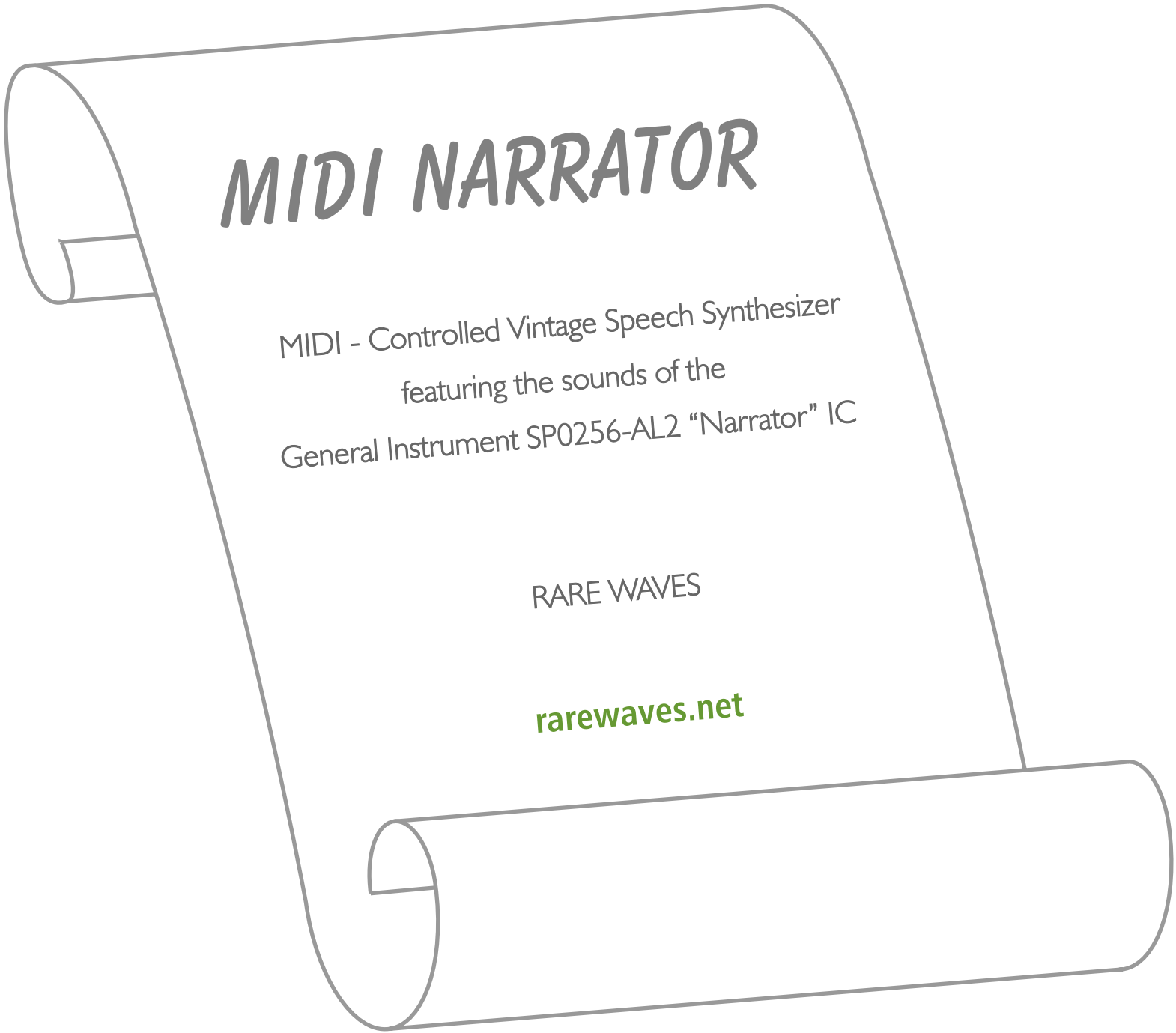

MIDI NARRATOR
MIDI - Controlled Vintage Speech Synthesizer
featuring the sounds of the
General Instrument SP0256-AL2 “Narrator” IC
RARE WAVES
rarewaves.net

OVERVIEW

MIDI Narrator is an electronic speech synthesizer for creative audio producers. It is available from **rarewaves.net** as a DIY kit (soldering required) or fully assembled.

MIDI Narrator uses the 1980's- era SP0256-AL2 speech chip from General Instrument corporation. The SP0256-AL2 was used in early home computers and classic arcade games for voice effects. It was also distributed to hobbyists by Radio Shack stores, branded as the ARCHER "SPO256 NARRATOR", Catalog Number 276-1784.

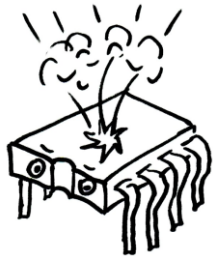
Although its sound quality is low-fi, monotonous, and unrealistic, it can be used to create intelligible speech in English and possibly other languages.

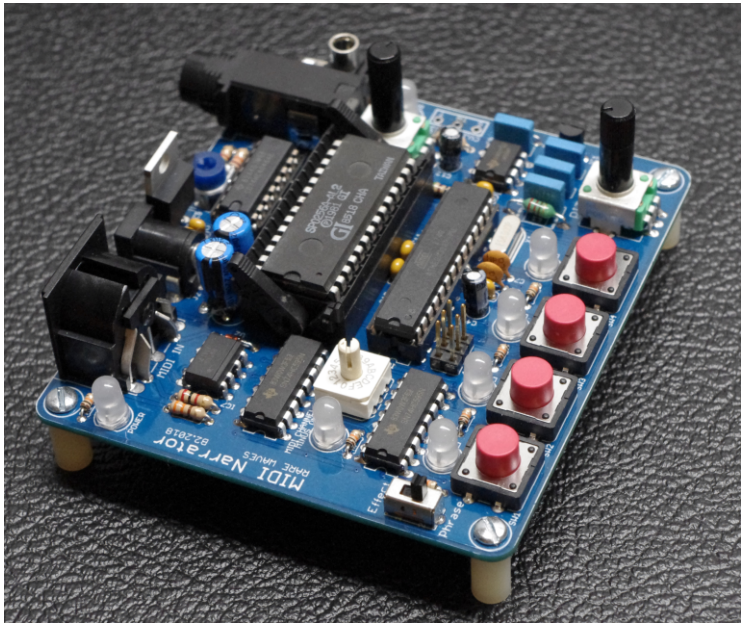
The SP0256-AL2 chips were popular enough that they're still available in limited quantities from specialist retailers and individual auction listings.

