

PROGRAM SEQUENCER

R. Bossart

1. INTRODUCTION

The proton beam will be extracted from the 70 GeV accelerator at Serpukhov by fast ejection, slow ejection and internal targets. There will be three fast ejections, two slow ejections and about five internal targets. The three fast ejections can be shared among the channels A,B and C. Slow ejection has been foreseen for channel D and B. The beam sharing between the channels A,B,C,D, etc. will be programmed by a program generator in the central desk of the LCR. The characteristics of this program generator have been described in ref. 1.

The program selected on the central desk will be repeated by a local program sequencer of the timing system for fast ejection. The fast ejection program sequencer is completely compatible with the central program generator. It provides an obvious display of the programmed beam extractions. For test purposes of the fast ejection equipment, the program sequencer generates an autonomous program for the timing system.

2. FUNCTIONAL DESCRIPTION

The operations of the program sequencer are selected and monitored on the synoptic front panel, see fig. 376-01-4. Ten different beam extractions can be programmed, each one displayed by a line of lamps and pushbuttons. The pushbuttons on the right of the front panel select the mode of operation. If local control is selected, the program established on the front panel is operational. If remote control is selected, the program of the central desk is repeated. For the mode control off, no fast ejection is programmed. The pushbutton lamp test switches on all lamps of the front panel to check them.

For each of the ten possible beam extractions, either a permanent or selected sequence of cycles can be programmed. If a permanent sequence is selected and indicated by the pushbutton, the extraction takes place during every cycle of the accelerator. If an extraction is not to be programmed for every cycle, a selected sequence of cycles can be programmed

1) Système de synchronisation de l'accélérateur de l'IFVE, traduit par A. Golovanoff DIR/PS/trad. 68-4

within a periodicity of ten cycles. The cycles are counted and the number of cycle is indicated by one of ten lamps. The pushbuttons of the programmed cycles are illuminated displaying the selected program.

If the number of cycles for a program is to be smaller than 10, only the cycles wanted are programmed and the counter returns automatically to cycle 1 after completion of the programmed number of cycles.

The selected program can be cancelled by an external inhibit signal, e.g. from the controls and interlock system. The inhibit signal is monitored by a lamp. The program transmitted to the timing equipment is monitored by the lamp called program.

3. CIRCUIT DESCRIPTION

The sequence counter, fig. 376-02-3, consists of a decade SN 7490 N with a decoder SN 7442 N and lamp drivers SN 7406 N to indicate by a lamp, what is the number of the cycle. The decade counts the start pulses of the accelerator cycle. The counter is reset to 9, respectively to cycle 10, by the mode control off. The modes local control, remote control and control off are memorized by two flip-flops, which are clocked by the start pulse. This ensures a defined change-over from one mode to another at the beginning of the subsequent acceleration cycle, when the button has been pushed and avoids any arbitrary change-over during the acceleration cycle.

In the modes local and remote control, the counter is reset by the return pulse to 0, respectively to cycle 1, if the number of programmed cycles has been accomplished. The return pulse is automatically generated from the selected program for local control. In the mode remote control, a return pulse from the program generator of the central desk is required at the same time as the start pulse of the accelerator. It has to be 1 μ s longer than the start pulse.

The program sequence for every extraction channel is generated by the circuit called selection of cycles, shown in fig. 376-03-3. There are ten of these circuits in the program sequencer corresponding to the ten extraction channels. For local control, the program selected by the switches of the front panel is gated by the sequence counter to the program output. The positions of the switches are transmitted simultaneously via some gating logic to the lamps of the pushbuttons. In the remote control mode, the remote program is gated directly to the program output. The display of the remote program necessitates a memory of ten flip-flops, which are clocked subsequently by the count pulse. The count pulse is delayed by about 20 μ s to avoid edge speculations with the sequence counter, which directs the count pulses to the appropriate flip-flops. A permanent sequence in remote control is indicated as long as the remote program is continuously on. If the remote program is interrupted, the flip-flop is cleared and the lamp is switched off.

The program generated either by local or remote control is blocked, if the inhibit relay is energized by an external inhibit signal.

The input amplifier for the remote program voltage has to be adapted to the output circuit of the central program generator, which transmits a logical level 0V ($R_i = 600$ ohms), if the central program is on and + 6 V ($R_i = 300$ ohms), if the program is off.

