6. Drumstore.

Main principles of control.

Transfer of information between the drumstore and the core store is divided up in a drum-synchronous serialtransfer between the drum and the buffer-register TI and a GIER-synchronous paralleltransfer between TI and the core store. The drumsynchronous transfer is performed by the drumcircuits simultaneous with the execution of instructions not concerning the drum. The corestorageadress to or from which the drumtransfer shall be done, is also calculated by the drumcircuits simultaneous with normal operations. At the moment when the drumcircuits are ready for the parallel transport the execution of simultaneous operations is interrupted for about 26 µS while the paralleltransfer to or from the core store is going on. This is done by a special microprogram which is activated by means of a special set of 8 microaddresses, MAB 1-8, and a special clockpulse, KPB. The time-interval between the 4o interruptions during a channel transfer is about 5oo µS.

Channel selection.

Selection of the channel to or from which a transfer is wanted is done by execution of the operation VK by which the channel number modulo 512 is transferred to the register TK. Any channel-transferoperation is normally executed on condition that an existing channel has been selected. If a transfer to a nonexisting channel is executed (no. 32o-511 or 832 - 1o23) the drumcircuits will be occupied the normal time (about 21 ms). After this the situation is unchanged in the store. If a transfer from a nonexisting channel is executed the corresponding cells in the core-store will be set to zero and the computer will not finish the LK-operation untill the pushbutton "annul. of the TR-paritet" is activated.

The 32o channels in the drumstore are mechanically represented by 32o read-writeheads, which are individually wired to 4o plugs (A2-A11, B2-B11, C2-C11 and D2-D11), but electrically they are separated in 2o groups each containing 16 channels. The read-write heads are decoded from the TK-register. Bits 1-5 (numbers according to the buswire no.) are decoded to an X-value: 1 out of 2o possible (12 are not used) and bits 6-9 are decoded to an Y-value: 1 out of 16 possible. These X- and

Y-values are defining the selected track, and this last part of the decoding is performed by means of the diodes placed in the plugs sitting upon the drum. This part of the decoding in only active during the execution of the operations LK or SK.

Changing of the contents of the TK-register during a channel-transfer is impossible due to the signal "block Gm TK" from card 2o5-4.

Locking for writing.

Some of the drumtracks may be locked for writing. The locking can be done in two levels. The first level comprises normally track no. o-31. This lock is manually operated and is accessible to the user. It is possible to expand this locking to comprise up to 5 groups of 16 tracks by connecting the X-group in the decoding to one of the spare-inputs upon card 2oo-4. For instance a connection between the pins C3-2o-15 and C5-21-12 will expand the lockingarea to tracks o-47.

The second level of locking comprises normally only track no. 0, and is not accessible to the user. Unlocking can be done by removing the short circuit pin upon card 2oo-4. This locking may also be expanded so that it comprises up to 16 tracks, no. o-15, by connecting the appropriate Y-group in the decoding to C3-24-1N.

The execution of an SK-instruction where the selected track has been locked will be finished without writing during 9 µsec. for the basic-operation plus the normal executiontime for the modifications.

Clocktracks.

The drum is equipped with 3 clocktracks and associated readamplifiers. Clocktrack no. I contains one mark for detecting word no. 0, track no. II a marking for each of the 4o words, and track III a marking for each bit in all words.

Transfers to and from the drum.

The microprograms for the druminstructions LK and SK begin with the micro•peration "Gm sæt TL" which will read the value of the signal TR" into the flip-flop TL upon card no. 266. If TL becomes 1 it means that the drumcircuits are unoccupied (TL means "Tromle ledig" or "drum ready"), and the microprogram will proceed with starting the drumcircuits by means of the microoperation "Gm start TR", which will set one of the flip-flops upon the card 264 dependent on whether it is a write-or a read-operation. This flip-flop will remain set during the drumaccess and will select the correct microprogram to be executed at the interruptions when words are transferred to or from the core store. The syncronizing signal to the start-stop circuits SL ("skriv-læs" means ready for write to or read from core memory)is derived from this flip-flop and clockpulse II. The delay of 12 μsec. upon card 261 is nescessary due to the parity check (see later).

As the drum acces is initiated non-syncronous to the drum, the serial transfer of information from the drum to the TI-register may start in the middle of a word, so that the first word transferred to the corestore is not correct. The drumacces is therefore always transferring 41 words so that the first word in the acces is beeing transferred 2 times where the last one is always correct. The counting of the number of words transferred is done by means of the counting register TKT. This register is cleared (set to zero) at the beginning of a drumaccess (and when a parityfault occurs in a word). When the contents of TKT is 41, the drumacces is finished by resetting the flip-flop upon the card 264.

If a SK-instruction is initiated during the word-time of word no. 39, the 41'st counting pulse to TKT will finish the drumaccess just before the second and correct writing of word no. 39 occurs. To prevent this, an extra clearing of TKT is being executed just before word no. 0 is written the first time in the above mentioned situation.

Addresscalculation.

The resultant address of a LK or SK-instruction is transferred to the TBA-register. The TOT-register always contains the word no. of the word thas has just passed the read/writehead. The sum of TBA and TOT is calculated by means of the drumadder. This number is the corememoryaddress to where the word from the drum shall be transferred at the storing-interruption during execution of a LK-instruction. In case of the SK-instruction this sum from the drumadder has to be increased by one to give the address in the corememory wherefrom to fetch the word that shall be written upon the drum. This is done by setting the carryinput of the lowest position of the adder to the value 1. When word no. 0 is to be transferred the contents of TOT must be -1 this value is set into TOT during wordtime 39.

The contents of register TBA cannot be seen from the display in the operators panel, but by means of a DM 160 lampcard placed in A1-23.

During the B-microprograms which executes the transfers between the corestore and the drumstore the output from the drumadder is transferred to the TA-register and the inputs to the addressdecoding of the core store are connected to TA instead of AD1. This shift of them decoding is done by means of a flip-flop upon the card 266.

Wordtransfer.

