or 'Smart'). **Android 4.3 or higher.**

## 4.3. Joystick Screen

| iPod 🛜 | 3:03 PM | ＊ ▭ |
|---|---|---|

| Slide | Pan | Tilt | A - Motor Port Settings |
|---|---|---|---|

Joystick Sensitivity: 100%

B - Joystick Sensitivity Slider

Use Dominant Axis ◯

C - Snap to Axis Toggle

D - Pan and Tilt Joystick Control

ⓘ

E - Information Button

F - Dolly/Slider Control

| Set Start | Set Stop | Next |
|---|---|---|

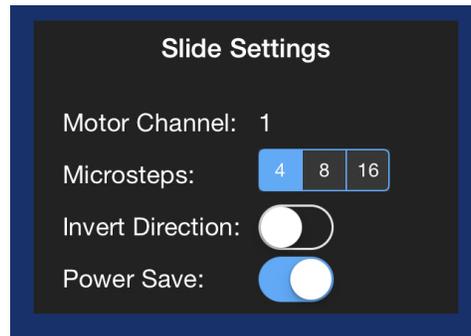G - Set Start, Set Stop and Next

| Fire Camera |
|---|

H - Camera Fire Button

## A - Motor Port Settings

Each of the motor port settings can be accessed independently, by default they are set to:

### Port 1 = Slide     Port 2 = Pan     Port 3 = Tilt

Motor Port Setting Screen



**Motor Channel**: (non-editable) shows the motor port the settings will affect.

**Microsteps**: effects the top speed of the motor when using the joystick/slider, in general this can be also thought of as setting the movement 'course' (4), 'medium' (8) or 'fine' (16). 4 being the fastest top speed or 'most coarse movement' and 16 being the slowest or 'finest movement'

**Invert Direction:** if the given motor port is moving opposite direction than desired it can be 'flipped'

**Power Save: (see 7.2.1)**: each port can independently control the Power Save mode the firmware will save (retain) the current setting even if the NMX is powered off/on.

## B - Joystick Sensitivity Slider

The sensitivity slider allows for more precise control through the joystick/dolly slider. This slider can be set from 10% to 100%, for example when set to 50% the joystick will only move the motors from 0 to 50% of the potential top speed.  This can be very helpful if you're trying to get very small precise movement or want to limit how fast the rig reacts to the interface.

## C - Use Dominate Axis or Snap to Axis

When enabled this toggle will only move the rig in the dominant direction the joystick is positioned. This is to say; pulling the joystick right and slightly up the system will only move right and ignore the up. This is helpful for isolating an axis of movement.

## D - Pan and Tilt Joystick

Affects the motion at the Pan or X-axis (Port 2) and Tilt or Y-axis (Port 3) motor ports. This is similar to a physical joystick, hold and drag the joystick in the direction of desired movement. If the movement is not in the direction desired use the Invert Direction switch (see A above)

## E - Information Button

Displays the current app version running and the current firmware loaded on the NMX (see 8)

## F - Dolly/Slider Control

Affects the motion at the Dolly/Slider (Port 1) motor port. This is a slider, hold and drag in the direction of desired movement. If the movement is not in the direction desired use the Invert Direction switch (see A above)

## G - Set Start, Set Stop and Next

Buttons are used to set the current beginning and end of the motion path. Use the Pan/Tilt Joystick and Dolly/Slider Control to position the rig and then set the Start or Stop of the overall move. **NOTE: The Set Stop can be set BEFORE the Set Start if desired**.  This can be helpful if for example with a long track to save some battery power. If the end is set first and then the start the system *does not need to return to the start position* when starting the program.

## H - Fire Camera Button

Can be used to trigger the camera at any time. A trigger signal will be sent from both CAM ports.