Dossier N°
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Mod.	Date	Nom	Tolérances générales
A			de à ±
B			de à ±
C			de à ±
Ensemble		S. Ensemble	
PROGRAM SEQUENCER FRONT PANEL 5H			Echelle
			1:2
ORGANISATION EUROPÉENNE POUR LA RECHERCHE NUCLÉAIRE CERN EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH			FES
1211 GENÈVE 23			

Dessiné	20-7-70	J. Braichet
Contrôlé		
Vu		
Remplace		
Remplacé par		
376-001-4		

PROGRAM SEQUENCER

INHIBIT PROGRAM

FAST EJECTION 1

FAST EJECTION 2

FAST EJECTION 3

SLOW EJECTION

TARGET 1

TARGET 2

TARGET 3

TARGET 4

TARGET 5

TARGET 6

CERN PS/FES

SELECTED SEQUENCE OF CYCLES

PERMAN. SEQUEN. 1 2 3 4 5 6 7 8 9 10

1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	6	9	10
1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10

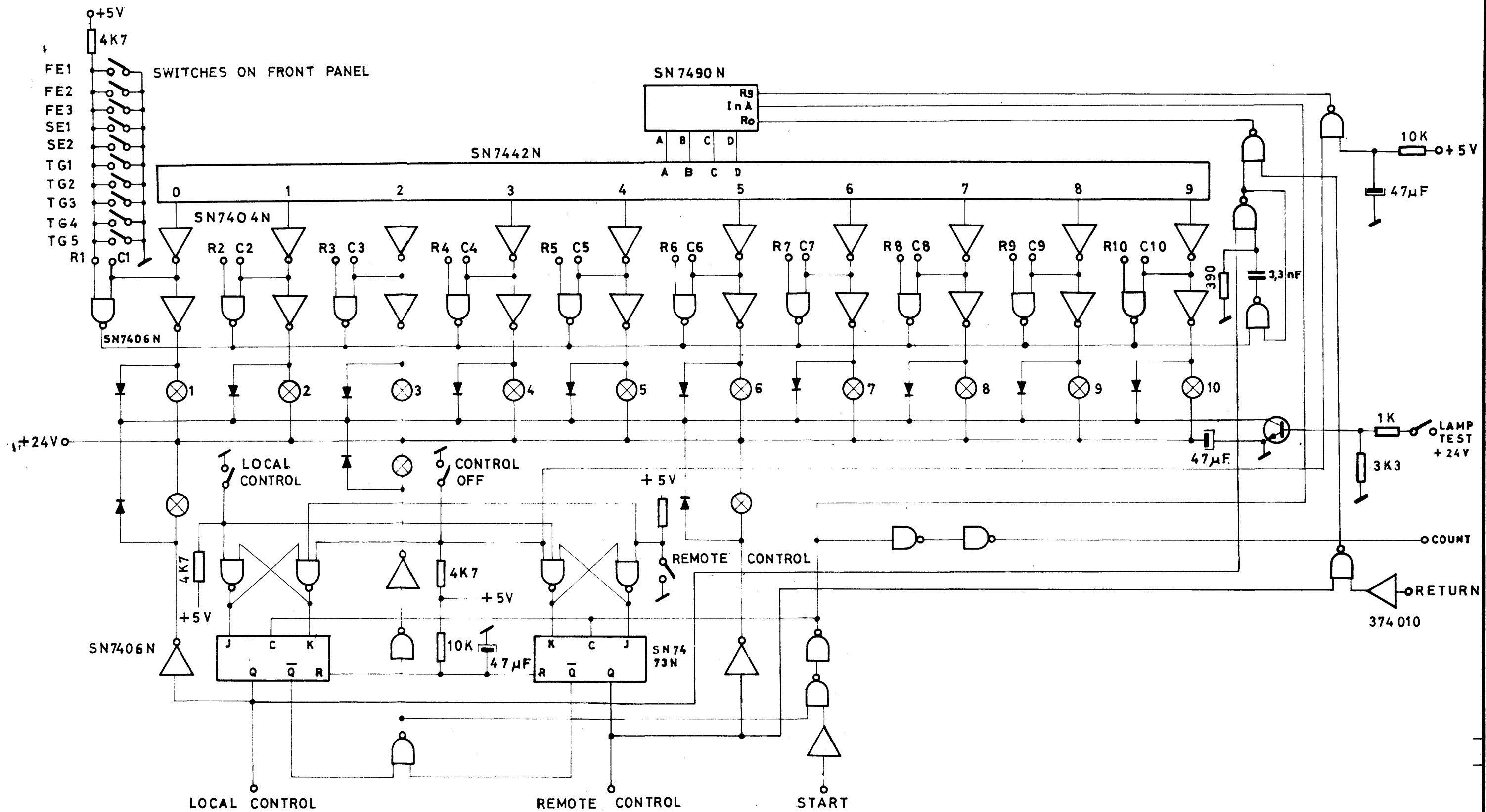
LOCAL CONTR.

REMOTE CONTR.

