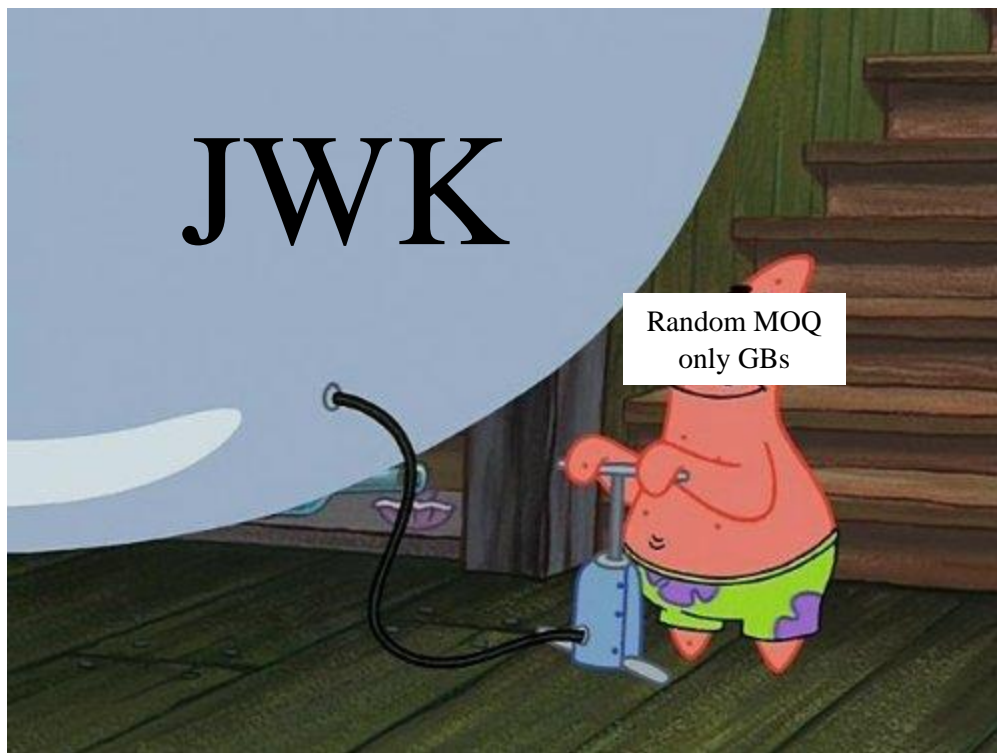


## Varmilo EC V2 Switch Review

-ThereminGoat, 10/25/2020

While I am relatively accustomed to what feels like a new switch ‘every single day’, the last few weeks have been especially fast in terms of announcements, interest checks, and social media posts by all of the various vendors out there. Among the long ass list of switches announced, Kailh Polias, Gateron Cap switches, DSA Magic Girl themed switches, Randomfrankp’s recolors for his custom NK65, and especially *Huano* recolors have all caught my attention. Now, I am fully aware that the vast majority of you reading this are not familiar with Huano, but this was a ‘knockoff Cherry clone’ brand that made switches long before I was around and effectively dropped off of the face of the earth a few years ago. Being among some of my first ‘unconventional’ switches that I was able to pick up for my collection, the resurfacing of that name alone has really put my collection and the last few years of work into perspective. As well, it has put into perspective the literal avalanche of switch releases over the last few months, and only makes me wonder even more if we are living in a switch bubble that will soon pop.



**Figure 1:** "Hey r/mk, I don't think this bubble can get much bigger." - Goat

Speaking of changes to the way that things are going, my website has received a bit of a behind the scenes shift that has struck me equally as much as one of my first Chinese-knockoff switch companies coming back from the dead. Roughly a few days after I posted my last article, the current largest source of traffic for the website switched from ‘direct’ to ‘search’, which means that my website is now generating more traffic from people searching my name, about the switches I review, or whatever associated content there is on Google, Bing, Ask Jeeves, or whatever your favorite search platform is. (I’m partial to Netscape, myself.) Alongside that transition, I’ve also seen an influx of newer folks in my DM’s over the past few months, asking more and more often for me to review and write on ‘beginner’ switches a bit. While I strongly dislike the concept that there is a thing such as ‘beginner’ switches, I recognize that a lot of my review articles tend to be focused on the ‘newest and brightest’ of recent switch sales which can be a bit off-putting to someone who has only ever vaguely heard of Cherry switches.

