FANOTEC

Nodal Ninja

MECHA

USER'S GUIDE

October 10, 2020

Contents

Tests and useful information ..... *iv*

WARNINGS *6*

Introduction *7*

MECHA Single Axis 14

Before first use *15*

Firmware update using the smartphone: method 1 ..... *16*

Test using MECHA's buttons *18*

Panorama with automatic shooting pattern using only the MECHA's buttons *19*

Test using the User Interface *20*

Programming a preset using the UI *23*

Presets for MECHA Single Axis *24*

Downloading the presets from server *24*

Programming a preset using parameters *26*

The User Interface (UI) *28*

Access the UI with a smartphone *28*

Access the UI on your computer *28*

UI Controls *29*

Configuration page *38*

Other updating methods *46*

Firmware update using the smartphone: method 2 ..... *46*

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MECHA MSA *47*

MECHA Dual Axis Combo − DAC 48

DAC Firmware update using the smartphone *53*

Pairing using MECHA's buttons *54*

zLM 2 − Automatic pairing using two buttons *54*

DAC test using MECHA's buttons *56*

DAC test without camera - 1312 parked position *56*

DAC test without camera - 1313 level position *57*

DAC test without camera - 1321 raised position *57*

Panorama with camera mounted *58*

Panorama with automatic shooting pattern using only the MECHA's buttons *58*

DAC test using the UI *60*

How to change the SSID password *62*

Working with Presets *63*

How to create your own Presets *63*

MECHA's Simple Scripting (MSS) *69*

S-Language inserts *75*

Download more Presets from server *76*

MECHA's S (shots) Language *82*

How to set both MECHA and smartphone to have Internet access *93*

Other pairing methods *95*

zLM − Automatic pairing using buttons *95*

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Pairing PIN for more than 2 MECHAs *97*
Temporary pairing *97*
Automatic pairing using the UI *98*
How to unpair MECHAs *100*
MECHA's Current Codes *101*
Current Codes list *102*

Tests and useful information

Splitting lights − set MECHA in AP, STA, AP+STA mode *10*
Table of equivalences: LEDs − characters *11*

MECHA Single Axis

Power up MECHA *15*
Check the battery level *15*
Quick panoramas using MECHA's buttons *16*
Set the rotator using MECHA's buttons *18*
Panorama with automatic shooting pattern for Single Axis . *19*
Set the rotator on Configuration page *21*

MECHA Dual Axis Combo − DAC

Check if two MECHAs are paired *52*
DAC Test 1312 ..... *56*
DAC Test 1313 ..... *57*
DAC Test 1321 ..... *57*
Panorama with automatic shooting pattern for DAC *58*
Preset power code *68*

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MECHA User's Guide

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How to use this User's Guide

Welcome to the MECHA User's Guide!

If you have never used MECHA before, we recommend that you read the introduction first, to get an overview of how it works and what you can do with it. Then read the MECHA Single Axis part and practice according to the instructions.

Once you are familiar with the MECHA Single Axis, if you are interested in MECHA Dual Axis, you can continue with the second part.

Even if you are an experienced user, please pay attention to the warnings.

If you find the firmware update and other operations difficult, you can receive support and guidance at mecha@nodalninja.com

Let's get started!

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WARNINGS

WARNINGS to dual axis MECHA users

- Test MECHA WITHOUT a camera mounted first!
- Please test for camera clearance before running any program.
- Test any preset supplied or adjusted WITHOUT a camera mounted FIRST, especially when the clearance is not enough.
- CHECK for clearance with shutter cable attached!
- ONLY use a coiled cable for dual axis that can be stretched to about 1m.
- Use short cable with extreme caution.
- The power button, ⏻, can be used always as an emergency stop.
- If the movement is not as expected, or there is any danger for the moving parts to hit something, please press ⏻, the power button of MECHA, to stop the movement immediately.

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Introduction

What is MECHA?

In short, MECHA is a wireless controlled motor that can rotate and trigger a camera or other devices.

In general, MECHA can rotate anything that can benefit from a controlled rotation, not only cameras directly or mounted on a panoramic or ball-head, but also turntables holding objects to be photographed or filmed, as well as lights or stands for presentations.

MECHA can be mounted on a tripod and on any other stand which has a mounting screw.

It can rotate along with anything mounted on it, or can rotate only the object mounted on it. The rotations/moves can be pre-programmed and launched using its buttons, or can be wireless launched via its web interface from any device that can run a web browser.

For example, its commands can have equivalent simple QR codes. At an exhibition, scanning a QR code can rotate the featured object at a certain angle without the need to touch the object or the stand. Series of rotations can be pre-programmed and launched wireless by the visitors or by the host.

It also has support for IR remote - just as the camera has its remote, or a TV set has one - and support for wired remote.

The built in battery lasts for one day after a full charge, and can be charged even while it is in use, from a power-bank or outlet adapter, thus allowing the non stop run.

As it uses Wi-Fi for connection, it can be accessed directly by a phone or via a Wi-Fi network, even through Internet, thus the commands can be sent from a few meters away, or from anywhere in the world, with a device connected to Internet.

This is a short description of MECHA, a long one could be a dozen, if not hundreds of pages.

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MECHA allows both simple and complex operations to be performed, even the most complex ones can be reduced to something as simple as pressing one or two buttons. That's due to its feature which allows that very complex sequences to be assigned to one button or to a code.

The ways for programming MECHA range from just asking for MECHA to be programmed remotely by manufacturer, to using its web interface, or exchanging programs with other MECHA users. Each way has its own levels of complexity, from very easy to the most powerful. For example, the web interface can be used to download a preset from server and use it directly, or to download, and modify, then use it. To program presets from scratch, support provided by experts or advanced users can make even programming from scratch easy, considering a starting script which can then be extended and made as complex as needed.

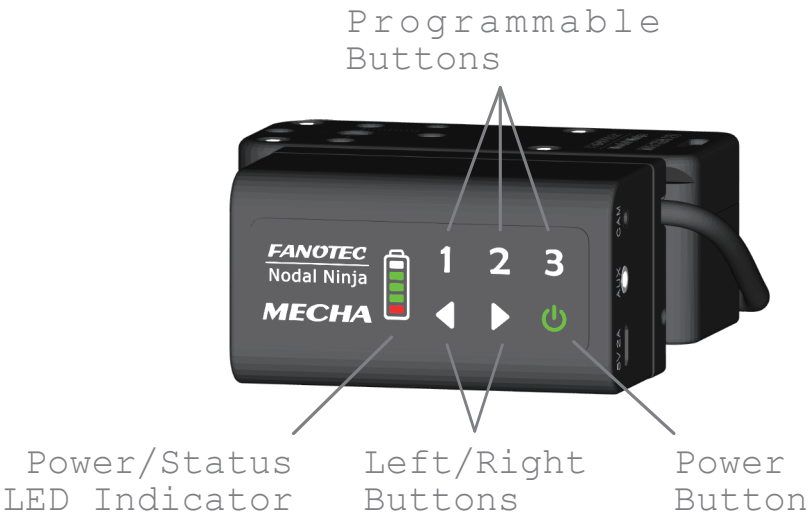
In this user guide, we'll focus first on using MECHA to automate the movements of a panoramic head on a single axis, like Fanotec R1, or dual axis, like Nodal Ninja 3 and alike, reducing the panorama shooting to a simple press of a button, or two, regardless of its complexity, and to do that without flaws, again and again.

MECHA consists of two parts: a motorized rotator (abbreviated E), and a controller (abbreviated C), and in this guide we are particularly interested in the controller.

MECHA C1 presentation

MECHA C1 controller has six buttons, three ports and a cable connector which connects the controller to a motorized rotator, such as E1.

It also has one LED under the power button, ⏻, and five LEDs under the battery symbol.



About buttons

The buttons **[1]**, **[2]**, and **[3]** are used to enter some numeric selections, or to enter specific codes.

⏻	The power button, ⏻, is used to power ON/OFF MECHA, to confirm or cancel some operations, and it is also the equivalent of the number 0 (zero) when power codes are entered.
1	Button **[1]** – comes pre-programmed with 4 shots around. Use it to enter the number 1.
2	Button **[2]** – comes pre-programmed with 6 shots around. Use it to enter the number 2.
3	Button **[3]** – comes pre-programmed with 8 shots around. Use it to enter the number 3.
▷ ◁	Left ◁ and right ▷ buttons are used to rotate MECHA manually to the left, or to the right, and also to specify directions when launching the presets using buttons, as terminator for codes.

About UI vs. Codes, or Buttons

MECHA can be controlled mainly in two ways: using the web User Interface (abbreviated UI), and using its own buttons.

Always start by powering up MECHA, by pressing and holding power button, ⏻, for 3 seconds. A beep will be heard and the LEDs will light up.

Although MECHA can be controlled via its own buttons, sometimes, for more complex tasks, or to assign complex tasks to a single button, the UI can be used.

But, before diving in assigning complex tasks to buttons, it's worth to mention that MECHA has an unique set of features – zLM which stands for zero Learning MECHA – which are specific designed to allow the use of MECHA without learning something new.

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The zLM makes possible this scenario: User calling to or chatting with Support and tell:

U: "*I want my MECHA to shoot a panorama 10 shots around, 3 rows, nadir and zenith.*"

S: "*Please press* ⏻*, then* ▷, the ***right*** *button.*"

And MECHA will do just that.

This will be explained in more details in the dedicated zLM chapter.

Many tasks, both simple and complex, can be performed either using the UI or the buttons.

About the UI

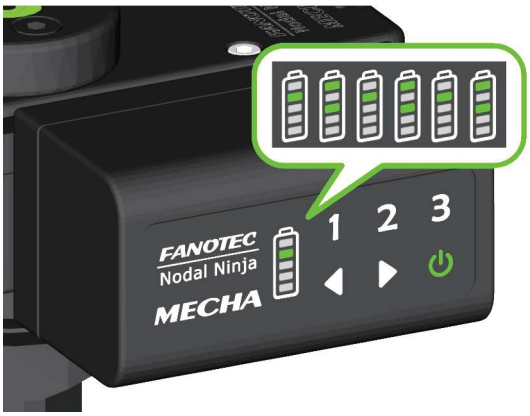
To access the UI of MECHA, a device with an Internet browser needs to be used. The simplest and handy, really handy, will be a smartphone.

MECHA uses wireless connection, abbreviated Wi-Fi.

It can be set as AP (Access Point), or STA (Station), or even both: AP+STA, as well as no Wi-Fi, in which case the control is possible only by buttons.

The desired mode can be set as default in MECHA's configuration page (more on that later), or by a short press of a button when MECHA expects that, and that is when the LEDs blink alternately, like this: -=-=-=-= (splitting lights).

Splitting lights – set MECHA in AP, STA, AP+STA mode



During this period:

- pressing **[1]** will set MECHA in AP mode
- pressing **[2]** will set MECHA in STA mode
- pressing **[3]** will set MECHA in AP+STA mode

When MECHA is in AP or AP+STA, it broadcast a SSID with a specific name - the default name contains the word "MECHA" in it - to which the smartphone can be connected using a password, which is 12345678 by default.

Once the smartphone is connected to MECHA SSID, the MECHA UI can be accessed in browser at 192.168.8.1

When MECHA is in STA or AP+STA, it can also connect to the SSID of a particular network, other than MECHA's own SSID, and as a result the User Interface of MECHA can also be accessed at the address given in that particular network, like this: 192.168.1.100

As a note, the particular network can be managed by the smartphone itself, if on smartphone a hot-spot is enabled, and MECHA can connect to it (more on that later).

If, for any reasons, the address of the MECHA UI cannot be known, MECHA has a way to show the address of the UI, if one of these codes is entered using MECHA's buttons:

[3][2][1]◁ will show on LEDs the last part of the UI address, like .100

[3][2][3]◁ will show on LEDs the full UI address, like 192.168.1.100

Table of equivalences: LEDs – characters

The conventions of how the numbers and symbols are shown on LEDs are featured in this table.

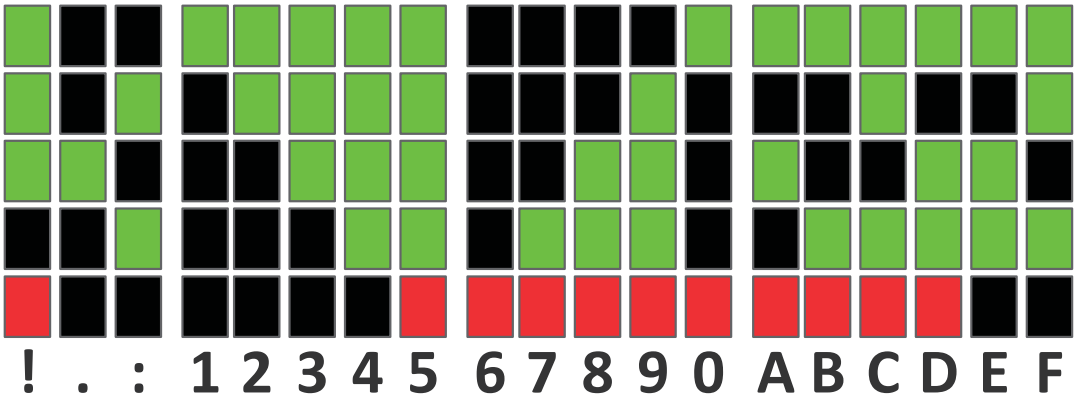


Table of equivalences: LEDs - characters

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About the Firmware (FW) update.

To benefit from all features implemented in MECHA, is recommended to update its firmware to the latest version available.

There are a couple of ways to update the firmware, and the easiest is via Internet.

To check and perform the update, on the UI there is an *[Update]* button.

If MECHA is not connected to a Wi-Fi with Internet access, it will ask for a SSID name and password, just like a guest in your house will ask if there is a Wi-Fi available, to be able to check something on Internet, a Wi-Fi the guest will connect the phone to. The same way, MECHA will use that Wi-Fi in order to download and perform the update.

MECHA is in the idle status after it is powered up, as long as it doesn't execute any preset.

If MECHA is OFF, pressing the power button, ⏻, for 3 seconds, will turn it ON and, depending on the configuration, it can take up to 35 seconds until the start sequence ends and MECHA reaches the idle status. This time frame will be reduced in the future firmware releases.

When MECHA is idle, some codes can be entered to perform specific tasks and tests without using the User Interface. This is useful if we don't know how to use the User Interface yet, or we don't want to use the User Interface.

For example, **131>** will perform a panorama test of 6 shots around, 60° apart, in clockwise rotation (CW), while

131< will perform a panorama test of 6 shots around, 60° apart, in counter-clockwise rotation (CCW).

These tests can be used for shooting an actual panorama with a fish-eye lens on ring type panorama head, like R1, mounted on MECHA.

132> will perform a panorama test of 12 shots around, 30° apart, in clockwise rotation, twice as much as the previous codes, and for counter clockwise rotation, **132<** can be used.

These tests can also be used for shooting a real panorama with a 18-55mm kit lens on a panorama head, like NN3, mounted on MECHA.

NOTE. Whenever you enter codes, press the buttons consecutively, one at a time.

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In the case of using only one MECHA, a cylindrical panorama can be shoot automatically, and if the tilting is done manually, even a spherical panorama can be made using the code again for each row, after manual tilting.

When two MECHAs are used, if they are wireless connected in DAC, the entire spherical panorama can be done automatically, without the need for manual tilting, using

1313> 1312> 1321> for CW, or **1313< 1312< 1321<** for CCW.

These codes will shoot a multi-row plus nadir and zenith panorama, the difference being the start position, the most used is **1313>**.

These 4-digit codes must be entered on the horizontal MECHA, the lower one, when it is idle, in MECHA DAC.

Often, in this guide, we will use the term **preset**, which means a set of instructions and configurations, that can be saved and used when needed, to perform specific operations much faster. For example, some presets contain all the information that MECHA needs to execute a whole panorama. You can create your own presets, or download presets from server.

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Part 1

MECHA Single Axis

Before first use

Before using MECHA, we recommend that you do specific checks and tests.

- First, if you have an R1, or an NN3, mount the R1 or the NN3 on MECHA as shown in the images below:

Power up MECHA

- Power up MECHA pressing the power button, ⏻, for 3 to 5 seconds. It may take about 40 seconds to start.

Check the battery level

- If no LED lights up, or only a red LED lights up, the battery may be discharged, and it is recommended to use a 5V-2A charger to charge it. It may take 3 to 5 hours to charge the battery.
- Otherwise, after 30-40 seconds, you will hear two beeps, and the LEDs below the battery symbol will turn off.

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Quick panoramas using MECHA's buttons

- **1<** – press the button **[1]**, which comes pre-programmed with 4 shots around, then the left button, ◁, to specify the direction of rotation to the left.
- **1>** – press the button **[1]**, then the right button, ▷, to specify the direction of rotation to the right.
- **2<** – press the button **[2]**, which comes pre-programmed with 6 shots around, then the left button, ◁, to specify the direction of rotation to the left.
- **2>** – press the button **[2]**, then the right button, ▷, to specify the direction of rotation to the right.
- **3<** – press the button **[3]**, which comes pre-programmed with 8 shots around, then the left button, ◁, to specify the direction of rotation to the left.
- **3>** – press the button **[3]**, then the right button, ▷, to specify the direction of rotation to the right.

These are the default presets assigned to the three buttons of MECHA. If the results are as expected, it means that they have not been overwritten yet, and you can use them to take panoramas from 4, 6 and 8 shots around with camera mounted. Later in this guide, we will see that these presets can be overwritten.

MECHA's firmware act as the device's complete operating system, performing all control, monitoring and data manipulation functions, and it's important to have the latest version installed.

However, if you prefer not to update at this time, or you're not comfortable with the firmware update procedure, you can skip now to Test using MECHA's buttons, in the next page.

Firmware update using the smartphone: method 1

This update method is available starting with firmware version **02118**.

For this simple method of updating the firmware, we assume that you know how to set up a hot-spot on your 3G, or 4G, smartphone, a smartphone with mobile data enabled and Internet available to it. In other words, you can navigate the Internet using that smartphone alone, without the smartphone being connected to a Wi-Fi.

- First, set up a hot-spot with the name **MECHA-UPDATE** and password **87654321**.
- Press the power button, ⏻, for about 3 to 5 seconds to power up MECHA, and wait until de splitting lights end: **-=-=-=-=** , there is no more LED activity and you will hear two beeps. MECHA is now in idle status and can accept commands and codes. If MECHA doesn't reach this status, then please power it down, by pressing the power button 3 seconds, and contact us at mecha@nodalninja.com.
- Using MECHA's buttons, enter the code **312123<**, by pressing one after another each button. Before pressing the last button, you can wait and look how the LEDs will show the entered sequence, just to be sure you entered the correct code. If there is any mistake, short-press the power button and enter the code again, and terminate with <, by pressing the left arrow button,◁. Now, notice how MECHA starts scanning the existing networks, and when it connects to the previously created hot-spot, two beeps are heard. The code **312123<** will update the firmware using the MECHA-UPDATE hot-spot you set. The response – displayed on the LEDs – can be: **!!!**, if Internet is not available for MECHA.

NOTE. See the Table of equivalences: LEDs – characters.
The update may take up to 5 minutes, but, in case of slow Internet connection, it could take more.

⚠ **Please do not turn off MECHA while updating!**

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Test using MECHA's buttons

After mounting MECHA on a tripod or on any stand with a mounting screw, you can perform a few tests, first without mounting the camera.

NOTE. The following codes are used to tell MECHA what type of rotator is connected to it, if you purchased it separatelly, or changed the rotator type, or if you want to be sure MECHA has the correct one:

Set the rotator using MECHA's buttons

- **23131<** set **E1** as preferred rotator
- **23132<** set **E2** as preferred rotator
- **23121<** set **P1** as preferred rotator

The code should match with the actual rotator connected to each MECHA, and needs to be entered by pressing the buttons of the MECHA to which the rotator is connected.

However, if you are in doubt about the type of rotator, you can try each code, then launch a 90° rotation – press the left arrow button, ▷, then quickly the button **[2]** – and if it is indeed 90°, then the rotator is correctly set.

Alternatively, you can contact your dealer, or mecha@nodalninja.com, for more info or help in identifying the type of rotator you have.

Once the rotator is correctly set, power up MECHA and wait until the LEDs are off and you hear two beeps, then enter the following codes using MECHA's buttons:

- **131** - to enter this code, press the buttons **[1]**, **[3]**, **[1]** , which is a hard-code for a test with 6 shots around, then the right button, ▷, to specify the direction of rotation to the right, or the left button, ◁, to specify the direction of rotation to the left.
- **132** is similar to **131**, but for 12 shots around.
- **3212<** - enter this code to find out the firmware version, which will be displayed on the LEDs.

Panorama with automatic shooting pattern using only the MECHA's buttons

Panorama with automatic shooting pattern for Single Axis

This method requires firmware version **02118**, or newer, and works for rectilinear lens from 10 to 200 mm (FF equiv).

The shooting pattern will be computed by MECHA based only on few presses of a button without using the User Interface, as follows:

- First, position the vertical rail on **LEVEL** position.
- Place **a sheet of paper in front of MECHA** in such way to fill the frame. The frame can be viewed through viewfinder or through the live view. Instead of the sheet of paper, any well defined feature or image on screen, or other means, can be used. A gray sheet of paper will work best for exposure purposes as well.
- The camera and lens must be set the same as for shooting the actual panorama.
- Enter the code **31<** on MECHA, and when the power button starts flashing, MECHA waits for two quick presses of the power button, ⏻, as follows:
  - **first** - in order to trigger the camera
  - and the **second** - after the camera was triggered
- After that, MECHA will rotate slowly to the right and waits for another **press of the power button**, ⏻, right after the sheet of paper is out of the camera's frame.
- Then MECHA will go back to the initial position, and

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- the LEDs 1, 2 and 3, under the battery symbol, will start flashing, and MECHA waits (15 seconds) for one of the buttons **[1]**, **[2]**, or **[3]** to be pressed, to assign the computed preset to that particular button. To cancel the assignment, the power button, ⏻, can be pressed instead.