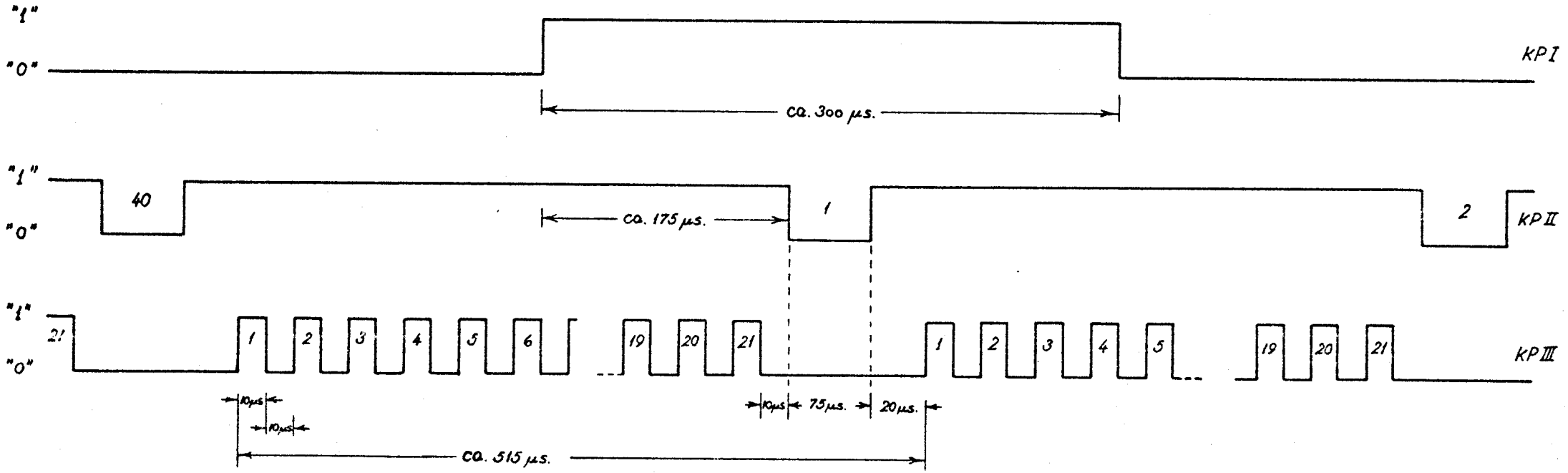
The serialtransfer between the drum and the bufferregister TI is performed one bit at a time, the contents of TI beeing shifted one position to the left for every bittime. During writing upon the drum the signal for controlling the write amplifier is taken from TI-position 0 while during reading the output from the readamplifier is connected to TI-position 41. The shiftpulse for TI is derived from clockpulse III and II, the shifts being performed at the times where the value of clockpulse III is changing from 1 to 0 and from 0 to 1 and where clockpulse II changes from 1 to 0. The principle of writing that is used is called NRZ, non-return-to-zero, because the current in the writehead is always running one or the other way. It is shifting at the beginning of words, at every bit = 1 in the words and after the finish of a word if the number of 1's was even.

The signal from the read amplifier is setting a flip-flop which again steers another flip-flop strobed by a signal derived from the clock-pulses. After this the shifting begins in a flip-flop called TI-pos.42. The last bit that is read in a word-time is the paritybit, which remains in TI-pos. 42 during the succeeding paralleltransfer to the corestore. At the shifting-in into TI of the next word from the drum, the proceeding word is shifted out through TI-0 and is lost.

Paritycontrol.

The paritycheck at reading claims that every word including paritybit contains an odd number of ones. The "ones"are counted by means of a flip-flop upon card 263. At the end of a word-time this flip-flop must contain a 0 indicating correct parity , at the beginning it contains 1. If this is not so the signal SL will via the logik cause a resetting of register TKT and the transfer will start from the beginning. If the fault continues the tracktransfer will never finish, unless the operator cancel the paritycheck by means of the switch "Annul.tr.paritet" (The red lamp will light when the check is inactive). Operating the "Reset"-button will as usual stop every action.

Simultaneously with the resetting of TKT because of parityfault another flip-flop upon the card 263 will be set, and later it will be reset when TKT = 41. This flip-flop will light the lamp at the operatorspanel called "Tromlefejl" indicating error in the drum. Because of the non-syncronous start of reading from the drum, the first word read is often with parityfault. To prevent the lamp from lighting for this reason, there is a delay between the flip-flop and the lamp.



GIER drumcircuits

Clockpulses I, II and III

Operation no 52

Operation LK

MA	Gs	Gm	CS	Decoding	No	Jum
1		set TI,ob+c step				T2
12	AD1	TBA start Drum		Drum ready TL	9a	1
12	Dummy			Drum busy $\overline{TL}$	9b	
13	Mode 4					
1B	AD1	TA				
2B	TR-Add.	AD1				
3B	TIO-41	LIO-41	Write			
4B						
5B	Dummy					
6B						
7B	TA	AD1				
8B	Stop B-pulse	shift B--A				

Unit GIER 6

REGNE CENTRALEN

Designed H.I.

Approved

Checked 1.2.62

Last Revision

MICROPROGRAMS

Drawing No

Drawn by L.L.21.2.67

Checked F.E.23-2-67

1 Sheets

Sheet 1

Operation no.: 53

Operation. SK

MA	Gs	Gm	C.S.	Decoding	No
1		set TI,ob+c			
		step			12
12	AD1	TBA		Drum readyTL	9a
		Start Drum			
				Drum busy TL	9b
12	Dummy				
13	Mode 4				
1B	AD1	TA			
2B	TR-Add	AD1			
3B			Read 0-41		
4B					
5B			Dummy		
6B	LI0-41	TI0-41			
7B					
8B	Stop B-pulse	shift B--A			
	TA	AD1			

Unit GIER 6

REGNE CENTRALEN

Designed H.I.