Thus, in regard to this influx of beginners and newer hobbyists to my website alike, I'm going to start to try and put up more reviews and scorecards on 'common' switches that high-end enthusiasts would brush over and/or not take entirely too seriously at first glance. Even though that will absolutely not change the scope of my articles nor will it change my pacing, tone, or structure, I want to assuage all of the more veteran readers out there by pointing out that I have already posted articles on Gateron KS-8 Yellows and Arctos switches. Clearly my intent is not to just flex the next best thing in switches. As well, I think even the most seasoned keyboard veteran could stand to re-learn about popular introductory options as they may have forgotten over the years how much they appreciated what are considered 'unconventional picks' for their builds now.

With these things in mind, I chose to reach out to Varmilo in order to see if I would be able to get a sample set of their newer EC V2 switches for a few reasons. First of all, the fact that these switches only come preinstalled in mostly bright, colorful, and large formfactor boards makes them an easy destination for folks newer to the hobby who don't feel like waiting until they're double their current age to build their board just because they *really* wanted GMK Hyperfuse. Secondly, the fact that I, as well as pretty much every enthusiast I know intimately, did not start out with a Varmilo board tells me that these are a fairly unexplored option and may be worth picking up as a gift for a beginner in the hobby. Thirdly, the few Varmilo EC V1 switches that I do have in my collection were a pain in the ass to get ahold of, so I am tried to make my life a bit easier for once by getting them from the company directly. Please feel free to go ahead and call me a shill all you'd like, I at least still paid for the shipping from China.

## Switch Background

Given the sort of 'beginner status' associated with Varmilo by many people that are far along into the hobby, its often a brand that is acknowledged in passing and then forgotten about altogether. Surprisingly to me, though, is that the company has had some digital footprint all the way back to 2014, in which they were selling prebuilt keyboards through platforms like Massdrop. While these earlier boards run by Varmilo featured Gateron or Cherry stock switches with relatively plain and unassuming color schemes, they've begun to develop lines of highly colorful, themed prebuilts in the last few years. In 2018, these themed boards began to see releases with Varmilo's own switches preinstalled, which were referred to as 'EC' switches. While many people would immediately jump to assuming that the 'EC' in these switches refers to an 'Electrocapacitive' style design, they would be correct in assuming the name though wrong in the likely next assumption that the switches are similar in appearance to Topre switches.

Featuring a rather unique internal setup, these seemingly normal, MX-style switches actually contain a different internal leaf structure that allows them to operate in a different way than normal MX style switches. Whereas 'normal' mechanical keyboard switches require the two leaves inside of the switch to contact and complete a circuit, in electrocapacitive designs no contact between the leaves occurs. Instead the electrical signal strength is measured as a result of proximity between one metal leaf and the other leaf, which is insulated, and the switch activates once a sufficient signal strength is read by the PCB. Seemingly overly complex for a mechanical keyboard switch, the components inside EC-style switches such as these theoretically don't suffer from as much degradation due to a lack of contact between the stems and leaves as well as have the ability to change actuation points depending on what the PCB underneath registers as a sufficient signal to produce a stroke. Thus, much like optical-style switches, these EC switches can't be swapped into a 'normal' mechanical keyboard kit due to the difference in PCB design. Even though these are presented in the similar, friendly looking format that we are used to, these actually represent one of a few fundamentally different underlying technologies out there that can function inside of a 'mechanical' keyboard switch.

The EC V1 switches that were featured in these early Varmilo boards came in Rose, Sakura, and Ivy varieties with the first two being linear and the latter one being a tactile switch. Seeing a fairly strong

adaptation of these switches into their sales and products, these switches remained the ‘go-to’ for Varmilo until August of 2020, when they announced a new line of the switches dubbed ‘EC V2s’. Featuring the original trio that was initially sold back in 2018\*, these V2s also saw the addition of another plant-themed linear switch under the name of ‘Daisy’, aptly named for their pale-yellow, Geekmaker-like colored stem. These switches debuted shortly thereafter in newly-themed keyboards through the various markets which Varmilos were sold, such as the Summit Fullsize keyboard, pictured below, which they sent to me even though I explicitly said that I had only wanted the switches.



