

Digital Computer Laboratory
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SUBJECT: TOGGLE SWITCH INPUTS AND INDICATOR LIGHT OUTPUTS AS EXTERNAL UNITS

To: 6889 Engineers

From: Guy A. Young

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Abstract: Several methods of Toggle Switch Input to the computer and Indicator Light Output from the computer are discussed. The possibility of using magnetic cores in Toggle Switch Input is also considered.

1.0

Several possible modes of Toggle Switch Input (TSI) operation are listed below. With each mode is a list of equipment needed, and the sequence of operation. All of these modes operate on an "si (TSI)" and a "rd", as conventional input units. All operate through the IOE.

For matching purposes, some type of driving system will have to be added for each Toggle Switch Register. Three methods have been suggested. One method uses a Buffer Amplifier for each digit. One set of 16 amplifiers would serve all registers that are physically close together. Another method requires one gas tube for each digit of each register. These gas tubes have a duty cycle limitation of about one millisecond. A third method would use D.C. levels from the IOS. An amplifier would be required for each register. A gate for each digit would be placed physically close to IOR. (See Fig. 4.)

All of the modes use approximately the same amount of equipment. It is felt that either "mode 1" or "mode 4" is preferable. Both of these modes allow the computer to skip an order.

1.10

Mode 1 - TSI reads in information only if the word has been changed. If no information has been read in, the computer ships an order. (See Fig. 2.)

1.11 Operation

si - selects TSI. Reads word into IOR if the word has been changed.

rd - if word has been changed, reads contents of IOR to AQ.

1.12 Equipment (for each TSI register)

1. One 16-digit toggle switch register
2. Three gates
3. One flip-flop
4. One push button synchronizing gate

It may be possible to use one synchronizing gate for several registers. The register could be selected with a toggle switch.

No changes would be required in the IOE except those contemplated for magnetic drums.

It may be desirable to place a toggle switch between the synchronizing gate and the flip-flop. (See Fig. 2.) This would allow the operator to eliminate a word if new information were available before the old information had been accepted by the computer.

1.20

Mode 2 - TSI reads in only if the word has been changed. If the word has not been changed, "+0" is placed in AC on a "rd" order.

1.21 Operation

si - selects TSI. Reads word into IOR if word has been changed.

rd - reads contents of IOR into AC. If word has not been changed, AC contains "+0".

1.22 Equipment - same as listed in 1.12.

1.23 No changes would be required in the IOE.

1.30

Mode 3 - TSI reads in only if word has been changed. Computer waits until word has been changed.

1.31 Operation

si - selects TSI. Reads word into IOR.

rd - reads word into AC. Computer must wait until si has been completed.

1.32 Equipment - same as listed in 1.12.

1.33 This mode is undesirable since the operator could stop the computer for an indefinite length of time.

1.40

Mode 4 - TSI reads in unless word is being changed. If word is being changed, the computer ships an order. (See Fig. 1.)

1.41 Operation - similar to mode 1.

1.42 Equipment (for each TSI register).

1. One 16-digit toggle switch register
2. Three gates
3. One flip-flop
4. One toggle switch

1.43 No changes would be required in the IOE except those contemplated for magnetic drums.

1.50

Mode 5 - TSI reads in unless word is being changed. If word is being changed, a "rd" will put "+0" in AC.

1.51 Operation - similar to mode 2.

1.52 Equipment - same as listed in 1.42.

1.53 No changes would be required in IOE.

1.60

Mode 6 - TSI reads in unless word is being changed. Computer waits while word is being changed.

1.61 Operation - similar to mode 3.

1.62 Equipment - same as listed in 1.42.

1.63 Undesirable, since computer could be made to wait an indefinite length of time.

1.70

Mode 7 - Computer always reads in. Two toggle switch registers could be used. The operator sets one while the computer reads in the other.

1.71 Operation

si - selects TSI. Reads word into IOR.

rd - reads word from IOR to AC.