If MECHA is unable to compute a pattern using the feedback received from pressing the power button (mostly caused by too small intervals), the LEDs will show **!!!**, which indicates that nothing has changed.

To execute the panorama computed by MECHA, make sure the vertical rail is in **LEVEL** position, and press the button to which you have assigned the panorama, then press either the left or right button.

If Single MECHA is used, after first row MECHA pauses and suggests, on LEDs, a manual tilt of the vertical axis to continue to full spherical panorama.

If only cylindrical is needed, or no manual tilt is possible, press the power button of MECHA, ⏻.

Test using the User Interface

Access the User Interface with your smartphone, as follows:

- Press the power button, ⏻, for about 3 to 5 seconds to power up MECHA, and wait until de splitting lights are displayed: -=-=-=-= .
- At splitting lights, press the button **[1]** to set MECHA in AP mode.
- Tap *Settings* icon on your device. Under *Wireless and Networks*, make sure *Wi-Fi* is turned on, then tap *Wi-Fi*. Tap the nettwork name that contains **MECHA** in its name, to connect the smartphone to MECHA. The default password for MECHA's network is **12345678**.
- Now, MECHA's User Interface (UI) can be accessed on the smartphone's browser at: **192.168.8.1** (which is a static IP address). This is the *New* page. At the top of the page, the current firmware version is displayed.

  NOTE. We will see later how the User Interface can be accessed on a computer.

If you didn't set the rotator type using the buttons, you can set it now on *Configuration* page.

Set the rotator on *Configuration* page

At the top of the *New* page, tap the *[Config]* button to access the *Configuration* page (192.168.8.1/config). The user and default password are: On this page you can make special settings, as we will see later. For now,

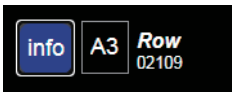
User:	**admin**
Password:	**Mecha**

enter the name of the rotator you are using: E1, E2, or P1.

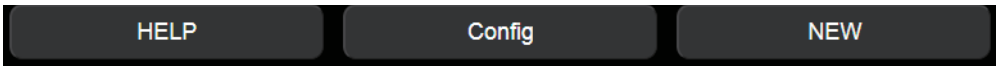
Then tap the *[Apply]* button at the bottom of the page. This is a one-time setting, and is usually done in the factory.

Now, access the *Row* page by tapping the *[Row]* button at the top of the *Configuration* page.

Tap the *[info]* button at the top of the *Row* page whenever you want to find out more details about the functions of the controls available on the User Interface.



At the same time, at the top of the page are displayed a few links to some useful pages: a quick *help* page, the *configuration* page and the *new* page:



When working with the User Interface, we can display all or only some of the controls. To see them all, select *A3* from the selection list next to the *[info]* button, which is the highest level of complexity of the interface. The other options are: *S1*, *S2*, *S3*, *A1*, and *A2*, where *S* means Simple, and *A* - Advanced.

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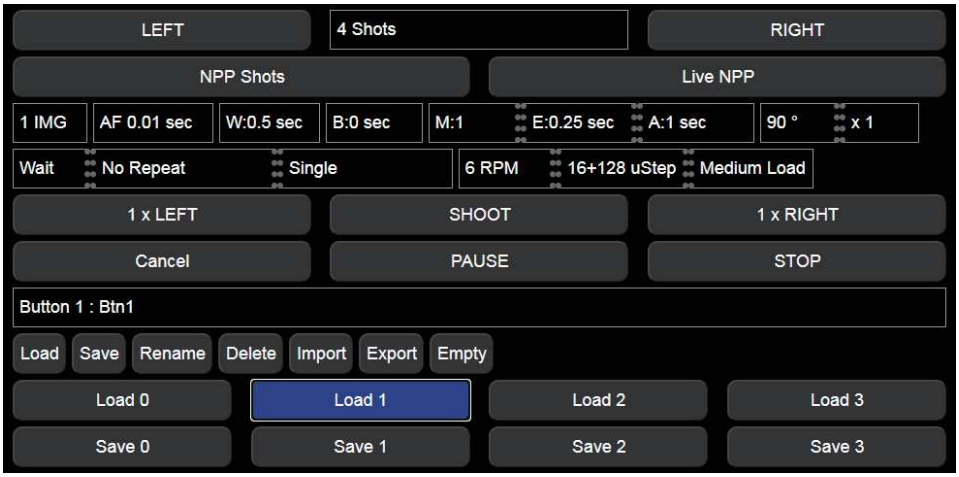
If we want to do the same tests that we did before with the buttons, we proceed as follows using the UI buttons:

- Tap the *[Load 1]* button to load the preset *Button 1*, then tap the *[LEFT]* button to execute the preset to the left, or *[RIGHT]* button to execute the preset to the right.

As an alternative, tap the *Presets*, under *[Cancel]*, *[PAUSE]*, *[STOP]* buttons, and select the *Button 1:...* from the presets list, then tap the *[Load]* button, to load the preset.

Do the same with the *Button 2* and *Button 3* presets, and use *[Load 2]* and *[Load 3*] buttons to load them, or select *Button 1:..* or *Button 2:...* from the presets list, and use *[Load]* button to load them.



Note how the settings on the Row page change when a preset is loaded. In other words, the settings we see are, in fact, the loaded preset.

Next, let's do some more simple tests to get acquainted with the interface, and because we are in the single axis mode, we check that the mode option is *Single*, as seen in the images above.

12 shots around to the left

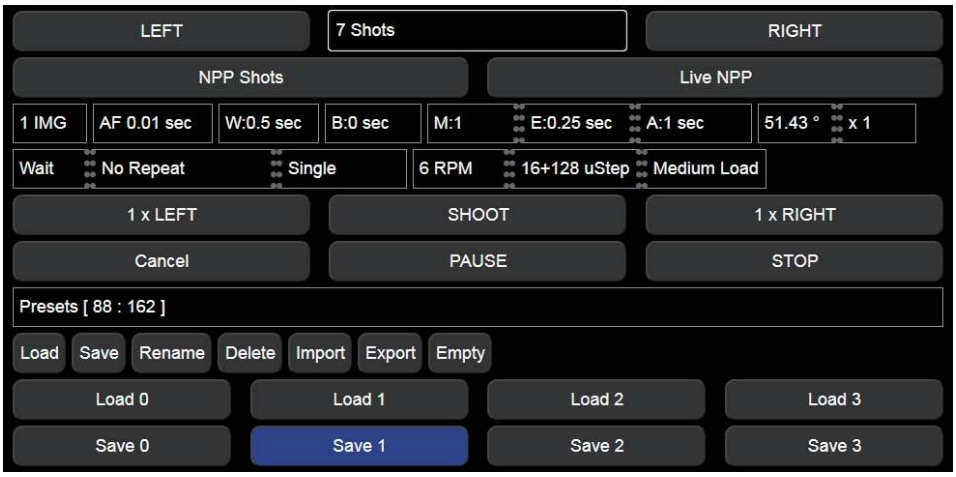
- Select *12 Shots* from the selection list between the *[LEFT]* and *[RIGHT*] buttons.
- Note that in the *Degrees of rotation* field, *30°* is automatically displayed, not *90°* as before. That's because a complete rotation has 360 degrees. Without changing any settings, tap the *[LEFT]* button.

For 12 shots around to the right, tap the *[RIGHT]* button.

Programming a preset using the UI

A custom number of shots around

- To execute a custom number of shots around, tap the *Shots* field, then tap the *Custom* option, and enter the desired number of shots. In our example, the number of shots is *7*.
- Tap the *[LEFT]* button to execute the sequence to the left, or *[RIGHT]* button to execute the sequence to the right.



Overwrite the preset *Button 1*

If you want to save the above settings and overwrite the preset *Button 1*, tap the *[Save 1]* button. Note that all settings displayed on the screen are saved along with the 7 *Shots* setting, including the value of degrees of rotation which is 51.43 in our example.

If desired, similarly, overwrite the presets *Button 2:...* and *Button 3:...* using *[Save 2]* and *[Save 3]* buttons.

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Presets for MECHA Single Axis

Downloading the presets from server

You can make your own presets or download presets from server. To download presets from server, on *Row* page, select the option *More from server* from the *Presets* list, and follow the instructions for downloading.

If *More from server* option is not in the *Presets* list, then tap the *[Connect to Wi-Fi]* button, enter the required SSID name and password for a Wi-Fi with Internet access then, after two beeps, re-load the User Interface. If no beeps are heard after the MECHA's LEDs scan up and down, then please try to connect again and pay attention to the name and password, as they are case sensitive.

If the Wi-Fi network you connect MECHA to is your regular network you want to use for MECHA, any time you start MECHA and press **[3]** at the splitting lights, MECHA will be accessible both via phone and local network, provided that for the local network the Internet is available. As a benefit, MECHA will also check for any firmware update, if available, and will show a pop-up on UI to read the news and update, if you want.

Downloaded presets are added to the end of the list, and note their names start with (s) and they are not saved yet.

The presets for MECHA Single Axis available for download, at the moment, are:

- *4_Shots_Around.mps*
- *6_Shots_Around.mps*
- *8_Shots_Around.mps*
- *10_Shots_Around.mps*
- *12_Shots_Around.mps*

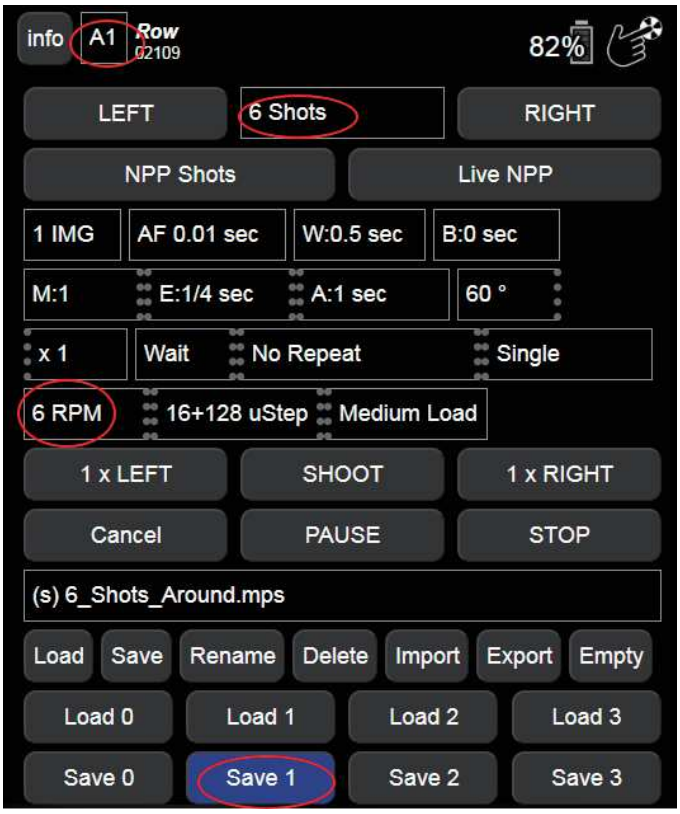
Let's analyze the *6_Shots_Around.mps*, noting that the description is close enough for all the others.

This preset is suitable for a single row panorama, 6 shots around, and can be used in *the S1* (Simple 1) display level. Just select the preset from the list and it will load automatically without tapping the *[Load]* button.

To launch the preset, tap either the *[RIGHT]* or *[LEFT]* buttons.

To change some advanced settings of the preset, such as speed, for example, from 6 RPM to 9 RPM, switch to *A1* (Advanced 1) display level, as shown in the image below.

Here you can tap the *[Save 1]* button to save this preset to button **[1]** of MECHA, then you can launch this preset by simply press the button **[1]** then ▷ (for clockwise rotation) when MECHA is in the idle status, or press the button **[1]** then ◁ (for counter-clockwise rotation). Also, you can tap the *[Save]* button to save it on MECHA, in the *Presets* list.



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To create a new preset, select any preset from the *Presets* list, make any changes you want (or not), and save it with the *[Save]* button. If you enter a new name, a new preset will be created, otherwise the current preset will be overwritten.

Programming a preset using parameters

A programming method available starting with firmware version **02134**.

This method of programming, or creating, a preset is reduced to simply passing some parameters in the url. The created preset is assigned to one of MECHA's buttons, so it can be executed by pressing that button, and the left or right buttons.

Being connected with the smartphone to the MECHA's SSID (MECHA's Wi-Fi), enter one of the following urls in the browser address bar and tap *Access*:

```
192.168.8.1/preset?b=1&s=12&p=2
192.168.8.1/preset?b=1&f=30&p=2
```

The page will ask for credentials, which are: **admin**, **Mecha** (by default).

Now, if you press the buttons **[1]>**, or **[1]<**:

- MECHA takes 12 shots around (s=12), if you entered **192.168.8.1/preset?b=1&s=12&f=30&p=2**
- or it will start to shoot a full 360 panorama for a 30 mm lens (FF equiv.) (**f=30**), if you entered **192.168.8.1/preset?b=1&f=30&p=2**

In both cases will be a pause of 2 seconds after each shot (**p=2**).

The parameters passed in the url are as follows:

- The first parameter is **b** and refers to the button to which the preset is assigned. Possible values are 1, 2, and 3, because MECHA has three buttons with numbers. This parameter is required.
- The second parameter - **s** - is the number of shots around; the third parameter can be used instead.
- The third parameter is the focal length - **f** - and it is optional. If you provide this parameter, the panorama will be spherical, otherwise it will be cylindrical.
- The fourth parameter - **p** - is the pause after each shot, and it's optional. The default value is 1 second.

- Starting with firmware version **02134**, you can use **h** and **v** parameters to specify, in degrees, the area of a partial panorama. For example:

```
192.168.8.1/preset?b=1&f=80&h=100&v=75
```

  This is the url for a partial panorama for **80** mm lens, **100°** wide, and **75°** tall.

For example, the url with two parameters looks like this:

```
192.168.8.1/preset?b=1&s=12
```

Now, all you have to do is replace the values in this example with the desired values, for example, for **6** shots around:

```
192.168.8.1/preset?b=1&s=6
```

and for a full spherical panorama for a **50** mm lens (FF equiv.):

```
192.168.8.1/preset?b=1&f=50
```

Since you are using the Single Axis MECHA, for a panorama made with 50 mm lens, you need to manually tilt the NN3 up or down.

MECHA will show you when to do this, and also shows you the value for tilting on LEDs, and waits until you tilt and confirm the tilting.

To understand what is displayed on the LEDs, please see the Table of Equivalences: LEDs - Characters.

If a Single MECHA is running a DAC preset, when rotation is needed along the second axis, MECHA will pause and will show on LEDs the angle for rotation along the second axis.

The value is rounded to the nearest integer and is displayed as follows, for example, for a tilt of 45°: **:45** or **:-45** if the value is negative.

0 is considered to be the Level Position (horizontal).

You can use **-** as tilting up or tilting down, depending on the desired order, upper part first, or lower part first.

When you'll add a second MECHA to the single one, thus having a MECHA DAC, the same preset will work automatically without pause, unless you manually add some pauses in script.

As a result of this new feature, the auto generated script, when the focal length is inputted, will not contain any pauses, the pauses will occur automatically if a single MECHA is used.

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The User Interface (UI)

Access the UI with a smartphone

- Press the power button, ⏻, for about 3 to 5 seconds to power up MECHA, and wait until the splitting lights are displayed: -=-=-=-= .
- To be able to connect your smartphone to MECHA's network, MECHA must be in AP mode. So, at splitting lights, press either button **[1]** to set MECHA in AP mode, or button **[3]** to set MECHA in AP+STA mode.
- Tap *Settings* icon on your device. Under *Wireless and Networks*, make sure *Wi-Fi* is turned on, then tap *Wi-Fi*. Tap the nettwork name that contains **MECHA** in its name, to connect the smartphone to MECHA. The default password for MECHA's network is **12345678**.
- Now, MECHA's User Interface (UI) can be accessed on the smartphone's browser at: **192.168.8.1** (which is a static IP address).

Access the UI on your computer

- Press the power button, ⏻, for about 3 to 5 seconds to power up MECHA, and wait until de splitting lights are displayed: -=-=-=-= .
- To be able to see MECHA's UI on your PC, MECHA must be in STA mode. So, at splitting lights, press either button **[2]** to set MECHA in STA mode, or button **[3]** to set MECHA in AP+STA mode.
- The next step is to find the IP address which is dynamic in this case. There are two ways to find it:
  - 1a. Using MECHA's buttons, enter the code **323<** to see on LEDs the full UI address, like **192.168.2.103** (See Table of Equivalences: LEDs - Characters),

or

  - 1b. Usually, the IP addresses in your local network differ only by the last number of the IP (the part displayed at the end, after the last point). To display the last part of the IP, enter the code **321<**. For the example above, **.103** will be displayed.

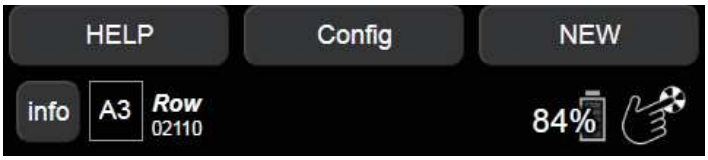
- 2. Access the UI with a smartphone, as shown above (make sure MECHA is in AP+STA mode, started by pressing **[3]**), then access the *Configuration* page, and scroll to the bottom of the page. Note the static IP address (192.168.8.1), and next to it, the dynamic IP address to access the User Interface on a computer. In our example, it is 192.168.2.103.

NOTE. If only the static IP is displayed, it means that MECHA is in AP mode and, as a result, the dynamic IP is not displayed.

Now, you can access the MECHA's User Interface (UI) on your computer's browser by entering the IP address you found, like 192.168.2.103, in the browser address bar.

UI Controls

In this section, we will explain the functions of the buttons and the options available on the *Row* page, with the mention that *Ring* and *Turn* pages are quite similar to *Row*.



- Tapping the *[info]* button, at the top of the page, will show the descriptions for all the controls. At the same time, three more buttons are displayed at the top of the page - *[HELP]*, *[Config]*, and *[NEW]* - for accessing the following pages:
  - *Help* - a page with info and codes for executing presets, and also for configurations, or for displaying information using MECHA's buttons.
  - *Configuration page* - user: **admin**, and default password: **Mecha**.
  - *What's new?* - a page where you can find information about the current firmware version and the versions published so far.

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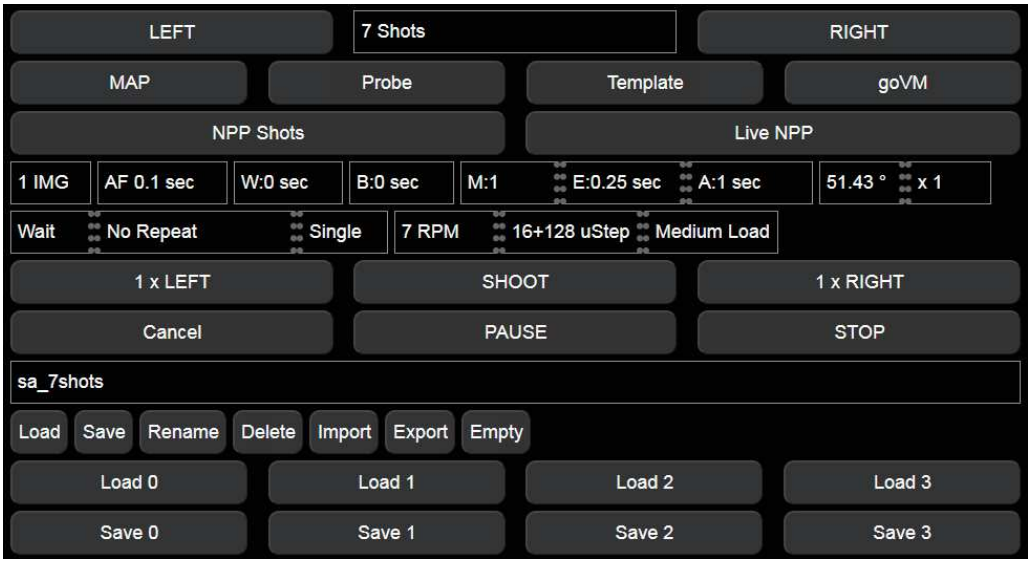
- Next to the *[info]* button there is a list of options to set the level of complexity of the page, from the simplest (*S1*) to the most complex (*A3*), where all the controls are displayed. So, select *A3* to show all the controls.
- Under the *Row* label, we see the current firmware version, *02110* in our example. By clicking this tag, we access the *What's new?* page.
- At the right side of the page, see the battery percentage (84% in our example). If the percentage drops too much and a red LED continuously blinks, it is recommended to recharge the battery, otherwise MECHA switches off. On the configuration page, we will see that there is a setting for disabling MECHA during charging, to prevent accidents caused by the charger cable which can twist around the tripod, if MECHA is commanded, by mistake, to do a preset during charging.
- The hand symbol toggles gesture mode. Tap on screen and drag to see how it works. Always make sure there are no objects near the robot, especially in gesture mode.