Original chips are imprinted "GI" for General Instrument corporation and have a 4-digit code such as 8518 to indicate the year and week of manufacture. Rare Waves only includes genuine, tested SP0256A-AL2 chips with this kit. There are many counterfeit versions for sale by online auction import sellers.

MIDI Narrator does not come with an enclosure or case. If you prefer yours to have an enclosure, feel free to modify it by replacing the on-board controls with panel mounted switches and potentiometers. Select the case of your choice, and create your own custom-built case mod.

MIDI Narrator was designed in 2018 by Eric Archer of Rare Waves LLC USA.
Limited technical support is available through rarewaves.net





FEATURES

Play all the SP0256-AL2 sounds in real time with a MIDI controller

1.5 octaves pitch control knob for voice expression and tone variation

Pitch bend, vibrato, and random pitch effects

Phrase player & recorder for sequencing words and short sentences

Stutter playback mode creates glitchy sound effects

Arpeggiator effect for looping allophone sequences from live MIDI

Modular synth compatible Gate Out and optional CV In modification

Produces many original sound effects with vintage 8-bit flavor!

ON-BOARD CONTROLS

Use the Effect / Phrase slide switch to change what the buttons do.

Phrase : Buttons 1-4 trigger the stored phrases, and the LED above the button lights up while the phrase is playing.
Effect : Buttons 1-4 select effects, and the LEDs indicate effect on/off status.

Use the Pitch knob to tune the voice, and the Volume knob sets the audio level.

POWER SUPPLY

An AC adapter is required with 9 volts DC output. The polarity is tip positive.

Don't use a power supply that is rated more than 12 volts DC. The unit is protected against reverse polarity.

Running it on a 9V battery is not recommended due to the high current consumption of the vintage speech IC. You will probably notice the SP0256-AL2 gets warm while its on.

MIDI CONNECTION

A standard MIDI cable is required. It does not take USB MIDI.

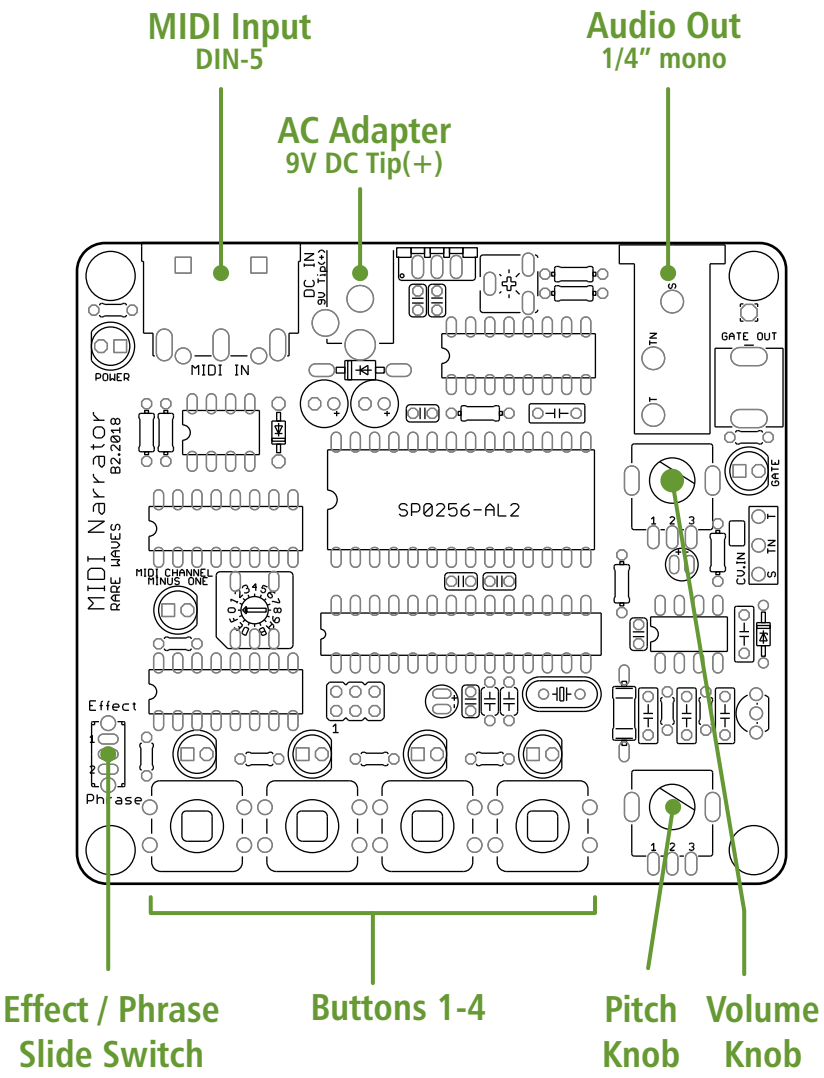
Basic setup: Connect your MIDI keyboard or pad controller to MIDI Narrator's input.
Advanced setup: Connect your MIDI controller to a computer with music production software. Then connect MIDI Out from the computer to MIDI Narrator's In port.

To have all of MIDI Narrator's sounds at your fingertips, we recommended using a keyboard controller with 60 keys or more, or an 8x8 pad MIDI controller. Or, open a piano roll editor window in your DAW and click the keyboard represented on the screen.

AUDIO OUTPUT

Connect MIDI Narrator's ¼" mono audio output to a line input on your audio mixer. You can also connect it to a keyboard amplifier or a powered speaker.

MIDI Narrator's audio output signal is somewhat quieter than most tabletop synthesizers. You'll probably need to add some gain to boost its output level where you want it.