1.72 Equipment (for each TSI register)

1. Two 16-digit toggle switch registers
2. Three gates
3. One flip-flop
4. One toggle switch

1.73 No changes would be required in IOE.

1.80

Mode 8 - Computer always reads in. The operator indicates, with a light gun for example, that TSI is ready to be read in. (See Fig. 3.)

1.81 Operation - same as mode 7.

1.82 Equipment (for each TSI register)

1. One 16-digit toggle switch register
2. One gate

1.83 No changes would be required in IOE.

1.90

Several of these modes could be combined using the equipment listed in 1.12 plus a few switches.

2.0

The possibility of using cores has also been considered. It is felt that a core could not be used as a synchronizer. It could be used as a memory, however. It may be possible to replace the flip-flop of "mode 1" by a magnetic core. The feasibility of doing this depends on the "jitter" of the synchronizing generator and the set-up time of the core. If two flip-flops were used to obtain a synchronous "set" pulse, the core would serve no purpose.

Assuming that the circuit would operate, the use of a flip-flop still has two advantages over the use of a core. An indication that a word has been read into the computer is much more easily done with a flip-flop than with a magnetic core. Also, once a process has been started, it cannot be stopped if a magnetic core is used. This is not true if a flip-flop is used. For these reasons, the use of a flip-flop seems to be the best method.

3.0

A method has been suggested for recording information from the recorder into a neon light indicator. A gas tube would be required for each digit of each register. Two possible modes of operation are:

mode 1 - The computer clears the indicator when it is ready to read in a new word. (See Fig. 5.)

mode 2 - The operator clears the indicator when he has read the word.

3.10 "Mode 1" Operation

si - the indicator is released, and a delay for the relay (about 12ms delay) started. Completion clears interlock and allows "rc" to proceed.

rc - place word in IOR. IOC reset pulse sets indicator to the contents of IOR.

3.20 "Mode 2" Operation

si - if the operator has read the word, he presses a push button. The next "si" releases the indicator light and starts a delay. If the operator has not read the word, IOC will be set up to skip an order on the next "rc".

rc - either sets indicator to new word or skips an order in the program.

3.21 "Mode 2" requires two flip-flops and several gates.

3.30

For either indicator system, a gate in IOC is required to set IODC. "Mode 1" requires no additional changes in IOC. "Mode 2" requires no additional changes in IOC other than those contemplated for the magnetic drum.

The above indicator systems display information in octal form. It may be desirable to display information in decimal form. Available methods seem to be either too slow or too complex.

