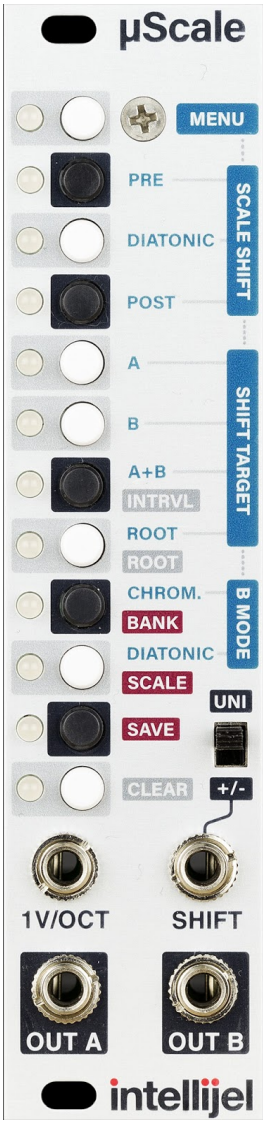
*µ*Scale

Intelligent Quantizer and Interval Generator



Manual Revision: 2018.09.13

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Technical Specifications

APPENDIX A - BANK PRESETS

Compliance

This device complies with Part 15 of the FCC 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 Intellijel Designs, Inc. could void the user's authority to operate the equipment.

Any digital equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

This device meets the requirements of the following standards and directives:

EMC: 2014/30/EU
EN55032:2015 ; EN55103-2:2009 (EN55024) ; EN61000-3-2 ; EN61000-3-3

Low Voltage: 2014/35/EU
EN 60065:2002+A1:2006+A11:2008+A2:2010+A12:2011

RoHS2: 2011/65/EU

WEEE: 2012/19/EU

Installation

Intellijel Eurorack modules are designed to be used with a Eurorack-compatible case and power supply. We recommend you use Intellijel cases and power supplies.

Before installing a new module in your case, you must ensure your power supply has a free power header and sufficient available capacity to power the module:

- Sum up the specified +12V current draw for all modules, including the new one. Do the same for the -12 V and +5V current draw. The current draw will be specified in the manufacturer's technical specifications for each module.
- Compare each of the sums to specifications for your case's power supply.
- Only proceed with installation if none of the values exceeds the power supply's specifications. Otherwise you must remove modules to free up capacity or upgrade your power supply.

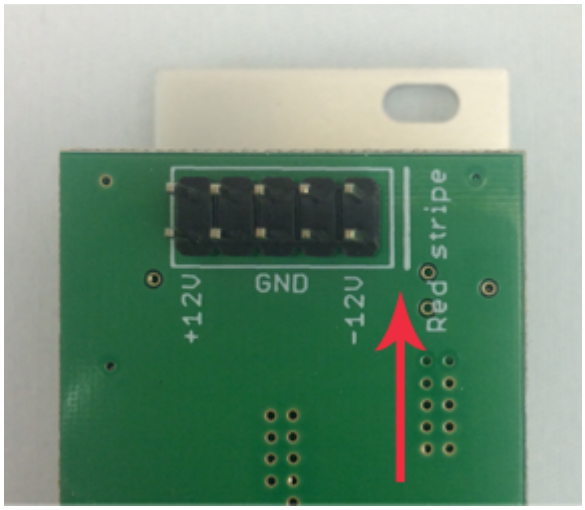
You will also need to ensure your case has enough free space (hp) to fit the new module. To prevent screws or other debris from falling into the case and shorting any electrical contacts, not leave gaps between adjacent modules, and cover all unused areas with blank panels. Similarly, do not use open frames or any other enclosure that exposes the backside of any module or the power distribution board.

You can use a tool like ModularGrid to assist in your planning. Failure to adequately power your modules may result in damage to your modules or power supply. If you are unsure, please contact us before proceeding.