MIDI CHANNEL

Set the MIDI receive channel by turning the rotary switch on MIDI Narrator.

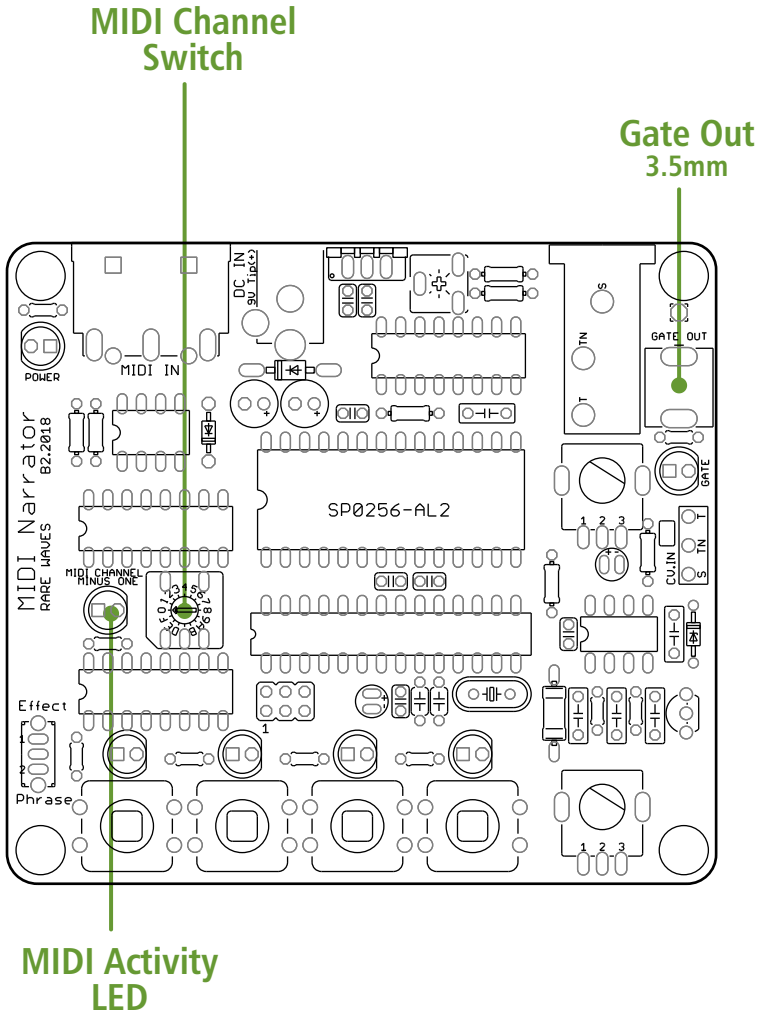
The rotary switch is very small, so you may need bright light to read it, and maybe even a magnifying lens. The shaft of the switch has a triangle molded into it. The triangle (not the slot!) points to the digits 0-9 and letters A-F on the switch. The unit's MIDI channel is equal to the switch position plus one. The table below will help you find the right setting.

MIDI Channel	Switch
1	0
2	1
3	2
4	3
5	4
6	5
7	6
8	7

MIDI Channel	Switch
9	8
10	9
11	A
12	B
13	C
14	D
15	E
16	F

The MIDI Activity LED next to the switch flickers whenever there is MIDI Note data on the selected channel.

If you can't see the tiny print on the MIDI Channel Switch, just play your MIDI controller while turning the rotary switch step by step and watching the MIDI Activity LED. It will eventually light up when you've found a MIDI channel with active data.



GATE OUTPUT

Eurorack-compatible Gate Out is available from the 3.5mm jack. Its output is +5V while the voice is speaking, and 0V when it is silent.

Gate Out is provided for experimental purposes. You can connect it to a modular synthesizer's envelope generator, step sequencer trigger, or any module that has a Gate In jack.

HOW TO MAKE IT TALK

The synthetic speech is created by sequencing short fragments of sound called allophones. The SP0256-AL2 chip gives you 59 allophones to work with, plus silent pauses of 5 different lengths. Most words are built by playing 3-8 allophones in order.

Before going any further, spend a few minutes reading the original data sheet for the SP0256-AL2. Pages 6-17 serve as a lesson and reference guide for how to create English words. Get acquainted with the names of the allophones, and read the examples of their use to form words.

MIDI Narrator lets you play the allophones live in real time by MIDI control. We suggest using your DAW software's piano roll edit window for sequencing words.

Use your MIDI controller to play MIDI Narrator while referring to the **allophone map PDF**. Play Middle C (MIDI Note #60). You should hear the allophone /YR/. It sounds like "Ear". Use the octave shift function on your MIDI controller to reach the lowest range of notes. For example, play note F-2 (MIDI Note #5). You should hear the allophone /OY/.

If your keyboard controller has fewer than 60 keys, you'll need to use its octave shift function to access the full allophone map.

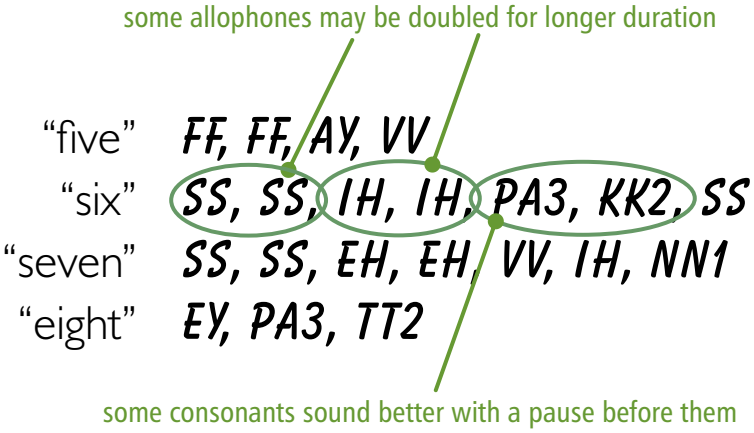
Notes #0-63 are equal to the SP0256-AL2's native decimal addresses for allophones
Notes #64 - 71 will trigger MIDI Narrator's 8 preset phrases (A1-A4, B1-B4)
Notes #72 - 127 are duplicates of the lower allophones

Expect trial and error while you learn the art of making words with the SP0256-AL2 allophones.