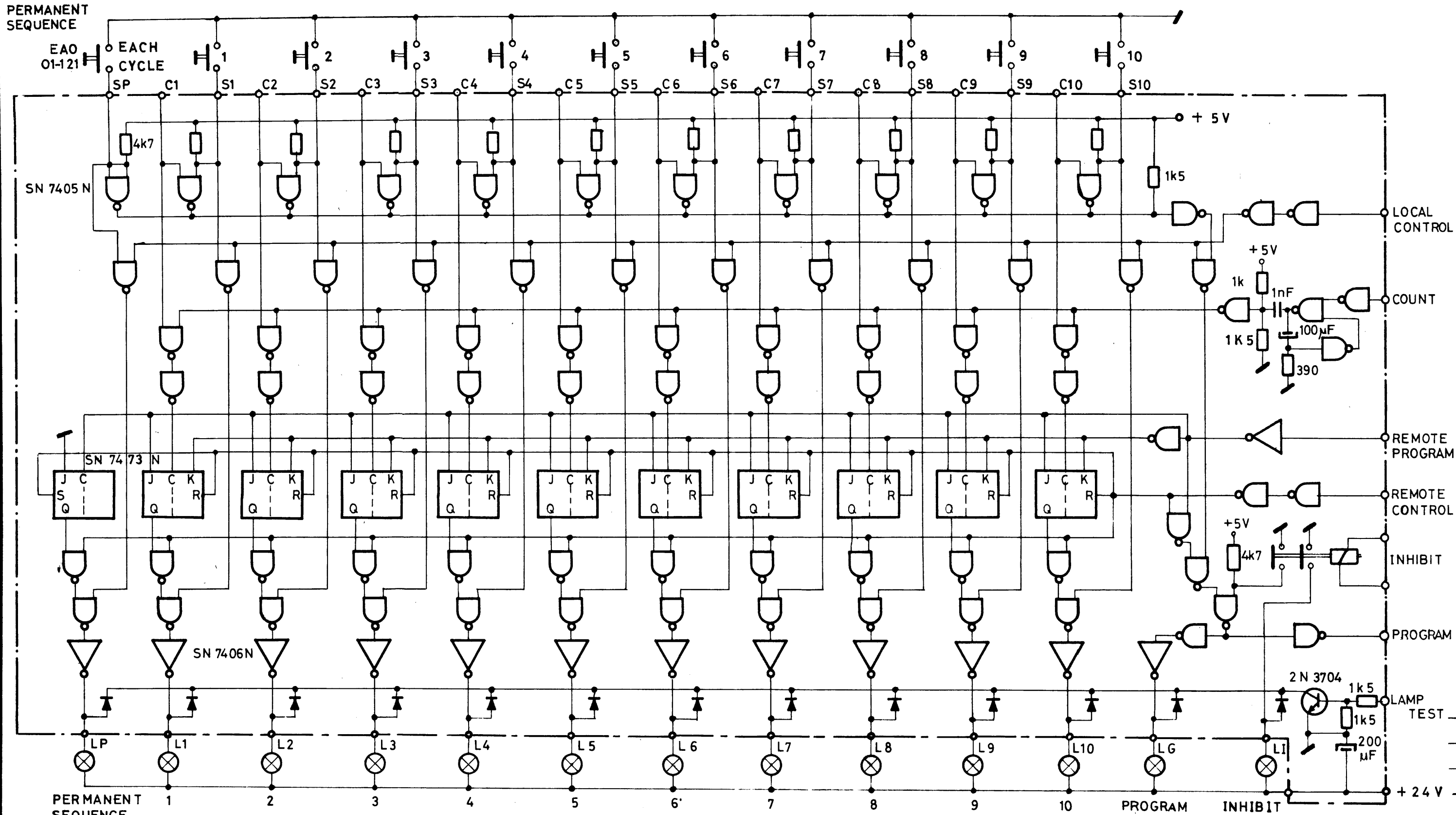
CONTROL OFF

LAMP TEST

376-1



III	II	I	Mod.	Date	Nom	Tolérances générales					
			A			de	à	±			
			B			de	à	±			
			C			de	à	±			
Ensemble						S. Ensemble			Dessiné	5.8.70	Morales
									Contrôlé	6 8 70	R. Bossart
									Echelle		
									Remplace		
									Remplacé par		
									<p style="text-align: center;">PROGRAM SEQUENCER SEQUENCE COUNTER</p> <p style="text-align: center;">ORGANISATION EUROPÉENNE POUR LA RECHERCHE NUCLÉAIRE CERN EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH FES</p>		
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III	II	I	Mod.	Date	Nom	Tolérances générales				
			A			de	à	±		
			B			de	à	±		
			C			de	à	±		
Ensemble						S. Ensemble	Dessiné	27-7-70	J. Braichet	
							Contrôlé			
							Vu	6. 8. 70	R. Bossart	
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PROGRAM SEQUENCER SELECTION of CYCLE						Echelle				
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