Approved

Checked 1.2.62

Last Revision

MICROPROGRAMS

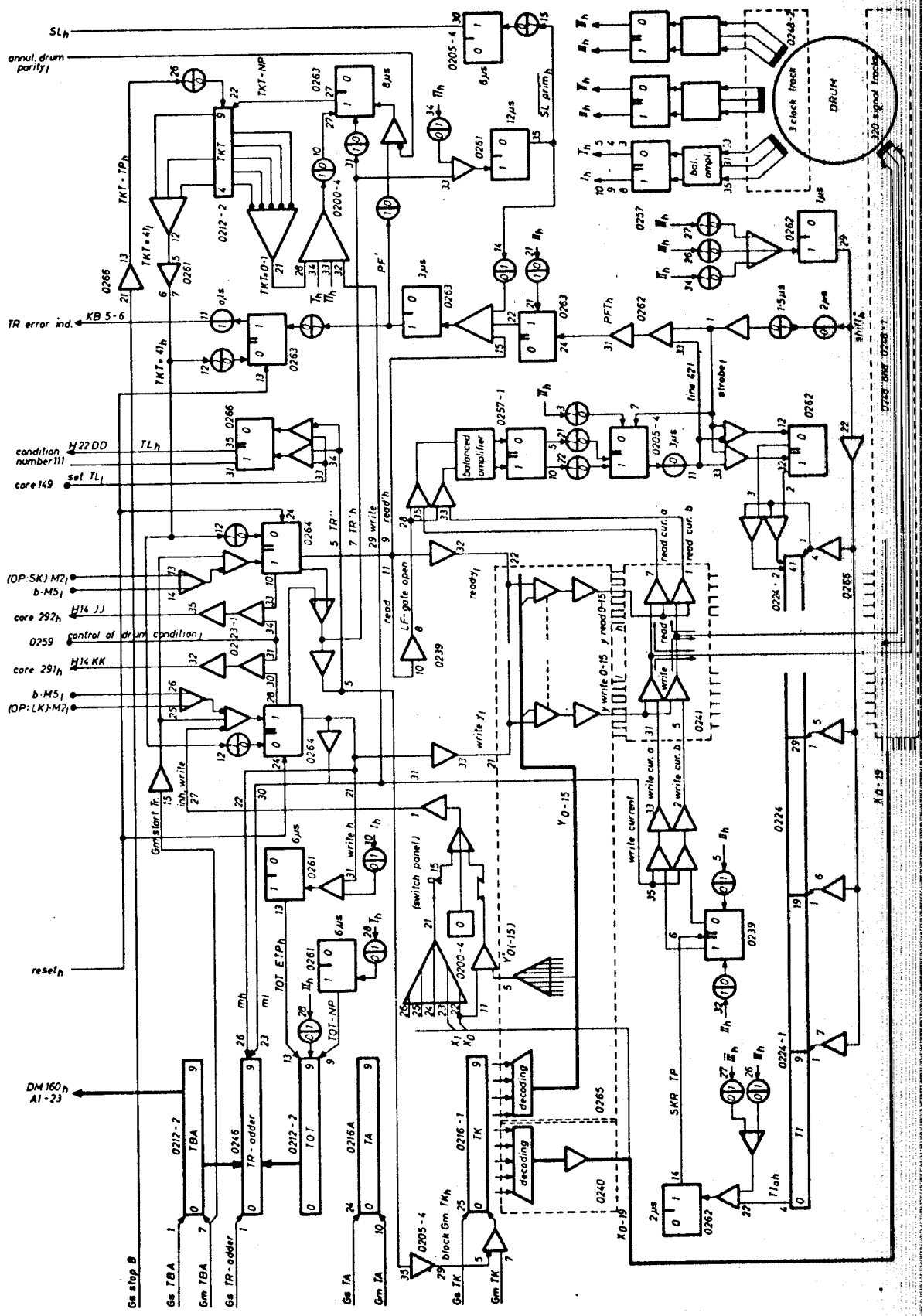
Drawing No

Drawn by L.L. 21.12.6

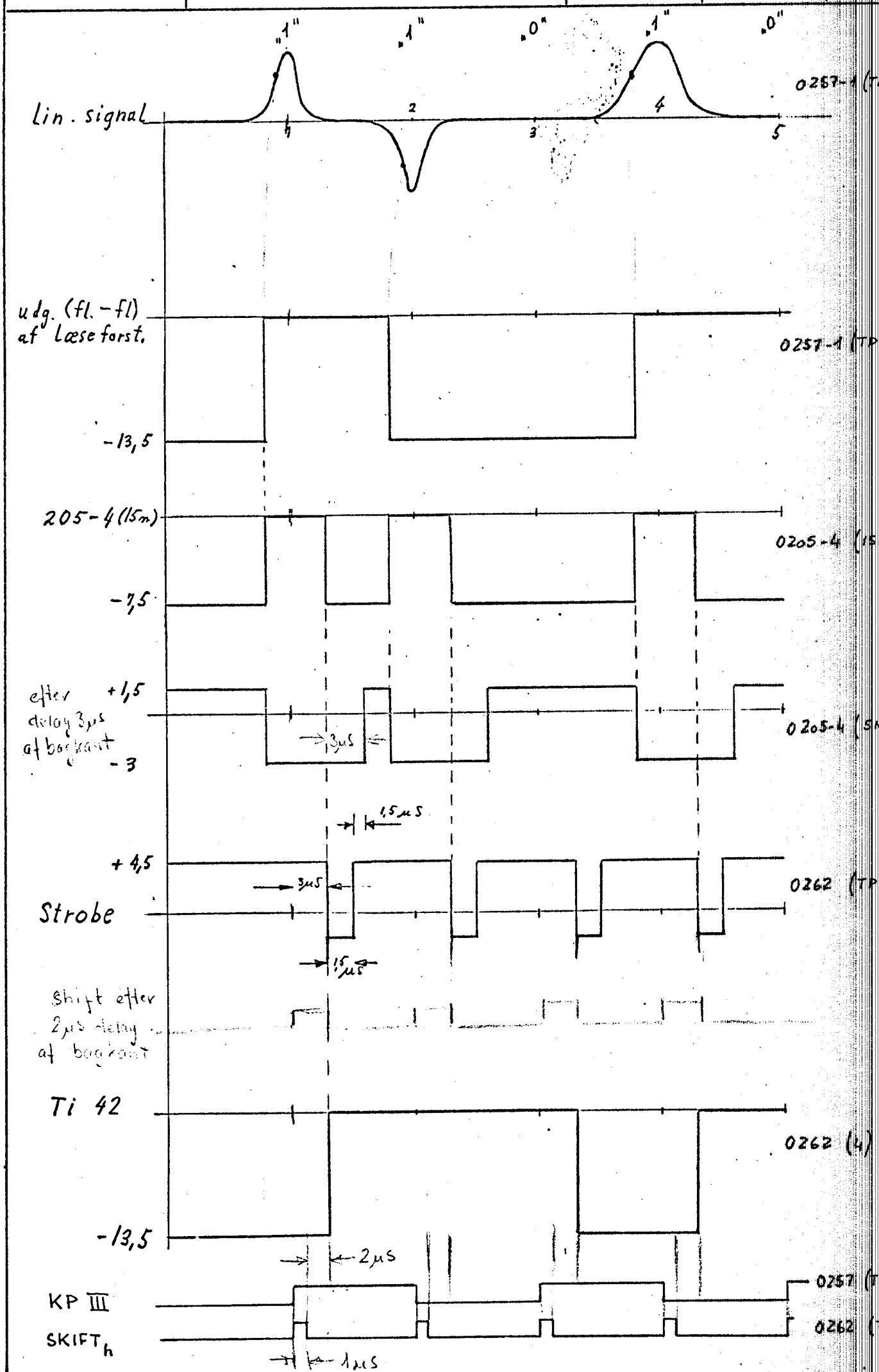
Checked F E 20-2-67

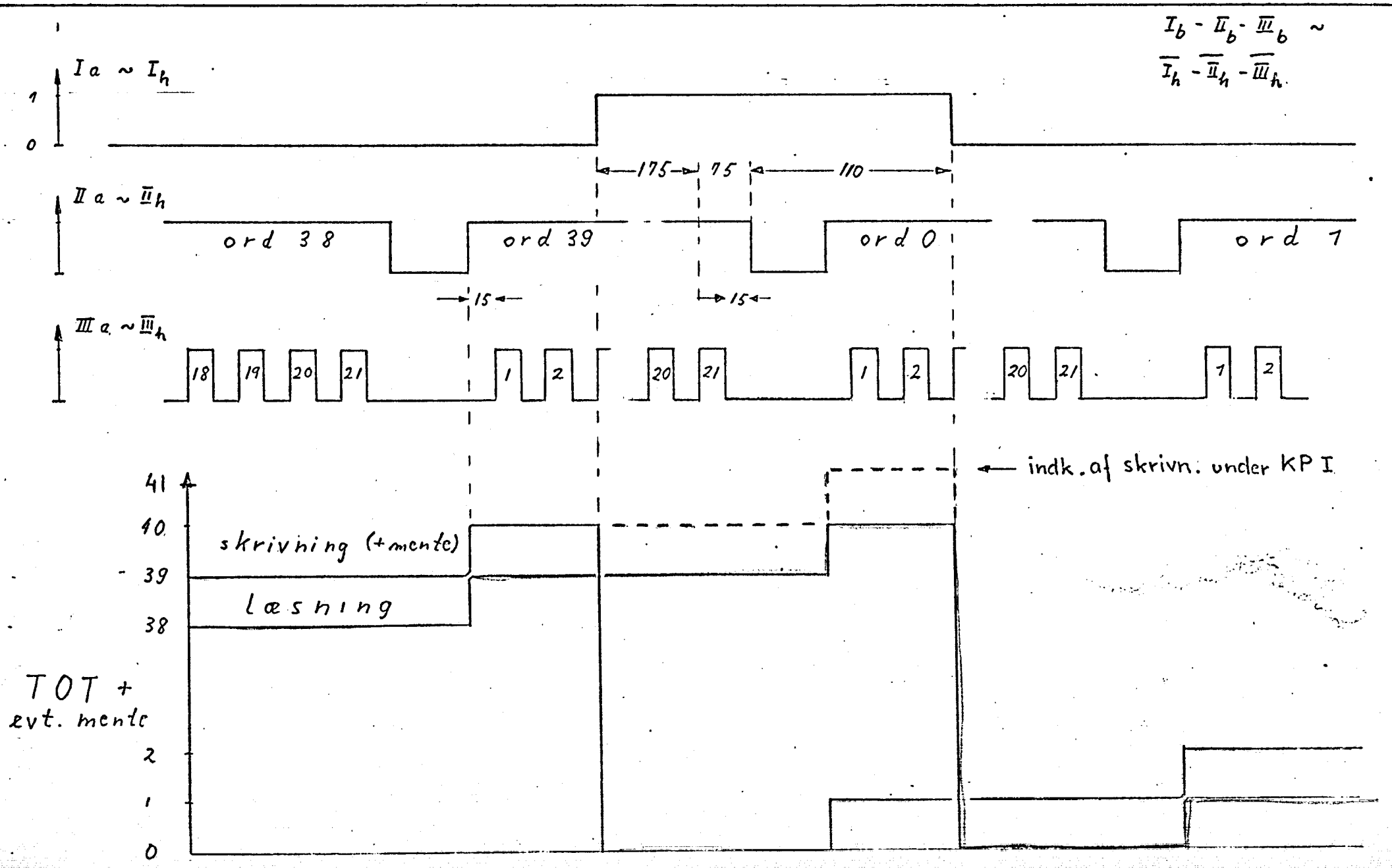
1 Sheets

Sheet 1



Unit: GIER 6	Designed P.E.P.	BLOCKDIAGRAMS FOR DRUM CIRCUITS	Drawing No
REGNECENTRALEN	Approved		Drawn by G.T. 9 9 66
	Checked 12.12.64.		Checked F.E. 22-2-67
	Last Revision		1 Sheets / Sheet 1