- In the next area, the *MECHA's ID*, the *Refresh rate of the motor/ controller status* and the *Current rotator* are displayed, followed by the *Current angle position*, and the *Current status* (shots remaining, position, repeat set). On MECHA DAC, the Status feedback (SF) also reflects the tilt angle for the 2nd axis. When scripting is used, yaw is shown on Status feedback, as well.
- At the right side of this area, we see the *Current time*, the *Current date or time remaining*, the *Current rotation degree interval*, the *Seconds remaining in current delay*.

- The horizontal slider allows manual rotation in degrees, relative to the current position. Click/tap on screen and drag to the left or to the right.

The controls displayed below the slider, shown in the image below, are directly related to the current preset and settings. The values displayed in the fields are the current preset (*sa_7shots* in our example).

- *[LEFT]* button - shoots a 360° panorama counter-clockwise. In our example, the panorama consists of 7 photos, and the first photo is taken in the current position, followed by the second 51.43° apart, and so on.



- *Shots* - Number of shots around for a full 360° panorama. Select the number of shots from the list, or select *Custom* and enter the desired number of shots, or the focal length of the lens used followed by *mm*. The *mm2* notation is also accepted. For example, *28 mm2* will compute the full spherical panorama for a 28 mm lens, using *Repeat*. If the number of shots is 1, using *[LEFT]* button, only one photo is taken followed by a rotation of 360° (return to the initial position), if the *Wait* option is selected. Useful when shooting (filming) 360°. If the *Rewind* option is selected, the rotation is 0° (no rotation).
- *[RIGHT]* button - shoots a 360° panorama clockwise. It is similar to *[LEFT]* button, but the rotation is to the right.
- *[MAP]* button - downloads a PTGui file with the current preset. Use this button after all the settings are set as you want.

  MECHA will also offer to download a *map.zip* file containing three small .png images. The images are the same for any map.

  A high resolution set is also available here, with **Mecha** as zip password: https://www.nodalninja.com/MECHA-MAP/map-png.zip
- *[Template]* button - downloads a PTGui file that can be applied on a real set of images. This template also contains the focal length. The angle of images is set to 5°.
- *[Probe]* button - downloads a probe (a PTGui file) from shooting pattern to study/refine the overlap.

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- *[goVM]* button - downloads a script (a *goVM.py* file) for the upcoming Virtual MECHA. Until Virtual MECHA will be available, this file can be also used for support and demo purposes.
- *[NPP Shots]* button - takes two shots for NPP (No-Parallax Point) check.
- *[Live NPP]* button - displays the instructions for determining the NPP along lens axis using camera live view, as follows:
    - Use two vertical reference points with one far behind the other. Turn on live view mode. Position tripod to line them up at image center. Use grid and magnified view for greater accuracy.
    - Scroll left to see the reference points. Slide the lens back or forth to line them up, being careful not to move the tripod!
    - Scroll right to see the reference points. Carefully slide the lens back or forth to line them up if needed.
    - Check if the reference points are still perfectly lined up at image center. Nudge tripod to line them up if needed.
    - Check if the reference points are lined up to the same extent as in the last step. Carefully adjust to achieve similar alignment.
    - End of Live NPP procedure. Repeat the process to confirm alignment if needed.
- *IMG* - number of (bracketed) images for each position. When using automatic exposure bracketing in continuous shooting or self-timer mode, MECHA treats it as 1 image. Select 0 if no image is needed. In our example: 1 shot, no bracketing.
- *AF (Auto-Focus)* - duration of AF signal time, for example, 0.05. If the value is negative, the AF signal will be ON during the entire image sequence. In order to trigger the camera, for some Sony cameras, you have to set an AF value greater than zero, even if the camera focus is set to manual.
- *W (Wake)* - pause for camera wake-up. If the value is negative, the pause will be forced even when the camera is ON, before each sequence begins. Also, it will force a *B (Before)* delay in case of *B: not zero*. A small negative value, under 1 second - for example, *W:-0.9* s, or *W:-0.1* s - will trigger the *Wake* signal, which is a focus signal, before every position instead of only at the beginning of a session. Useful for moving out of the camera's view.
    - When *W* delay is negative, B delay is referenced to MCU's clock rather than added delay. For exemple, in time lapse sessions, for *W:-*

0.001 sec and *B:5 sec*, the result will be a shot at every 5 seconds. If movements are executed, the value of B needs to be large enough to cover the time taken by the move.

- Also, when *W* delay is negative, a log file – */intervals.txt* – will be produced, with all intervals, in ms, between the triggers of the shutter done by MECHA.

- *B (Before)* - the pause before each bracketing sequence or set of images. If the value is negative, up to 2 seconds will be used for Mirror Lock Up.
- *M (M*odifier of Exposure) - modifier of the duration of shutter button signal, a list of multipliers, like 1,0.5,2 for normal, half and double exposure time in case of 3 IMG, or it can be entered as -0.7EV (for under, normal, over), or 0.7EV (for normal, under, over), in which case it will automatically extend to the number of IMG. If the modifier starts with B, like B-2EV, or B1, or 1,0.5,2, the "Bulb" mode will be assumed.
- *E (E*xposure) - duration of shutter button signal, for example, 3 or 0.5*3 for progressive half Exposure, or 2*3 for progressive double Exposure in a set. These can be entered as custom values. The values can be entered as 1/100.
- *A (A*fter) - the delay after each bracketing sequence or individual image. If the value is negative, there will be a delay after each shutter actuation.
- *Degrees of rotation* - the rotation angle between two consecutive positions in a sequence, specified for *[N x LEFT]* or *[N x RIGHT]* buttons. The rotation angle is updated automatically, simultaneously with the number of *Shots*. However, if the rotation angle is changed, the number of *Shots* does not change. Use this feature when you want to take a certain number of shots, not an entire panorama. Specify this number in the next field (*x N*), and execute the sequence with the *[N x LEFT]* or *[N x RIGHT]* buttons.
- *x N* - the number of moves (N) for *[N x LEFT]* or *[N x RIGHT]* buttons.
- *Wait/Rewind* - these options tell MECHA to *wait* after last shoot, or to rewind to initial position. *Rewind* is useful if there are cables attached, or for partial panorama and time-lapse.
- *Repeat* - delay in seconds until the shooting sequence will be repeated automatically, for example, 300 for 5 minutes, or 4*300 to repeat 4 times 5 minutes apart, or 0, or *no repeat*, for no repeat.
- *Single/Dual/Scripted* - select *Single* if you use one MECHA. See MECHA MSS for details about *Scripted* option.

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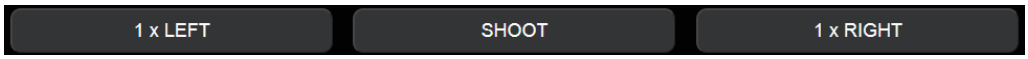
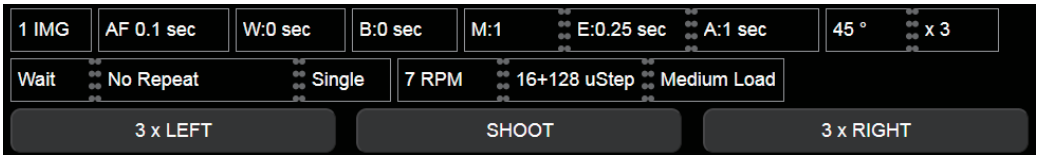
- *Speed* - speed denoted by Revolutions Per Minute. Select an option from the list, or enter a value via *Custom*. If the value is too high, the device may stop, or move too fast, in which case be prepared to stop it by clicking/tapping the *[Stop]* button.
- *uStep* - micro-stepping value, simple or combined; for example, different values for acceleration + constant speed region.
- *Load* - the options for *Load* are: *Custom*, *Light*, *Medium*, *Heavy*, and *Ring*. These are optimized motion profiles for a rated load. We encourage you to try them all, to see which one is best for the camera and lens used, or for what you want to do. You may prefer the *Heavy* option, even if you use a light camera.



- *[N x LEFT]* button - shoots & rotates counterclockwise for N positions with the degrees interval specified above, regardless of the number of shots specified in the *Shots* field.

  For example, if you want to take 3 shots 45° apart to the left, set the degrees of rotation to 45, and the number of positions to 3, as in the image below, and click the *[3 x LEFT]* button.



- *[Shoot]* button - shoots the number of photos in a set for a single position. In our example, 1 photo (*1 IMG*) is taken. Use this feature when you want to take some photos in a certain position, without any rotation.
- *[N x RIGHT]* button - the same as *[N x LEFT]*, but shooting and rotation are done clockwise.

- *[Cancel]* button - executes a smooth stop.
- *[PAUSE] button* - pauses the current running preset. Click/tap again to continue. The code **21<** switches MECHA to or off pause mode, the same as clicking the *[Pause]* button on UI, or on IR Remote.

  If MECHA is in pause mode, the LEDs blink like **:** (a colon). In idle status, there is a slow blink, and when running presets and paused, there is the regular blink.

If MECHA is in pause mode and a preset is started, MECHA will pause before every position, resulting in step by step movement.

When MECHA runs a preset and is paused, pressing ▷, or [>||] on IR Remote, or *[PAUSE/NEXT]* on UI, MECHA will continue to the next position.

If, instead, ◁ is pressed on MECHA, or on IR Remote, MECHA will continue to the next position and switches on/off the step by step mode.

The above allows both:

1. Starting a preset in step by step, then switch off step by step when it is not needed, thus the preset will continue automatically.

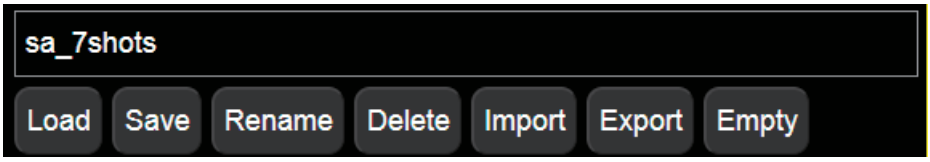
2. If a preset is paused by remote/UI/script, then pressing ◁ will advance and switch on/off the step by step.

A possible application is a spherical panorama with certain areas needing to be done step-by-step, and which areas depends on events on the field.

During the pause, pressing [O] on IR Remote, or *[SHOOT]* on UI, MECHA will trigger the number of shoots specified by *[IMG]* in presets.

This can be used for extra shoots for a particular position.

- *[STOP]* - emergency stop.



- *Presets list* - this list contains all the presets, both those created and those downloaded from the server. The names of those downloaded from the server start with (s), which means they are not saved. You can load and save the presets you want to keep. The option *More from Server...* allows you to download presets from the server.
- *[Load]* button - loads the preset selected from the *Presets* list. In our example, the current preset is *sa_7shots*.
- *[Save]* button - allows you to save the current preset with the same name (overwrite), or with a different name.
- *[Rename]* button - renames the selected preset.
- *[Delete]* button - deletes the selected preset.

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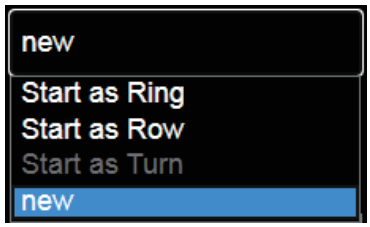
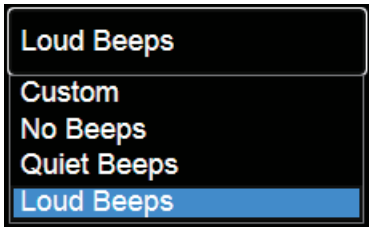
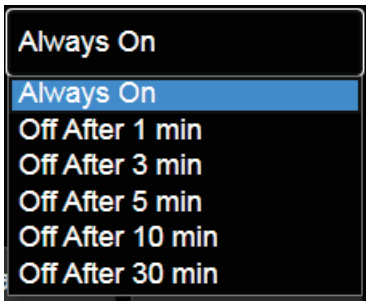
- *[Import]* button - imports a preset to list, or multiple presets at once, if *all_presets(..).mps* file is given when importing.
- *[Export]* button - exports the selected preset, or exports all the presets, if *Presets* is selected.
- *[Empty]* button - empties the *Presets LIST* without deleting them.

- [Load 0] button - loads the default preset, a preset saved with the [Save 0] button.
- *[Load 1]* button - loads the preset assigned to MECHA's button **[1]** using the *[Save 1]* button.
- *[Load 2]* button - loads the preset assigned to MECHA's button **[2]** using the *[Save 2]* button.
- *[Load 3]* button - loads the preset assigned to MECHA's button **[3]** using the *[Save 3]* button.
- *[Save 0]* button - saves the current preset as default preset which can be loaded with the *[Load 0]* button.
- *[Save 1]* button - saves the current preset and assigns it to MECHA's button **[1]**, and can also be loaded with the *[Load 1]* button on the User Interface.
- *[Save 2]* button - saves the current preset and assigns it to MECHA's button **[2]**, and can also be loaded with the *[Load 2]* button on the User Interface.
- *[Save 3]* button - saves the current preset and assigns it to MECHA's button **[3]**, and can also be loaded with the *[Load 3]* button on the User Interface.

- Default page at start - MECHA's home page, or start page, can be one of the following pages: Row, Ring, or new (like in our example). Select the desired option from the list.







- *[Reboot]* button - restarts MECHA, similar to restarting a computer.
- *Volume of Beeps* - is a value from 0 to 250, and can be entered via *Custom*, or select another option from the list.
- *Power Saving Mode* - a list of options to set MECHA to shut down automatically after a certain number of minutes of inactivity, or vice versa, to keep it always on. The setting for this field can be done on the *Configuration* page, in which case it has priority over other options, and is displayed on a gray background.
- *[Go to Ring]* button - accesses the *Ring* page, and alternates with *[Go to Row]*.
- *[Team]* button - initiates a temporary pairing with a second MECHA, which can be controlled if it joins the team. To confirm joining, enter the code **12<** on the second MECHA using its buttons. The second MECHA will act as a MECHA-V, and the first as a MECHA-H in Dual Axis Combo. Both MECHAs can be connected to the local wireless network.
- *[Shut Down]* button - shuts down MECHA in 20 seconds. Press *[Cancel]* or *[Stop]* to cancel.
- *[Connect to Wi-Fi]* button - initiates the process of connecting to a Wi-Fi network, to use MECHA in station mode, or for firmware update.
- *[Wi-Fi Off]* button - turns Wi-Fi OFF. It needs power cycling to have it ON again.
- *[More or Less...]* button - shows more or less settings.

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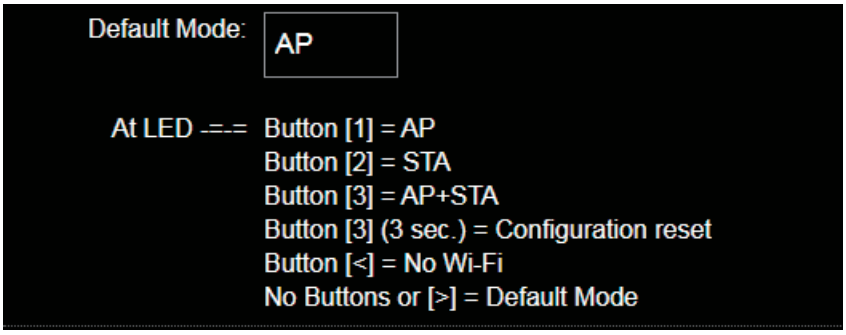
Configuration page

The Configuration page can be accessed at 192.168.8.1/config, using the following username and password:

User:	**admin**
Password:	**Mecha**

Default mode. The possible values for default mode are: AP, STA, AP+STA. The default mode set here will be the current mode for MECHA after powering up. However, the default mode can be changed by pressing one of the MECHA's buttons at splitting lights, as follows:



Press MECHA's button **[3]** - at splitting lights - to return the individual settings to the default values. Very useful if you have forgotten the set passwords and cannot access, for example, the configuration page, or the user interface. The default passwords are mentioned in this user guide.

The maximum value for *Wi-Fi Power* is 100. In our example (see the image below), it is 25.

AP Mode SSID is the name of MECHA's nettwork. This is how it appears in the list of available networks on your device.

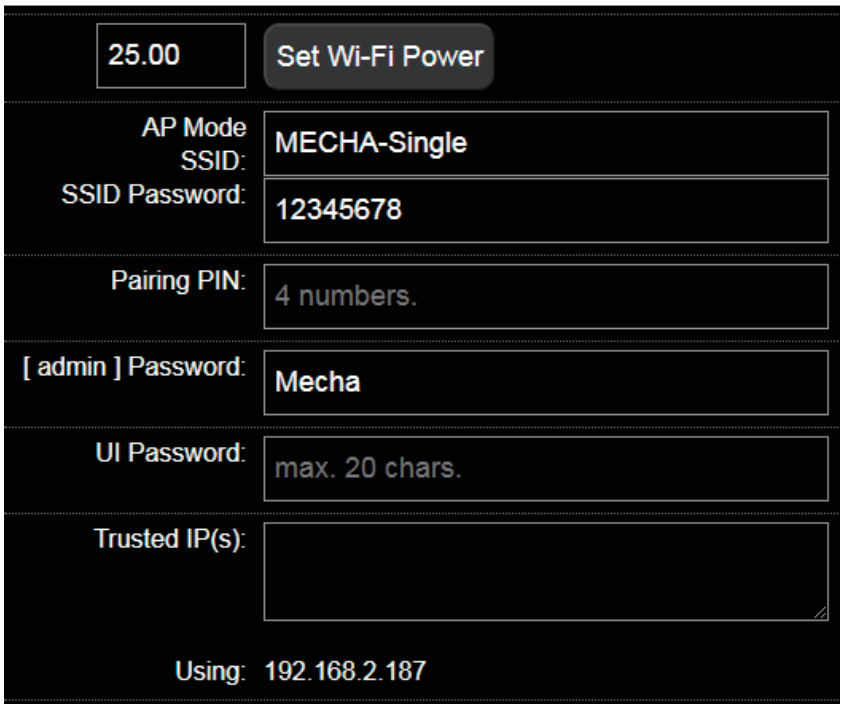
SSID default password is **12345678**.

Pairing PIN is a four-digit number that allows you to pair automatically at start more than 2 MECHAs connected to the same network or to the same hot-spot. See Pairing PIN for more than 2 MECHAs.

UI Password allows you to prevent someone from changing the settings on the *Configuration* page. You may want to allow someone to access your interface, but may not want the settings to be changed.

Trusted IP(s): IPs added to this field will not be restricted in any way when accessing MECHA. Add the IPs of the personal devices with which you connect to MECHA.

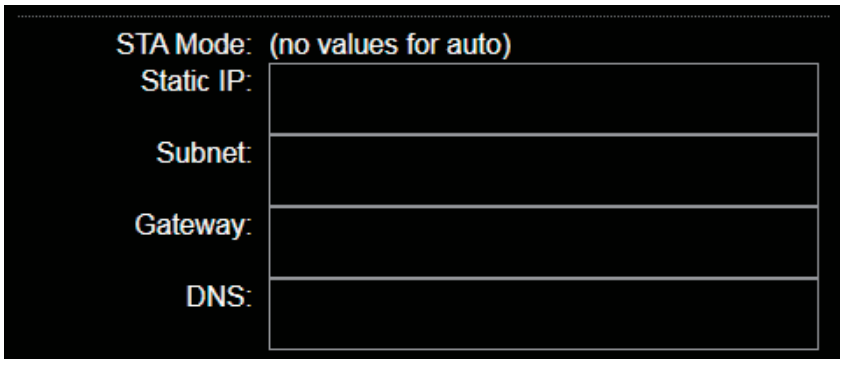
Using: this is the IP of the current device connected to MECHA. In our example, 192.168.2.187.



STA Mode.

Static IP: Remember that the IP address to which MECHA can be accessed from the computer is dynamic. Therefore, from time to time, it changes and, every time, you have to find it by accessing the *Configuration* page with your smartphone, for example. Enter this IP address in the *Static IP* field to make it static.

You can ignore the *Subnet*, *Gateway* and *DNS* fields if you do not know what information to provide.



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Fixed Settings are settings that overwrite the corresponding settings on the *Row/Ring/Turn* page. For example, if the *fixed Motor Speed* is 7, the one provided by the preset will be ignored and MECHA will use 7 RPM as speed.

If *Power OFF after* field is not empty, then the value specified in this field tells MECHA to power off if there is no activity a number of seconds equal to this value.

The next *Power OFF after* field is the same as the field above, but it refers to the period immediately after powering up MECHA and no presets are executed. Value 1 means *No Power OFF.*

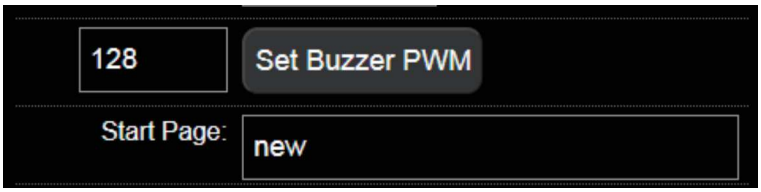
When Charging: Stay ON means that MECHA does not stop during charging and you can use it as usual. The other possible value is *Turn OFF* which means that MECHA stops automatically and remains off, except the charging function during charging.

MCU i2c Speed: is the communication speed between MECHA's processors. Select *Standard*, as there are no major differences from the *Fast* and *Turbo*.

Rotator: Set the rotator in use by selecting an option from the list, or using MECHA's buttons, as follows: **23131<** for E1, **23132<** for E2, and **23121<** for P1.

Inverted: Check this checkbox if, for a particular reason, the rotator needs to have all its movements in the opposite sense of rotation.