## 4.4. Motion Calculation Screen

Any changes made on this screen will automatically update & reflect in affected values.
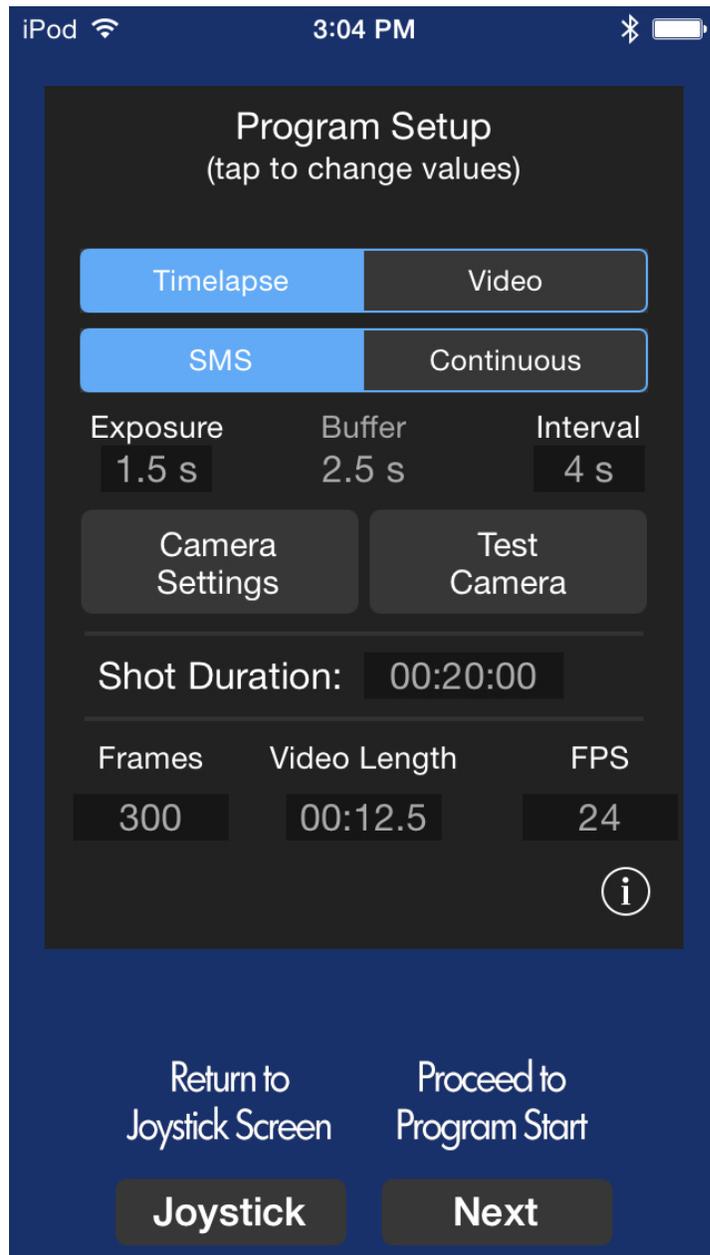


## A - Timelapse vs Video Mode

Choose between calculation screens that represent the more complex timelapse calculations and the more basic video shot duration.

## B - SMS (shoot move shoot) vs Continuous Mode (see 7.3)

(Active in timelapse mode) Choose between interleaved shoot and motion vs slow continuous motion. In SMS the camera is triggered and the system moves to the next position.

## C - Exposure + Buffer = Interval (See 5.2)

Basic interval setup: Exposure should be set to match the exposure time on the camera (See 5.2 'Important Note'). If below 1/30 second this is negligible. Exposure is actually the sum of Focus Time + Trigger Time + Delay Time but **when set in this area it only affects the Delay Time**. The buffer time is editable and is simply the remaining 'non-active' time in which typically the camera's buffer is allowed to clear. The Interval is the overall cycle time and the sum of the Exposure and Buffer time.

## D - Advanced Camera Settings (See 5.2)

This button brings up the detailed interval cycle settings
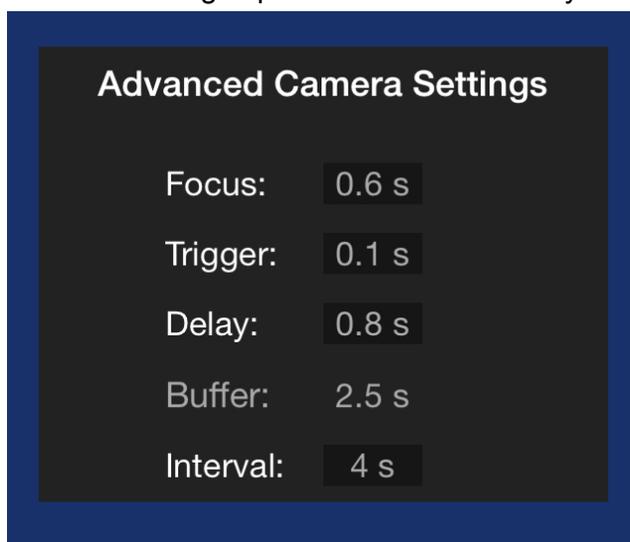


Detailed breakdown of the Exposure Time is displayed, more information on how to use the settings can be found in section 5.2, changes made in this window will be reflected when returning to the main calculation screen.

## E - Test Camera Interval

This button will test the current interval cycle without any movement. This is useful for testing settings and adjusting for Trigger cycles, testing for camera buffer time etc.

## F - Shot **Duration**

This editable value represents the entire shot duration from start to finish or 'how long the system will run'

## G - Frames, Video Length & FPS

Total amount of frames desired, the overall video length and the frames per second can be set in this area. Note any changes to one value will result in a recalculation of the others.