"1"
"1"
"0"
"1"
"0"
Lin. signal
1
2
3
4
5
0257-1 (T
udg. (fl.-fl) af Læse forst.
0257-1 (TP
-13,5
205-4 (15m)
0205-4 (15
-7,5
efter delay 3µs af bagkant
+1,5
-3
3µs
0205-4 (SK
1,5µs
+4,5
3µs
Strobe
0262 (TP
1,5µs
shift efter 2µs delay af bagkant
Ti 42
0262 (4)
-13,5
2µs
KP III
SKIFT h
0257 (T
0262 (
1µs



% REGNECENTRALEN

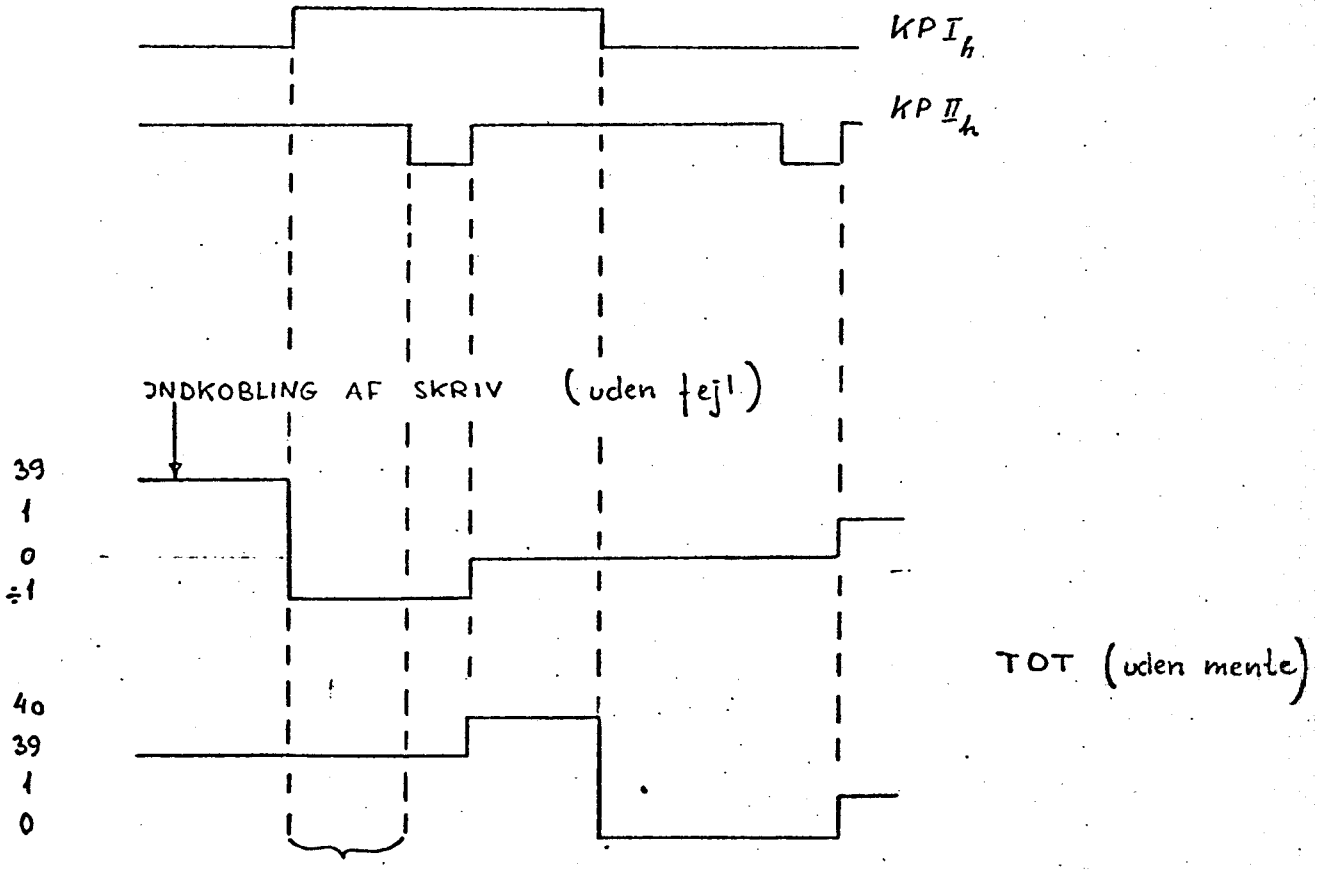
Emne: Tidsdiagram for tromle klokimpulser

Opg. nr.:

1 19

Sign.