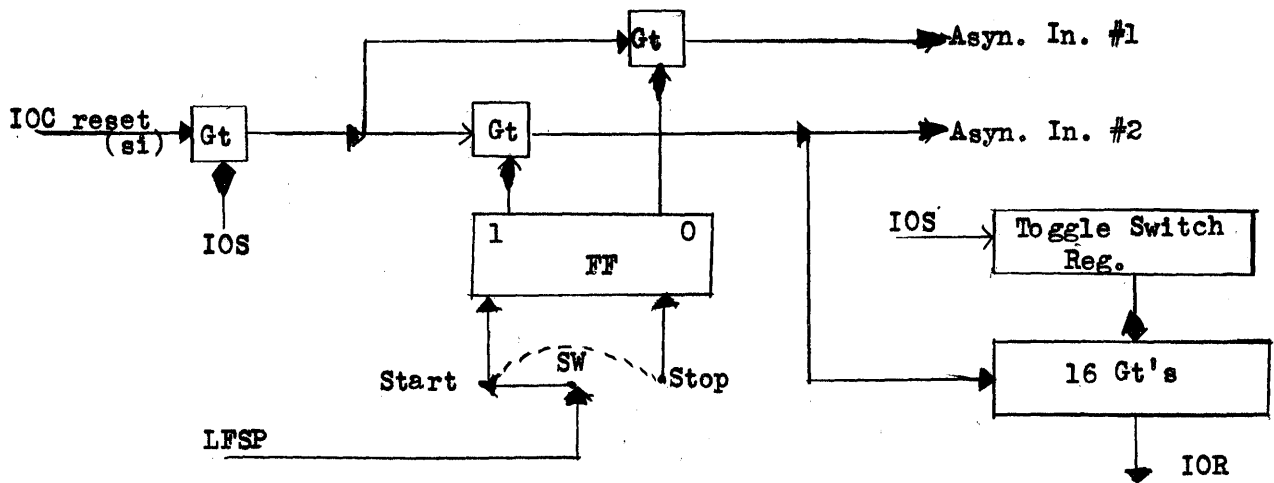
Signed Guy A. Young (BEM)
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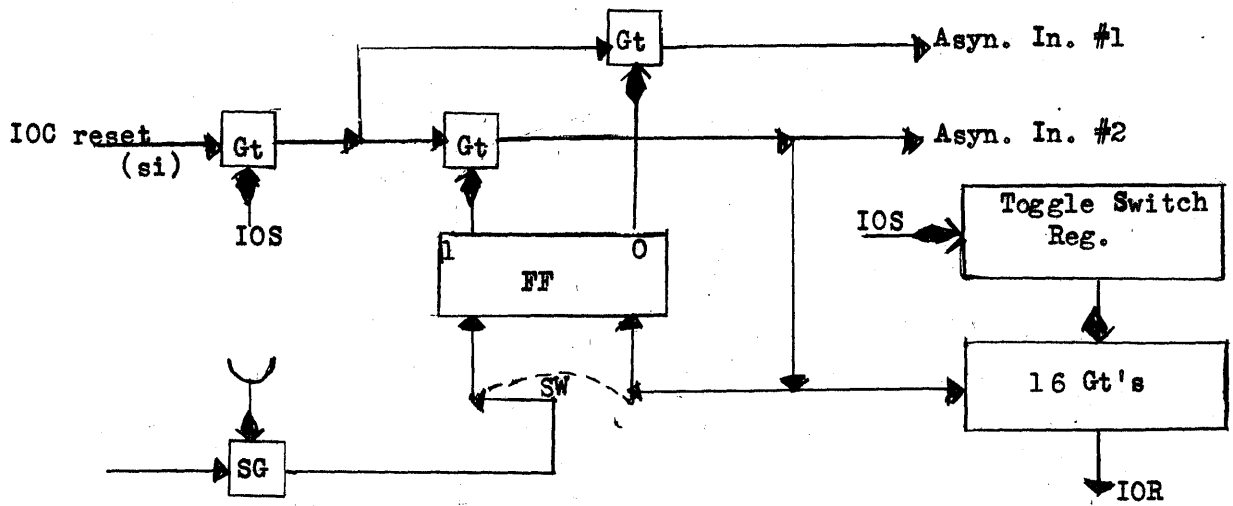
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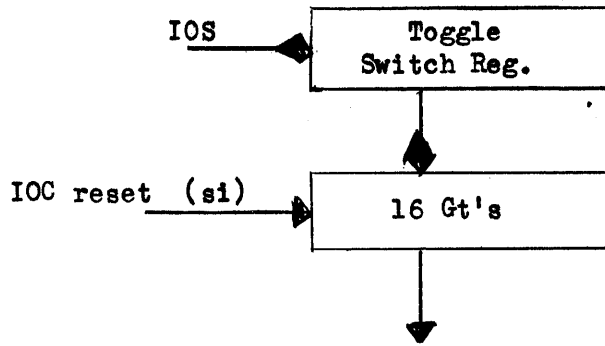
Toggle Switch Input - mode 4