# 5. Camera Control

The NMX is capable of controlling up to two cameras simultaneously through the wired remote shutter ports with 3/32" (2.5mm) Male TRS connector on the NMX side to unique camera specific connector on the other. See 'appendix A' for a list of tested compatible cameras and cable specifications. If your camera does not have a remote shutter port, it may need to be triggered via an infrared remote trigger relay. For example the 'gentLED-TRIGGER'

> (i) The remote shutter port only provides control over the focus and shutter trigger only, it is not possible to control ISO, aperture, or other settings over this port.

## 5.1. Connecting the Camera

To connect the camera, first plug the camera cable into one of the NMX trigger ports; ('CAM 1' or 'CAM 2'). After connecting the cable to the NMX plug the other end into your camera's remote shutter port.

> (i) For some cameras you may be required to set a specialized input option to enable control from the remote shutter port, Check your camera's user manual to determine if this is necessary.

To test the camera, power on the NMX and the camera. Set the camera to **Manual Exposure and Manual Focus**, then dial in an exposure of 1/60th of a second. Using the NMX Motion app use the Fire Camera button on the joystick screen to test.

## 5.1.1 Camera Trigger Troubleshooting

First make sure that your camera is set in the most basic/manual modes:

- **Auto Focus Off** (Manual Focus)
- **Manual Exposure Mode** (example set to 1/100" exposure and f/8 aperture)
- **Live View Off** (see 6.5 for more info)
- **Focus Priority Off**
- **Single Exposure Mode** (Continuous or High-Speed Exposure drive modes may cause multiple exposures and delayed exposure timers cause event timing issues)

Note that some cameras go into a soft sleep mode after about thirty seconds, make sure to wake your camera up by tapping the shutter trigger before performing the following steps. With the NMX Motion app, set an interval of 4 seconds and use the Test Button to activate the interval trigger test. The two green LEDs in the center of the MocoBus Ethernet Port should blink every 4 seconds, if the camera does not trigger try the following:

- **Set the Trigger time higher in the Advanced Camera Settings area, try setting it to 0.2 or 0.3 and retest.**

- **If the Camera appears to "wake up" (displays exposure time, etc.) but no fire.**

  ○ Your camera is either sleeping, or requires the focus line brought high before firing, set the focus time to 0.2 to 1.0 Seconds in the Advanced Camera Settings and adjust to see if the camera starts firing

  ○ If your camera happens to force auto-focus mode, and needs more time to focus before triggering the exposure. Set the Focus time to 2.0 - 4.0 Seconds, you may need to adjust this time depending on how long it happens to take for your camera to lock focus.

- **If the Camera neither wakes up nor exposes**

  ○ The camera may not accept a remote trigger in its normal (or current) firing mode, there may be a 'remote control mode' try to find and enable/disable on camera

  ○ Double check that the cable is fully seated and properly oriented in the camera body and controller (the Nikon DC2 cable is notorious for it's rectangle shape fitting in the camera body in both directions)

If you have gone through the entire troubleshooting guide and your camera still doesn't fire, you may have a defective cable, which we will happily replace under warranty (support@dynamicperception.com).  Note: less than 0.2% of tested cables have proven to be defective and usually the only cables replaced due to obvious damage (compromised cable, broken housing, etc.). Most non-firing situations are resolved by adjusting camera and/or controller parameters.

# 5.2. Understanding the NMX Interval Cycle

Each NMX interval cycle is a sequence of events. At program start or at each AUX trigger event, the cycle repeats:
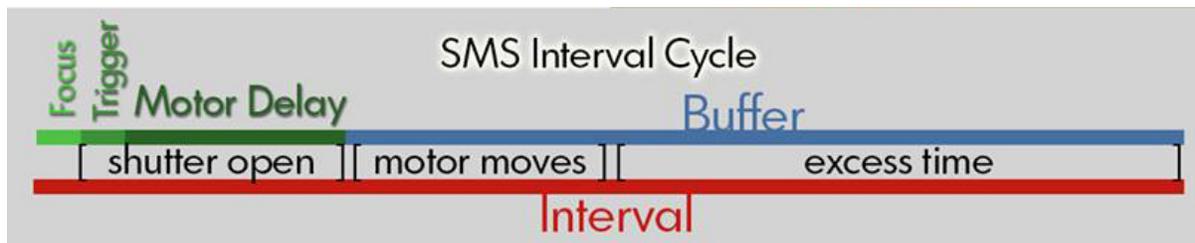


**The Interval is the sum of:**

1. **Focus Time**
   - This is similar to a trigger 'half press' on your camera causing the autofocus to become active. In most cases it's best to have your auto-focus off but this setting can be useful when **using Live-View** (or auto-review) settings, or to 'wake' your camera if your interval is long enough that the camera goes to a sleep mode between shots.
2. **Trigger Time**
   - This is essentially a 'full press' of the trigger on camera causing an exposure. In most cases 0.1 Seconds (100ms) is enough time to trigger the exposure. This setting can also be used to set a Blub Exposure (when setting the camera to Bulb Mode) or when using the camera's AEB (Auto Exposure Bracketing) for HDR. For AEB you would set the trigger time long enough to fire off all of the brackets (which will vary depending on the sum of the AEB exposure sets)
3. **Motor Delay Time**
   - This is a set duration time AFTER the Trigger Time and BEFORE the motors move, in general you want set this setting around 10% longer than your exposure. see ***IMPORTANT NOTE** below.
4. **Motor Movement** (note: the further the motor moves in SMS mode the longer this takes)
5. **Buffer Time**
   - This is excess time, if the interval is longer than all the above this excess time will be leftover and added to the buffer time.