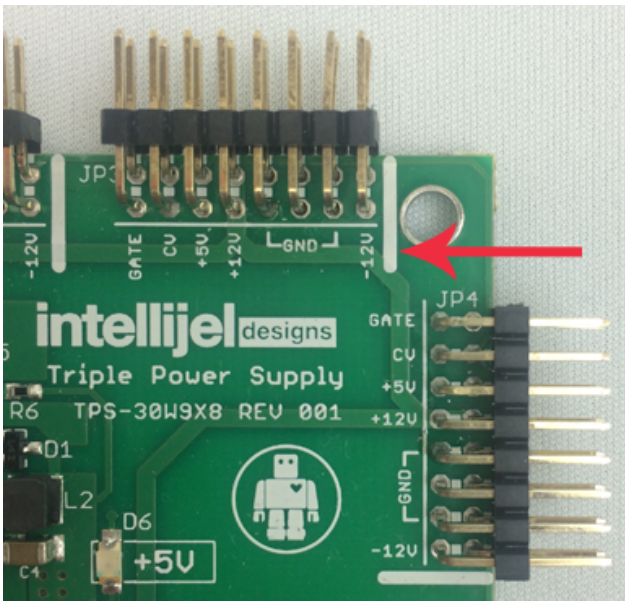
Installing Your Module

When installing or removing a module from your case always turn off the power to the case and disconnect the power cable. Failure to do so may result in serious injury or equipment damage.

Ensure the 10-pin connector on the power cable is connected correctly to the module before proceeding. The red stripe on the cable must line up with the -12V pins on the module's power connector. The pins are indicated with the label -12V, a white stripe next to the connector, the words "red stripe", or some combination of those indicators.



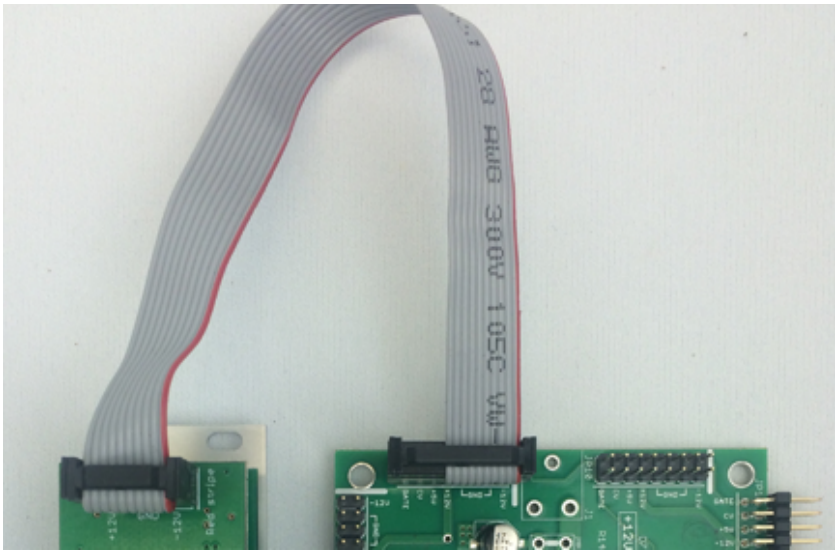
Most modules will come with the cable already connected but it is good to double check the orientation. Be aware that some modules may have headers that serve other purposes so ensure the cable is connected to the right one.



The other end of the cable, with a 16-pin connector, connects to the power bus board of your Eurorack case. Ensure the red stripe on the cable lines up with the -12V pins on the bus board. On Intellijel power supplies the pins are labelled with the label “-12V” and a thick white stripe:

If you are using another manufacturer’s power supply, check their documentation for instructions.

Once connected, the cabling between the module and power supply should resemble the picture below:



Before reconnecting power and turning on your modular system, double check that the ribbon cable is fully seated on both ends and that all the pins are correctly aligned. If the pins are misaligned in any direction or the ribbon is backwards you can cause damage to your module, power supply, or other modules.

After you have confirmed all the connections, you can reconnect the power cable and turn on your modular system. You should immediately check that all your modules have powered on and are functioning correctly. If you notice any anomalies, turn your system off right away and check your cabling again for mistakes.

Overview

The µScale is a 6 hp CV quantizer module. 1V/Oct 0-10 V range pitch CV signals are fed into the input marked **IN** and 0-10 V unipolar or ±5 V bipolar CV is fed into the **SHIFT** input to generate interesting and complex melodic CV out of the two outputs **OUT A** and **OUT B**. The buttons and tricolour LED's allow users to easily program in scales and manipulate how the shift values affect the generated CV voltages in a wide variety of useful combinations. With the µScale it is possible to transform analog voltage sources from sequencers, LFO's, controllers and CV generators into quantized musical values.