Backlash: If the value needs to be entered manually instead of using the automatic procedure, for E1 and E2 rotators it is around 21 (in our example, 33). It is recommended to use the automatic procedure for a better result, if the conditions to detect the small movements are met. Please see the code **12321<** (Backlash compensation calibration) for more details.



Buzzer PWM values range from 1 to 255, and do not necessarily refer to the sound loudness. We recommend that you try a few values to find your preferred value.

Start Page: can be *New*, *Row*, or *Ring*, and can also be set on these pages.

Use local CAM and AUX ports only: check this checkbox if you want to connect camera to the horizontal unit in Dual Axis Combo. This means faster communication between MECHA and camera. Note that the camera cannot be connected to the vertical unit while this setting is active.

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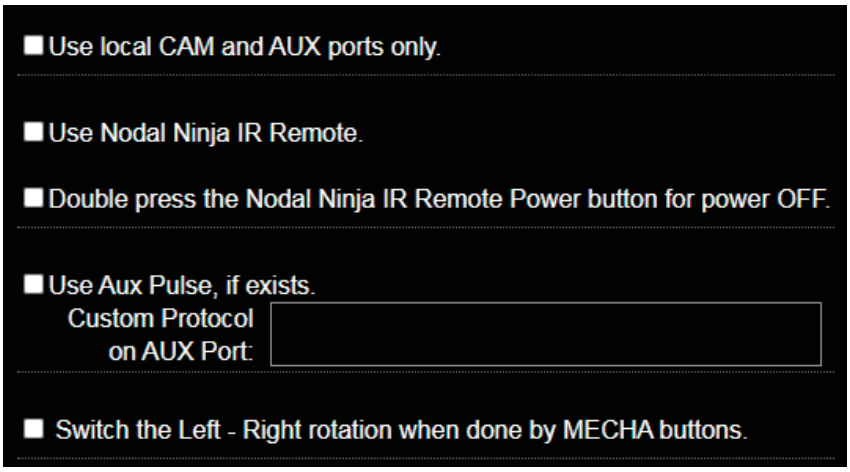


Use Nodal Ninja IR Remote: check this checkbox if you use an NN IR remote control, and connect the receiver to the AUX port.

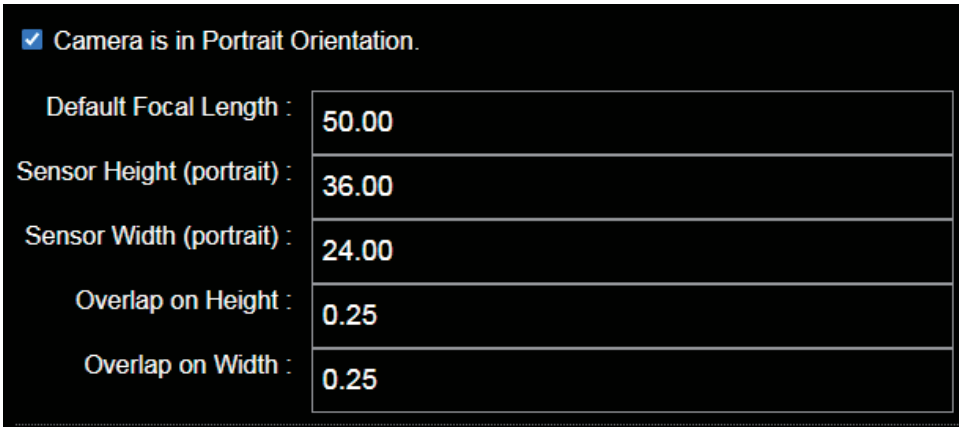
Double press the Nodal Ninja IR Remote Power button for power OFF: check this checkbox to be able to power off MECHA pressing the power button on the remote control twice.

Use Aux Pulse, if exists: check this checkbox if you use MECHA in applications requiring the Aux Pulse file. Default is clear and can be ignored.

Custom Protocol on AUX Port: allows the use of the auxiliary port for equipment that uses a specific protocol. With common remotes, a half-press is detected as 1A, a full press is detected as 1A1S. These are the possibilities for a half-press:

- **045=1A** executes a preset whose name starts with 045 + blank.
- **-045=1A** executes a preset whose name starts with 045 + blank, but in the opposite sense of rotation.
- **HS=1A** - Home Set. A Home Set can also be done by pressing the power button.
- The following uses the inverted rotation for buttons, if it is set:
  - **45.0=1A** rotates MECHA 45.0° from Home position, absolute.
  - **-45.0=1A** rotates MECHA -45.0° from Home position, absolute.
  - **^45.0=1A** rotates MECHA 45.0° from previous position, incremental.
  - **^-45.0=1A** rotates MECHA -45.0° from previous position, incremental.
- **H=1A** returns MECHA to Home position set by HS or by the power button.

Switch the Left - Right rotation when done by MECHA's buttons. Left button, for example, rotates the camera to the left, and the controller to the right, when this checkbox is checked.



Camera is in Portrait Orientation: this checkbox is checked by default. You can uncheck it if you want to specify that the camera is in landscape orientation. For example, if the number of shoots around is *35mm* or *35mm2*, via custom, the shooting pattern will be computed considering the camera orientation.

Usually, the following settings do not need to be changed. If these values are changed, the script on the *Row* page must be generated again by entering the focal length in the *Shots* field, via custom, for example: *56mm*.

- *Default Focal Length*: **50.00** (used unless otherwise specified). MECHA supports a focal length from 10 to 1500mm (FF equiv.), with camera in Portrait or Landscape orientation.
- *Sensor Height (portrait)*: **36.00**
- *Sensor Width (portrait)*: **24.00**
- *Overlap on Height*: **0.25**
- *Overlap on Width*: **0.25**

Arrow buttons

Arrow buttons Speed (RPM): rotation speed when a button is held down. If the *RPM* is zero, pressing MECHA's directional buttons, the rotator will start slowly and accelerates afterwards, if the button is kept pressed. Useful for precise alignment done with the buttons of the controller or IR remote.

Arrow buttons Interval Speed (RPM): rotation speed over a certain interval.

Arrow buttons Interval 1: rotation angle for the combination of left / right button and button [1].

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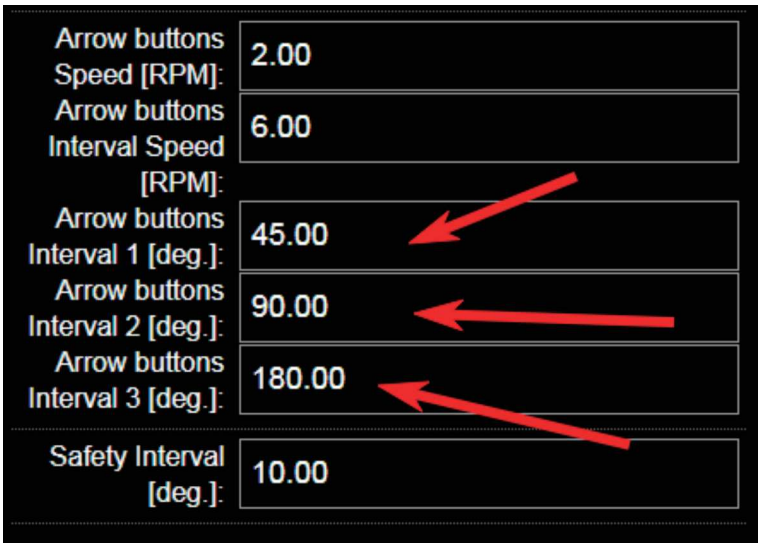
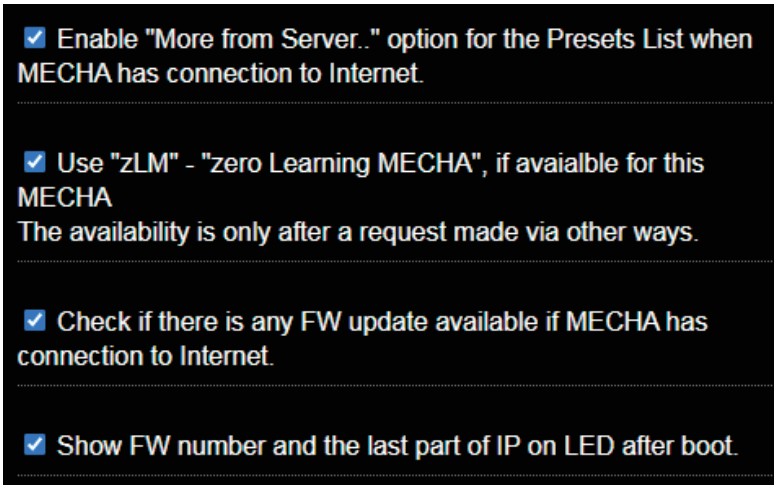


Arrow buttons Interval 2: rotation angle for the combination of left / right button and button [2].

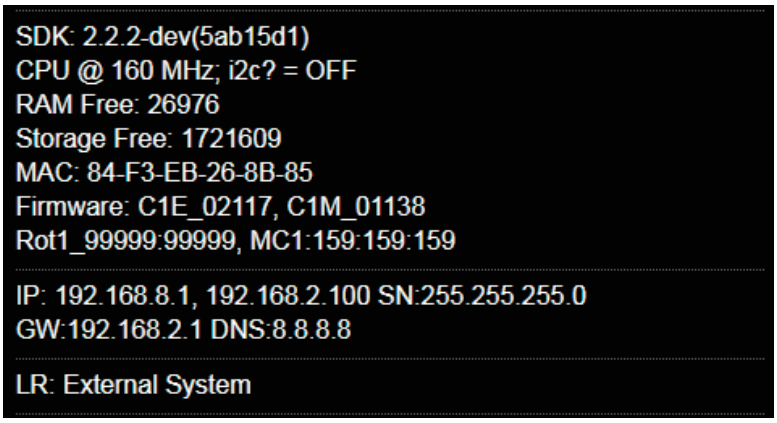
Arrow buttons Interval 3: rotation angle for the combination of left / right button and button [3].

Safety interval: if, for some reasons, the vertical unit no longer communicates with the horizontal one, the vertical one stops after a rotation equal to the Safety interval.

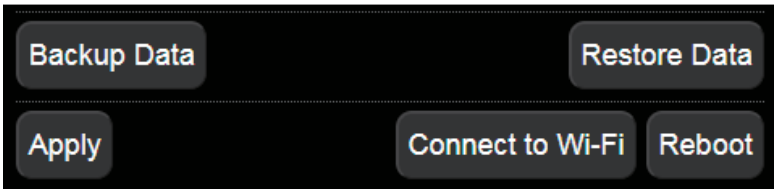
The following four settings have fairly self-explanatory descriptions, and we just add that the second - *Use „zLM"* - refers to a custom preset, specially created according to the specifications provided by you.



Finally, several technical details are displayed, including the firmware version and the IP addresses to which the User Interface can be accessed:



- the first is the static address for access from smartphones: 192.168.8.1
- and the second, which is displayed only when MECHA is in STA mode, is the dynamic IP for accessing the User Interface on the computer.



[Backup Data] button creates an archive for download, which contains all the settings and files of MECHA, except the firmware.

[Restore Data] button uploads the archive downloaded with the backup button.

[Connect to Wi-Fi] button - initiates the process of connecting to a Wi-Fi network, to use MECHA in station mode, or for firmware update.

[Reboot] - restarts MECHA, similar to restarting a computer.

[Apply] button - applies / saves the settings.

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Other updating methods

Firmware update using the smartphone: method 2

- Press the power button, ⏻, for about 3 to 5 seconds to power up MECHA, and wait until de splitting lights are displayed: -=-=-=-= .
- At splitting lights, press the button **[1]** to set MECHA in AP mode.
- Tap *Settings* icon on your device. Under *Wireless and Networks*, make sure *Wi-Fi* is turned on, then tap *Wi-Fi*. Tap the nettwork name that contains **MECHA** in its name, to connect the smartphone to MECHA. The default password for MECHA's network is **12345678**.
- Now, MECHA's User Interface (UI) can be accessed on the smartphone's browser at: **192.168.8.1** (which is a static IP address).

  NOTE. We shown how the User Interface can be accessed on a computer.
- This is the *New* page. At the top of the page, the current firmware version is displayed. Tap the *[Update]* button and follow the instructions to update the firmware:
  - Connect to Wi-Fi for Internet acces. Enter the Wi-Fi network name that you want to connect to. It can be your home Wi-Fi, or work Wi-Fi. The name and the password are case sensitive, like **MyWiFi** and **myPassword**! It's not about MECHA's passwords here, but the Wi-Fi name and password MECHA needs to connect to Wi-Fi.

> ⚠ **Please do not turn off MECHA while updating!**

- When the update is complete, a few beeps are heard, and the new firmware version is displayed at the top of the page. If it is not displayed in 1-2 minutes, refresh the page, or reconnect the smartphone to MECHA, if necessary.

MECHA MSA

MECHA MSA – Manual Second Axis – mode is when a single MECHA executes a dual axis script. For example, the case of a NN3, or other panoramic head, mounted on a single MECHA unit.

In MECHA MSA, MECHA enters in pause at the end of each row and waits for the 2nd axis to be set/tilt manually. For example, if a row consists of 12 images, after the 12th image you will notice the panning to the initial position, and then MECHA waits for the manual tilt.

The expected manual angle for the 2nd axis is shown both on UI and on LEDs. To understand what is displayed on the LEDs, please see the Table of Equivalences: LEDs - Characters.

After manual tilt, press ▷, or [>||] on NN Remote, or click the *[PAUSE]* button on UI.

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Part 2

MECHA Dual Axis Combo – DAC

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Fanotec, the manufacturer of Nodal Ninja Branded Products, has over a decade of experience in building products specifically designed for panoramic and high-resolution photographers. The auto-rotator (**E1**) with the single axis controller (**C1**) are precision built with quality motors, components and circuitry.

MECHA Dual Axis Combo – DAC – is a compact and affordable dual-axis pan tilt head solution. We use parts from NN3 MK3, together with 2 MECHA E1 Rotators and 2 C1 Controllers which are wireless linked together.

Use as a single-axis horizontal rotator single row shooting for turntable object VR, or use as a dual-axis rotator for both horizontal and vertical movements.

The MECHA E1 and C1 being modular in design, will be compatible with future MECHA rotators and controllers paving the way for future low-cost upgrade paths.

This setup supports a camera/lens up to 1.25kg (2.75 lb) and NPP up to 110mm from the pivot point, making it ideal for mirror-less, compact and lighter DSLR cameras. Shoot 360° panoramas or even high-resolution gigapixel images.

MECHA Dual Axis Combo – DAC – is preassembled and packed in a carrying case. If the two MECHA units are not mounted, please see below DAC installation image, or watch the video:

Dual Axis Automated NN3 MK3 with 2 MECHA C1 and E1 Upgrade Instruction

https://www.youtube.com/watch?v=wvAJoXsX6Kw

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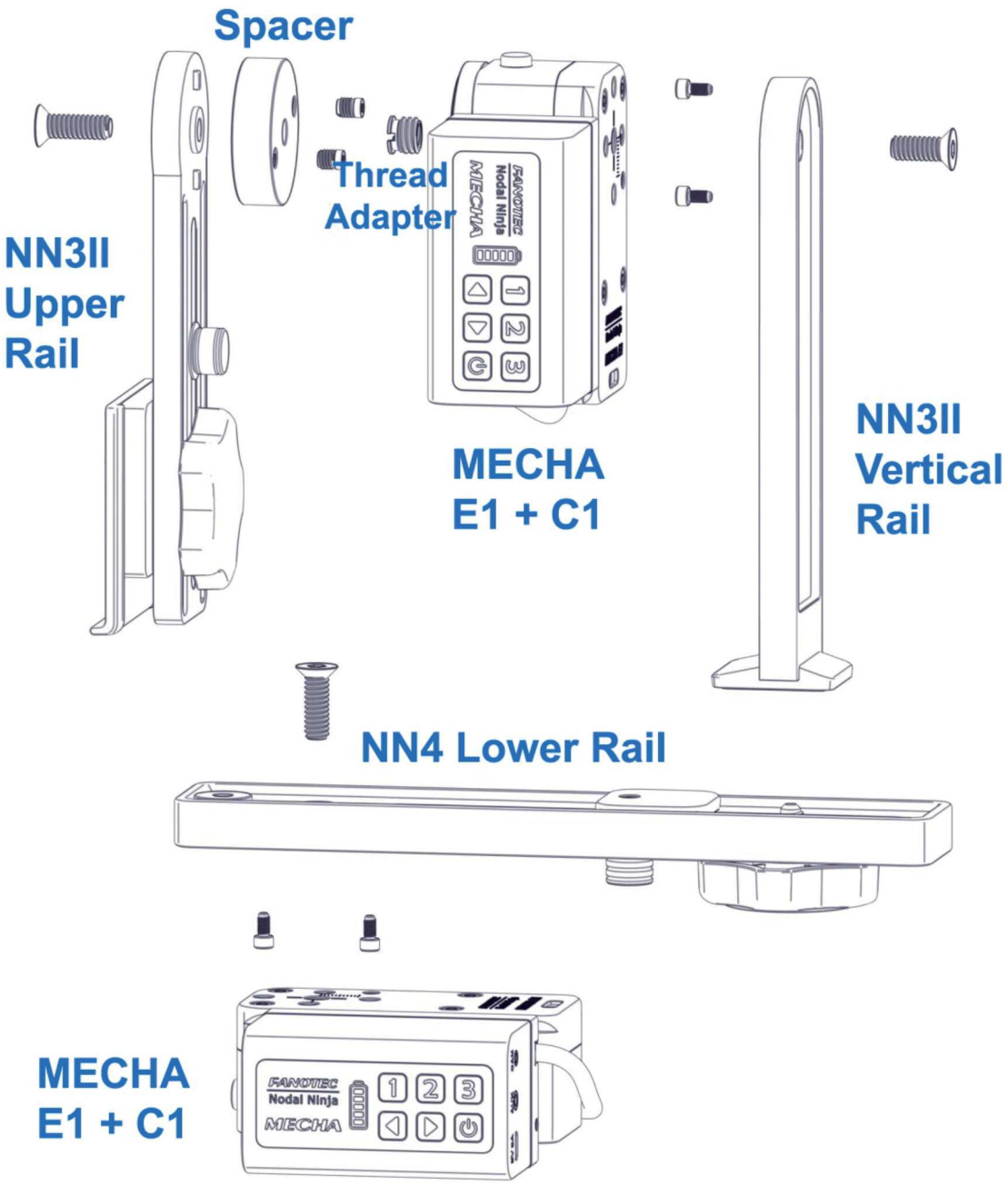
Spacer
Thread
Adapter
NN3II
Upper
Rail
MECHA
E1 + C1
NN3II
Vertical
Rail
NN4 Lower Rail
MECHA
E1 + C1
FANOTEC
Nodal Ninja
MECHA

A term used quite often in the second part of this guide is **pairing**. Pairing MECHAs means preparing two, or more, MECHA units to work as a team.

In general, the MECHA units can be both on your desk when you pair them, or even one in a room and the other in another room, and you can mount them as required, after pairing. However, we recommend that you do the mounting first, as shown in the image above.

The pairing of MECHA units is the same, both in case of panoramic photography - dual axis application - and in case you use them for other purposes, for example to rotate a video camera and a subject at the same time and with different speeds.

In this guide, we will present three methods of automatic pairing of MECHA units, automatic meaning that the units remain paired until you unpair them:

1. **zLM 2** - pairing using only 2 of MECHA's 6 buttons, a very quick method, especially for non-technical persons.
2. **zLM** - a method of pairing using a power code, using a few more of MECHA's buttons.
3. The third method - **pairing using the user interface**, for advanced users.

MECHA has only six buttons, which have various functions, some of them being already mentioned at the beginning of this guide.

As we will see, once paired, usually one MECHA rotates horizontally (MECHA-H), and the other rotates vertically (MECHA-V).

Usually, MECHA-H is mounted on the horizontal rail of the panohead, and MECHA-V is mounted on the vertical rail. However, if necessary, MECHA-H can be mounted on the vertical rail, for example, and MECHA-V on the horizontal rail, depending on what you want to do.

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Check if two MECHAs are paired

How do you know that two MECHA units are already paired?

If MECHA units are paired, you will notice - few seconds after both units are powered up - one unit has the middle LED turned on (MECHA-H), and the other has the two middle LEDs turned on (MECHA-V).

If a red LED is lit on MECHA-V, as shown above, this indicates that it is not the same firmware version in both units, and it is recommended to update the firmware.

Also, while the MECHA units are on, if you want to check if they are paired, press the power button, ⏻ of MECHA-H, then wait for 10 seconds, and the LEDs should light up as mentioned above.

Assuming both MECHAs are mounted as shown in the image above, let's see how to update the firmware, how to pair MECHA units, if they are not paired, and how paired units work.

DAC Firmware update using the smartphone

This update method is available starting with firmware version **02118**.

For this simple method of updating the firmware, we assume that you know how to set up a hot-spot on your smartphone, and the MECHA units are already paired.

- First, set up a hot-spot with the name **MECHA-UPDATE** and password **87654321**.
- Power up the horizontal MECHA (hold down its power button, ⏻, for 3 to 5 seconds).
- Then power up the vertical MECHA (hold down its power button, ⏻, for 3 to 5 seconds).
- Wait until de splitting lights end: **-=-=-=-=** and you hear two beeps and, using the buttons of horizontal MECHA, enter the code **312123<**, which will update the firmware of both units. The MECHA's response – displayed on LEDs – can be: **!!!**, if Internet is not available for MECHA.