**If you are using longer exposures, the setting to concentrate on is #3 the Motor Delay.** You'll need to set the exposure delay LONGER than your exposure time set on the camera. So for example if your camera is set to 10 second exposures then you might want to set the exposure delay to about 11.5 seconds.
***IMPORTANT NOTE:** be aware due to the rule of reciprocity **the camera exposure setting is not 100% accurate, it's longer!** Camera manufacturers have traditionally rounded off exposure times, in reality the longer the exposure time the further off it will be! **The actual exposure time for a 30 second exposure is closer to 32.5 seconds..** (use a stopwatch to time it and you will see the truth for yourself!) The NMX timing however is 100% accurate to the mS.

**If there is no room in the interval cycle for buffer time** (in other words the camera seems to be starting the exposure too close to the *end of the motor move*), this problem can be resolved by setting the Focus Time a little higher to give the system time to settle before firing the camera. There is a built-in 100ms delay between the end and the beginning of the loop, but that's so quick it may appear that the motor is still moving when the camera is triggered.

## 5.3. Controlling Exposure on the Camera

For most applications, it is best to let the camera control the exposure. In this case, we only need to inform the NMX how long the exposure is set for. The NMX will signal the camera to fire (0.1 to 0.3 Trigger Time is plenty) the shutter and the camera will control the exposure time.

Set the camera to Manual exposure mode and set the proper exposure for your scene. In the NMX Motion App use the Exposure setting (or Delay setting in Advanced Camera Settings) to inform the system how long your exposure on the camera is set. This is so the motors will remain still in SMS mode. (see ***IMPORTANT NOTE in 5.2 above**)

> (i) It is usually best to err on the safe side, and choose an exposure time on the NMX which is a little longer than the exposure time on the camera, especially for Shoot-Move-Shoot motion control. This ensures that the NMX does not try to perform any actions while the camera is exposing. See 5.2

## 5.4. Controlling Exposure with the NMX

You may want to control the exposure using the NMX Trigger Time setting. This is usually for situations where exposures greater than 30 seconds are desired (typical max setting for DSLRs). In this case, the NMX will control the length of the exposure by sending a trigger signal for the entire exposure time desired. In this case there is no need set the Delay Time..

Set the camera to Bulb Mode. In the NMX Motion App navigate to the Advanced Camera Control screen and use the Trigger time to set the desired exposure time. Since the Trigger Time already encompases the entire exposure time the Delay Time is not necessary or can be set to a short duration so the motors move soon after the exposure completes.

> (i) Most cameras cannot handle a bulb exposure shorter than 1/30th of a second.  For exposures less than 1 second, bulb exposure is not recommended as deviations can occur in the bulb timing between the camera and the NMX.

## 5.5. Controlling Focus, Waking Camera up from Sleep

When using 'live view' or to wake the camera before exposing during long intervals, it may be necessary to send a focus signal to the camera before triggering a shot. To control the focus line, go to the Advanced Camera Control in the NMX Motion app, choose Focus to adjust.

To wake a camera up from a soft sleep during long intervals or in 'live view', not more than 0.5 second (500 mS) of focus time should be required. On the other hand if operating the camera's autofocus is desired, most cameras will require around 1-3 seconds of focus signal in a well lit scene to lock focus. Darker scenes can be more challenging for cameras and may require the focus time to be set over 3 seconds to lock.  Always use the 'AFS' or auto focus single setting.

## 5.6. Controlling AEB (Auto Exposure Bracketing for HDR)

When bracketing multiple exposures set your camera to **Auto AEB (and multi frame high-speed drive mode)**. The Trigger Time and Exposure Delay settings are used to control this cycle.  Add up the total exposure time in the AEB shot sequence and set the Trigger Time to match in the Advanced Camera Settings.  One way to arrive at the correct time is to count off or use a stopwatch while holding the camera's fire button, then test and adjust as necessary to trigger all the exposure brackets. The Exposure Delay time helps provide enough time for the last exposure and to allow the camera's buffer to clear (will vary depending on camera model and memory card speed).  With this method the AEB shot sequence will be executed as fast as is possible particularly with the high speed multi frame drive mode  selected on the camera.