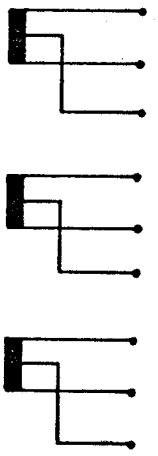
Ved skrivning skal transport af et ord foregå før skrivning, i modsætning til læsning hvor transporten foregår efter læsningen. TOT tilføres derfor en mente i sidste pos. under skrivning. For at kunne transportere ord nr. 0 stilles TOT på ÷1 på forkanten af KP I. Hvis indkoblingen sker som vist på tegningen, vil ord nr. 0 ikke blive transporteret, og operationen ville blive afsluttet netop som ord nr. 0 skulle skrives. For at hindre dette nulstilles TKT ved indkobling af skrivning under $KP\,I_h \cdot KP\,II_h$



	Column D	Column A	Column B	Column C
1	0248-2			
2	0248	0248	0248	0248
3	0248-1	0248	0248-1	0248
4	0248	0248	0248	0248
5	0248	0248-1	0248	0248-1
6	0248	0248	0248	0248
7	0248	0248	0248	0248
8	0248-1	0248	0248-1	0248
9	0248	0248	0248	0248
10	0248	0248-1	0248	0248-1
11	0248	0248	0248	0248

2 Cards for each plug

The clock pulses are transferred from D1 (or possibly from A1, B1, or C1) via Cards 0248-2, which do not contain Diodes, but are Connected according to the following Diagram.

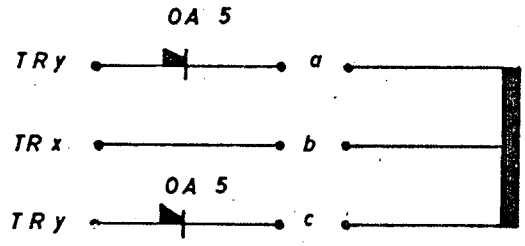


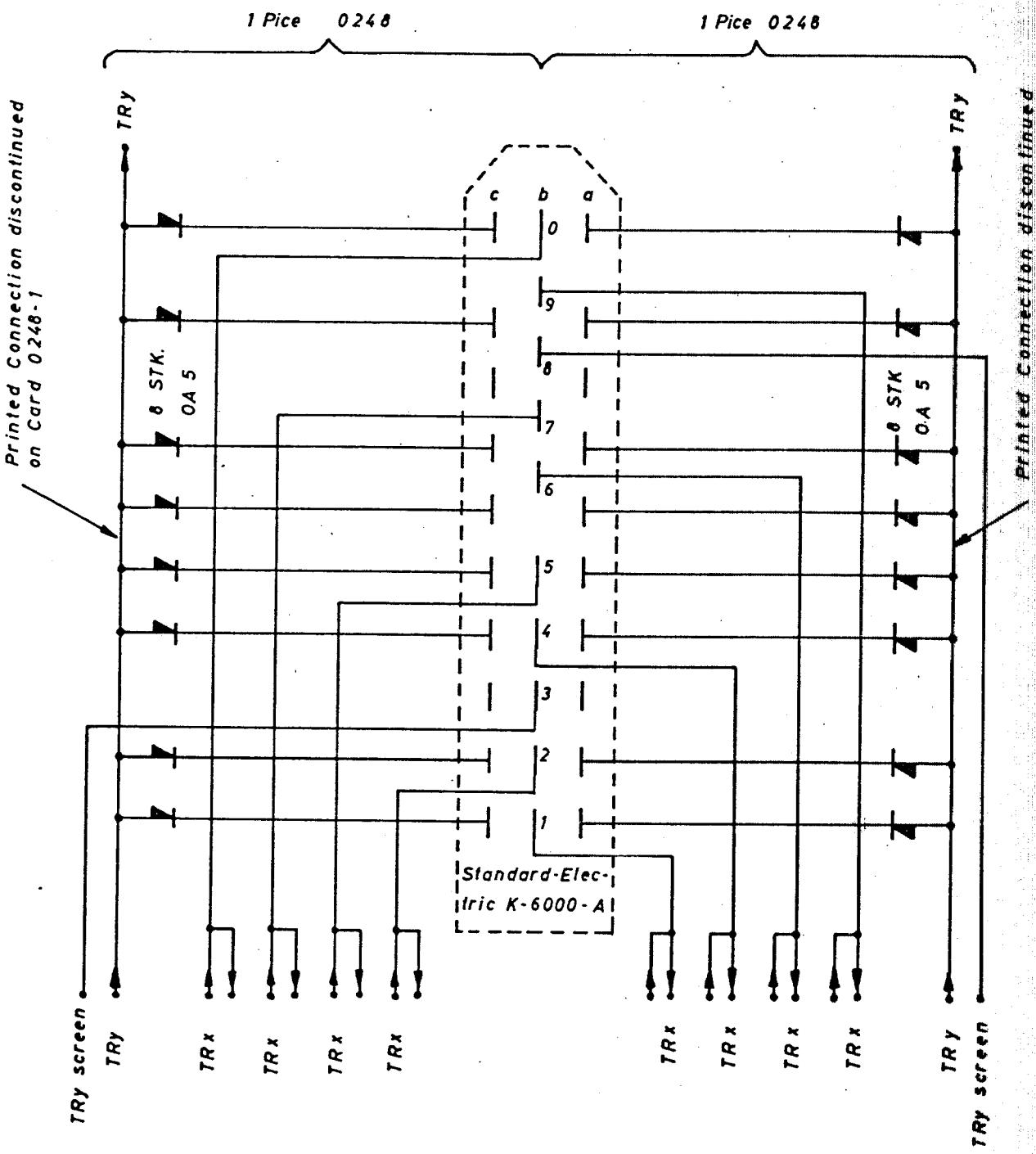
TR	Ia	5b
TR	Ib	2b
TR	I screen	5c
TR	IIa	0b
TR	IIb	7b
TR	II screen	0c
TR	IIIa	1a
TR	IIIb	1c
TR	III screen	1b

Unit: GIER 6	Designed H.I.	Drum Plug Distribution	Drawing No
REGNE CENTRALEN	Approved		Drawn by R.N. 2.1.67
	Checked 1.2.62		Checked F.E. 25-2-6
	Last Revision		3 Sheets Sheet 2
			0248-1-2