You may find sequences of allophones that have interesting rhythmic sound textures, despite not being actual words.

Note: the pitch of the voice is not controlled by MIDI keyboard.

"ein"	AY, NN1
"zwei"	ZZ, VV, AY
"drei"	DD2, RR2 ,AY
"vier"	FF, YY1, XR



PITCH CONTROL

MIDI Narrator's voice pitch is tuned manually using the PITCH potentiometer. The tuning range is about 2 octaves.

At the lowest pitch settings, the audio quality is degraded and a high pitched whining sound may be audible. MIDI Narrator's built-in 10 kHz low pass filter removes most of the high frequency digital junk.

PITCH EFFECTS

Vibrato Effect: frequency modulation at 7 Hz.
Random Pitch Effect: voice pitch jumps randomly at the beginning of each allophone.

Both effects can be used simultaneously. Note: If your unit has the optional CV In jack mod, these effects are unavailable while a patch cable is plugged in.

SINGING A TUNE

Sorry, there is no built-in feature to play a melody on a keyboard and have MIDI Narrator sing it in tune. But here are some suggestions...

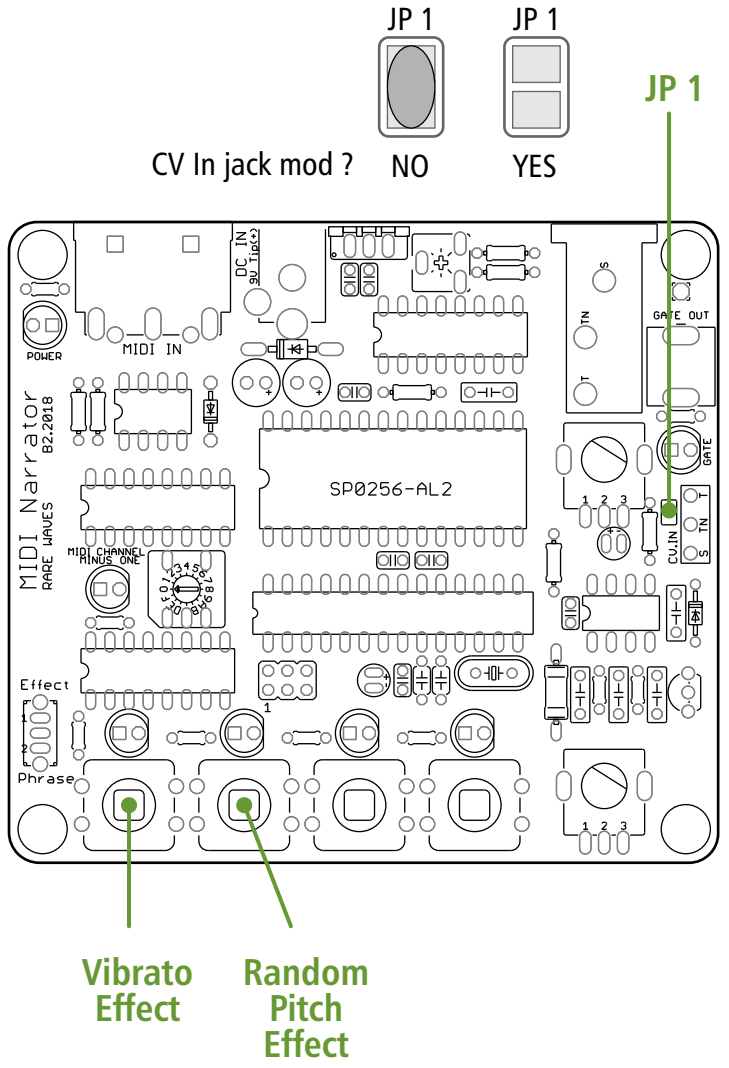
MIDI Narrator responds to pitch bend messages. You can use your DAW's MIDI editor to automate pitch bends so it follows a tune of your choice. But, the pitch bend range varies depending on the pitch knob setting. Once you've carefully edited your pitch bend automation points, avoid changing the pitch knob because it may not transpose accurately.

Add the optional CV In jack modification. It will give you analog voltage control of the voice pitch. But it does not conform to the 1 v/oct standard. That means in order for it to sing a melody, you'll have to tune each pitch by trial and error from an external controller. An analog step sequencer would be useful.

Or, if you have a MIDI pad controller, set up the pads so they send MIDI CC data to your MIDI-CV converter. Patch it to CV In. Preset the pads to the pitches you need by editing their controller values. Then you can make it sing live, tapping the pads to change the pitch while playing allophones with a keyboard.

Or, maybe your DAW has a vocal tuning plug-in that will let you craft a melody from a recording of MIDI Narrator's monotone voice.

Note: the JP1 solder jumper must be enabled if the CV In jack modification is absent.



NORMAL VS. STUTTER MODE

MIDI Narrator has two speaking modes. Normal and Stutter.

In Normal mode, each allophone is sustained for as long as a key is held down.

Stutter is activated by the Effect Button 3.

With Stutter on, each allophone is re-triggered (looped) for as long as the MIDI note is held. If you press multiple keys simultaneously, the sounds are sequenced like an arpeggiator. This lets it speak a word repeatedly by holding a chord. It is also useful for making purely rhythmic sounds and abstract sound textures.

With Stutter on, whenever external MIDI Clock is ON (press play on your DAW or controller), the preset phrases get a beat-synced variation of stutter effect: each allophone is automatically re-triggered until the next 1/8th note on the tempo grid. This gives the preset phrases a heavily chopped, drawn-out effect.

