

These notes list the changes between versions 2.1 and 2.2. They arise from the attempt to implement Richard Jennings' program for playing music which, not surprisingly, revealed a number of significant bugs.

Input paper tape code The translation of input tapes in ascii to EDSAC code has been completely re-written. Because EDSAC used 5-hole paper tape, which allows only 32 distinct characters, shift characters were used to extend the range to include letters. Program tapes are all in figure shift and the previous code handles this correctly, however data tapes could use letter shift and these were not translated properly.

In the new version input tape name is initially set to "", and error is reported if there is no tape in tape reader 1 at the start. Choosing a filename for the input tape sets the flag `new_input_tape` to `True`. There are two occasions when an input tape could be changed: during the manual wait before the program is run and during a 102 wait order. The flag is tested for a new input tape at these points and a translation done.

Main Store Addresses The main store indirect addressing and the 105 and 108 orders use wrong half of register. The implementation is internally consistent and hence passed simple tests but the explicit construction of indirect addresses or arithmetic on the `b` modifier would lead to incorrect results.

There was also an error when a computed main store address was not in the range 0 to 16383; the value is now taken modulo 16384.

Titles It is difficult to implement the title facility (`t directive`) when using the external assembler. Titles are ignored because the chars to be copied onto the output tape would need to be translated into EDSAC paper tape code; they will be translated back again when the output is displayed. In the earlier version titles in external assembler were not ignored and produced error messages.

Minor changes

- The `nn` prefix is now implemented correctly.
- The `use_main_store` flag is now initially set because the external assembler can refer to the store to put things like digit layout parameters into the reserved store.
- 120f16 order has been modified to include bit 23 as the phase of mains cycle so that the music program can measure the speed of the machine. (See notes on the music program for details.)

- The initial configuration of the peripherals has been changed to connect a device to both output channels. In fact output to both channels is always displayed but testing which channels are connected could lead to failure to send output.
- The order 120f0, which is not unambiguously defined in the programming manual, now lights the optional stop light and waits until the reset button is pressed.

Limitations of the External Assembler

The external assembler was written so that there was at least minimal support for programs that used the main store. Several features of the original assembler are not implemented including the loading of library programs from magnetic tape and the appending of data to the program tape after the program itself. Because of these limitations the sample programs "hello_world.edsc", "test_library.edsc" and "sqrt1000.edsc" will not run with the external assembler.

New Sample Program to compute π to 1000 figures Almost everyone knows about π and I thought that this demonstration program would appear impressive to lots of people. It uses a well known method based on series for arctangent:

$$\pi = 16 * \arctan(1/5) - 4 * \arctan(1/239)$$

and the arctangents are evaluated using the series

$$\arctan(x) = x - \frac{x^3}{3} + \frac{x^5}{5} - \frac{x^7}{7} \dots$$