0248 8 half-circuits per Card

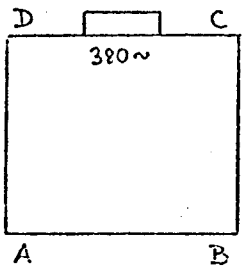
0248-1 2x4 half-circuits per Card

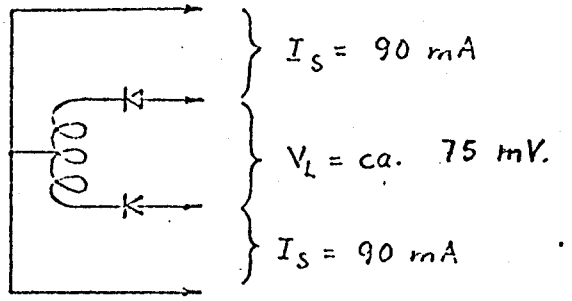


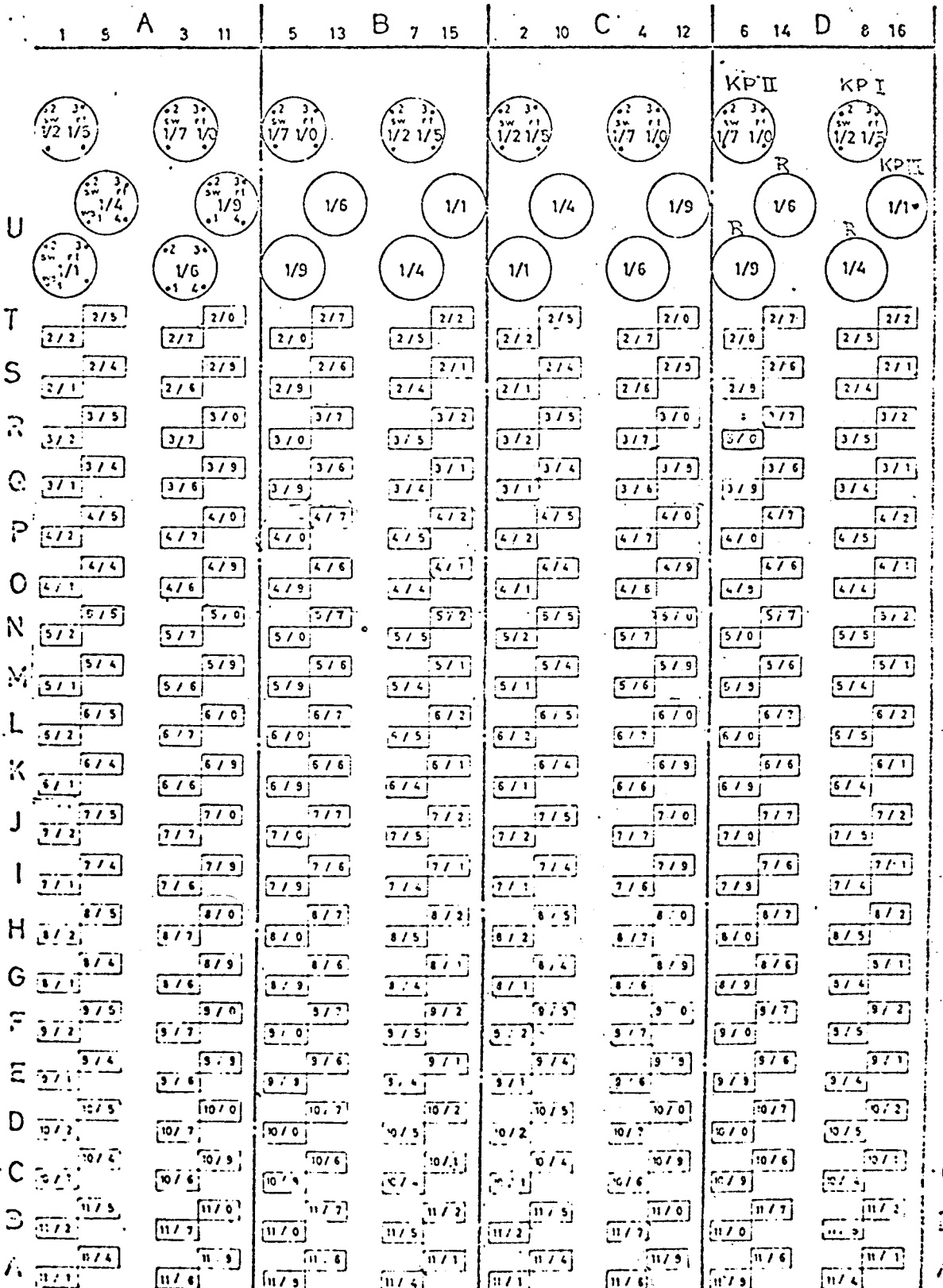


Unit: GIER 6	Designed H.I.	Diodelogik, TR,	Drawing No
REGNE CENTRALEN	Approved		Drawn by R.N. 11.1.62.
	Checked 1. 2. 62.		Checked F.E. 23-2-67
	Last Revision		3 Sheets / Sheet 1
			0248

½ REGNECENTRALEN	Emne: TROMLE	Opg. nr.:	13/11 19	Sign.







Associated track numbers and locations: Ex. Track no. 197: (X,Y)= (12.5). Location: Plug 09-5

X \ Y	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	A2-0	A3-1	A4-0	A6-1	A7-0	A8-1	A9-0	A11-1	C2-0	C3-1	C4-0	C6-1	C7-0	C8-1	C9-0	C11-1
1	A2-9	A3-2	A4-9	A6-2	A7-9	A8-2	A9-9	A11-2	C2-9	C3-2	C4-9	C6-2	C7-9	C8-2	C9-9	C11-2
2	A2-7	A3-4	A4-7	A6-4	A7-7	A8-4	A9-7	A11-4	C2-7	C3-4	C4-7	C6-4	C7-7	C8-4	C9-7	C11-4
3	A2-6	A3-5	A4-6	A6-5	A7-6	A8-5	A9-6	A11-5	C2-6	C3-5	C4-6	C6-5	C7-6	C8-5	C9-6	C11-5
4	A2-5	A3-6	A4-5	A6-6	A7-5	A8-6	A9-5	A11-6	C2-5	C3-6	C4-5	C6-6	C7-5	C8-6	C9-5	C11-6
5	A2-4	A3-7	A4-4	A6-7	A7-4	A8-7	A9-4	A11-7	C2-4	C3-7	C4-4	C6-7	C7-4	C8-7	C9-4	C11-7
6	A2-2	A3-9	A4-2	A6-9	A7-2	A8-9	A9-2	A11-9	C2-2	C3-9	C4-2	C6-9	C7-2	C8-9	C9-2	C11-9
7	A2-1	A3-0	A4-1	A6-0	A7-1	A8-0	A9-1	A11-0	C2-1	C3-0	C4-1	C6-0	C7-1	C8-0	C9-1	C11-0
8	D2-1	D4-0	D5-1	D6-0	D7-1	D9-0	D10-1	D11-0	B2-1	B4-0	B5-1	B6-0	B7-1	B9-0	B10-1	B11-0
9	D2-2	D4-9	D5-2	D6-9	D7-2	D9-9	D10-2	D11-9	B2-2	B4-9	B5-2	B6-9	B7-2	B9-9	B10-2	B11-9
10	D2-4	D4-7	D5-4	D6-7	D7-4	D9-7	D10-4	D11-7	B2-4	B4-7	B5-4	B6-7	B7-4	B9-7	B10-4	B11-7
11	D2-5	D4-6	D5-5	D6-6	D7-5	D9-6	D10-5	D11-6	B2-5	B4-6	B5-5	B6-6	B7-5	B9-6	B10-5	B11-6
12	D2-6	D4-5	D5-6	D6-5	D7-6	D9-5	D10-6	D11-5	B2-6	B4-5	B5-6	B6-5	B7-6	B9-5	B10-6	B11-5
13	D2-7	D4-4	D5-7	D6-4	D7-7	D9-4	D10-7	D11-4	B2-7	B4-4	B5-7	B6-4	B7-7	B9-4	B10-7	B11-4
14	D2-9	D4-2	D5-9	D6-2	D7-9	D9-2	D10-9	D11-2	B2-9	B4-2	B5-9	B6-2	B7-9	B9-2	B10-9	B11-2
15	D2-0	D4-1	D5-0	D6-1	D7-0	D9-1	D10-0	D11-1	B2-0	B4-1	B5-0	B6-1	B7-0	B9-1	B10-0	B11-1
16	D3-0	D3-5	A5-1	A5-6	D8-0	D8-5	A10-1	A10-6	B3-0	B3-5	C5-1	C5-6	B8-0	B8-5	C10-1	C10-6
17	D3-9	D3-4	A5-2	A5-7	D8-9	D8-4	A10-2	A10-7	B3-9	B3-4	C5-2	C5-7	B8-9	B8-4	C10-2	C10-7
18	D3-7	D3-2	A5-4	A5-9	D8-7	D8-2	A10-4	A10-9	B3-7	B3-2	C5-4	C5-9	B8-7	B8-2	C10-4	C10-9
19	D3-6	D3-1	A5-5	A5-0	D8-6	D8-1	A10-5	A10-0	B3-6	B3-1	C5-5	C5-0	B8-6	B8-1	C10-5	C10-0