**Figure 2:** Feel free to roast my deskmat game, I'm too poor from buying switches anyhow.

\*While these are currently on the market as per the publication of this article, the EC V2 Ivy switches are still under production, for some unstated reason, and will be released alongside the Sakura, Rose, and Daisy EC V2s sometime in the future.

## Varmilo EC V2 Switch Performances

Given that the three Varmilo EC V2 switches that I obtained are all linear switches with the only difference being related to spring weight, I'm going to discuss the performances for them as a collective rather than each switch as that would get a bit repetitive. They will, however, still be scored separately.

### Appearance

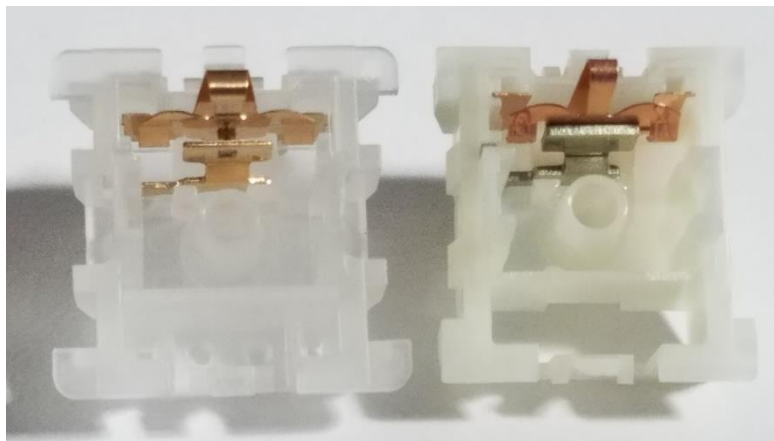
All of the Varmilo switches, EC V1 or V2, feature fairly similar designs with the exception of the color of the stems and the bottom housings. The transparent, clear top housings of the EC V2 switches are attached to a thin white and smooth bottom housings using a ‘winglatch’ style attachment similar to that of Kailh’s or Hako’s switches. The bottom housings on the EC V1s, though, feature a more solid, opaque white colored bottom and may have actually come from another manufacturer due to a difference in mold marking locations, though this merely speculation. While the mounting of these switches doesn’t necessarily matter due to their incompatibility with normal PCBs, these come in only plate mount, or 3-Pin, variety. The top housings, which could be used in frankenswitch mixing and matching, feature a unique ‘VARMILO’ nameplate as well as a fully open LED-bar allowing for nearly any configuration of standard keyboard LEDs to be used in conjunction with these top housings. The stems of these switches are colored based off of their respective plant name, as can be seen below in the following photo, with the Rose being a dark red color, the Sakura being a vibrant pink color, and the Daisy featuring a pale yellow

stem. The Ivy switch, which is not pictured, will feature a light-green colored stem similar in color to that of FEI Matcha switches (V1 or V2) and will otherwise be identical.

Taking a bit of a detour from the normal appearance of the switches to look at the internal components, you can see the electrocapacitive leaf setup (right) and how it differs slightly from a normal MX-style contact leaf setup (left). While these look similar in fashion, you'll notice a thicker, silver colored smaller leaf in the EC V2 switches, which is the insulated plate discussed above in the background section. In fact, its completely possible to modify normal contact leaf setups like the switch seen to the left into an electrocapacitive design such as the EC V2 on the right, though the usability of these will be marred by the fact that they likely won't line up with the same activation points established in the Varmilo PCBs. There is a fantastic writeup by Hasu on Geekhack demonstrating this exact modification, which can be found in the Further Reading section below.



**Figure 3:** Varmilo EC V2 switches.



**Figure 4:** Normal cross-point contact leaf (left) compared to electrocapacitive leaf (right).

### Push Feel

Honestly, for being a 'stock' option that many people may brush over, the first thing that jumps out from the push feel of the EC V2s is that these are surprisingly smooth switches. Sure, there is a slight bit of scratch to the stroke feel in all of the switches, but it is fairly uniform across the entirety of the stroke making it a bit more tolerable. As well, this scratch is only minorly more pronounced with the lightest spring weight option in the EC V2 Daisy (35g), as compared to the Sakuras and Roses. The bottoming out feeling of all of these switches, though, suffers a bit due to what I imagine is the thickness of the plastic used. While I described the bottom housings as seemingly 'thinly white' colored, the actual performance of these switches truly belays how thin the construction of the bottom housings is. Granted, even though these top housings still feel relatively light and plasticky along the same lines as some of the more recent options from JWK/Durock, they are still noticeably better in feel in the top out than the thin feeling bottoming out portion of the stroke.