Fig. 1



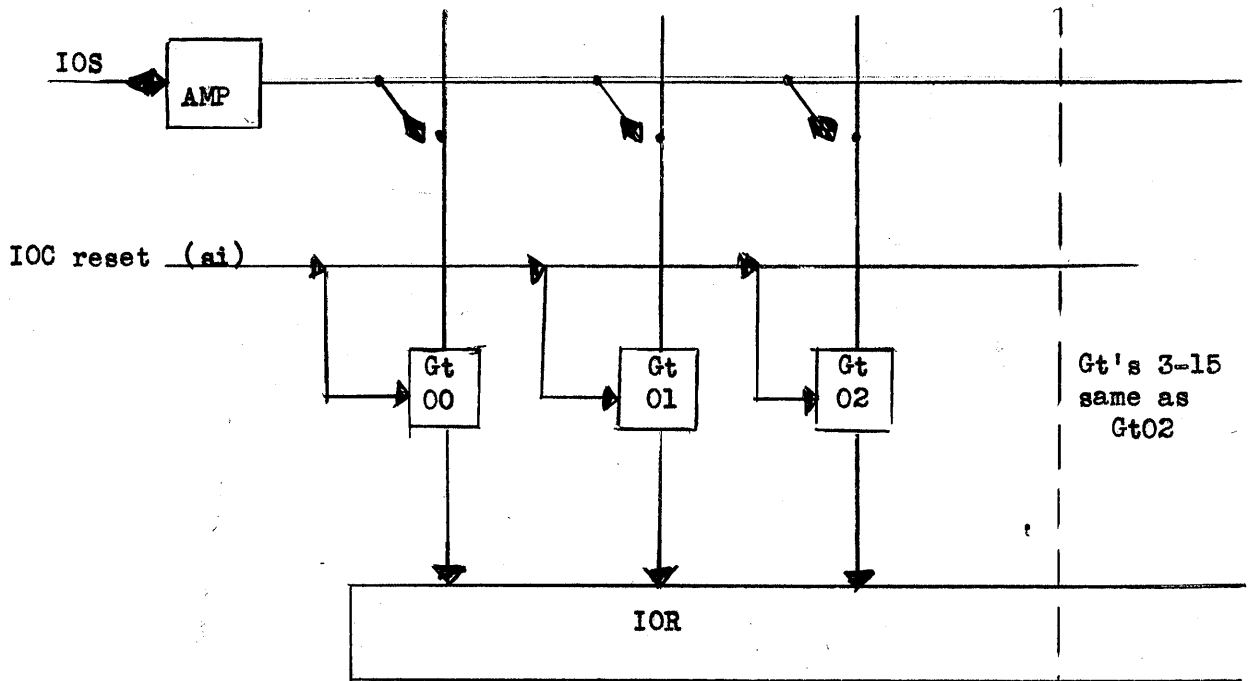
Toggle Switch Input - mode 1

Fig. 2



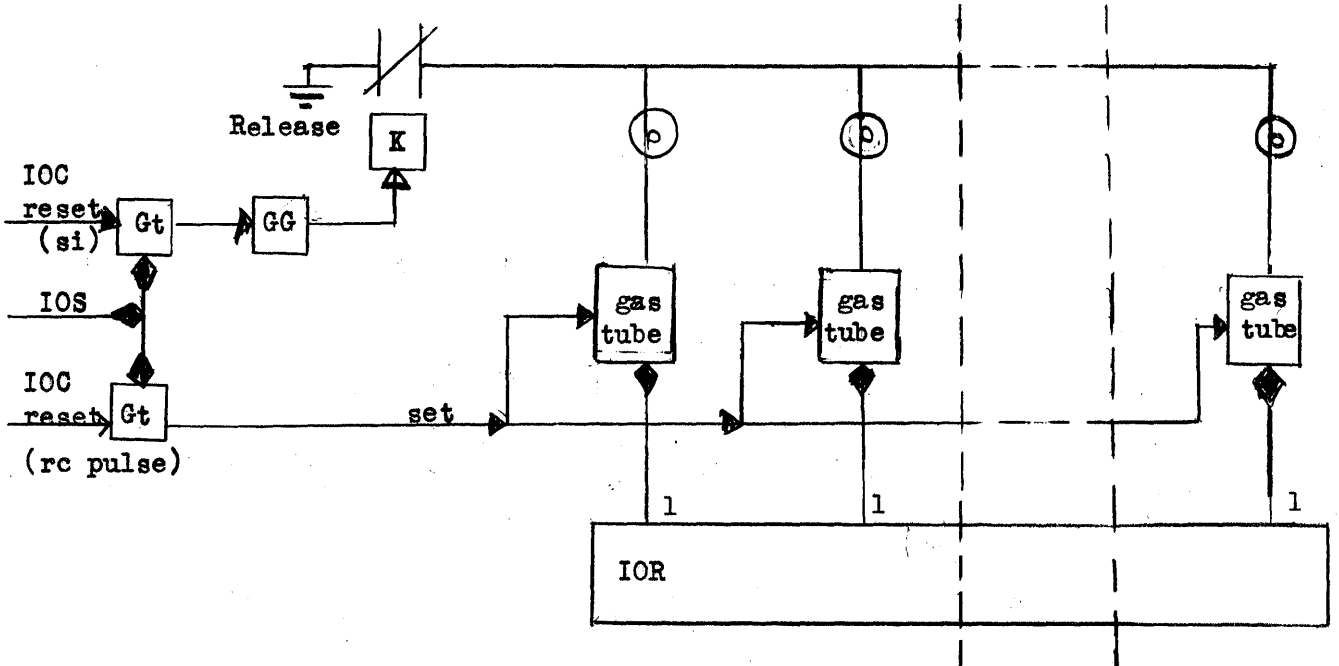
Toggle Switch Input - mode 8