Drum Tracks 0-319 are represented by bit 1-9, which are decoded in x (bit 1-5), and y (bit 6-9).

TK: 0 1 2 3 4 5 6 7 8 9

X Y

Unit: GIER 6

Designed H.I

Approved

Checked 1.2.62

Last Revision

BEGNE CENTRALEN

Numbering and location of drum Tracks

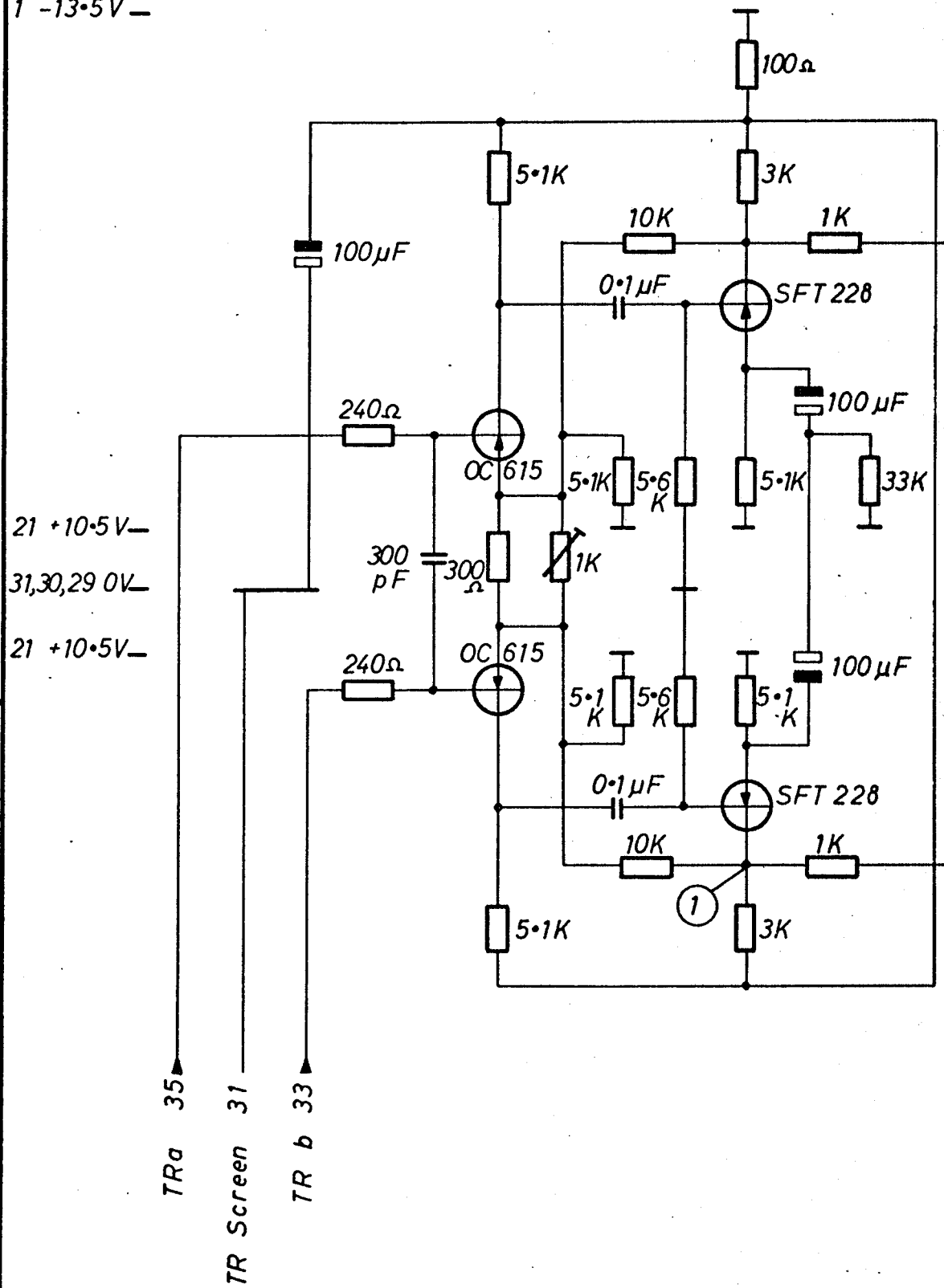
Drawing No

Drawn by R. N. 1.2.62