If Internet is availabe for MECHA, the update will be performed in a maximum of 5 minutes. If you encounter problems while updating the firmware, please contact us by e-mail at mecha@nodalninja.com specifying the id of the MECHA you're using.

In most cases, the problems encountered when updating the firmware are caused by the wrong Wi-Fi password. However, due to the nature of the Internet, sometimes the update server cannot be reached, and this can be investigated once we get in contact by e-mail.

NOTE. See the Table of equivalences: LEDs – characters.

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Pairing using MECHA's buttons

zLM 2 – Automatic pairing using two buttons

This is a zero learning method – **zero Learning MECHA** – for firmware **02057** or newer.

1. Power off both MECHA units in case they are running. To do that, hold down the power button, ⏻, for 3 to 5 seconds.
2. Power up only the horizontal MECHA (hold down the power button, ⏻, for 3 to 5 seconds). When you see the splitting lights (-=-=-=-=), press the button **[1]** for 3 seconds (until multiple beeps are heard). The unit powered up first, **rotates horizontally**, so we name it **MECHA-H**.
3. Let the horizontal MECHA running then power up the other MECHA using its power button, ⏻, and when you see the splitting lights (-=-=-=-=), press the button **[2]** for 3 seconds (until multiple beeps are heard). The second powered up unit **rotates vertically**, so we name it **MECHA-V**.

On successful pairing, MECHA-H has the middle LED on, and MECHA-V has the two middle LEDs on, as shown in image on the previous page. Otherwise, power down and up both MECHAs again, preferably power up the MECHA-H first.

Next step is to test the combo using MECHA's buttons, and see how it works.

Once you get more familiar with MECHA, you can use it in an advanced way, via the UI (User Interface). The zLM pairing method is only given as a quick start, with very little to learn.

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For those interested in technical details, see below zLM 2 explained.

First, please read the chapter about the UI.

> MECHAs will be automatically paired and will remain paired after power OFF then ON.

> This procedure will create
> MECHA-H-DAC with password 12345678 and
> MECHA-V-DAC with password 12345678

> If in /config of MECHA-H, the SSID name is changed and password is changed, if both MECHAs are ON and paired, the SSID and password will be changed in MECHA-V as well, as long as SSID starts with MECHA-H in the first one.

> So after the MECHAs are paired and the SSID and name is changed in config of MECHA-H, say, from MECHA-H-DAC to MECHA-H123 with password 87654321, MECHA-V will receive the name MECHA-V123 and the same password: 87654321.

> As a result of these, without using any method of pairing, a MECHA-V999 in STA mode will always try to pair with MECHA-H999 if its SSID is ON, and both have the same password, and only the H-V difference in SSID name.

> This also opens the way to pair remotely two MECHAs via support, if needed, if they can access the Internet.

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DAC test using MECHA's buttons

After pairing, every time the MECHAs are powered up, you will notice they are connected as DAC (Dual Axis Combo). It's recommended to power up the horizontal unit first, then power up the vertical unit.

Wait until all LEDs are off, and perform the following tests without camera mounted.

Please note that tests can be stopped by pressing the power button, ⏻, if necessary.

Use the MECHA-V left/right buttons (which look like up and down due to the mounting orientation) to position the vertical rail on **parked**, **level**, or **raised** position. You can press ▷ then, quickly, [2] or ◁ then, quickly, [2] to rotate vertical MECHA by 90°.

To enter the codes below, use the numeric buttons and left button, ◁, to enter <, and right button, ▷, to enter >.

DAC test without camera - 1312 parked position

DAC Test 1312

With vertical rail on **parked** position, as shown in the image to the right, enter the code **1312<**, or the code **1312>**, in MECHA-H, using the buttons of MECHA-H.

This code tells the Combo to execute a panorama to the left, or to the right, made of 12 shots around, 3 rows at 0, +/- 45°, plus zenith and nadir, starting from **parked** position.

DAC test without camera - 1313 level position

DAC Test 1313

With vertical rail on **level** position, as shown in the image to the right, enter the code **1313<**, or the code **1313>**, in MECHA-H, using the buttons of MECHA-H.

This code tells the Combo to execute a panorama to the left, or to the right, made of 12 shots around, 3 rows at 0,+- 45°, plus zenith and nadir, starting from **level** position.

DAC test without camera - 1321 raised position

DAC Test 1321

With vertical rail on **raised** position, as shown in the image to the right, enter the code **1321<**, or the code **1321>**, in MECHA-H, using the buttons of MECHA-H.

This code tells the Combo to execute a panorama to the left, or to the right, made of 12 shots around, 3 rows at 0, +/- 45°, plus zenith and nadir, starting from **raised** position.

DAC tests using MECHA's buttons

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Panorama with camera mounted

If the above DAC tests are successful, you can repeat each test with camera mounted.

Mount the camera on the upper rail, using the camera mounting knob, and plug in the Camera Port (CAM) a specific shutter cable for the camera in use. This allows the triggering of the shutter automatically.

The units being paired, the camera can be connected to any of them.

Use the test codes mentioned above whenever you want to quickly shoot this type of panorama without using the User Interface.

Panorama with automatic shooting pattern using only the MECHA's buttons

Panorama with automatic shooting pattern for DAC

This method requires firmware version **02118**, or newer, and works for rectilinear lens from 10 to 200 mm (FF equiv).

The shooting pattern will be computed by MECHA based only on few presses of a button without using the User Interface, as follows:

- First, position the vertical rail on **LEVEL** position using the left/right buttons of MECHA-V.

- Place **a sheet of paper in front of MECHA** in such way to fill the frame. The frame can be viewed through viewfinder or through the live view. Instead of the sheet of paper, any well defined feature or image on screen, or other means, can be used. A gray sheet of paper will work best for exposure purposes as well.
- The camera and lens must be set the same as for shooting the actual panorama.
- Enter the code **31<** on MECHA-H, and when the power button starts flashing, MECHA waits for two quick presses of the power button, ⏻, as follows:
  - **first** - in order to trigger the camera
  - and the **second** - after the camera was triggered
- After that, MECHA will rotate slowly to the right and waits for another **press of the power button**, ⏻, right after the sheet of paper is out of the camera's frame.
- Then MECHA will go back to the initial position and will start slowly to tilt down and waits, again, for **another press of the power button**, ⏻, when the sheet of paper is out of the camera's view.
- Then MECHA will go back to the initial position, and
- the LEDs 1, 2 and 3, under the battery symbol, will start flashing, and MECHA waits (15 seconds) for one of the buttons **[1]**, **[2]**, or **[3]** to be pressed, to assign the computed preset to that particular button. To cancel the assignment, the power button, ⏻, can be pressed instead.

If MECHA is unable to compute a pattern using the feedback received from pressing the power button (mostly caused by too small intervals), the LEDs will show **!!!**, which indicates that nothing has changed.

To execute the panorama computed by MECHA, make sure the vertical rail is in **LEVEL** position, and press the button to which you have assigned the panorama, then press either the left or right button.

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DAC test using the UI

For this test, we assume that the pairing method was zLM2.

Considering that both MECHA units are powered up and paired, to access the MECHA web User Interface (UI) using a device:

- Open your device's Settings app., turn on *Use Wi-Fi*, and in Wi-Fi network list of the device tap the network (SSID): *MECHA-H-DAC*

Please refer to your device manual on how to connect to Wi-Fi. Here is a web page with **animated instruction for many smartphones**. Here is a generic guide about **connecting to a Wi-Fi Network**.

- Enter the password: *12345678*
- After connecting to the network, you can access the web control interface by typing *192.168.8.1* in the web browser address bar.
- MECHA will show the *"What is new?"* page.

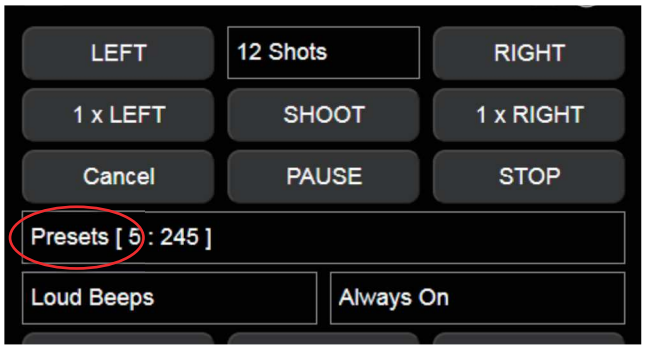
Tap *[Update]* if there is a newer firmware than the current one displayed at the top, if you want, and wait until all MECHA status LEDs are off. The update may take several minutes.

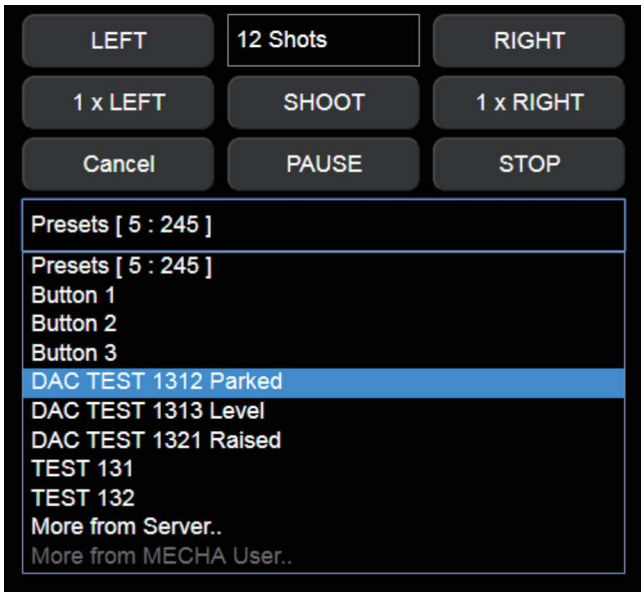
In the update process MECHA may ask for a Wi-Fi network with Internet access (like your Wi-Fi at home or office) and the password to be able to download the firmware from Internet.

⚠ **Please do not turn off MECHA while updating!**

- Tap the *[Row]* button to go to *Row* page.

- On *Row* page, tap *Presets* and select the preset *DAC TEST 1312 Parked* from the presets list, which is the panorama executed before, on chapter DAC test using MECHA's Buttons (12 shots around, 3 rows – at 0° and +/- 45° – plus zenith and nadir). If necessary, use the MECHA-V left/right buttons to position the vertical rail on **parked** position.





- To load the preset, tap the *[Load]* button, if visible, under *Presets* list. Otherwise, it means the UI complexity is *S* (Simple) and some buttons and options are not visible, and the selected preset is already loaded. So, go to the next step.
- Tap *[LEFT]* button to execute the preset to the left, or *[RIGHT]* button to execute the preset to the right.

Do the same with the presets *DAC TEST 1313 Level* and *DAC TEST 1321 Raised.*

If the tests are successful, go to the next chapter and see how to change the password, if necessary.

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How to change the SSID password

If your password is *12345678* (automatically created in **zLM2** pairing, or in **pairing using the UI**), or *01231231* (from our **zLM** pairing example), now is time to change the SSID password.

- Access the MECHA-H web User Interface (UI) using a device, as we showed on chapter DAC test using the UI.
- Access *Row* page, tap *[info]* button at the top of the page, then tap *[Config]* button to access the *Configuration* page.
- The user and default password are:

User:	**admin**
Password:	**Mecha**

- On *Configuration* page, scroll to *SSID Password* field, delete the current password and enter the new password. You can also change the default password for *Configuration* page, if you haven't changed it yet.
- Scroll to the bottom of the page and tap *[Apply]* button.

Once the SSID password is changed on MECHA-H, it changes automatically on MECHA-V, because the MECHA units are paired.

Next step should be to create your own presets.

Working with Presets

How to create your own Presets

Besides the very simple method with buttons only, described above (see Panorama with automatic shooting pattern), and the url with parameters method, like **192.168.8.1/preset?b=1&f=30&p=2** (see Programming a preset using parameters), the following is the method using the UI.

After accessing the MECHA-H web User Interface (UI) using a device, as we showed in chapter DAC test using the UI, tap *[Row]* to access *Row* page.

An easy way to create a preset is to select one from the *Presets* list, and edit it as needed, then save it with a different name.

First, let's analyze the default presets. Before you overwrite them:

- *Button 1*, *Button 2*, and *Button 3* are default presets consisting of 4, 6, and 8 shots respectively (for a single MECHA). These presets can be also executed with MECHA's buttons **[1]**, **[2]**, and **[3]**, in combination with left ◁ or right ▷ buttons.
- *DAC TEST 1312 Parked* - 12 shots around, 3 rows – at 0° and +/-45° – plus zenith and nadir, starting from **parked** position.
- *DAC TEST 1313 Level* - 12 shots around, 3 rows – at 0° and +/-45° – plus zenith and nadir, starting from **level** position.
- *DAC TEST 1321 Raised* - 12 shots around, 3 rows – at 0° and +/-45° – plus zenith and nadir, starting from **raised** position.
- *TEST 131* - 6 shots around (for a single MECHA).
- *TEST 132* - 12 shots around (for a single MECHA).
- *More from Server* - this is an option that allows you to get more presets from server. See chapter Download More Presets from Server.

> Note that MECHA accessed by *192.168.8.1* (as we did) is in AP mode, and *[More from Server]* is not available.
> MECHA Controller C1 (or MECHA) works in two network modes:
> Access Point (AP) and Station (STA). AP mode allows it to create its own network and have up to 5 devices to connect to it. STA mode allows it to connect to a Wi-Fi network (for example, one created by your wireless router), acting as a client.

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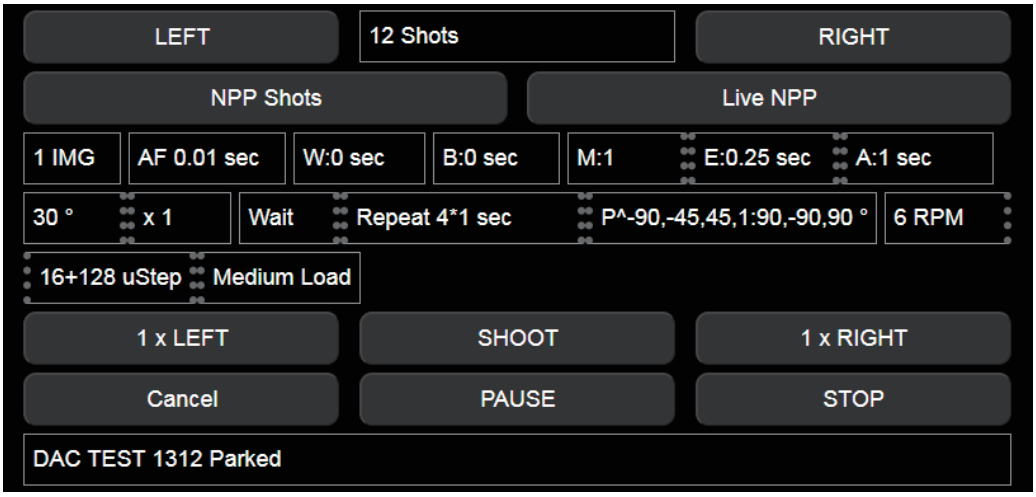
> Out of the box, MECHA works in AP mode. Since it does not have a wireless modem, it does not have Internet access. A device connected to it may also lose Internet access. Please, refer to MECHA Controller C1 Manual on STA mode for more details.

To execute a preset to the right/left, select the preset, tap *[Load]* button to load the preset, then tap *[RIGHT]/[LEFT]* button. For the moment, we do not want to execute the preset, but to create a new preset.

We take a look at preset descriptions above, and select the preset most similar to what we want to get. Suppose we want **6 shots around, 1 row, plus zenith and nadir, starting from parked position**. The most appropriate template seems to be *DAC TEST 1312 Parked*.

To find out more about a preset, you can choose a higher **level** for the UI complexity from the drop down list next to *[info]* button, at the top of the page. Select *A3*, which is the most advanced **level**.

Now, we have the full description of the selected preset and, in addition, clicking the *[info]* button will toggle descriptions for all the controls:



- *12 Shots* - 12 shots around for a full 360° panorama. Notice how the rotation angle changes according to the number of photos, so that if we multiply them, the result is 360°. On the other hand, if we change the rotation angle, the number of images does not change.
- *1 IMG* - This is the number of (bracketed) images for each position. When using automatic exposure bracketing in continuous shooting or self-timer mode, MECHA treats it as 1 image. In other words, this is how many times the camera will be triggered by MECHA. Select 0 if no image is needed.

- *AF 0.01 sec* - auto-focus 0.01 sec. If the value is negative, the AF signal will be ON during the entire image sequence. In order to trigger the camera, for some Sony cameras, you have to set an AF value greater than zero, even if the camera focus is set to manual.
- *W:0 sec* - no pause for camera wake up. If the value is negative, the pause will be forced even when the camera is ON, before each sequence begins. Useful for moving out of the camera's view.
- *B:0 sec* - no pause before a set of images. If the pause before each bracketing sequence or set of images is negative, up to 2 seconds will be used for Mirror Lock Up.
- *M:1* - normal modifier of exposure. Modifier of Exposure is the Modifier of the Duration of shutter button signal, a list of multipliers, like 1,0.5,2 for normal, half and double exposure time in case of 3 IMG, or it can be entered as -0.7EV (for under, normal, over) or 0.7EV (for normal, under, over), in which case it will automatically extend to the number of IMG. If the modifier starts with B, like B-2EV, or B1, or 1,0.5,2, the "Bulb" mode will be assumed.
- *E:0.25 sec* - exposure 0.25 sec. Duration of shutter button signal, for example, 3 or 0.5*3 for progressive half Exposure, or 2*3 for progressive double Exposure in a set. These can be entered as custom values. The values can be entered as 1/100.
- *A:1* - 1 sec. delay after each bracketing sequence or individual image. If the value is negative, there will be a delay after each shutter actuation.
- *30°* - the rotation angle between two consecutive positions in a sequence specified for *[N x LEFT]* or *[N x RIGHT]* buttons.
- *x1* - 1 move. The number of moves (N) for *[N x LEFT]* or *[N x RIGHT]* buttons.
- *Wait* - wait after last shoot. The other option is Rewind, which means rewind to initial position. Useful if there are cables attached, or for partial panorama and time-lapse.
- *Repeat 4*1 sec* - repeats the shooting sequence 4 times, 1 sec. apart. This is the delay in seconds until the shooting sequence will be repeated automatically. Set zero (0) or [No repeat] for no repeat.

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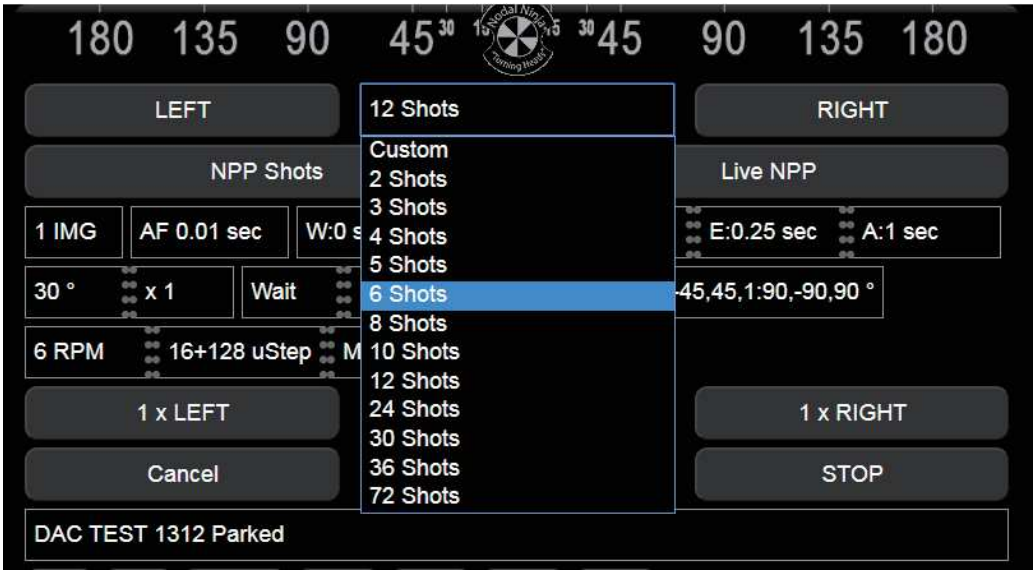
- *P^-90,-45,45,1:90,-90,90°* - the script that describes our preset.
  - If the list of angles (which always refers to the MECHA-V) starts with *"P^"*, MECHA-V rotation angle is the specified angle, then the shooting set follows.
  - *P^-90* means -90° movement in P convention (as in PTGui with camera with grip up). So, -90° rotation from the initial position, then the sequence will be executed (useful when MECHA DAC is **parked** and camera is oriented up, usually for transportation and lens cleaning). The camera will rotate to the horizontal position, then will do the sequence.
  - *P^90,...* is suited when camera is oriented toward nadir (spirit level in frame, as after vertical mounting on horizontal base, good time to double-check the NPP settings left-right).
  - *P^-90,-45,45,1:90,-90,90* is a sequence for doing 12 shots around, 3 rows (+/-45°) + zenith + nadir, starting from **parked** position, and ending in **parked** position (last 90).
  - For example, *-45,45,1:90,-90,0* is the same, but it starts and ends in horizontal position (0° pitch).
- *6 RPM* - Speed denoted by Revolutions Per Minute.
- *16+128 uStep* - Micro-stepping value, simple or combined; for example, different values for acceleration + constant speed region.
- *Medium Load* - means a profile for an average load. The other options are Light, Heavy, and Ring. These are optimized motion profiles for a rated load. We encourage you to try them all, to see which one is best for the camera and lens used, or for what you want to do.