Fig. 3



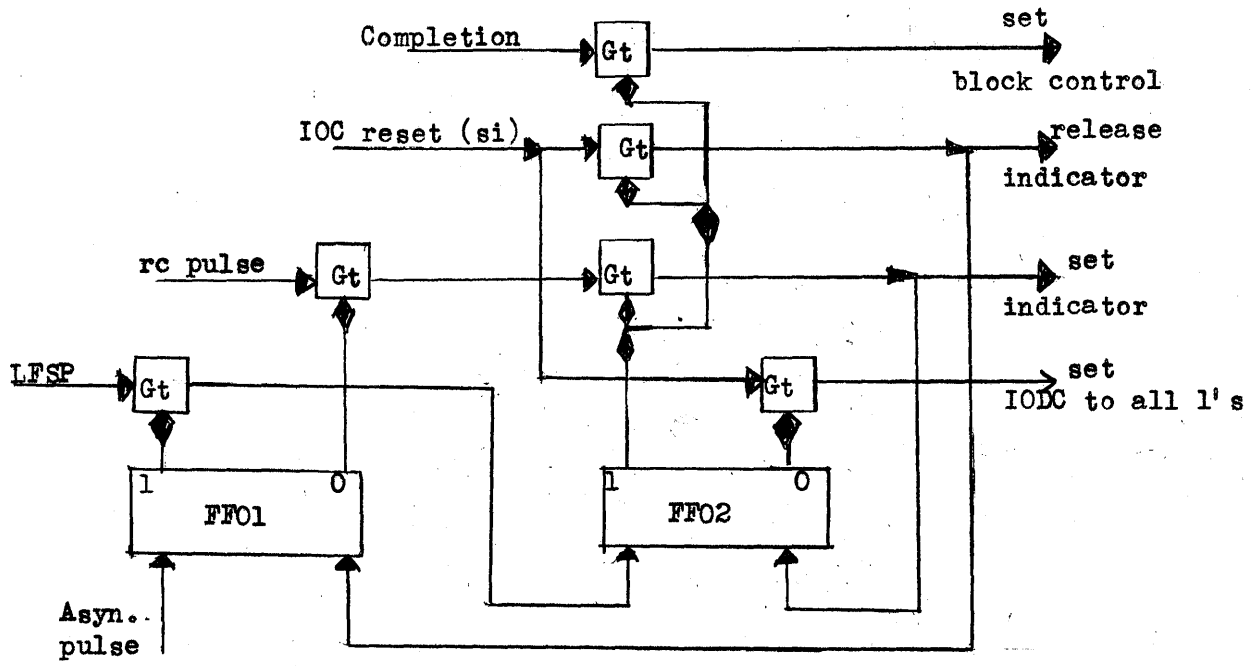
Toggle Switch Input

Fig. 4



Indicator Light Unit - modes 1 and 2

Fig. 5



Indicator Light Control - mode 2

Fig. 6