A Standard for Morse Timing Using the Farnsworth Technique

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In recent years there has been a renewed interest in Farnsworth timing of Morse transmissions. Farnsworth timing is defined as sending the characters at a faster speed than the words. For example, sending the characters at 20 WPM but adding enough time between them to slow down the rate to 10 WPM.

The problem in learning Morse is that at speeds above a few WPM, Morse is most easily read by ear when the characters are recognized rhythmically rather than by counting the dots and dashes. But the person just learning Morse starts at very slow speeds, where counting is easier than recognizing the slow rhythm of the characters. So in order to increase their ability to read Morse above a few words per minute, students are forced to shift from the counting mode to the rhythm recognition mode. This is probably the cause of the oft-mentioned "13-WPM barrier."

The idea behind the Farnsworth method is to eliminate the counting phase by sending the characters at a speed at which rhythm recognition is easy and counting is not. This forces the student to learn the rhythms. Initially, the

The ARRL Morse Transmission Timing Standard

1. General

This standard is motivated by recent changes in the systems used to generate Morse text for ARRL.

1.1 Scope

This standard defines the timing parameters used for all ARRL Morse training materials, including code-practice tapes, code tests and W1AW Morse transmissions.

2. Timing

At speeds of 18 WPM and above, standard timing specified in 2.1 will be used. At speeds below 18 WPM, Farnsworth timing specified in 2.2 will be used.

2.1 Standard timing

Standard timing is as follows:

The period of a single *dot* is one *unit*, measured in seconds.

A *dash* is a period of three units.

A period of one unit separates each *element* (dot or dash) within a character.

A period of three units separates each character within a word. A period of seven units separates each word.

For purposes of specifying code speed, the "PARIS" 50-unit standard is used.[1] From that standard, the following relationship is derived:

$$u = \frac{1.2}{c}$$

where:

u = period of one unit, in seconds

c = speed of transmission, in words per minute (WPM)

2.2 Farnsworth timing

At speeds below 18 WPM, characters are sent using 18-WPM timing, but with extra delay added between characters and words to produce an overall lower speed.

Speeds are specified as s/c, where *s* is the overall transmission speed and *c* is character speed. For example, a 5-WPM transmission sent with 18-WPM characters is specified as 5/18 speed.

The character timing used is as specified in 2.1 (above), using the *unit*, *dot* and *dash* periods, as well as the one-unit interelement spacing. The adjustment to a lower speed is made by adding delay between characters and words. The added delays are constant for a given Farnsworth speed and will maintain the 3/7 ratio of character space to word space.

The added delays are calculated as follows:

$$t_a = \frac{60c - 37.2s}{sc}$$

$$t_c = \frac{3t_a}{19}$$

$$t_w = \frac{7t_a}{19}$$

where:

t_a = Total delay to add to the characters (31 units) of a standard 50-unit word, in seconds

[1]Notes appear on page 9.

rate of transmission is slowed (by the addition of time between characters) to allow the student to gradually build the skill of recognizing and writing the received text. The process by which the student recognizes the characters is never changed; he just gets better (faster) at doing so.

Recently, ARRL finished converting all of its Morse materials to Farnsworth timing. ARRL is using a standard of sending transmissions at an 18-WPM character rate. (Of course, at 18 WPM and faster speeds, ARRL transmissions revert to standard timing, since no extra time has to be inserted.) This standard applies to all code practice and test tapes, and to W1AW transmissions.

In implementing Morse generation here at ARRL, we ran across a problem: There is no standard for Farnsworth timing. In fact, we couldn't find any definitive specification for how Farnsworth timing is calculated. It's fine to say that you're going to transmit, for example, a 10-WPM text using 18-WPM characters, but exactly how much time needs to be added to the transmission, and where? The ARRL code tapes and W1AW transmissions are generated by computers, and you need a specific answer to that question to write the computer program. Thus, the ARRL Morse transmission timing standard. Note that while ARRL has settled on a standard character speed of 18 WPM, this is not inherent in the idea of Farnsworth timing—any speed can be used.

Bits

Eastern VHF/UHF/SHF Conference

The 16th Annual Eastern VHF/UHF/SHF Conference will be held May 18-20, 1990, at Rivier College, Nashua, New Hampshire. The Conference is sponsored by the Northeast VHF Association.

Activities will include: Friday evening, informal gathering; Saturday, technical talks and "rap sessions" for each of the VHF/UHF bands, with a buffet-style banquet set for the evening followed by informal social activities; Sunday, antenna gain measurements and, weather permitting, a parking-lot swapfest.

Preregistration by May 14 is $23, at the door is $30. Saturday banquet cost is $20. For those wishing to attend *only* the Sunday activities, there will be a $5 registration fee.

For more information on the 16th Annual VHF/UHF/SHF Conference (and where to stay) please contact David Knight, KA1DT, 15 Oakdale Avenue, Nashua, NH 03062.

t_c = period between characters, in seconds
t_w = period between words, in seconds

Reference

[1] Hale, Bruce S., et al, *The 1989 ARRL Handbook for the Radio Amateur*, Newington, CT, ARRL, 1988, p 19-4.

APPENDIX A — DERIVATION OF TIMING EQUATIONS

A.1 Unit period

The unit period, *u*, is derived from the "PARIS" 50-unit standard as follows:

s words of 50-units each transmitted in the space of one minute are, by definition, being transmitted at *s* words per minute. Thus, units are occurring at 50*s* units per minute. The equation is:

$r = 50s$ where *r* is the rate in units/minute

To convert to units/second:

$$r\,\frac{\text{units}}{\text{min}} \times \frac{1\text{ min}}{60\text{ sec}} = \frac{r}{60} = \frac{50s}{60} = \frac{5s}{6}$$

the reciprocal gives *u*, the period of a unit in seconds:

$$u = \frac{6}{5s} = \frac{1.2}{s}$$

A.2 Farnsworth Timing Delays

The total delay added to each 50-unit word transmitted is the difference between the time it takes to send the word using standard timing at speed *s* (the overall speed) and the time it takes to send just the characters at speed *c* (the character speed). The time it takes to send a 50-unit word at speed *s* is, by definition:

$$t_{50} = 50 \times \frac{1.2}{s} \text{ seconds}$$

A standard 5-letter, 50-unit word contains 31 units of element and interelement spacing (that is, everything exclusive of intercharacter and interword spacing). The time it takes to send 31 units at speed *c* is:

$$t_{31} = 31 \times \frac{1.2}{c} = \frac{37.2}{c} \text{ seconds}$$

The difference between these two times at a given Farnsworth (s/c) speed is therefore:

$$t_a = \frac{60}{s} - \frac{37.2}{c}$$ where *s* and *c* are as defined in paragraph 2.2

or, by algebra:

$$t_a = \frac{60c - 37.2s}{sc}$$

In the transmitted word, this delay is divided among four intercharacter spaces, each t_c long, and one interword space t_w long, representing 19 total units (4 × 3 + 7 = 19). This gives the relationships for the division of t_a into these delays:

$$t_c = \frac{3t_a}{19} \text{ and } t_w = \frac{7t_a}{19}$$