Another interesting point to discuss here is a trend that I have seen across a lot of switches and have tried to discuss before but always seem to fall short of due to lack of comparable switches through

which to explain it. In my opinion, the higher the spring weight is in a linear switch within a reasonable range (roughly less than 90g of force), the more ‘solid’ the stroke, bottoming out, and topping out feel in general. While it may be entirely in my own head, this trend seems to be present across various brands and types of switches, and the Varmilo EC V2s are definitely not an exception to this. Comparing these switches down the line with the Daisy having a 35g spring, Sakuras having a 45g spring, and the Rose having a 55g spring, I absolutely feel as if there is marginally lesser wobble in both directions of the stem with each step up in terms of spring weight.

### Sound

Unlike normal switch reviews, where I don’t necessarily always have enough switches to test the sounds in a completed build, the fact that Varmilo was so kind in sending me a full Summit keyboard with EC V2 Sakura switches really let me develop a good understanding of how the sound of these switches work in hand as well as in the only boards that they are compatible with. Surprisingly, while these switches have a fairly strong mid to high pitched plasticky sound to match with their push feel, the sheer magnitude of noise of them is amplified several times over in the Varmilo keyboards – which I found quite surprising.

Keeping in mind the fact that all of the noises amplify significantly when in board, the in-hand bottoming and topping out noises of the switches are a bit sharply plasticky as described above. While it isn’t necessarily a bad thing for a linear switch to have a higher pitched noise with them, many beginners often seek out linear style switches over tactile or clicky switches assuming that they will be quieter when in use. Additionally, with increasing numbers of newcomers coming into the hobby via the way of videos and articles on things like TFue’s keyboard, the vast majority seem to be infatuated with deeper sounding, muted switches rather than loud, high pitched ones. Thus, to this end, while these switches aren’t necessarily bad for the sound that they produce, they simply don’t cut it contextually with respect to what their targeted audience seems to prefer these days.

### Wobble

Sandwiched between the surprisingly smooth stroke feel of these switches and their fairly jarring bottoming out sound, the wobble on these switches as a whole appears fairly expected for this caliber of switch. While there is absolutely no play in the top housings whatsoever, which is a fairly standard characteristic of most winglatch-style switches, there is a noticeable amount of wobble in the N/S and E/W directions of the stem. In fact, the wobble in the E/W direction appears slightly larger in all of the switches with it appearing to decrease with increasing spring weights.

### Other

While I’ve already internalized the idea that these switches can’t be used in normal builds due to their electrocapacitive internal setups, I find myself kind of wishing that Varmilo would release some ‘traditional contact’ style versions of these switches so that the community at large would get some more exposure to them. Of all of the Varmilo EC switches I have tried, though, this feeling is the strongest for the EC V2 Daisy switches, as they along with TTC Gold Pinks, have me very intrigued as to the future of the ‘super-low’ weighted linear realm.

## Comparison Notes to Other Notable Linear Switches

*Note* – These are not aimed at being comprehensive comparisons between all factors of these switches as this would simply be too long for this writeup. These are little notes of interest I generated when comparing these pieces to Varmilo EC V2s side by side.



**Figure 5:** Switches for comparison. (L-R, Top-Bot: Cherry MX Black, Alpaca V1, Gateron Milky Yellow, Tealio V2, C3 Tangerine V2 (62g), and Varmilo EC V1 Rose)

### Cherry MX Blacks

- The most immediately recognizable difference between the Varmilo EC V2s and a stock, as-bought Cherry MX Black is that that Blacks have a significantly greater amount of scratch to them. That being said, the lubrication and modification of MX Blacks, specifically, has been done enough over a long enough stretch of time that *somebody* out there can make these comparable in smoothness, and thus should not be held too strongly against them.
- While there are roughly similar magnitudes of N/S stem wobble between these switches and the EC V2s, the MX Blacks have noticeably lesser E/W stem wobble.
- The EC V2 Roses, in particular, have a fairly similar sounding bottoming out noise at slow, in-hand testing speeds as the MX Blacks. However, the sound of the EC V2s is much more ‘full-bodied’ compared to the relatively deep and flat sound of the MX Blacks.