Features

- 12 buttons with dual color leds for selecting scale notes in real time (and visual feedback of quantizing).
- Processes 0-10 V (as 1 V/oct) in the **IN** input.
- Accepts 0-10 V or ±5 V on the **SHIFT** input for a shift range of ±12 semitones or ±12 scale degrees.
- Two 0-10 V outputs with 1 V/oct scaling.
- **OUT B** is a user selectable interval based on the root note of **OUT A**. this interval can be chromatic (fixed semitones) or diatonic (interval is within the current scale and the value is based on scale degrees). this interval can be a bipolar value of ±12.
- **SHIFT** has user selectable destinations of output A, B, A+B, or the scale root.
- **SHIFT** has user selectable modes of where shifting occurs: pre-scale, diatonic, or post-scale (key shifting).
- Menu for shifting the scale root manually.
- Special **Scale Select** mode allows the **SHIFT** input to select scales from the current bank (so 12 scales can be selected by CV).
- Can store 12 scales in 12 banks for a total of 144 different user scales.
- Module ships with 5 banks preloaded with scales (they can be erased by the user and reprogrammed).
- **PITCH** CV input with +/-0.0005 V accuracy.

Front Panel

Controls

1. **SHIFT Polarity Switch** - This switch alters the range of the **SHIFT** input. When set to **UNI** the input voltage is assumed to be unipolar with a range of 0 to 10 V. When set to **±5 V** it's assumed to be a bipolar signal with a range of -5 to 5 V.
2. **Scale Buttons** - The 12 scale buttons are used to alter the currently active scale as well as perform several additional functions. The details are described in the Usage section below.

Inputs & Outputs

A. **IN** - This input accepts 0-10 V. Connect the 1 V/Oct (or equivalent) voltage source here from things like a sequencer, keyboard/controller, offset generator etc.
B. **SHIFT** - This input accepts either 0-10 V or ±5 V signals depending on the position of the shift switch. Connect modulation sources such as a secondary sequencer output, LFO, offset generator, or keyboard.
C. **OUT A** - Pitch CV voltages in the range of 0-10 V and tuned to 1V / Oct CV. This output is the quantized version of the signal fed to the **IN** jack.
D. **OUT B** - Pitch CV voltages in the range of 0-10V and tuned to 1V/Oct. The **B** output voltages are intervals based on the **A** output. The amount of that interval and its harmonic relation to the root note on **A** depends on several configurable settings.

Usage

Active Scale

The µScale is real-time programmable, which means you can edit the scale while it is in the process of quantizing CV. To do this, simply click any of the 12 buttons which represent the keys of a 12 note keyboard where the top-most button is C and the bottom-most button is B. Adjacent to each button is a tricolour LED. In normal operation (i.e. while not in a submenu display) the notes of the scale are denoted by red LED's. The currently quantized note is shown as a green LED. So if you have a variable voltage source such as a sequencer output connected to **IN** and you have more than one note selected to be part of your scale, you should see the green LED lighting up at different positions of the scale to indicate the changing quantized values.

The scale you are editing is volatile and will not be recalled unless you save it to a bank and preset. Furthermore, if you want to make sure the scale is saved offline you must make sure to store the banks+presets to EEPROM .

Menus

There are seven menus accessible by pressing and holding the scale buttons for approximately 1 second:

MENU

Enters a menu for editing of three different parameters:

- Scale Shift (called Shift Type on some older panels): Pre-scale, Diatonic or Post-Scale
- Shift Target: **A**, **B, A+B** or **ROOT**
- B Mode: Chromatic or Diatonic

The current menu settings are denoted with three separate and different coloured LEDs. To exit the menu, make a selection or click the **MENU** button again. See the section on Shifting for details of how these parameters affect the quantizer operation.

INTRVL

Sets the interval value used by output B. The LED position and colour shows the current interval value. A green LED shows a positive value in the range of 1-12 (where position ‘C’ is 1 and ‘B’ is 12). To set a negative value in the range of -1 to -12 simply double click the equivalent positive value. (E.g. for an interval of -3 double click the ‘D’ key). Negative interval values are displayed

as a red LED. This interval is calculated in terms of fixed semitones (chromatic) or scale degrees (diatonic), depending on the option set in the **Scale Shift** menu.