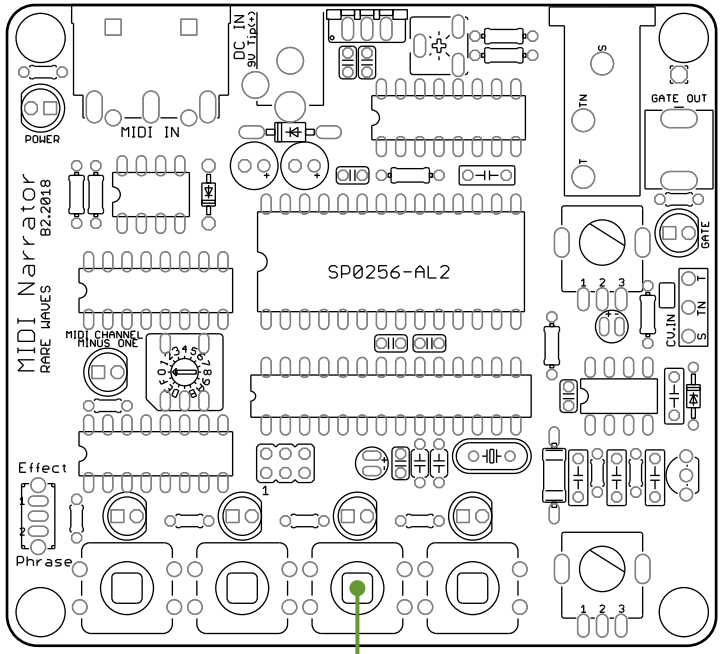
SPEECH BUFFER

The allophones vary in duration. The **allophone map PDF** lists the standard durations of the allophones in milliseconds. For example, /EH/ is short at 70ms, and /OY/ is long at 420ms.

In Normal speaking mode, MIDI Narrator buffers the speech data. If you send allophones faster than the voice can speak in real time, it will continue to sound after you stop pressing keys, until all the data you sent is done playing. The buffer is more noticeable when the pitch is low. At low pitch each allophone takes more time to complete, so the data tends to pile up, and the unit may continue sounding for several seconds after you stop pressing keys on the MIDI controller.

You don't need to be super accurate about the timing of your allophone data. For instance, if you send a sequence of 8 allophones at a very fast rate, such as 64th note grid, the results will probably be the same as if you had quantized those notes on a 16th note grid.

When sending MIDI sequences, pay attention to how the notes overlap because it can affect the results.



PHRASE PLAYBACK

Set the slide switch to PHRASE position. Phrase playback is triggered by Buttons 1-4. Phrase playback can also be triggered by MIDI Note Numbers #64-71.

MIDI Narrator has memory storage for 8 phrases, divided between Bank A and Bank B. The Effect 4 button switches between Bank A and Bank B.

Bank A : 47 allophones maximum per phrase. Suitable for short sentences
Bank B : 15 allophones maximum per phrase. Suitable for a few words.

PHRASE RECORDING

The default phrases can be replaced with your own. Your data will stay in memory when power is removed.

How to record a new phrase:

Select Bank A or B. Then set the slide switch to Phrase and decide which memory location you want to over-write. Press and hold the pushbutton. The LED above it will blink. Now play the allophones on your MIDI controller. They are recorded in step time, and any pauses or gaps will be eliminated. To program a silent pause in the phrase, use the PA1..PA5 allophones. If you make a mistake or don't want to save your new data, press any of the buttons that isn't blinking. To commit your new data to memory, press and hold the button that is blinking.

The phrase recorder ignores the rhythm timing of the data you enter. Therefore, for the most expressive control of the voice's cadence, we suggest playing it from the MIDI input. Use your DAW to tweak the rhythm of the allophones in your composition.

RESTORING THE DEFAULTS

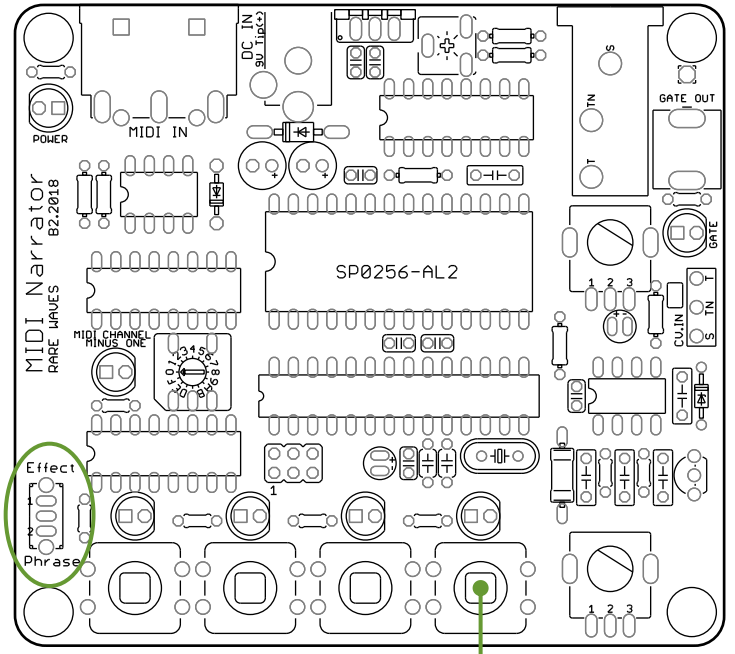
Holding any button during the first 5 seconds after power-on will restore the default phrases. To protect your data, avoid pressing the buttons until 5 seconds after applying power.

How to restore the default phrases:

Unplug the AC adapter cable from MIDI Narrator's DC In jack. Wait 5 seconds, then plug it back in. As soon as the lights come on, press and hold any of the pushbuttons for 5 seconds. The standard phrases will be restored. Any user-programmed phrases will be erased.

Table of MIDI-triggered phrase locations

MIDI Note #	Note Name	Phrase
64	E4	A1
65	F4	A2
66	F#4	A3
67	G4	A4
68	G#4	B1
69	A4	B2
70	A#4	B3
71	B4	B4



(Effect)

Phrase Bank A/B Select

LED Off = Bank A
LED On = Bank B

CV INPUT JACK MODIFICATION

You can add an optional control voltage (CV) input jack that lets you play the voice pitch with an analog controller.