## 5.7. Focus Lock with the Trigger

Some cameras, most notably those made by Nikon, require the focus control to be held along with the shutter control to trigger an exposure.  This is enabled by default on the NMX, and should not present a problem with other brands.

# 6. AUX Port (Slave Mode)

There are common cases where you might want to setup a move and then have an external device set the timing between moves (or shots) in SMS mode. This is important when using external 'Bulb-Ramping' devices as the exposure time may gradually change or when shooting 'Stop-Motion' where the scene is adjusted and after triggering the next shot/move.

**Enabling 'Slave Mode'**

Setup on the NMX is very simple, the firmware has a 'toggle' to switch this mode on/off using the Emergency Stop button. After booting the NMX **TRIPLE CLICK** the stop button and the far right light on the mocobus ports will light up indicating that the NMX is in 'Slave Mode' for Stop Motion or Bulb Ramping.



Normal Mode



Slave Mode Enabled

**Bulb-Ramping Devices**
**(see 'Holy Grail' article)**
There are a couple of ways to link 'bulb ramping' devices to the NMX, some devices (like the RamperPro or Timelapse+) have an 'out' signal port, in this case you simply link the out signal port to the NMX AUX port using **our 3/32 (2.5mm) Canon E3 cable**. Other devices may not have an out port or you may prefer to monitor the camera's shutter instead and have the NMX only move when the camera's exposure is complete, in this case you can use the camera's PC-SYNC port (or flash shoe PC-SYNC adapter) and link to the NMX using **our PC port monitoring cable**. In either case, the NMX is set to move only at the end of the signal (or end of exposure).

**Stop Motion with the NMX**

For stop motion there are a couple of options as well, you can connect a hand or foot trigger directly to the AUX port and use it to trigger both camera and the move (don't forget to set the exposure in the app properly if your shooting longer exposures to ensure that the rig sits still while the exposure is occurring). Some examples of triggers would be **our multi-function switch**, any basic camera trigger (with 3/32" / 2.5mm TRS or 'mini-stereo') or a wireless shutter trigger will work as well.  Another option would be to trigger the camera with an external trigger device and use our **PC port monitoring cable** to link the camera to the NMX and trigger the next move when the exposure is complete.

**How to set up a shot in 'Slave Mode'**

In both cases the setup is the same as it would be normally, you can use one of our apps to setup the start and end points, then choose SMS mode and choose how many shots you want over the course of the move. First start the program on the NMX and then start your external device, the NMX will simply wait for the signal before advancing to the next position. Note: although the app may give you a 'time remaining' this is of course is not accurate =)

# 6.1. Auxiliary I/O Technical Details

The Aux I/O port is a tip-ring-sleeve (TRS) 3-conductor, 2.5mm jack.  Each jack has two I/O conductors, and one common line (sleeve) connected to ground.
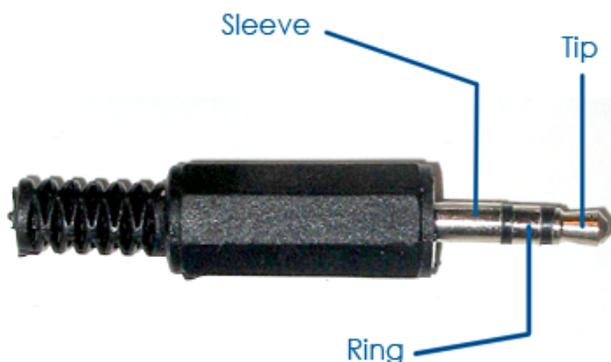


Typically, one of the I/O lines is connected to the common line for its port to register an input signal.  For example, one can trigger activity by using a switch to connect the tip of a TRS cable to the sleeve. Each I/O port is pulled HIGH (+5VDC) internally via 20KOhm resistors.

> (i) I/O port interaction happens with +5VDC, if you are working with an external device that operates at a different voltage, it must be isolated from the NMX or a level-shifter must be used.

