**WP-34S Patch Descriptions**

This file describes some patches for the WP-34S firmware. These aren't bug fixes in any sense; rather, they are small pieces of code that change the behaviour of the calculator in various ways.

If you build your own firmware, each patch can be separately enabled by uncommenting the relevant #define statement in the trunk\features.h file and rebuilding the firmware. Otherwise I intend to make the firmware with all of these patches included available for download, and to keep this reasonably up-to-date! The link to this firmware is http://www.mediafire.com/folder/j7orcmm3okdk5/wp-34s\_patches

**NEW:** Some of the features can now be turned on or off by setting or clearing flags. This allows each user to customise the firmware including all the patches to their own tastes.

**NOTE:** the firmware starts off with flags I, J, and L cleared. To enable SIGFIG display mode, y-register display, or the Casio-style exponent key, these flags need to be set.

**Summary Table**

|  |  |  |  |
| --- | --- | --- | --- |
| **Patch** | **Brief Description** | **Enabled / disabled by . . .** | **Compiled in by uncommenting …** |
| Casio-style exponent key | Makes the EEX key enter PI if pressed at start of number entry | **Flag L** | #define INCLUDE\_EEX\_PI |
| *Casio-style fraction separator* | \_| instead of / | *Cannot be disabled if compiled in* | #define INCLUDE\_FRACTION\_SEPARATOR |
| *Double-dot fraction separator* | Makes “3..7” enter 3/7 instead of 3 0/7 | *Cannot be disabled if compiled in* | #define INCLUDE\_DOUBLEDOT\_FRACTIONS |
| SIGFIG display mode | Replaces ALL mode; displays numbers to fixed number of significant figures | **Flag I** | #define INCLUDE\_SIGFIG\_MODE |
| y-register display mode | Displays y-register contents in dot-matrix display | **Flag J** | #define INCLUDE\_YREG\_CODE |
| *Right-justify the exponent* | Pads the three-digit exponent with zeros | *Cannot be disabled if compiled in* | #define INCLUDE\_RIGHT\_EXP |

**More detailed descriptions**

**1.** *“Casio style” exponent key behaviour.*

* Turned on by uncommenting #define INCLUDE\_EEX\_PI
* **NEW:** this patch is enabled by setting FLAG L and disabled by clearing this flag.

On older Casio calculators pressing the exponent key when a number is expected – e.g., after an arithmetic operator – enters PI. Doing this on the WP-34S enters “1 EEX”; this behaviour is standard on HP machines. I prefer the Casio behaviour and so this patch emulates it on the WP-34S.

* Note: in program mode, this changed behaviour persists. This means that this patch will break code (written by you or a third party) that depends on the standard HP behaviour.
* Note 2: in program mode the key still displays as EEX even though it acts as PI.

**2.** *New “Casio style” fraction separator.*

* Turned on by uncommenting #define INCLUDE\_CASIO\_SEPARATOR
* If compiled into the firmware, this patch cannot be disabled.

This is simple: old 7-segment Casio calculators display fractions with \_| as the separator. I remember this from my childhood; this patch duplicates this on the WP-34S.

**3.** *Double-dot fraction entry.*

* Turned on by uncommenting #define INCLUDE\_DOUBLEDOT\_FRACTIONS
* If compiled into the firmware, this patch cannot be disabled.
* **NEW:** this patch causes fraction entry to be displayed differently. Pressing 3.4. puts 3 4/ in this display, rather than 3.4. . Pressing 3.. displays 3/ in the display, rather than the previous “comma” arrangement.

On the HP-32SII, pressing 3..7 enters the fraction 3/7. On the WP-34S, the same key sequence enters 3 0/7. The WP-34S behaviour is logical, but the HP behaviour is (to me) more convenient. This patch implements the double-dot entry on the WP-34S.

Note: once again, code that depends on the standard behaviour will be broken by this patch. Such code is unlikely to be common.

**4.** *A new display mode.*

* Turned on by uncommenting #define INCLUDE\_SIGFIG\_MODE
* **NEW:** this patch in enabled / disabled by setting or clearing FLAG J. Clearing this flag restores the normal behaviour of ALL mode.

The new mode (SIGFIG) takes over from the ALL display mode and can be activated by selecting ALL mode. SIGFIG mode formats numbers to a number of significant figures equal to one more than the argument to ALL. Unlike SCI or ENG mode, exponent notation is not used unless the number is outside the range 10-3 to 109, and by default trailing zeros are removed. So entering PI and successively multiplying it by 10 would display (in ALL 5 mode):

|  |  |
| --- | --- |
| 3.14159 | 3.14159 |
| 31.4149 | 0.314159 |
| 314.159 | 0.0314159 |
| 3,141.59 | 0.00314159 |
| 31,415.9 | 3.14159e-4 |
| 314,159 | 3.14159e-5 |
| 3,141,590 | Etc. |
| 31,415,900 |  |
| 314,159,000 |  |
| 3.14159e9 |  |

As a physics teacher I like this mode because the data that I am working with is normally correct to 4 significant figures at best. I could use SCI 5 instead but I like not being forced to look at trailing zeros or exponents unless I have to.

If you would prefer trailing zeros, setting user flag K will give them. So in mode ALL 2 the number “3” displays either as 3 or as 3.00 depending on the state of flag K.

Flag K has no effect when ALL 10 or ALL 11 are selected.

Note: SHOW and RND still work as expected.

**5.** *y-register displayed in dot matrix portion of the display.*

* Turned on by uncommenting #define INCLUDE\_YREG\_CODE
* **NEW:** this patch requires FLAG J to be set. If FLAG J is clear, the y-register is only displayed after complex operations.

This patch inspired the inclusion of the complex display mode on the WP-34S, and the improved code from that has been fed back into this. Briefly, it does what it says: instead of the y-register only being shown after a complex operation, it is visible at all times. (Almost. See below.)

* Alpha-mode display and messages are not affected.
* In integer mode the y-register is not displayed; mode and bit number (e.g., 2c64) are shown as normal.
* The y-register contents are displayed as a decimal number even when the main display is in fraction or HMS mode.
* Double precision mode is handled with four digits of exponent display, if needed, but for four digit exponents the “e” is replaced by a colon for positive exponents and removed completely for negative exponents.
* The y-register display replaces certain information normally displayed in that area – grad angle mode and date format mode. These annunciators are still visible when a function shift key is pressed.
* **NEW:** this patch now includes the previously separate "Smaller Hyphens" patch, which allows more digits to fit in the dot-matrix display.

**6.** *Right-justified exponent*

* Turned on by uncommenting #define INCLUDE\_RIGHT\_EXP
* If compiled in, this patch cannot be disabled.

This patch right-justifies the exponent display, including leading zeroes. So 2 × 10-3 appears as 2 -003, rather than as 2 -3. All my old LED calculators behave like this; I prefer it.