The CV input works with voltages between 0..5 volts only. Voltages outside that range will be limited by internal circuitry.

CV In is not compatible with 1 v/oct standard. To play melody you must manually tune each note with an analog step sequencer or some other means.

The built in pitch effects are disabled whenever a patch cable is inserted to the CV In jack.

Adding the CV Input jack:

Obtain a 3.5mm mono jack (or ¼") with Tip, Tip Normal, and Ground terminals. Find the CV.IN pads on the PCB, located next to the volume knob. Solder your jack to these terminals with 3-conductor cable, referring to S=sleeve, TN=tip normal, T=tip. Finally, remove the solder jumper from JP1 to enable the CV In jack.

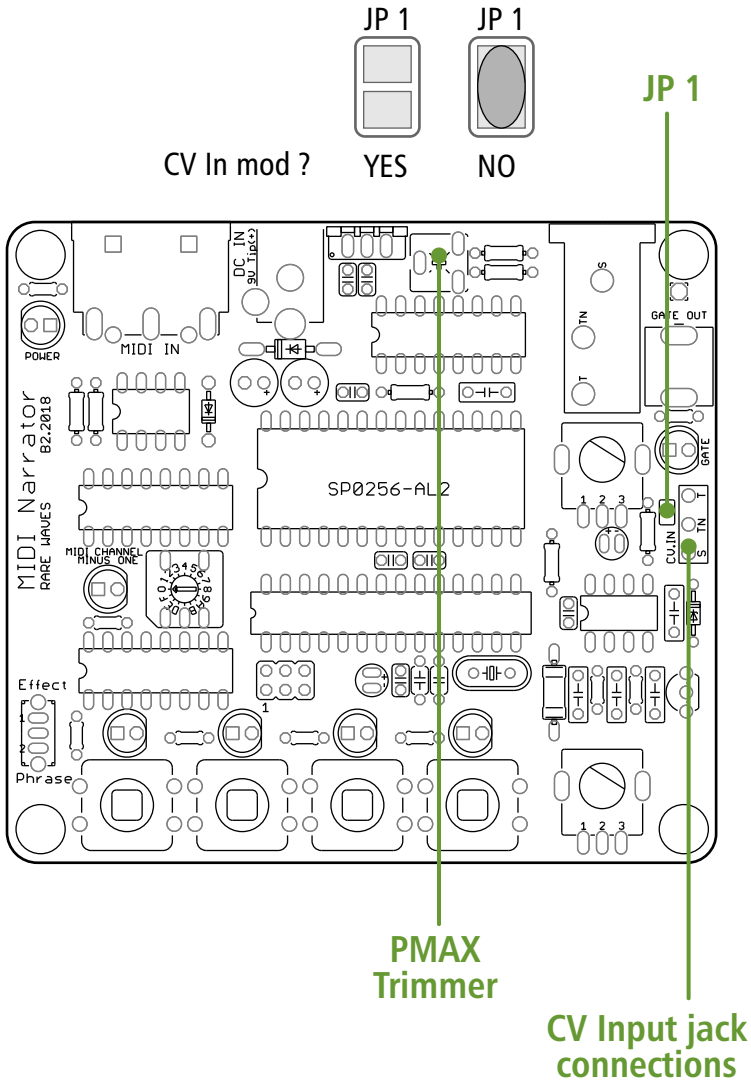
PMAX : PITCH LIMIT TRIMMER

MIDI Narrator controls the voice pitch by varying the clock frequency to the SP0256-AL2 chip. There is a limit to how high the voice can be tuned before the chip malfunctions.

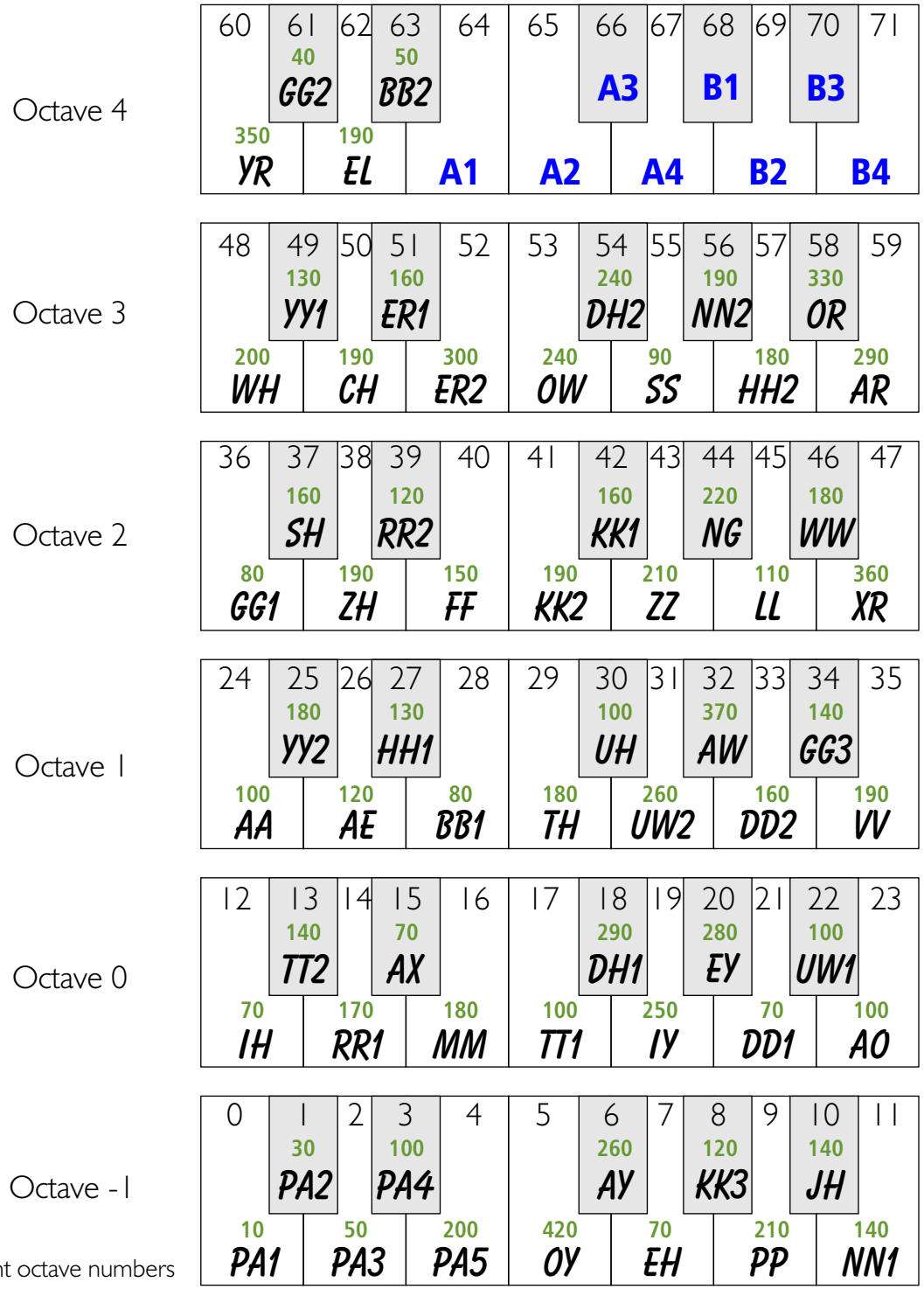
When the SP0256-AL2's clock is too fast, symptoms of malfunction are loud bursts of static-like noise. If this happens, the only remedy is to restart MIDI Narrator after unplugging its power supply.