# 7. Motor Control

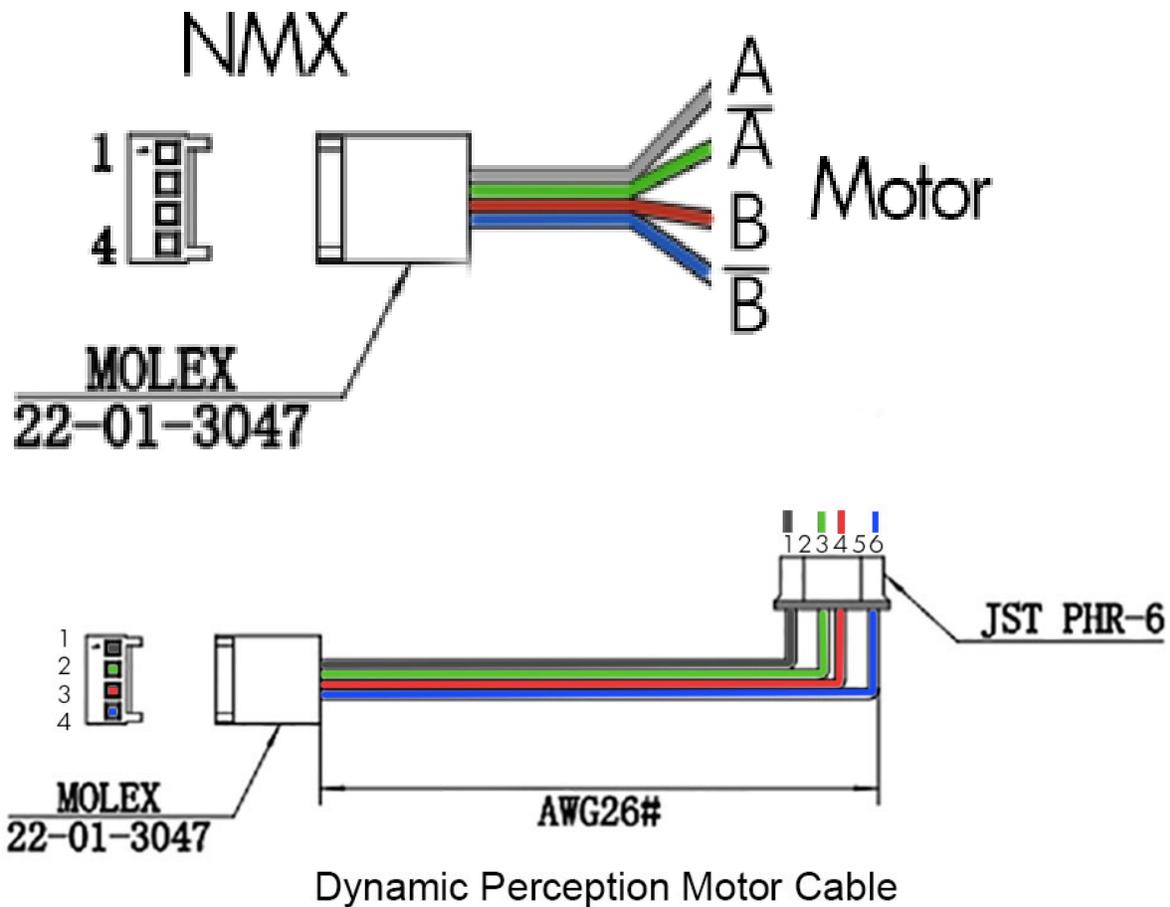The NMX can control up to three Stepper motors simultaneously.

## 7.1. Stepper motor and wiring specifications

**General Motor Characteristics**

- Bi-polar 4 wire stepper motors

- Recommended maximum 6V rating

- Recommended maximum 1A rating

(higher rated motors may work, but will not be able to produce full torque)

**Motor Wiring Guide**





Dynamic Perception Motor Cable

## 7.2. Motor Power Consumption

With the introduction of NMX firmware .22 (and later) we decided it was best to turn the Power Save function OFF by default for all three motor ports. We did this as a 'better to be safe than sorry' measure, **with the Power Save option OFF the motors will have the maximum HOLDING POWER** ( some customers were having trouble with heavier loads). However this does come at a power consumption cost.. With the power save off the NMX will consume about **300mA per motor driver** on top of approximately **150mA for core functions**.

## 7.2.1 Power Save Mode

**With Power Save ON the motor drivers will automatically turn off when they are not actively moving a motor.** This primarily saves energy when using the system in a 'Shoot Move Shoot' timelapse mode as the motors are usually at rest, only moving for a small percentage of time. In Continuous timelapse or in Video mode this setting will have little effect since regardless of the Power Save mode the motors are constantly in motion during run time in these modes.

## Turning Power Save On/Off

Power Save is inside the Slide, Pan or Tilt options (top of the joystick screen)
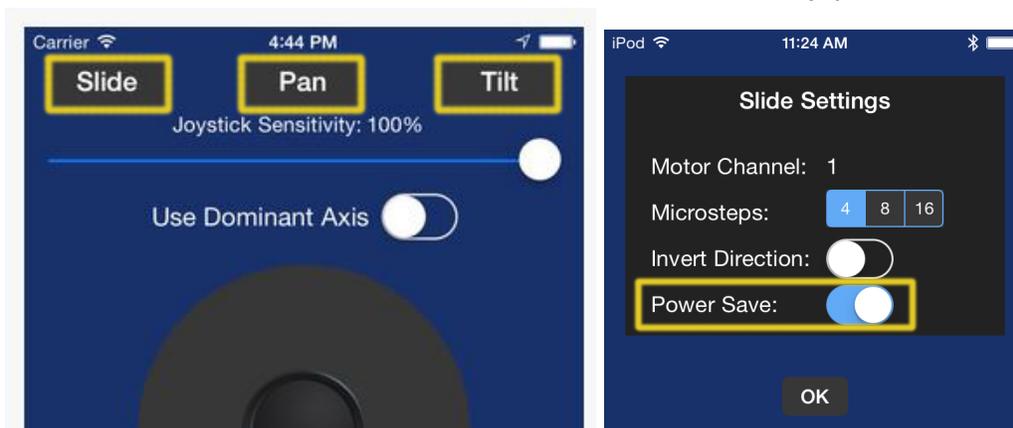