ROOT

Shifts the scale forwards or backwards relative to its root note. The green LED indicates the current lowest note of the programmed scale relative to 'C'. So if a C# pentatonic scale is programmed (all the black keys) the root note would be the C#. Pressing the F key would then shift the entire scale two semitones upwards. This means the note A# (last note in the scale) would be shifted off the scale but wrapped around to the bottom as C. Technically the new scale root should be F but since the scale root is always calculated as the lowest note relative to C the new scale root will actually be indicated as C.

BANK

Selects one of 12 scale banks. The currently selected bank is indicated with a red LED if it is empty, or a yellow LED if it contains any scaled. Banks containing any saved scales are indicated by a green LED.

SCALE

Selects one of 12 scales from the current bank. The currently selected scale is indicated with a yellow LED. Stored scales are indicated with a green LED. Empty scale slots are indicated by the LED being turned off.

SAVE

Saves the current scale to one of 12 locations in the current bank. Empty locations are non-illuminated while used locations are indicated with a green LED.

CLEAR

Clears the currently active scale steps when pressed again. All other buttons will exit while doing nothing.

Special Functions (Long Hold)

Several functions are accessible by pressing and holding the following buttons for approximately 2 seconds:

Load from EEPROM (BANK Button):

Reloads all banks and settings that are stored in EEPROM non-volatile memory. Every time the *µ*Scale is powered on it automatically performs a load from EEPROM.

Save to EEPROM (SAVE Button)

Saves all stored scales/banks and settings to EEPROM non-volatile memory. If you do not do this, all edits and changes to banks, scales and settings will be lost when you power down the module.

Scale Select Mode (SCALE Button)

Enters a mode where the **SHIFT** input CV selects between the 12 scales in the current **BANK**. Scale editing becomes disabled and the main display will show the currently selected scale pattern in real time. The **ROOT**, **SCALE** and **SAVE** menus are all disabled in this mode but you can still choose different banks, edit the interval amount and make changes to **Scale Shift** although only **B MODE** has any effect. In order to edit the scales you must exit this mode by pressing and holding the **SCALE** button again.

If you have set the **SHIFT** setting to bipolar then positive values in the range of 0-5 V will select scales 7-12 in the current Bank while -5 V to 0 V will select scales 1-6.

Shifting

Holding the **MENU** button for one second enters a menu for editing the **SCALE SHIFT**, **SHIFT TARGET** and **B MODE** settings.

The incoming CV values at the **IN** jack are first quantized to a chromatic scale value and then quantized to the current active scale. All shifting is applied after the chromatic quantizing which means it starts with some note value in the 10 octave range. The CV values at the **SHIFT** jack are quantized to a value in the range of +/-12.

Pre-Scale

This type of shifting occurs after the chromatic quantizing but before the scale quantizing. What this means is that the CV value at **IN** is quantized, the **SHIFT** value is added to it, and then it is quantized to the current scale.

For example, if the incoming note was C2 and the shift value was 3, and the Shift Destination was A, then the resulting note would be C2 + 3 semitones = D#. This new value is then quantized to the current scale. So if the active scale is C major (which contains C,D,E,F,G,A,B)

then the final resulting note that will play out of **OUT A** is E2, the nearest note in the C major scale to D#, rounded up.

The interval value (generated at **OUT B**) uses the **A** value as its root, but uses the value before the shifting is added to it.

So in the above example if the interval value was '5' and its mode was 'Chromatic' then the note at **OUT B** would be C2 + 5 = F2 (not E2+5).

If the shift destination had been **B** instead of **A**, then **OUT A** would have been C2 (no change), but **OUT B** would be the sum of the chromatically quantized root note at **IN** (in this case C2), plus the shift amount (3), which would be quantized to the scale (resulting in a value of E2),and finally the interval value is added. (5). Therefore, (C2+3)+5=G2#.

If the destination had been **A+B** then the result would have been **OUT A** = E2 and **OUT B** = G2# (both got shifted).

Diatonic

Diatonic shifting occurs after both the chromatic and scale quantizing. This means that the shift amount represents the amount of degrees within the currently active scale. So a note value of C2 with a shift value of 3, destination of **A** and an active scale of C major would result in a shifted note at **OUT A** of F2 since this is three scale notes above C2 (remember the C major scale C,D,E,F,G,A,B where the distance between C and F is three scale degrees).