If you find that the PITCH potentiometer causes malfunction at the high end of its range, adjust the PMAX trimmer to limit the pitch range.

Note: the JP1 solder jumper must be removed to enable the CV In jack modification.



middle C



Phrase Playback Trigger

MIDI Note # 64-67 : Bank A

MIDI Note # 68-71 : Bank B

MIDI note #

nominal allophone duration (ms)

ALLOPHONE NAME

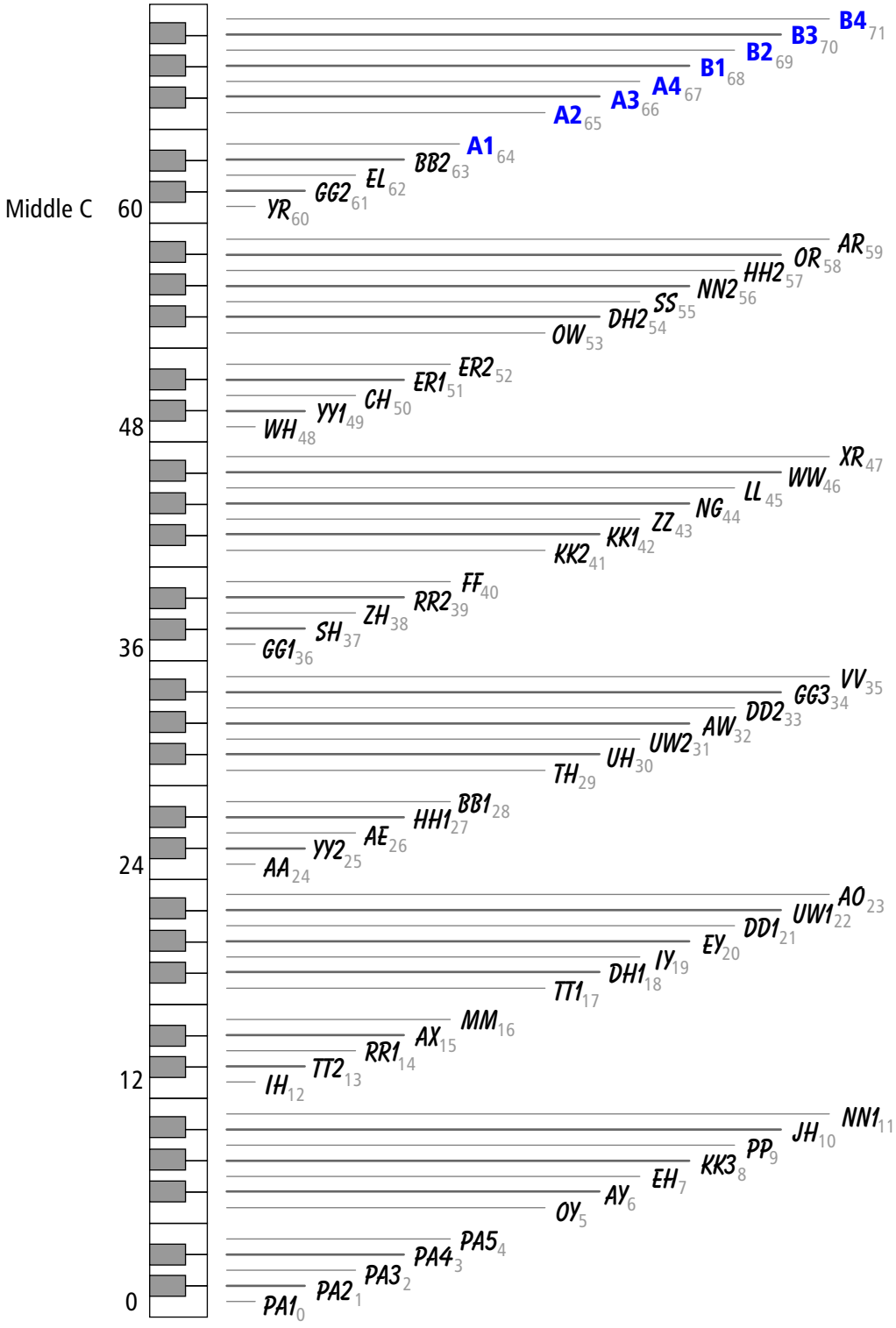
Your controller may use different octave numbers