> ⚠ Most input lists, in both Ring and Row, can receive custom values. There is no error check, nor range check for the custom values at the moment. So, please use this feature with caution.

To get a preset with 6 shots and just 1 row, instead of *12 shots*, select *6 shots*:



and instead of *Repeat 4*1 sec*, select *No Repeat*, as we have only one row.

To save the preset, do one of the following:

1. Tap *[Save]* button to save the preset with a different name. The preset name can be preceded by a power code of maximum 7 digits. This

feature also allows you to execute the preset using MECHA's buttons.

For example, if the preset name is *01 DAC 6 shots*, to execute this preset using MECHA's buttons, press the power button, ⏻, then button **[1]**, and left button, ◁ (to execute the preset to the left), or right button, ▷ (to execute the preset to the right).

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Preset power code

Create a **preset power code** as follows:

- the first digit must be **0** (zero) (remember that every power code starts with zero)
- the next sequence of maximum six digits must be a combination of the digits **1**, **2**, or **3**, so that two identical digits are not in consecutive positions.

Example: 01, 023, 0123, 02123, 0123123 etc.

2. Tap *[Save 1]* button to overwrite the preset with the name *Button 1*, assigned to MECHA's button **[1]**.
3. Tap *[Save 2]* button to overwrite the preset with the name *Button 2*, assigned to MECHA's button **[2]**.
4. Tap *[Save 3]* button to overwrite the preset with the name *Button 3*, assigned to MECHA's button **[3]**.

Now, the new preset is saved and displayed in the presets list and ready to be used in the future.

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MECHA's Simple Scripting (MSS)

Starting with firmware version **02116**, **MECHA's Simple Scripting (MSS)** reached a level of flexibility that allows easy scripting for common shooting patterns, for both MECHA Single and MECHA DAC.

In MECHA DAC**,** MECHA needs to know its starting position. This can be **Parked**, **Level**, or **Raised**. These conventions are also used in naming the presets available from Server.

Considering the quite popular shooting pattern made with kit lenses at around 29mm (FF equiv), that consists in:

1. one row of 12 positions at a tilt of 0° (horizontally)
2. another row of 12 positions at a tilt of +45°
3. another row of 12 positions at a tilt of -45°
4. a single position at a tilt of -90°, known as Nadir
5. a single position at a tilt of 90°, known as Zenith

Considering the **Start Level** position, as in the image above, this pattern can be programmed by the following **MSS**:

```
SL,0x12,45x12,-45x12,N,Z
```


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Breaked down, you'll recognize the description above:

- **SL**: **S**tart Level
- **0x12**: at a tilt of **0°**, one row of **12** positions
- **45x12**: at a tilt of **45°**, one row of **12** positions
- **-45x12**: at a tilt of **-45°**, one row of **12** positions
- **N**: the **N**adir position
- **Z**: the **Z**enith position

In MECHA DAC, when the units are paired - which is a requirement for the above script to work - after start, the LEDs settles in showing the status of successful pairing, as shown in this image:

If a red LED is lit on the Vertical MECHA, this indicates that while the pairing is established, the firmware version is different from the one in the horizontal MECHA, and depending on the differences, some of the recently added features might not work.

To have the full benefit of MSS, it is recommended to launch an update from horizontal MECHA, and that should synchronize the firmware by updating both to the latest firmware version, resulting in having both MECHAs with the same firmware, indicated by no red LED ON.

With the latest firmware on both MECHAs, if the buttons ▷ and **[2]**, or ◁ and **[2]**, are pressed one after another on MECHA-V, MECHA-V will be rotated with a predefined interval - interval 2 - which is **90°** in our case. As you might have guessed, this can be used to rotate MECHA-V from **Parked** to **Level**, and back:

- ▷**[2]** rotates MECHA-V from **Parked** to **Level**.
- ◁**[2]** rotates MECHA-V from **Level** to **Parked**.

There are also the intervals 3 (180°) and 1 (45°).

The default values of these intervals can be changed in *Configuration* page, if needed (user: **admin**, pass: **Mecha**).

As a result, you can go from **Level** to **Raised** in one go, using ▷**[3]**, and back, using ◁**[3]**.

NOTE. On the *Configuration* page, there is also a checkbox that establishes if the left is left, or the left is right, regarding the movements when the buttons are pressed. You might want to change its status, if you prefer a particular behavior over the other.

Starting with firmware version 02117, there is the code **2313<** that changes the sense of rotation if it is done using the buttons ◁▷, without the need to access the *Configuration* page.

If the direction for the intervals above needs to be changed to be more natural, you can use **2313<** code as well.

If you notice that instead a 90° rotation, MECHA seems to rotate more or less, the cause could be a wrong setting regarding the type of the rotator you have.

Please use the following codes to specify the type of rotator, or set the rotator on *Configuration* page.

- **23131<** set E1 as the preferred rotator
- **23132<** set E2 as the preferred rotator
- **23121<** set P1 as the preferred rotator

The code should match with the actual rotator connected for each MECHA, and needs to be entered pressing the buttons of the MECHA the rotator is connected to.

However, if you are in doubt about the type of rotator, you can try each code, then launch a 90° rotation, and if it is indeed 90°, then the rotator is correctly set.

Alternatively, you can contact the dealer or mecha@nodalninja.com for more info or help in identifying the type of rotator you have.

Considering the script:

```
SL,0x12,45x12,-45x12,N,Z
```

what needs to be changed, sometimes, in real situations:

instead of a single Zenith, more Zeniths may be needed, say, for flare reasons, in which case Z can be replaced with Zx2, for example, which will produce 2 Zeniths 180° apart (360°/2):

```
SL,0x12,45x12,-45x12,N,Zx2
```


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For 2 Zeniths 90° apart, the ZZ convention can be used, or ^90 which tells to use 90° interval between Zeniths instead of the computed 360°/2.

```
SL,0x12,45x12,-45x12,N,ZZ
SL,0x12,45x12,-45x12,N,Zx2^90
```

The same way, for 2 Zeniths **120°** apart:

```
SL,0x12,45x12,-45x12,N,Zx2^120
```

Now, for Zeniths at a tilt of 80° instead of 90°, which might help in automatic control points, because the Zenith is just like any row, but at a tilt of **90°**, **90x1** will do the same as **Z**, thus **80x1** is what you need for a Zenith at a tilt of **80°** instead.

For 2 Zeniths at a tilt of 80° and 180° apart, 80x2, and for 2 Zeniths 90° apart, we can use **80x2^90**, thus we will end with this script:

```
SL,0x12,45x12,-45x12,N,80x2^90
```

Suppose that the rows at a tilt of +45° and -45° must have 10 positions instead of 12, then the script can be changed as follows:

```
SL,0x12,45x10,-45x10,N,80x2^90
```

The above apply for Nadirs as well, in which case the **N, NN, -90x1, -80x1, -80x2^90** can be used.

The Nadir is like a row at a tilt of **-90°**.

NN IR Remote

Let's take a pause.

Sometimes, to the above, we need a pause, say, before the horizontal row, or before Nadir, to be sure we are out of view.

The pause can be added using **P**, so

0x12 will mean: at a tilt of 0°, a row of 12 positions, while

P0x12 will mean the same, but with a pause before, and MECHA will wait for button ▷ to be pressed, or for UI *[PAUSE]* to be pressed, or for the pause button of the NN IR Remote to be pressed, to continue.

That pause can be used to adjust some camera settings, like exposure, aperture, WB, focus, and more.

```
SL,P0x12,45x10,-45x10,N,ZZ
```

If you want a pause before each row, for focus, for example, then:

```
SL,P0x12,P45x10,P-45x10,N,ZZ
```

or even before Nadir and Zenith:

```
SL,P0x12,P45x10,P-45x10,PN,PZZ
```

To customize it even more, let's say we want an extra image at the beginning, a kind of clapboard you may want to use, for WB or even for focus, will be a kind of image you need to take again, without the extra elements in it, and the second one to be used in panorama.

As the horizontal row is scripted by 0x12, for the extra shoot we can add another horizontal row, but made from only one position, like 0x1 with pause or not. For example, if starting from **Level**, we may not need a pause, as we can launch the preset after the clapboard preparations are done, and we'll have the pause only before the actual row of 12 to start, time to remove, say, the gray card.

```
SL,0x1,P0x12,45x10,-45x10,N,ZZ
```

If MECHA is in **Parked** position, we need a pause to adjust the camera settings right after MECHA arrives in horizontal orientation for the first horizontal row.

```
SP,P0x1,P0x12,45x10,-45x10,N,ZZ
```

Let's take a more dense approach with more photos toward gigapixel imagery.

Suppose we want a shooting sequence made out of rows at a tilt of 15°, instead of 45°, as we had before:

```
SL,0x36,15x32,30x28,45x24,60x20,-15x32,-30x28,
-45x24,-60x20
```


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- **SL**: Start Level
- **0x36**: first row at a tilt of 0° (horizontally) made out of 36 positions
- **15x32**: one row at a tilt of 15° of 32 positions
- **30x28**: one row at a tilt of 30° of 28 positions
- **45x24**: one row at a tilt of 45° of 24 positions
- **60x20**: one row at a tilt of 60° of 20 positions

The same for the negative tilts:

- **-15x32**: one row at a tilt of -15° of 32 positions
- **-30x28**: one row at a tilt of -30° of 28 positions
- **-45x24**: one row at a tilt of -45° of 24 positions
- **-60x20**: one row at a tilt of -60° of 20 positions

Because there are many shots to be taken, it will take a while.

Now suppose we want only a vertical slice of it, of **45 degrees**, a kind of preview, also to test overlap and to see if the full 360 around can be used in production, or just simply as a partial panorama 45 degrees wide, instead of 360, with the same camera-lens combo.

To achieve that, we need to add **(45)**, which tells MECHA that only a bit over 45 degrees should be taken.

The resulting MSS script will be:

```
SL,0x36,15x32,30x28,45x24,60x20,-15x32,-30x28,
-45x24,-60x20(45)
```

As in the examples above, it can have pause(s) before row(s), or extra 1 position row for clapboard, so on.

We can also add 1 Nadir and 1 Zenith with pause, and even use that pause to replace the lens with a fish eye, or change the focal lens to the shortest (widest angle) extent.

```
SL,0x36,15x32,30x28,45x24,60x20,-15x32,-30x28,
-45x24,-60x20,PN,Z(45)
```

If the preview slice looks good, we can remove the (45), and make some changes regarding the number of shoots per positions (HDR), ending up with the full 360° around and 150° tall panorama:

```
SL,0x36,15x32,30x28,45x24,60x20,-15x32,-30x28,
-45x24,-60x20,PN,Z
```

S-Language inserts

MSS language accepts S-Language inserts, for example:

```
SL,0x11,-44.90x11,44.90x11,Z,N
```

means that 11 shots are taken on each row, one at 32.72(72)°. With S-L insert, this can be written as

```
SL,0x11,_33,-44.90x11,_33,44.90x11,_33,Z,N
```

which means that the first position after the previous row is at 33° instead of 32.72°.

This allows a fine-tuned alignment of images, especially for gigapixel photos.

The inserts can be full S-L – like **,=24_14,** – in which case the inserted positions are as in the S-Language, with all features available.

Rewind after each ROW

The *RW* term in the MSS script indicates rewind after each ROW, useful in gigapixel sessions when cables to a power bank are used.

For example, for 50mm (FF equiv.):

```
SL,0x18,-28.30x17,-56.60x12,28.30x17,56.60x12,
ZZ,NN,RW
```

Shooting in Horizontal Zig Zag pattern

The HZ term in MSS script indicates shooting in Horizontal Zig Zag pattern.

MECHA will change the sense of rotation after each row.

For exemple, for 50mm (FF equiv.):

```
SL,0x18,-28.03x18,-56.06x14,28.03x18,56.06x14,
```


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```
ZZ,NN,HZ
```

Example of partial panorama with explicit intervals for H (24°) and V (36°) in Horizontal Zig Zag, 4 rows, 8 columns:

```
SL,54x8^24,18x8^24,-18x8^24,-54x8^24,HZ
```

Download more Presets from server

In short, to download presets from server, make sure MECHA is connected to the Internet, then select the option *More from server* from the *Presets* list. If the option *More from server* is not displayed in the list, it means that MECHA is not connected to the Internet. In this case, tap the *[Connect to Wi-Fi]* button at the bottom of the page, and after connecting, refresh the page.

- On *Row* page, select the option *More from server* from the *Presets* list.
- Provide a keyword if you want to get only certain presets, and tap the *[OK]* button. The names of the presets found on server are added to the *Presets* list.
- The preset name describes what the preset does, and over time you will know which keywords to use. For example, the sequence _*P*_ in a preset name means that the preset includes a pause.
- (*S)* in a presets name means that the preset is not saved yet on MECHA.
- Save the presets you find useful, as we showed in the previous chapter:
  - Select a preset from the *Presets* list.
  - Tap on *[Load]* button to load it (if the button is visible).
  - Modify the preset if necessary.
  - Save the preset with the same name, or with a different name.

The presets for Dual Axis available to download at the moment are:

- DAC_8_Shots_3_Rows_Z_N_Level.mps
- DAC_10_Shots_3_Rows_Z_N_Level.mps
- DAC_12_Shots_3_Rows_Z_N_Level.mps

We analyze ***DAC_10_Shots_3_Rows_Z_N_Level.mps***, noting that the description is similar for the other two.

This preset is suitable for multi-row panorama, 10 shots around, for MECHA DAC, in A1-A3 mode.

In *A* levels, select the presets, then click on *[Load]* to load it. Also, it can be deleted, and other operations can be performed as well, but still some are possible only after the preset is saved with *[Save]*, and loaded with *[Load]* button.

MECHA needs to be in Level starting position.

It will shoot three rows of 10 positions each:

- one at a tilt of 0°
- one at a tilt of 45°
- one at a tilt of -45°
- one Zenith
- one Nadir

To change from 10 positions each to 12 position each, you need to select *12 Shots* instead of *10 Shots*.

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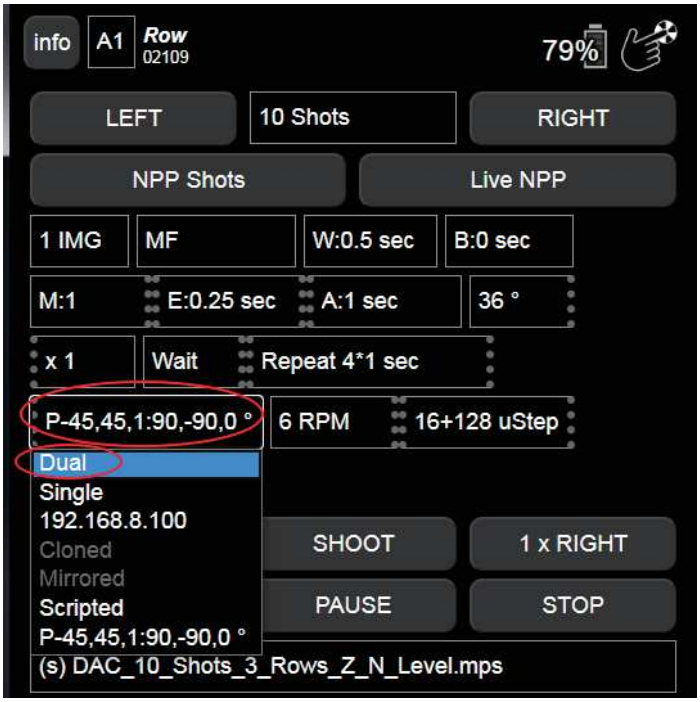
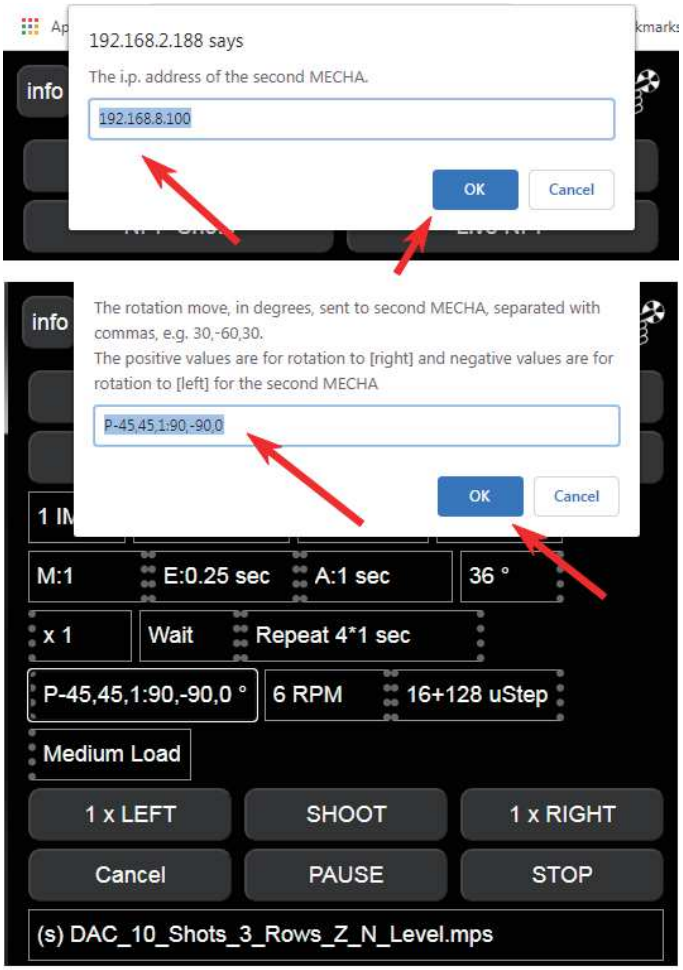
And to change the degrees of tilt for row, for example, from 45° to 30°, click on *P-45,45,1:90,-90,0°*, then click on *Dual*.



Click *[Ok]* to let the IP of the 2nd MECHA unchanged, then edit the list of angles as follows:



P-**30,30**,1:90,-90,0 then [Ok].

------8<----------

This preset uses the repeat feature offered by MECHA before the scripting features were added.

The list of angles explained

P is a convention in which tilting is like pitch in Ptgui.

After first row of 10 or 12 is made just like for a single MECHA, the repeat is called and the list says what changes are for each repeat:

- for 1st repeat is -35 (2nd MECHA will tilt to -35°)
- for 2nd repeat is 35 (2nd MECHA will tilt to 35°)

then there is something different: 1, which says: from now on, there is only one position per row, 1:90 means 1 position at a tilt of 90°, -90 means 1 position at a tilt of -90°, then go back to 0° tilt.

------8<----------

Then you can click on *[Save 1]* to save and assign this preset to button **[1]** of MECHA-H-DAC. From now on, you can launch this preset by simply press [1] then ▷ (for clockwise rotation) when MECHA is idle, or press **[1]** then ◁ (for counter-clockwise rotation).

Also, you can click on *[Save]* button to save it on MECHA, in the *Presets* list, with a desired name.

DAC_14-10-8-6_Shots_7_Rows_2N_2Z_Level.mps

This is a bit intimidating, but it works very well, for a pre-scripting era.

Why not use it?

It is very similar with the previous one, except it shoots a different number of positions per each row:

- 14 positions on 1st row
- then 10 positions at a tilt of -12°
- then 8 positions at a tilt of - 45°
- then 6 positions at a tilt of -60°
- then 10 positions at a tilt of 12°
- then 8 positions at a tilt of 45°
- then 6 positions at a tilt of 60°

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- then 2 Zeniths 90° apart
- then 2 Nadirs 90° apart

This is the script:

```
P10:-12,8:-45,6:-60,10:12,8:45,6:60,2^90:90,
2^90:-90,0
```

After the first row of 14 is made just like for a single MECHA, the repeat is called and the list says what changes are for each repeat:

- **10:-12** – for 1st repeat, 10 positions from now on (2nd MECHA will tilt to -12°)
- **8:-45** – for 2nd repeat, 8 positions from now on (2nd MECHA will tilt to -45°)
- **6:-60** – for 3rd repeat, 6 positions from now on (2nd MECHA will tilt to -60°)
- **10:12** – 10 positions from now on (2nd MECHA will tilt to 12°)

- **8:45** – 8 positions from now on (2nd MECHA will tilt to 45°)
- **6:60** – 6 positions from now on (2nd MECHA will tilt to 60°)

Now, something different: instead of saying **2:90**,

which means two positions at a tilt of 90° (which will turn to be 180° apart, and it could be good as well), we say **2^90:90**,

which means two positions 90° apart at a tilt of 90° – for example, for two Nadirs 90° apart – then the same for two Zeniths **2^90:-90**,

then go back to 0° tilt.

Changes can be made to this presets as well.

If you need more rows, for exemple two extra rows, change the numbers of repeats by click on *Repeat* and enter, via *Custom*, 10*1 instead of 8*1. Suppose we need 2 more rows at **-70** made of **4** positions each:

```
P10:-12,8:-45,6:-60,4:-70,10:12,8:45,6:60,4:70,
2^90:90,2^90:-90,0
```

If we want the order of rows to be changed, their position in the list of angles can be adjusted, for exemple, with the positive tilts first:

```
P10:12,8:45,6:60,4:70,10:-12,8:-45,6:-60,4:-70,
2^90:-90,2^90:90,0
```

Again, the *Repeat* must be set at *Repeat 10*1 sec*.

If, for some reasons, more seconds are needed between rows – for example, 5 seconds – the *Repeat* can be set at *Repeat 10*5*.

Also, the number of positions can be changed as well:

```
P12:12,10:45,8:60,6:70,12:-12,10:-45,8:-60,6:-70,
2^90:-90,2^90:90,0
```

Then you can click on *[Save 1]* to save and assign this preset to button **[1]** of MECHA-H-DAC. From now on, you can launch this preset by simply press **[1]** then ▷ (for clockwise rotation) when MECHA is idle, or press **[1]** then ◁ (for counter-clockwise rotation)

Also, you can click on *[Save]* button to save it on MECHA, in the *Presets* list, with a desired name.

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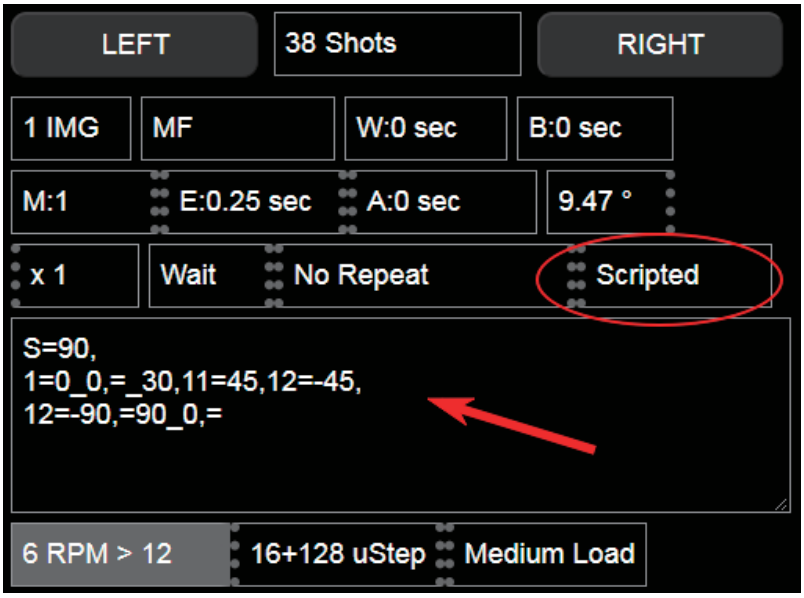
MECHA's S (shots) Language

The S Language requires the firmware 02054 or newer.

In this chapter we will explain how to make a script for your desired pattern of shooting.

The S language is Shots oriented, and it can be used for both Single MECHA and MECHA Dual Axis Combo, abbreviated MECHA DAC.

Access *Row* page of MECHA-H using the UI, and select *Scripted*. As a result, a blank text area is displayed in which you will write the script.

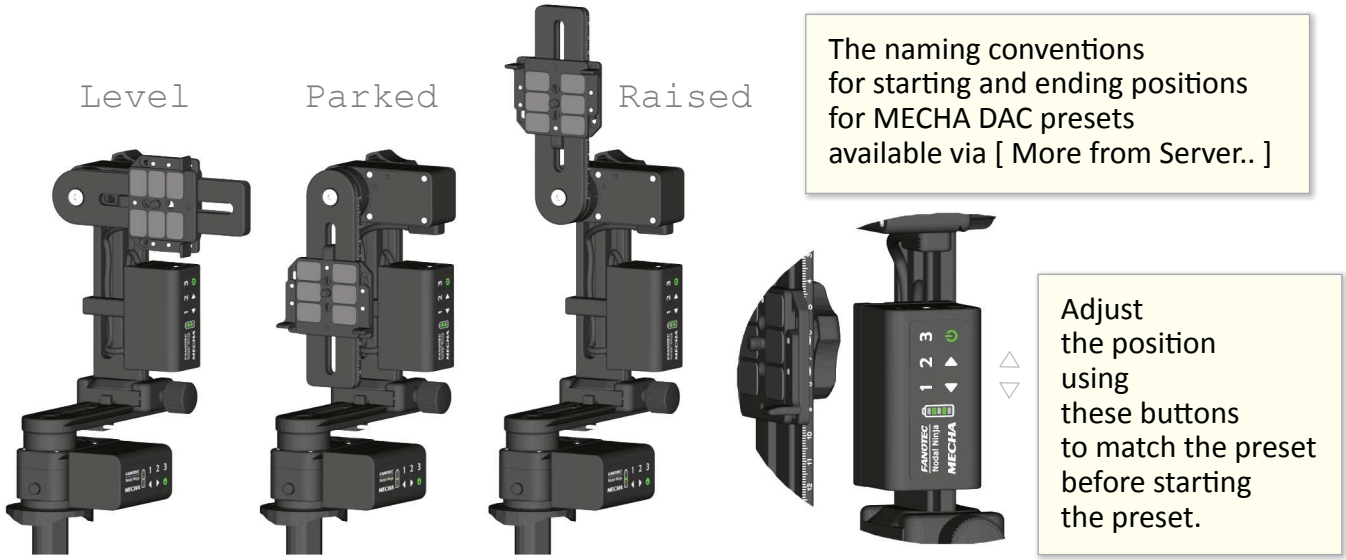


The script starts with the initial position of MECHA, as follows:

S={position in degrees}

> Please note that usually MECHA position refers to the position/ orientation of the rail/device controlled by MECHA.

In the case of DAC, we commonly have 3 possible start positions: **level**, **parked**, and **raised**.



With the firmware 02097 or newer, you can turn from Level to Parked and back by pressing:

▷, then press quickly the button [2], or

◁ , then press quickly the button [2] of MECHA-V.

You can use also MECHA-H buttons for rotating by intervals:

▷ [1] 45°

▷ [2] 90°

▷ [3] 180°

The same intervals for ◁, but in the opposite direction.

These intervals can be changed on *Configuration* page, if needed.

So, on MECHA-V, ▷**[3]** or ◁**[3]** can be used to rotate from Raised to Parked and back.

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There are a couple of conventions in S language, and the most important are:

_	*underscore* refers to MECHA-H: 1 LED is ON when paired
=	*equal sign* refers to MECHA-V: 2 LEDs are ON when paired
::	*double colon* is equivalent to the *equal sign*
( )	*round brackets* indicate a loop
^	*caret* means „relative to the previous position", and can be used for MECHA-V, as positions for MECHA-H are always relative to the previous position

EXAMPLE 1 (MSS)

Let's start with a simple example, an MSS script (MECHA's Simple Scripting), and then continue with S-Language examples.

Suppose we want to script a panorama starting from **parked** position, made of 12 photos around, zenith, nadir, one row at 0°, one row at +45° and, finally, one at -45°. The MSS script, in this case, can be:

```
SP,Z,N,0x12,45x12,-45x12
```

In the **parked** position, the camera - mounted on the upper rail - is facing up, as in the image above.

If we want the starting and ending positions to be **level**, the script will be:

```
SL,Z,N,0x12,45x12,-45x12
```

and if we want the starting and ending positions to be **rised**, the script will be:

```
SR,Z,N,0x12,45x12,-45x12
```

If we want a pause before a row, we can add **P** in script before that row. For example, this will set a pause just before the row, at 0°:

```
SP,Z,N,P0x12,45x12,-45x12
```

In the example above the pause is infinite, and to continue, you need to press ▷, the right button of MECHA, or the equivalent UI button, *[RIGHT]*.

The S-Language also accepts precise values for the pause, of integer and float type. For exemple, **2.5:** means 2.5 seconds. To cancel a pause whose value is of integer or float type, you need to set another pause, of zero seconds: **0:**

```
S=90, 1=2.5:0_0, =0:_30, 11=45, 12=-45, 12=-90,
=90_0, =
```

EXAMPLE 2

> In the Script text area, **::** will be automatically replaced with **=** (equal sign), to allow more easy input from phones.

A simlilar case example as before, suppose we want to script a panorama starting, again, from **parked** position, made of 12 photos around, 3 rows in total, at 0° and at +/- 45°, + zenith and nadir. In this case, we want zenith and nadir to be taken at the end.

This way of scripting is more complex, but allows more flexibility for a particular shooting pattern.

In the **parked** position, the camera - mounted on the upper rail - is facing up, as in the image above, and MECHA has to rotate the upper rail 90° to photograph the first row, as required in our example. So, we specify the **parked start position for** MECHA-V as follows: **S=90**.

If the start position is **raised**, **S=-90**. For the **level** position, **S=0**, or **S=** (**S=0** is equivalent to **S=**).

Level	Parked	Raised	Other
S=0	**S=90**	**S=-90**	**S=45**

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After start position, we have to specify the details for the **first position**, as follows:

> {Number of position until the changes occurs}
> ={MECHA-V position}_{MECHA-H position}

1=0_0

1	Next 1st position for the change to occur
=0	MECHA-V at a tilt or pitch of 0° (thus MECHA-V does not move)
_0	MECHA-H at yaw of 0° relative to previous (thus MECHA-H does not move)

Assuming **parked** position, our script becomes:

```
S=90, 1=0_0,
```

Then we have to think about how we want MECHAs to move so that we have 12 photos around, 30° apart.

For the next position, MECHA-H rotation will be 30°, while for MECHA-V the position does not change.

We can write that as **1=0_30**, but S language also allows this compact form instead: **=_30,** by omitting the number 1, and writing the equal sign followed by nothing, meaning no changes for MECHA-V.

So, the script becomes:

```
S=90, 1=0_0, =_30,
```

The movement for the next 10 positions or photos (as we have only one photo at every position) will continue by changing only the rotation of MECHA-H, then at 11th photo something changes, MECHA-V should rotate the upper rail up 45°, so we have to add **11=45,** to our script:

```
S=90, 1=0_0, =_30, 11=45,
```

Then 11 positions will continue in the same manner, and at the 12th photo MECHA-V should rotate down 45 (-45)°. So, we have to add **12=-45,** to our script, and it becomes:

```
S=90, 1=0_0, =_30, 11=45, 12=-45,
```

As for the previous row, things goes the same for another 11 photos, and at the 12th photo MECHA-V has to rotate at -90°, which is the position for nadir, so we have to add **12=-90,** and the script becomes:

```
S=90, 1=0_0, =_30, 11=45, 12=-45, 12=-90,
```

Finally, we only need a position for the zenith photo, at 0° from the nadir, for MECHA-H. So we have to add **=90_0, _0** is to tell that the previous position and the next position are 0° apart.

So, now the script is:

```
S=90, 1=0_0, =_30, 11=45, 12=-45, 12=-90,
=90_0,
```

To complete the script, now we can add an equal sign **=**, which in other cases can be omitted. Now, our final script is:

```
S=90, 1=0_0, =_30, 11=45, 12=-45, 12=-90,
=90_0, =
```

which you can see in the above image, as well.

Just a side note. The script allows to have some pieces of the code in a loop, and much less code to enter, especially in the case of gigapixel panoramas. This feature will be exemplified later.

Before launching the panorama, enter 38 in the *number of shots* field, via custom option, then click/tap on either *[RIGHT]* or *[LEFT]* buttons.

We'll explain in another example how to tell MECHA to wait, or to take extra shots, on a particular orientation, so on.

EXAMPLE 3

Same as example 1, but for 8 shots around on each row instead of 12.

```
S=90, 1=0_0, =_30, 11=45, =_45, 7=-45, 8=-90,
=90_0, =
```

Before launching the panorama, enter 26 in the number of shots field, via custom option, then click on either *[RIGHT]* or *[LEFT]* buttons.

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EXAMPLE 4

Spiral movement, camera in **parked** position, say, *5 Shots*.

```
S=90,1=0*65_,=0*0.18R-65_4R2880,=0*9R90_,=
```

0* means no photo taken.

0.18R and **4R** values for speed for RPM.

=4R will change the speed for MECHA-V to 4 RPM from then on, while

_3R will change the speed for MECHA-H to 3 RPM from then on.

It is a spiral in which MECHA-V is moving continuously at 0.18 RPM, and at/in the same time MECHA-H is moving continuously at 4 RPM. The rotation is 2880° for MECHA-H, and due to speed difference it is only 130° for MECHA-V.

EXAMPLE 5

Panorama consisting of 27 frames shot in 3 rows with 9 shots in each row.

```
S=90,1=21_0,=_14,8=0_0,=_-14,8=-21_0,=_14,
8=90_-112,=
```

=90 tells the start and end position,

which can be omitted or set to zero, if no zenith is needed:

```
S=0,1=21_0,=_14,8=0_0,=_-14,8=-21_0,=_14,
8=0_-112,=
```

The equal sign, **=**, at the end means the end of the script, but if you want no zenith photo, then you can move the end a position forward.

= is like a script terminator, no photo, only end, and the number of shots will be ignored.

```
S=0,1=21_0,=_14,8=0_0,=_-14,8=-21_0,=_14,
8=0_-112
```

Now, the end is **=0_-112** (instead of the previous single equal sign **=**) which indicates to terminate not anyway, but exactly at zero **level**, and **-112°** rota-

tion for MECHA-H from the previous position (return to the starting position).

Remember that **=0** is **level**, **=90** is **parked**, **=-90** is **raised**, as for the nadir.

These sequences can be used for start and end positions.

EXAMPLE 5a

Another example of shooting starting from the **parked** position.

```
S=90,1=30_0,=_3,119=_0,=_-3,
```

S=90, means start position is **parked**.

1=30_0, means 1 photo in the first position, which is at a rotation of 30° for MECHA-V, and 0° for MECHA-H.

=_3, from here, there are 3° rotation for MECHA-H until

119=_0 after the position 119, where the rotation for MECHA-H becomes 0°.

=_-3, from then on, the rotation is -3° for MECHA-H, and it will continue to be -3° until the end, which can be at 200 if you select *200 Shots*, *No Repeat*, *Scripted*.

119 is the position after 1st position, where MECHA-H rotation changes from **3** to **0**, and after that it is changed in **-3**. As there are no changes for MECHA-V, we have only **=30**, and the rest is **the equal sign and nothing after** (=).

Remember **_** (underscore) refers to MECHA-H, and **=** (equal sign) refers to MECHA-V.

If you wonder why MECHA counts from the last position instead of having absolute positions, here are some reasons:

1. a panorama often consists of rows of images, each row at a certain tilt, so
2. you can repeat a piece of script, thus in the case of a gigapixel panorama you have to write less.

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```
S=90,1=0_0,10=30_3,99=_0,10=_-3,
```

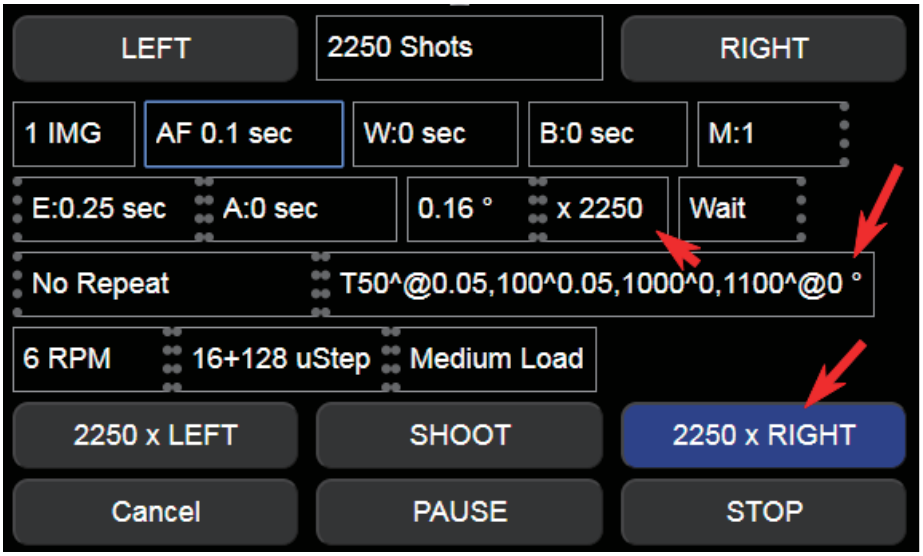
The system will stay 10 seconds in the same position, then again after 100.

EXAMPLE 6

The time-lapse list starting with T has to be entered selecting *Dual*, and let the IP unchanged, then enter:

```
T50^@0.05,100^0.05,000^0,1100^@0
```

It should look like this:



Then click/tap on *[2550 x RIGHT]* button.

EXAMPLE 7: Loop

```
S=90, 1=0_0, =10(^3_30, =^3), =10(^-3_30, =^-3),
```

S=90, - start from **parked** position.

1=0_0, - first position is at =0_0

From the next position, we start a loop (round brackets) 10 times:

=10(^3_30,

which set H rotation interval at **30°** apart, and MECHA-V tilts **3°** from the previous position (specified by the **^** sign):

=^3),

In the loop, we have only the tilting of 3° for MECHA-V, and no changes for H interval.

The above loop repeats with **-3**° instead of 3° for MECHA-V:

=10(^-3_30, =^-3),

EXAMPLE 8

Script for 28mm on a full frame camera: two images 90° apart for both zenith and nadir. 2 rows of 10 shots at 45° above & below horizontal, and 12 shots around for the horizontal. 36 shots in total. Start in **parked** position (zenith), and end in **raised** position (nadir).

```
S=90, 1=0_0, =_30, 11=-45, =_36, 9=45, 10=90,
=_90, =-90_0, =_-90, =
```

S=90, - start position is **parked**.

1=0_0, - first shot is at **0,0** (no rotation).

=_30, - the next shot is at the same tilt, but 36° apart, and will keep going so

11=-45, - then at the **11th** shot from the previous change, the tilt becomes **-45** and

=_36, - the next shot is at the same tilt, but **36**° apart, and will keep going so

9=45, - then at the **9th** shot from the previous change, the tilt becomes **45**, and

10=90, - then at the **10th** shot from the previous change, the tilt becomes **90** for zenith, and

=_90, - the next shot is at the same tilt, but **90**° apart (the second zenith shot)

=-90_0, - then at the next shot, the tilt becomes **90** for nadir, and

=_-90, - the next shot is at the same tilt, but **90**° apart (the second nadir shot)

= end.

To end in **parked** position, as it started, in order to repeat it again and again:

```
S=90, 1=0_0, =_30, 11=-45, =_36, 9=45, 10=90,
=_90, =-90_0, =_-90, =90
```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Available via *More from Server..* :

DAC_28MM_FF_12_10_10_2Z_2N_Parked

When the camera is facing down, and the buttons and display are not accessible in this position, you can add P to the first shot:

1=P0_0,

MECHA will pause before the first shot, and will continue only after you click the *[PAUSE]* button in UI or press the button ▷ of MECHA-H.

This can be also helpful:

- Assign to button **[1]** of MECHA-V in *Row* of MECHA-V
  - *1 Shot* via custom
  - *0 IMG*
  - *90°*
  - *x 1*
  - then *[Save 1]*

In this way, with **[1]**▷ or **[1]**◁, you can rotate MECHA-V from **parked** to **level**, or to any position, with a step of 90°.

- Assign to button **[2]** of MECHA-V in *Row* of MECHA-V
  - *1 Shot* via custom
  - *0 IMG*
  - *45°*
  - *x 1*
  - then *[Save 2]*

In this way, with **[2]**▷ or **[2]**◁ you can rotate MECHA-V with a step of 45°.

How to set both MECHA and smartphone to have Internet access

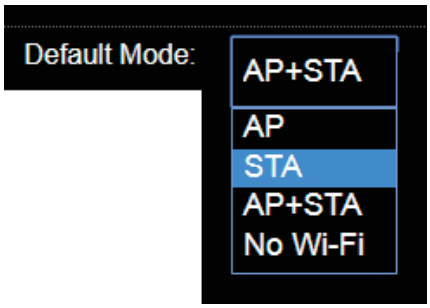
In this chapter, we will explain how to do that and, also, how to enable updates, and how to use your device for usual Internet browsing, at the same time.

First, set up a hot-spot on your device and name it **MECHA-PHONE**. Please refer to your device documentation about how to set up a hot-spot.

Suppose the hot-spot is disabled for the moment.

That hot-spot gives 192.168.43.xxx address to its clients.

1. Start paired MECHAs, MECHA-H first.
2. Connect to MECHA-H /config with your device, then set it in STA mode, choosing the STA option from the Default Mode select list.



   Scroll to STA Mode and enter the following values:

   - Static IP: 192.168.43.101
   - Subnet: 255.255.255.0
   - Gateway: 192.168.43.1
   - DNS: 8.8.8.8

3. Scroll to the bottom of the page and tap on *[Apply]* button.
4. Switch to config of MECHA-V (at the bottom of the page).

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5. Set it in STA mode and enter the following values in STA Mode fields:
    - Static IP: 192.168.43.102
    - Subnet: 255.255.255.0
    - Gateway: *192.168.43.1*
    - DNS: *8.8.8.8*
6. Tap on [*Apply]* button.
7. Tap on *[Connect to Wi-Fi]* at the bottom of the page, then enter **MECHA-PHONE** and the required password.
8. Switch to config of MECHA-H, tapping the button *[H MECHA / config]*, which should be visible at the bottom of the page.
9. Tap on *[Connect to Wi-Fi]* at the bottom of the page, then enter **MECHA-PHONE** and the required password.
10. Start MECHA-PHONE hot-spot.

MECHAs should connect to **MECHA-PHONE** after a little while.

As a result:

- We have the MECHAs connected to a SSID with Internet access, provided 3g, 4g, so on, is available.
- This enables downloads of presets from server, updates, and the use of your phone for Internet browsing as usual.
- MECHA-H-DAC will be accessible always at 192.168.43.101, and
- MECHA-V-DAC will be accessible always at 192.168.43.102

All you have to do is turn **MECHA-PHONE** hot-spot on when powering up MECHAs, and to maintain it on while using MECHAs, for example disable any automatic turn-OFF of hot-spot on phone/device.