If the destination had been **B** then the **OUT A** would be unchanged (C2) but **OUT B** would be the diatonically shifted value of C2 (F2) plus the interval value (e.g. 5 semitones) which results in **OUT B** = F2+5 = A#2. If the destination had been **A+B** then **OUT A** = F2 and **OUT B** = A#2.

Post-Scale

Post-Scale shifting is the easiest to understand of all the shifting types. For this type, the shift value is simply added to the scaled note.

If the shift destination is **A**, the quantized note is C2, and the shift value is 4 then the resulting note of **OUT A** = C2 + 4 = E2. **OUT B** would be the unshifted note (C2) plus the interval value (e.g. 5) **OUT B** = C2 + 5 = F2.

If the destination is **B** then **OUT A** = C2 (no change) but **OUT B** = C2 + interval + shift = C2+4+5 = A2.

If destination is **A + B** then **OUT A** = E2 and **OUT B** = A2. Both are shifted by the same amount of semitones and can be considered to have changed keys by the amount of shifted semitones.

The **ROOT** destination is an exception. With this destination the Scale Shift type is irrelevant and changing those values will have no effect. Instead the shift value is applied to the entire active scale moving it forwards or backwards by the shift amount. When the scale is being shifted it maintains the interval relations between each scale step so that the result is that the root note of the scale is shifted.

It is recommended that you experiment with these different Scale Shift types and Shift Targets. You will find that small changes of settings can result in dramatic changes to the melodies generated.

Technical Specifications

Width	6 hp
Maximum Depth	24 mm
Current Draw	60 mA @ +12 V 7 mA @ -12 V

APPENDIX A - BANK PRESETS

The *µ*Scale ships with 5 banks pre-filLED with scales. The user is free to erase, modify and program their own scales/banks instead. These can serve as a starting point or provide inspiration on how to set up ones own set of banks

BANK1: MAJOR SCALES - Each of the 12 Major scales is stored at its respective root note. E.g. C Major is on Button#1 (C note), F Major on Button#6 (F note) etc.

BANK 2: NATURAL MINOR SCALES - Each of the 12 Natural Minor scales is stored at its respective root note. E.g. C Minor is on Button#1 (C note), F Minor on Button#6 (F note) etc.

BANK 3: HARMONIC MINOR SCALES - Each of the 12 Harmonic Minor scales is stored at its respective root note. E.g. C Minor is on Button#1 (C note), F Minor on Button#6 (F note) etc.

BANK 4: CHORDS IN Cmajor - The first seven scales are triads based off of each degree of the C Major scale. You can easily shift each one (use the ROOT function) and restore it in a different key. This is just an example of a bank that might be useful for something like SCALE SELECT MODE.

1. Cmaj
2. Dmin
3. Emin
4. Fmaj
5. Gmaj
6. Amin
7. Bdim
8. Cmaj7
9. Dmin7
10. Emin7
11. Fmaj7
12. Gmaj7

BANK 5: CHORDS IN Cminor

1.Cmin
2.Ddim
3.Ebmaj
4.Fmin
5.Gmin
6.Abmaj
7.Bbmaj

8.Cmin7
9.Dm7b5
10.Ebmaj7
11.Fmin7
12.Gmin7

BANK 11: SPECIAL SCALES (mostly in C) - You can use the ROOT function to shift these scales into another key.

1. Chromatic (all notes)
2. C Major Pentatonic
3. C Major Locrian
4. C Hungarian Minor
5. C Gypsy Minor
6. C Arabic Scale
7. C Phygian Dominant
8. C Octatonic
9. C Altered Dominant
10. Wholetone
11. Minor Pentatonic
12. Octave

BANK 12: CV UTILITY - This is a special set of scales that you can use to create a CV bar graph when in SCALE SELECT MODE Scale 1 has one note while each subsequent scale has an additional note stored right up to Scale 12 which has all 12 notes. The result is that a CV value of 0 (or -5 depending on the jumper setting on the PCB) will select the lowest scale and the highest CV value will select the highest scale. (See video demo on Intellijel Vimeo page or website)