56 NN2 190	57 HH2 180	58 OR 330	59 AR 290	60 YR 350	61 GG2 40	62 EL 190	63 BB2 50
48 WH 200	49 YY1 130	50 CH 190	51 ER1 160	52 ER2 300	53 OW 240	54 DH2 240	55 SS 90
40 FF 150	41 KK2 190	42 KK1 160	43 ZZ 210	44 NG 220	45 LL 110	46 WW 180	47 XR 360
32 AW 370	33 DD2 160	34 GG3 140	35 VV 190	36 GG1 80	37 SH 160	38 ZH 190	39 RR2 120
24 AA 100	25 YY2 180	26 AE 120	27 HH1 130	28 BB1 80	29 TH 180	30 UH 100	31 UW2 260
16 MM 180	17 TT1 100	18 DH1 290	19 IY 250	20 EY 280	21 DD1 70	22 UW1 100	23 AO 100
8 KK3 120	9 PP 210	10 JH 140	11 NN1 140	12 IH 70	13 TT2 140	14 RR1 170	15 AX 70
0 PA1 10	1 PA2 30	2 PA3 50	3 PA4 100	4 PA5 200	5 OY 420	6 AY 260	7 EH 70

MIDI note #

ALLOPHONE NAME

nominal allophone duration (ms)



Phrase Playback Triggers

MIDI Note # 64-67 : Bank A
MIDI Note # 68-71 : Bank B

Allophone	Sample words	Duration (ms)	Guideline	Category
AA	hot, pottery, cotton	100		Short Vowels
AE	hat, extract, acting	120		Short Vowels
AO	talking, song, aught	100		Short Vowels
AR	alarm, farm, alarm, garment	290		R-Colored Vowels
AW	out, sound, mouse, down	370		Long Vowels
AX	succeed, lapel, instruct	70		Short Vowels
AY	sky, kite, sky, mighty	260		Long Vowels
BB1	rib, fibber, bleed, brown	80	final position; between vowels; in clusters	Voiced Stops
BB2	beast, business	50	initial position before a vowel	Voiced Stops
CH	church, feature	190		Affricates
DD1	played, end, could	70	final position	Voiced Stops
DD2	do, down, drain	160	initial position; clusters	Voiced Stops
DH1	this, then, they	290	word-initial position	Voiced Fricatives
DH2	bathe, bathing, they	240	word-final and between vowels	Voiced Fricatives
EH	end, extent, gentlemen	70		Short Vowels
EL	saddle, little, angle, gentlemen	190		Long Vowels
ER1	fir, letter, funiture, interrupt	160		R-Colored Vowels
ER2	bird, fern, burn, fir	300	monosyllables	R-Colored Vowels
EY	beige, great, statetmen, tray	280		Long Vowels
FF	food	150	may be doubled for initial position and used singly in final position	Voiceless Fricatives
GG1	got	80	before high front vowels: YR, IY, IH, EY, EH, XR	Voiced Stops
GG2	guest, green, glue	40	before high back vowels: UW, UH, OW, OY, AX; and clusters	Voiced Stops
GG3	anger, peg, wig	140	before low vowels: AE, AW, AY, AR, AA, AO, OR, ER; and medial clusters and final position	Voiced Stops
HH1	he	130	before front vowels: YR, IY, IH, EY, EH, XR, AE	Voiceless Fricatives
HH2	hoe	180	before back vowels: UW, UH, OW, OY, AO, OR, AR	Voiceless Fricatives
IH	sit, sitting, stranded	70		Short Vowels
IY	see, treat, people, penny	250		Long Vowels
JH	dodge, judge, injure	140		Affricates
KK1	cute, clown, scream, can't	160	before front fowels: YR, IY, IH, EY, EH, XR, AY, AE, ER, AX; initial clusters	Voiceless Stops
KK2	speak, sky, task	190	final position final clusters	Voicelsss Stops
KK3	crane, quick, clown, scream, comb	120	before back vowels: UW, UH, OW, OY, OR, AR, AO; initial clusters	Voicelsss Stops
LL	lake, like, hello, steel	110		Resonants
MM	milk, alarm, ample	180		Nasal
NG	anchor, string, anger	220		Nasal
NN1	earn, thin	140	before front and central vowels: YR, IY, IH, EY, EH, XR, AE, ER, AX, AW, AY, US; final clusters	Nasal
NN2	no	190	before back vowels: UH, OW, OY, OR, AR, AA	Nasal
OR	store, fortune, adorn, store	330		R-Colored Vowels
OW	beau, zone, close, snow	240		Long Vowels
OY	boy, noise, toy, voice	420		Long Vowels
PA1	PAUSE	10	before BB, DD, GG, and JH	
PA2	PAUSE	30	before BB, DD, GG, and JH	
PA3	PAUSE	50	before PP, TT, KK and CH, and between words	
PA4	PAUSE	100	between clauses and sentences	
PA5	PAUSE	200	between clauses and sentences	
PP	pleasure, ample, trip, pow	210		Voiceless Stops
RR1	read, write, x-ray, rural	170	initial position	Resonants
RR2	brain, brown, crane, grease	120	initial clusters	Resonants
SH	ship, shirt, leash, nation	160		Voiceless Fricatives
SS	vest	90	may be doubled for initial position and used singly in final position	Voiceless Fricatives
TH	thin	180	may be doubled for initial position and used singly in final position	Voiceless Fricatives
TT1	tests, it, part	100	final clusters; before SS	Voiceless Stops
TT2	test, street, to	140	all other positions than TT1	Voiceless Stops
UH	book, cookie, full	100		Short Vowels
UW1	computer, to	100	after clusters with YY	Long Vowels
UW2	two, food	260	in monosyllabic words	Long Vowels
VV	vest, prove, even	190		Voiced Fricatives
WH	white, whim, twenty, whig	200		Voiceless Fricatives
WW	wool, we, warrant, linguist	180		Resonants
XR	repair, hair, declare, stare	360		R-Colored Vowels
YR	clear, hear, earring, irresponsible	350		R-Colored Vowels
YY1	cute, beauty, computer, yes	130	clusters	Resonants
YY2	yes, yarn, yo-yo	180	initial position	Resonants
ZH	beige, pleasure, azure	190		Voiced Fricatives
ZZ	zoo, phase	210		Voiced Fricatives