Each of the 3 motor ports can be independently toggled on/off so **if you have no motor connected to the motor port definitely turn Power Save ON!** There is no need to consume power if you're not using the port.. Notice when set immediately the motor port light will turn off indicating that the motor driver is currently off.

## 7.2.2 Would the payload 'free fall' with Power Save ON?

No, it may *slowly descend* but our standard 19:1 motors have a good amount of holding power even when the motor driver is off. **The motors will not 'release and spin freely' when the motor driver is off.** You can test this out and get a feel for it by disconnecting the motor and twisting the rotary axis or pushing the slider cart by hand to see how much force it takes to move it. You'll find that it's possible to move but not necessarily that easy.. worse case scenario the rig would slowly creep out of position or slump, **it would never 'free fall'**

## 7.2.3 Will motors hold a load in position with Power Save ON?

Not always, with very small SMS timelapse incremental moves **against gravity** with say a heavy lens or a heavy dolly cart, what can happen is the driver will move the motor the small move to position but when the motor driver turns off it can potentially slump/slip back a bit. It's difficult to draw a definitive line when this will happen and when it will not therefore **when in doubt keep the Power Save OFF**. If the motor is able to hold it's load and the move is **WITH gravity** (for example; downhill on a slider or a big lens that is tilting down) then it's usually safe to go with the Power Save ON!

## 7.2.4 Motor Driver Heat

**This is normal.** When the motor driver is on it does produce heat. The motor drivers are thermally bonded to the aluminum top of the NMX which acts as a heat sink. It's not uncommon for the top of the NMX to reach temps upto 95 degrees with all three motor drivers constantly running. Although this feels quite warm to the touch it's not enough to harm you or the NMX.

## 7.2.5 Motor Driver Sound

**This is normal.** When the motor driver is on and actively holding a position there will be some harmonic frequency from the motor driver. This can sound like the tube in an old TV set. Its tone will vary based on the motors position but this sound is nothing to be concerned about.

## 7.3 Choosing Motion Mode

The two basic motion control modes for the NMX motion controller are *Continuous Motion* and *Shoot-Move-Shoot*. (Also known as *SMS*.) In Continuous Motion mode, the motor moves as the camera is being fired, in SMS mode, the motor only moves briefly between exposures. These two motion control modes can result in different aesthetics in your output video, and each are best geared to a specific result. The following table will help to summarize the best way to choose between the two motion types based on the parameters of your shot or the effect you wish to achieve:

| Description | Continuous | SMS | Notes |
|---|---|---|---|
| *Moderate Speed, Short Exposure* | X | | Can add a small amount of motion blur, and is easier to set up |
| *Long Exposure* | | X | SMS reduces blur during long exposures |
| *Very Slow Speeds* | | X | Use SMS to achieve motion over hours or days, much slower than motor can move |
| *Static Subjects, Medium Exposure* | X | | Adds nice motion blur to otherwise static subjects |
| *Static Subjects Sharp, Moving Subjects Blurred* | | X | Set longest exposure time achievable |
| *Star Scenes* | X | X | If moving with stars, cont. can help prevent streaking, but will reduce foreground focus on very long exposures |
| *Critical Focus, Macro, or Long Lens* | | X | Prevent movement when exposing |

Photographers will use one mode or the other as a matter of taste or artistic intent. While the table above attempts to serve as a guide to when to choose between the modes, your workflow or shooting style may call for a specified mode that is in contradiction with the table. Every photographer is unique, and their style is their own — practice with each mode to understand which is right for you.

## 7.3. Continuous Motion

Continuous Motion is the most common motion mode for daylight videos. In continuous motion, position signals are sent to the motors thousand of times per second. The faster the speed requested, the more often these pulses are sent. The one drawback for this method is that motors do not have an effective speed range from 0% to 100% of the overall speed range, but instead have an effective speed range, typically from 10% to 100%.

## 7.4. Shoot-Move-Shoot Motion

SMS motion is primarily for longer shot time duration (2+ hours), the motor is briefly moved a short distance/angle between each exposure. This allows the NMX to produce very short movements over long periods of time, by breaking the entire move up into very small increments that are executed once per interval.