### Alpaca V1s

- Surprisingly, the topping out noise of the Alpaca switches is quite higher pitched than that of any of the EC V2 switches. The most similar sounding of the EC V2s, though, are the Daisy switches which still have an audibly deeper topping out noise than the Alpacas.
- Being that the Alpacas are JWK/Durock made switches, the tolerances with respect to stem wobble even on older model switches is still leaps and bounds better than most companies, and Varmilo’s switches are no exception to this rule.
- I will say, though, that the smoothness in the stroke feel between the Alpaca V1s and the EC V2s is fairly comparable.

### Milky Gateron Yellows

- Comparing the sound of these as compared to the EC V2s is... difficult. The Milky Yellows have both a more muted and yet simultaneously snappier sound to their bottoming out as compared to the EC V2s.

- The wobble on these are fairly similar in magnitude to that of Cherry MX Blacks, and thus the Milky Yellows have a similar amount of N/S wobble and significantly lesser E/W wobble in the stem as compared to the Varmilo EC V2s.
- While there is a bit more noticeable scratch in the sound of the Gateron Milky Yellows, these feel only marginally scratchier than any of the EC V2s.

### Tealio V2

- Of all of the non-Varmilo switches on this comparison list, these are the switches that by far have the most similar magnitude of noise in the bottoming out and topping out sound. In fact, as you increase the activation speed of the Tealios, they start to quite resemble the sound of the Daisy and Sakura EC V2s.
- The Tealio V2 switches have noticeably less stem wobble than any of the EC V2s in respect to both the N/S and E/W directions.
- While there is a slight bit of scratch that is noticeable in the stroke feel of the Tealios as compared to the EC V2 switches, they feel pretty similar overall in terms of push feel smoothness.

### C3 Equalz Tangerine V2 (62g)

- Much like with the Milky Gateron Yellow switches, these have a slightly snappier sounding bottoming out noise than the EC V2s, though it's a lot closer to the sound of the Rose EC V2s than the Gateron switches could achieve.
- At slower activation speeds, the Tangerine V2s have a noticeably thinner topping out feeling and sound than that of the heavier EC V2s. It's most comparable to that of the Daisy EC V2s, which is strange given its similarity in sound to that of the heaviest EC V2 option in the Roses.
- Without much competition, the stem wobble on the Tangerine V2s is significantly lesser than that of any of the EC V2s.

### Varmilo Rose EC V1

- The first noticeably different feature of the EC V1s as compared to the V2s are the bottom housings. Not only are the bottom housings of the V1s thicker, they are an opaque white color and stamped in such a fashion to lead me to believe that these had a different mold than the V2s or even maybe a different manufacturer.
- The reason that I am leaning towards different manufacturer than molds, though, is that the V1 switches are noticeably scratchier in push feel and in sound compared to the V2 switches.
- As well, the thicker bottom housing in the EC V1 switches lends it to an ever so slightly deeper and base-shifted bottoming out sound than that of any of the EC V2s.

## Scores and Statistics

*Note* – These scores are not necessarily completely indicative of the nuanced review above. If you've skipped straight to this section, I can only recommend that you at least glance at the other sections above in order to get a stronger idea of my opinion about these switches.

Varmilo EC V2 Daisy			Varmilo EC V2 Sakura			Varmilo EC V2 Rose		
23	/35	Push Feel	23	/35	Push Feel	23	/35	Push Feel
13	/25	Wobble	13	/25	Wobble	14	/25	Wobble
5	/10	Sound	5	/10	Sound	5	/10	Sound
13	/20	Context	12	/20	Context	12	/20	Context
5	/10	Other	5	/10	Other	5	/10	Other
59	/100	<b>Total</b>	58	/100	<b>Total</b>	59	/100	<b>Total</b>

### Push Feel

The biggest benefit to the push feel scores for the three of these switches boils down simply to how smooth they are. While the only real issue affecting the push feel is the bottoming and topping out feelings, these are so prevalent relative to the smoothness that it's hard *not* to detract from their push feel scores because of this.

### Wobble

In a similar fashion to many 'beginner' switches out there, the EC V2s feature a likely noticeable amount of stem wobble in both the N/S and E/W directions, with the E/W direction being a hair larger in magnitude. As for the phenomena I described above in which lighter spring weights appear to tend to correlate to a more wobbly feeling stem, this is the reason that the scores for the Sakura and Daisy EC V2s are one point lower than that of the Roses.