Now, your device is connected to the Internet and to MECHAs, and you can download presets from server.

Other pairing methods

zLM – Automatic pairing using buttons

This is a zero learning method – **zero Learning MECHA** – for firmware **02011** or newer.

As you already know, we communicate with MECHA through a web interface, or using its own buttons, especially to enter some codes. We use the power button, ⏻, to enter 0 (zero) into the MECHA unit. Therefore, a code that starts with zero, we call it a power code.

In the **zLM** method of pairing, the first step is to create a code – a power code, and the second, to use this code to pair the MECHA units.

Step 1

Create an 8-digit code followed by the **greater-than sign**, as follows:

- the first digit must be **0** (zero)
- the next sequence of seven digits must be a combination of the digits **1**, **2**, and **3**, so that two identical digits are not in consecutive positions
- add the **greater-than sign** (>) at the end

Example:

0	1	2	3	1	2	3	1	>

Please do not use this code, because you will also use it as a password.

When the **power code** is entered in both MECHAs, these two MECHA units connect automatically and become a Dual Axis Combo (DAC).

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Step 2

1. Power off both MECHA units in case they are running. To do that, hold down the power button, ⏻, for 3 to 5 seconds.
2. Power up the horizontal MECHA (hold down the power button, ⏻, for 3 to 5 seconds). Wait until the splitting lights (-=-=-=-=) end and all LEDs are off. The unit powered up first, **rotates horizontally**, so we name it **MECHA-H**.
3. Enter the **power code** in the MECHA-H using the MECHA-H buttons. After entering the code, MECHA-H gives 5 beeps, if not muted in settings. That means "*I'm ready, another unit can pair to me*".
4. Power up the other MECHA using its power button, ⏻, and wait until splitting lights (-=-=-=-=) end and all LEDs are off. The second powered up unit **rotates vertically**, so we name it **MECHA-V**.

As an alternative to „Wait until splitting lights end", on steps 2 an 4, you can press button **[1]** when LEDs shows -=-=-=-=.

5. Enter the same **power code** in the MECHA-V using the buttons of MECHA-V. After entering the code, MECHA-V gives 2 beeps, if not muted in settings. That means "*I'm done, I'm the pair of MECHA-H*".

On successful pairing, MECHA-H has the middle LED on, and the MECHA-V has the two middle LEDs on. Otherwise, power down and up both MECHAs again, preferably power up the MECHA-H first.

Next step is to test the combo using MECHA's buttons, and see how it works.

Pairing PIN for more than 2 MECHAs

This section should be read after you read DAC test using the UI, where we explain how to access the user interface.

The Pairing PIN is an extra option you can use when the pairing method is **zLM** or **zLM 2**, to pair automatically at start more than 2 MECHAs connected to the same network or to the same hot-spot.

To set a pairing PIN number:

- Access the MECHA-H web interface, as shown in the chapter DAC test using the UI, and go to */config* page.
- Create a four-digit number - the pairing PIN - and enter this number in the field *Pairing PIN*.
- Then click on *[Apply]* button at the bottom of the page.

All MECHA units which have the same PIN, will be paired together.

All pairing methods and requirements presented in this guide are still valid.

Once paired, if the PIN is changed in MECHA-H, it will be automatically set the same in MECHA-V.

If you want to break the pairing, please set a different PIN in MECHA-V.

Temporary pairing

This type of pairing, or team, only lasts until the MECHA units are powered off. To temporary pair two MECHA units:

- Power up both MECHAs.
- Start team building entering the code **1212<** on horizontal MECHA. In other words, the unit on which you enter this code, will rotate horizontally.
- Confirm the participation in the team, entering the code **12<** on vertical MECHA. This unit will rotate vertically.

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Automatic pairing using the UI

Power up horizontal MECHA and press **[1]** when LEDs shows splitting lights (- = - = - = - =).

1. Connect to horizontal MECHA with MECHA SSID and password. Refer to **MECHA Controller C1 Manual** if needed. SSID and password are printed on the supplied QR code label. Record them if the label is not available.
2. Open **192.168.8.1/config**

User:	**admin**
Password:	**Mecha**

3. Select *Default Mode*: *[AP+STA]*
4. Select *[Apply]*
5. Power up vertical MECHA and press **[1]** when LEDs shows splitting lights (- = - = - = - =).
6. Connect to vertical MECHA with MECHA SSID and password.
7. Open **192.168.8.1/config**

User:	**admin**
Password:	**Mecha**

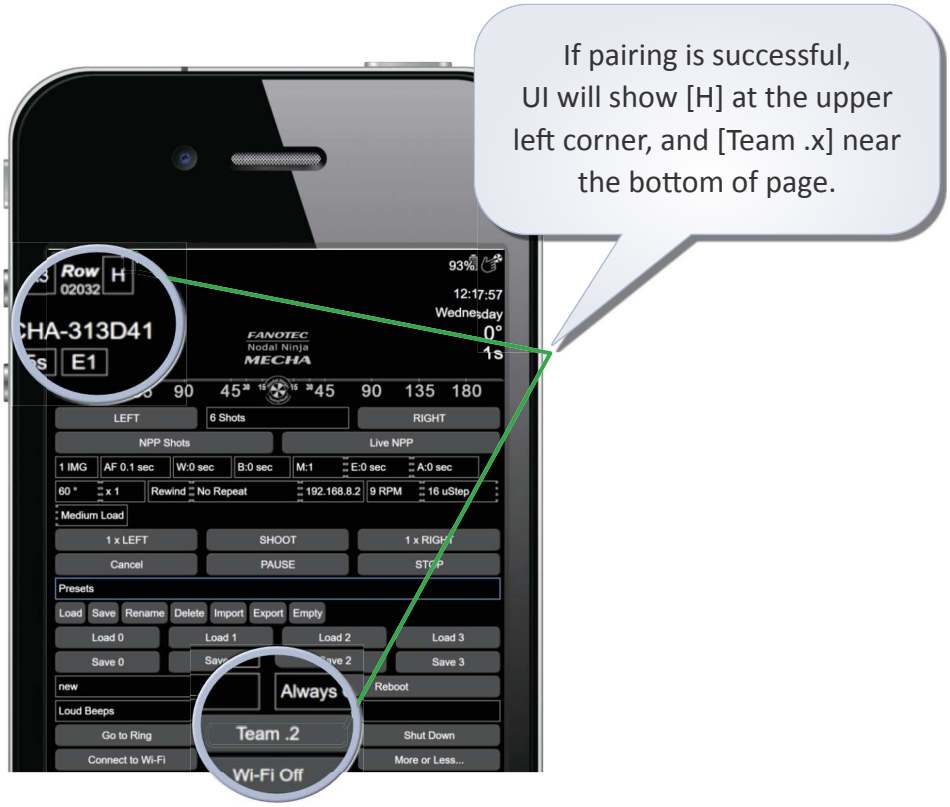
8. Select *Default Mode*: *[STA]*
9. Select *[Apply]*
10. Select *[Connect to Wi-Fi]*, enter SSID and password for horizontal MECHA.
11. Connect to horizontal MECHA again using MECHA SSID.
12. Access **192.168.8.1/row**
    If pairing is successful, UI will show *[H]* at the upper left corner and *[Team .x]* near the bottom of page, where *x* is the last part of the IP in *192.168.8.x.* The vertical MECHA can be accessed by selecting the *[H]* icon or by typing *192.168.8.x* on browser address. Vertical MECHA UI will show *[V]* at the upper left corner and *[Team]* near the bottom of page. Select *[V]* to go back to horizontal MECHA. Use 2 Tabs with MECHA IPs in browser to access both MECHAs quickly.

13. To get presets from server, select *[Connect to Wi-Fi]* and enter SSID and password for the Wi-Fi network with Internet access.

14. Select *[Presets],* load *[More from Server]* to get some presets to test. You can ask for presets for your specific setup at

    forum.nodalninja.com

15. Note that MECHA (accessed by *192.168.8.1*) is in AP mode. If you use the hot-spot/ Wi-Fi Tethering function on the same device to provide the Internet access, MECHA cannot connect to the Internet and *[More from Server]* is not available. You can use MECHA's STA_IP to access it. For example, on Android, STA_IP is *192.168.43.x,* where x can be *2-254*; on iPhone / iPad, STA_IP is *172.20.10.x*, where x can be *2-14.* Refer to **MECHA Controller C1 Manual** on STA mode for details.



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How to unpair MECHAs

Temporary Unpairing

Power up MECHA-V and **press MECHA-V button [1]** when LEDs show splitting lights (**- = - = - = - =**). It does not matter whether MECHA-H is on or off at this moment. The units remain unpaired until you power up the system again.

Permanent Unpairing

While the units are temporarily unpaired, access the MECHA-H configuration page, and select the option *AP* from the *Default Mode* list, then tap/click *[Apply]* button at the bottom of the configuration page.

Re-Pairing after Unpairing

Power up MECHA-V and **press MECHA-V button [2]** when LEDs show splitting lights (**- = - = - = - =**). It does not matter whether MECHA-H is on or off at this moment. When both units are powered up, they will pair automatically.

If a pairing PIN is set

If a pairing PIN is set, and you want to permanently break the pairing, please set a different PIN in MECHA-V.

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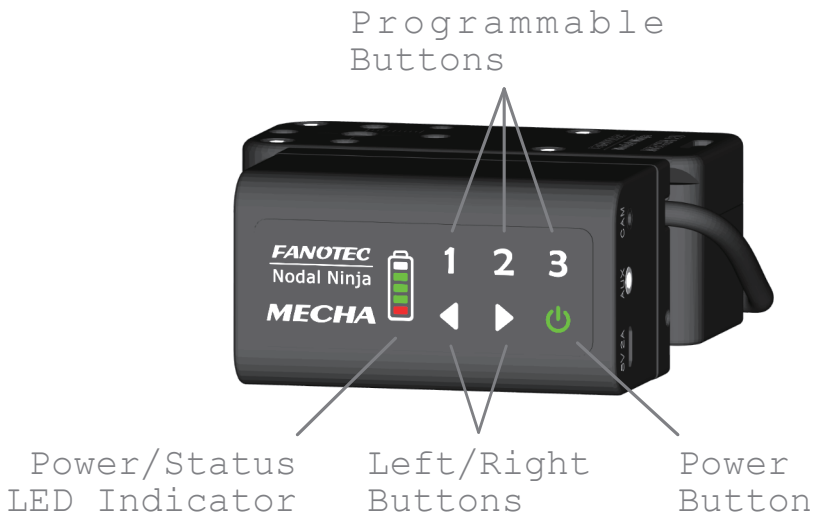
MECHA's Current Codes

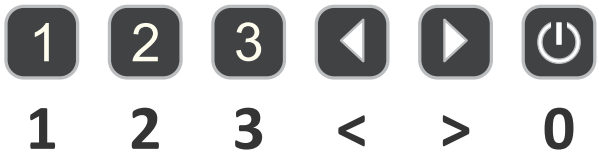


MECHA's buttons allow you to quickly perform some operations, and they can be an alternative to the web interface, in most cases.

MECHA has 5 LEDs which show you the result of the performed operation.

Pplease see the Table of equivalences: LEDs – characters at the beginning of this guide.
Power up the device by pressing the power button, ⏻, for a few seconds, and enter the code you need, using MECHA's buttons.

See below the equivalence of buttons and characters:



For example, to enter the code **1<**, use the buttons 1 and ◀.

This code executes the preset 1 to the left.

Any code ends with one of the signs **>** or **<**, which usually tells MECHA to execute the preset to the right or to the left.

See all standard current codes below.

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Current Codes list

1< or 1>
Executes the *Preset 1* to the left or to the right.
By default, *Preset 1* consists of 4 shots around, or it is the preset saved with the ***[Save1]*** UI button.

2< or 2>
Executes *Preset 2* to the left or to the right.
By default, *Preset 2* consists of 6 shots around, or it is the preset saved with the *[Save2]* UI button.

3< or 3>
Executes *Preset 3* to the left or to the right.
By default, *Preset 3* consists of 8 shots around, or it is the preset saved with the *[Save3]* UI button.

131< or 131>
Execute a test pano for a single MECHA, to the left or to the right (6 shots around).

132< or 132>
Execute a test pano for a single MECHA, to the left or to the right (12 shots around).

1312< or 1312>
Execute a test pano for MECHA DAC, to the left or to the right (12 shots around, 3 rows – at 0° and and at +/-45° – plus zenith and nadir). The code must be entered in MECHA-H, and the MECHA-V must be **parked** i.e. oriented upward, as for zenith photo.

1313< or 1313>
Same as 1312, but with MECHA-V in **horizontal** position. First time, please test the codes without camera mounted on the panohead. The tests can be stopped by pressing the power button, ⏻.

1321< or 1321>
Same as 1312, but with the MECHA-V in **raised** position. First time, please test the codes without camera mounted on the panohead. The tests can be stopped by pressing the power button, ⏻.

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1212<

Starts an assembly of a team of MECHAs, can be canceled or ended with the power button, ⏻, or *[Team]* button on its UI (user interface).
After 1212< code is entered, or after first tap/click on *[Team]* button in UI, the LEDs will show scanning for any MECHA willing to join the team and be controlled.
The MECHA where Team was started in UI or 1212< code was entered, becomes the main MECHA and will have control over other MECHAs.
To join any other MECHA in team, enter the 12< code on that MECHA.
The effect of joining by 12< should be instant and echoed by beeps in main MECHA. However, if nothing happens, the code can be entered again.
To stop the team assembly, either tap/click again on *[Team]* button in UI or press power button, ⏻, on main MECHA.
Regardless of being in a team or not, each MECHA still have its UI functional, further more, each MECHA can start its own team:
For example, with 5 MECHAs in network, 1 can assemble the 1,2,4 team and at the same time, 2 can assemble the 2,1,3,4 team, provided the other MECHAs confirm the participation.
For now, the control is limited to dual axis:
Main MECHA and the last MECHA joined with 12< , the dual axis control itself will be extended further.
Soon, the control will be extended to as many axis as MECHA team consists of.
As a note, the goal is assembly and save a team by MECHA IDs, independent of IP addresses and that will be achieved at some point.

12<

Confirms the participation in a MECHA team started by another main MECHA.
After entering the code, the unit will send its IP address to other MECHAs in the same network. On 1st MECHA, there is no need to enter the IP manually, except when you want to use a different 2nd MECHA in the network.
Team build started on one MECHA with *[Team]* or **1212<** code will automatically exit from the team building once a signal from another MECHA is received (after the **12<** confirmation on other MECHA), and LEDs will light accordingly.

121<

Shows the MECHA ID like '123ABC'.

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123<
Shows the entire MAC address like '123ABC123ABC'.

323<
Shows the Full IP address like '192.168.0.100'. To avoid confusion, the IP address is shown only once, then it automatically exits from IP address display.

321<
Shows the Last part of the IP address, starting with dot, like '.100'.
If '***AAA***' is shown, MECHA is in AP mode, and the IP address is 192.168.8.1
If ***!!!*** is shown, Wi-Fi is OFF.
If either '***.0***' or '***0.0.0.0***' is shown, MECHA isn't in AP mode, nor does it have an IP assigned. In which case, a re-start, then button **[1]** pressed 3 seconds at **-=-=-=** (splitting lights) will enable AP mode, and will allow to access the web interface through 192.168.8.1

13<
Shows the Battery percentage.

131313<
Reboot MECHA without power cycling it.
This is useful when you want MECHA to reboot (say, to enable Wi-Fi, or change the AP-STA mode, or re/un/pairing), without disengaging the motors. Thus, the camera will not move due to gravity, or other causes.

21<
Switches MECHA to or off pause mode, the same as clicking the *[PAUSE]* button on UI, or on IR Remote.

23<
Disables/Enables the motor.
UI *[Reboot]* command will be ignored if the motor is disabled.
When motor is disabled, the power LED will blink rarely, it blinks also in UI , and in UI "(o)" will be shown on top, for now.
This is useful to prevent MECHA turning on by accident while charging, for kids protection, or to simulate the use for learning purpose, saves energy and the battery can be charged faster.
There are other applications, not listed here.

231<

Everything OFF, for faster battery charge. First, plug the charger cable, then enter the code.
Press the power button, ⏻, to show/hide battery **level** on LEDs when charging.
If it's no power on charging cable, the code will be ignored.
If the code is executed, the LEDs will show charging, then the cable has to be unplugged and MECHA has to be powered-up again to go back to normal use.
Pressing other buttons than [p] will have no effect.
As an alternative, in UI */config* page, *When Charging* option should be *Turn OFF*.
This reduces the charging time to minimum, and is also recommended if MECHA is not intended to be used with charging cable inserted, to prevent accidental rotation of MECHA by UI commands, when charging.

232<

Disable/Enable all LEDs, useful during night photography.
As the power LED is off, don't forget the device turned on.
The LEDs will light however if buttons are pressed for entering a code, to show the result of a code, or for battery check.
It enhances the performance of MECHA DAC by using less RAM for communication.

12321<

Backlash compensation calibration.
After the code is entered, MECHA will turn slowly to the right, then power LED will start flashing.
After that, you have to press ⏻ when you see/feel the MECHA starts moving very slightly to the left.
You can use the viewfinder, LIVE view with zoom, other devices attached, like a laser pointer, so on, or simply feel by hand when that small movement begins.
At the end, the LEDs will show, say, ":24", where 24 is the new calibration factor (it should be around this value).
You can repeat the code if you want to do it better or you have more precise ways to determine the small movement.
You can cancel the procedure with any other button when the power button, ⏻, flashes, or press ⏻ right after it starts to flash, to have no compensation at all, or it will time-out in 5 minutes if no buttons are pressed.

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In the (far) future, might be a simple add on to be attached to AUX port to do this completely automatically.

TIP: If you have a R1 with camera in portrait mode, with grip up and no Live view, and you have to look through viewfinder to see when the small movement begins, you can look with the left eye, and so there is no need to close the right eye.

If the grip is mounted to the bottom of the camera, you can look with the right eye, and there is no need to close the left one.

This will make the process more bearable.

123123<

Speed calibration.
The procedure takes 1 hour and is silent, the motor isn't moving.
Please wait until MECHA turns OFF automatically, and don't use the web interface during this time.
This is a one-time procedure, which you can omit if you wish, as default factory calibration is good.
It cannot be canceled once started.

Both codes can be used only if they are absolutely necessary for your application. Both procedures save the results automatically.

The speed calibration makes the RPM value set in the interface as close as possible to the same calculated RPM value.

Backlash compensation is to compensate the backlash of the gear assembly, to have a better precision for left-right movements, like rewind to initial position for cable protection, or in case of partial panoramas and time-lapse.

The procedure can be repeated after a longer period of time, after gear wears.

If you hear or see a slight right-left movement when starting the unit, a compensation is set. Otherwise, the compensation is 0, or is not set.

3212<

Show the firmware version on LEDs, then **32123<** code can be used to update the firmware, provided MECHA has Internet access, or the Wi-Fi with Internet that MECHA was connected to before is on.

32123<

Updates the firmware, if possible.
To update the firmware using the code **32123<**, MECHA have to be in *STA* or *AP+STA* mode and connected to a Wi-Fi with Internet access, before entering the code. Depending on the *Default Mode*, it may be necessary to enable temporarily *STA* or *AP+STA* at start via buttons, then enter the **32123<** code. MECHA LEDs will show "**...**" if no update was found, or **!!!** if there is no Internet connection.

3212312<

Updates the firmware on both paired MECHAs, if there is a new one.

312123<

Update the firmware, using a hot-spot
with name MECHA-UPDATE and with password 87654321
which needs to be created and active when the code is entered.

31212<

The code must be entered in the horizontal unit, and it will re-update both MECHAs. The last update is performed again and it is checked if there is a new firmware, until is reached the latest firmware version.

312<

Like **31212<**, but only re-updates the unit where it is entered.

3231<

Code for testing the IR Remote. After the code is entered, MECHA will not execute the commands given by buttons. Instead, it will only beep and display the code of the button pressed, on LEDs (after the button is released), and over the battery symbol, in UI. To end the test, press the power button, ⏻, which flashes during the test.

2313<

Changes the sense of rotation when done manually using ◁▷ buttons.

The following three codes should match with the actual rotator connected.

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23131<
Sets E1 as preferred rotator.

23132<
Sets E2 as preferred rotator.

23121<
Sets P1 as preferred rotator.

231231231<
Factory reset. The code need to be entered twice:
enter **231231231<** then after LEDs stop lighting as **',',** (one green LED at the top, and one red LED at the bottom),
enter **231231231<** again.
The power LED will flash and needs to be pressed short.
If three exclamation marks - **!!!** - are displayed on LEDs, it means that the factory file is not found, and nothing is done.

Useful links:

https://www.nodalninja.com/Manuals/mecha-card.pdf

MECHA Quick Reference Card

https://www.nodalninja.com/manual

Quick reference guides and complete manuals.

https://www.youtube.com/user/Fanotec

Fanotec Youtube Channel

https://www.youtube.com/user/NodalNinja

Nodal Ninja Youtube Channel

https://forum.nodalninja.com/

Nodal Ninja's Panoramic Photography Forum

https://www.fanotec.com/

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FCC Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

-- Reorient or relocate the receiving antenna.

-- Increase the separation between the equipment and receiver.

-- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

-- Consult the dealer or an experienced radio/TV technician for help.

This device complies with FCC PART15B Rules. Operation is subject to the following two conditions:(1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

The device has been evaluated to meet general RF exposure requirement. The device can be used in portable exposure condition without restriction.