SMS motion also allows for the use of very long lenses, critical focus, and extreme exposure lengths by eliminating any movement during exposure.

# 8. Updating Firmware

The DPWebUpdate utility is used to automatically download the latest firmware versions as they become available and upload them to the NMX. The DPWebUpdate utility can be found on the Dynamic Perception support website (http://support.dynamicperception.com/hc/en-us/articles/201810200-Firmware-Update-Utility-download-), the application is available for Windows and Mac OSX.

> (i) On Mac OSX, in most cases you do not need to install a driver for the NMX, *note: the NMX will be recognized as a generic 'cu.usbmodem' or 'cu.usbkeyboard'*.  **On Windows you will need to use the device manager manually load the driver**, note: for Windows use the CDC Lufa driver located in the /Drivers subdirectory of the DPWebUpdate utility.

The following steps will allow you to upload a new firmware version to the NMX (**Important: Only connect the USB when updating, disconnect all other power sources/motors**):

1. Download and unzip the DP Web Update folder from support.dynamicperception.com onto your desktop
2. **Hold the Emergency Stop button down on the NMX while connecting a Micro USB cable into the NMX USB port**, this puts the NMX into an 'Upload Mode'
   a. The controller lights will not blink and the motor driver lights will not appear, only a single light will appear on the left side of the MocoBus ports, nothing more.
   b. Mac will usually find the drivers automatically, with windows use the device manager to manually load the driver in the /drivers directory of the DP Web Update utility folder
3. Launch the DPWebUpdate program inside the unzipped folder
4. Allow DPWebUpdate to retrieve any new updates (internet access required)
5. Find and select the correct COM port with the 'LUFA CDC' ('cu.usbmodem' or 'cu.usbkeyboard' in OSX) as its description below the COM selector.
6. Select 'NMX 3-axis Motion Controller' as the device
7. Select the latest firmware version (should be by set by default)
8. Press Update Firmware

Should any problems occur during the process, please contact Dynamic Perception support for assistance at support@dynamicperception.com.  Click the 'Output' button on the lower left of the DP Updater Program to see the details, cut and paste the entire output in the support request for fastest resolution.

# Appendix A: List of Camera Trigger Cables

The following cameras are supported, listed by camera connection cable available from Dynamic Perception.  Note that not all cameras may support all features.

| Make | Model | Cable |
|---|---|---|
| **Canon** | 10D, 20D, 30D, 40D, 50D, 7D, 6D, 1D Mark II, 1Ds Mark II, 1D Mark III, 1Ds Mark III, 1D Mark IV, 1DX, 1DC, 5D, 5D Mark II & 5D Mark III | Canon N3 |
| **Canon** | 60D, All the 'Rebels' (500D, 550D, 600D etc), T41, T3i, T2i, T1i, Kiss | Canon E3 |
| **Nikon** | D90, D3100, D3300, D5000, D5300, D7000, D7100, D600, D610 | Nikon 3N (DC2) |
| **Nikon** | D70S, D80 | Nikon DC1 |
| **Nikon** | D1H, D1X, D2H, D2X, D2Xs, D2Hs, D200, D3, D300, D700, D800, F90x, F90, F100, F6, F5 | Nikon 10-Pin (DC0) |
| **Pentax** | K5, K7, *istD, *istDL, *istDs, *ist, *istDL2, *K100D, K110D, K10D, K200, K20D | Canon E3 |
| **Sony** | a900. a700, a550, a500, a450, a350, a300, a200, a100 | Sony Alpha S1 |
| **Sony** | A7R, A7S, A58, NEX-3NL, A6000, A5000, HX300, RX100 | Sony Alpha S2 |
| **Panasonic** | Lumix DMC FZ20, FZ20K, FZ25, FZ30, FZ50 LC1, L10, L1, G1, G2, G10, GH1, GH2, GH3, GF1 | Panasonic 4-Pole (RS1) |
| **Olympus** | e520, e510, e420, e410, e300, sp-570 uz, sp-560 uz, sp-550 uz, sp-510 uz | Olympus UC1 |
| **Olympus** | E1, E3, E10, E20, E30 | Olympus CB1 |
| **Samsung** | GX, 1L, GX 1S, GX-10, GX-20 | Canon E3 |
| **Contax** | 645, N1, NX, N Digital | Canon E3 |
| **Kodak** | DCS-14n | Nikon 10-Pin (DC0) |
| **Fujifilm** | S3 Pro, S5 Pro | Nikon 10-Pin (DC0) |
| **Leica** | Digilux 1, DIGILUX 2, DIGILUX 3 D-LUX3 D-LUX2 D-LUX1 | Panasonic 4-Pole (RS1) |
| **Konica Minolta** | 7D, 5D, DiMAGE 9, 7HL 7U 7, 5, 4X, 3 | Sony Alpha S1 |