### Sound

As discussed above, while the mid to high pitched sounding bottoming and topping out sound of these switches isn't necessarily bad for its own sake, the fact that these are so significantly louder and higher pitched than what is expected and seen in similar caliber linear switches is what ultimately detracts from the score of these switches the most.

### Context

Being a fundamentally different technology than most other keyboard switches out there currently, I find that electrocapacitive switches are contextually quite interesting to find as a fairly accessible, though slightly pricy 'beginner' option in keyboards. If Varmilo so chose, they really could take these up a step further in my opinion in terms of their performance as well as potential compatibility with other options in the hobby. Unlike the other switches, the Daisy EC V2s get a slight bit of a leg up in this category for the fact that they provide a fairly solid beginning option in the otherwise sparse super-lightweight linear option game.

### Other

Aside the interest I take in these switches as a result of the contextual aspect above, I think that these switches as a whole are a step back from the EC V1 switches though not entirely by much. My biggest reasoning that these are not scored higher is due to the fact they have an extremely narrow range of compatibility due to their electrocapacitive style.



## Statistics

Average Score			Varmilo EC V2s (D/S/R)		
25	/35	Push Feel	23/23/23	/35	Push Feel
14.8	/25	Wobble	13/13/14	/25	Wobble
6.3	/10	Sound	5/5/5	/10	Sound
11.9	/20	Context	13/12/12	/20	Context
6	/10	Other	5/5/5	/10	Other
64	/100	<b>Total</b>	59/58/59	/100	<b>Total</b>
Total Switches Ranked			29		
Total Linears Ranked			13		
Varmilo EC V2s Rank			20/23/20 Overall, 7/11/7 Linear		

## **Final Conclusions**

For what it was worth, I am extremely glad that I chose to reach out to Varmilo in order to get ahold of these switches for review. While they are not exactly usable outside of Varmilo branded boards, they still were an interesting dive into an aspect of the mechanical keyboard scene that I and many enthusiasts at my level don't really participate in anymore. As well, the chance to get to make a useful review article for beginners who haven't even purchased their own first board, much less are sure if they are quite ready to pay \$2,000 for an Iron165 on whatever 'Mech Market' is, is a refreshing one. These switches aren't exactly anything to write home about in terms of sheer performance level nor technical aspects, though to the average beginner, these certainly are not a bad steppingstone into the hobby. Even though the top housings and stems could potentially be used for frankenswitches by those more experienced users, the amount of winglatch options being pushed onto the market currently makes their usage by more seasoned enthusiasts likely rare at best. Ultimately, the use of these switches and their associated bright, colorful keyboards will likely continue to remain a beginner-oriented option so long as these remain the most modern of the Varmilo EC switch like. As these stand currently, though, I believe these are a fairly competitive entry level switch for beginners interested in linear switches, and especially lighter weight ones as spring weights like those seen in these switches are quite below the standard Cherry, Gateron, or JWK switch.

## Further Reading

Varmilo's Website

Link: <https://en.varmilo.com/keyboardproscenium/>

Wayback: <https://web.archive.org/web/20201025161253/https://en.varmilo.com/keyboardproscenium/>

Varmilo's Instagram

Link: <https://www.instagram.com/varmilo/>

Varmilo's Facebook Page

Link: <https://www.facebook.com/varmilozhh>

Varmilo's Twitter Page

Link: [https://twitter.com/Varmilo\\_Zhh](https://twitter.com/Varmilo_Zhh)

Varmilo's YouTube Page

Link: <https://www.youtube.com/channel/UCAAdAPgmTDpCrR6VjNdWwOIA/videos>

Hasu's Varmilo EC Review and Modification Post

Link: <https://geekhack.org/index.php?topic=94239.0>

Wayback: <https://web.archive.org/web/20201025161600/https://geekhack.org/index.php?topic=94239.0>

Original Varmilo Massdrop Posting

Link: <https://archive.fo/Ge2fn>

Varmilo EC V1 Geekhack Review

Link: <https://geekhack.org/index.php?topic=95353.0>

Techradar's 'Review' of Varmilo's EC V2s

Link: <https://www.techradar.com/reviews/varmilo-keyboard-with-ec-switches-v2>

Wayback: <https://web.archive.org/web/20201025161815/https://www.techradar.com/reviews/varmilo-keyboard-with-ec-switches-v2>