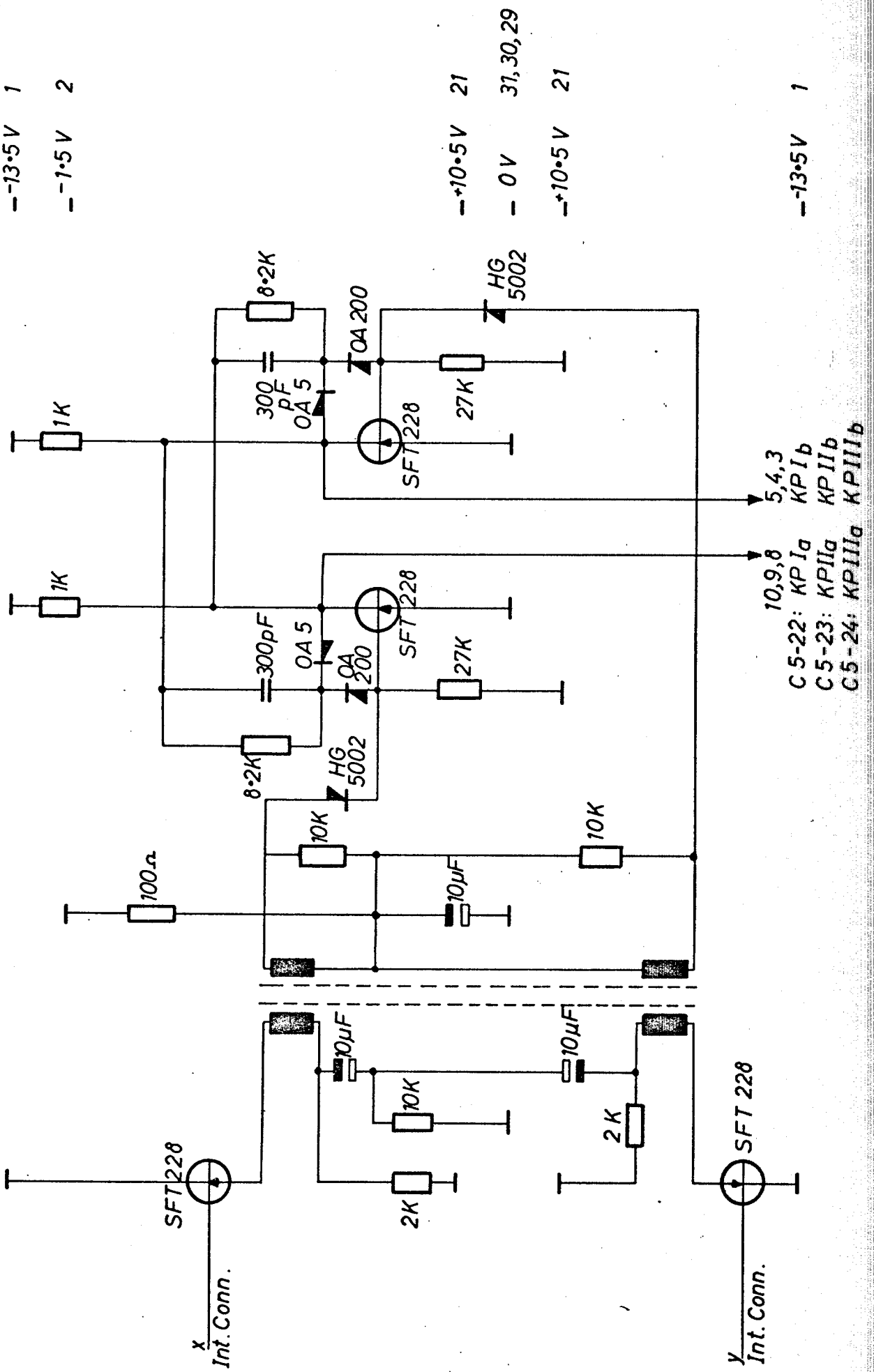
Checked F. E. 26-2-62

3 Sheets Sheet 3

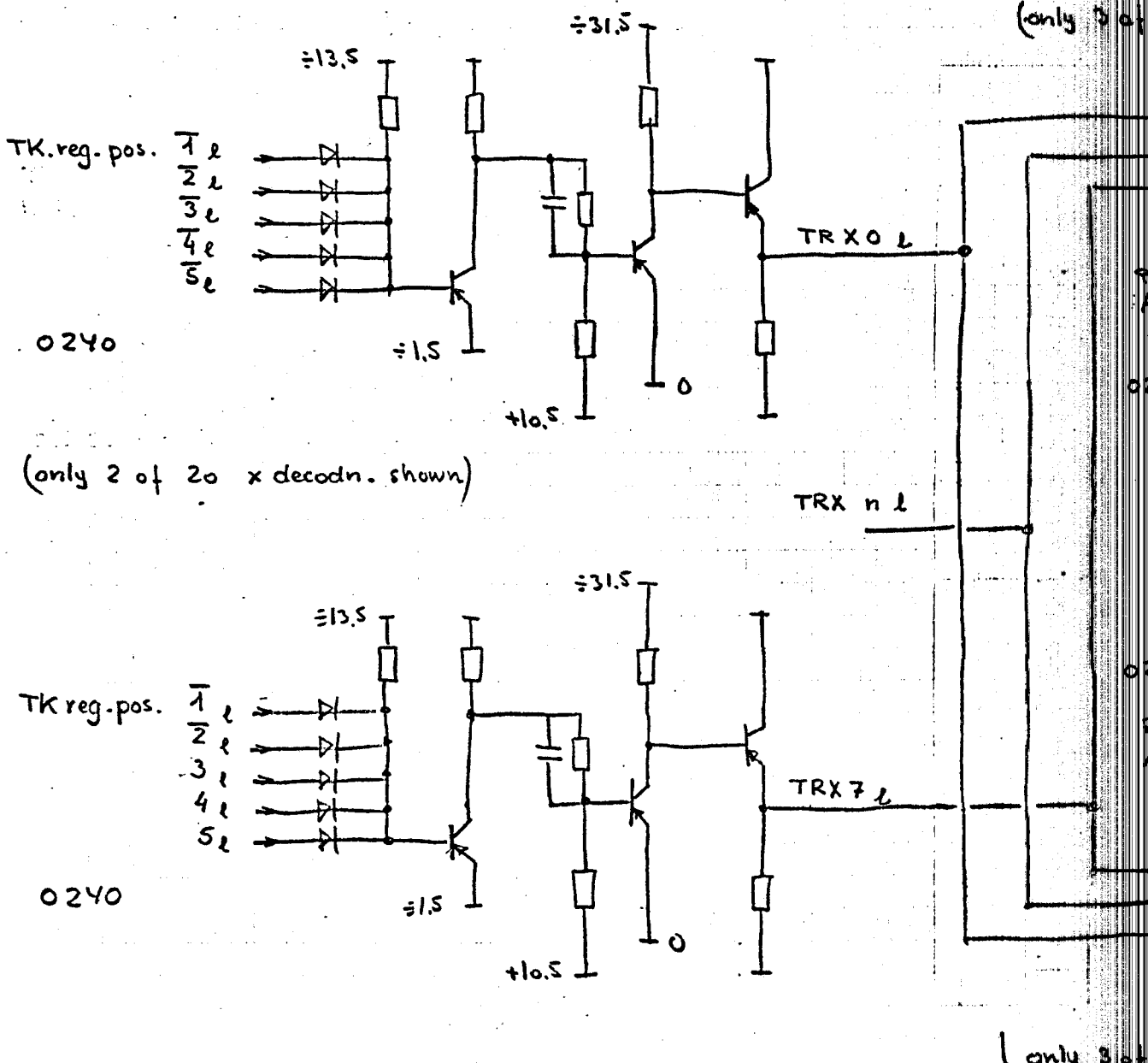
278-1-



Unit: GIER 6	Designed H. I.	DRUM CLOCK PULSE AMPLIFIER	Drawing No
REGNE CENTRALEN	Approved		Drawn by B. R. 23. 8. 6
	Checked 1. 2. 62.		Checked F. E. 22-8-6
	Last Revision		2 Sheets / Sheet 2
			C 5 / 257

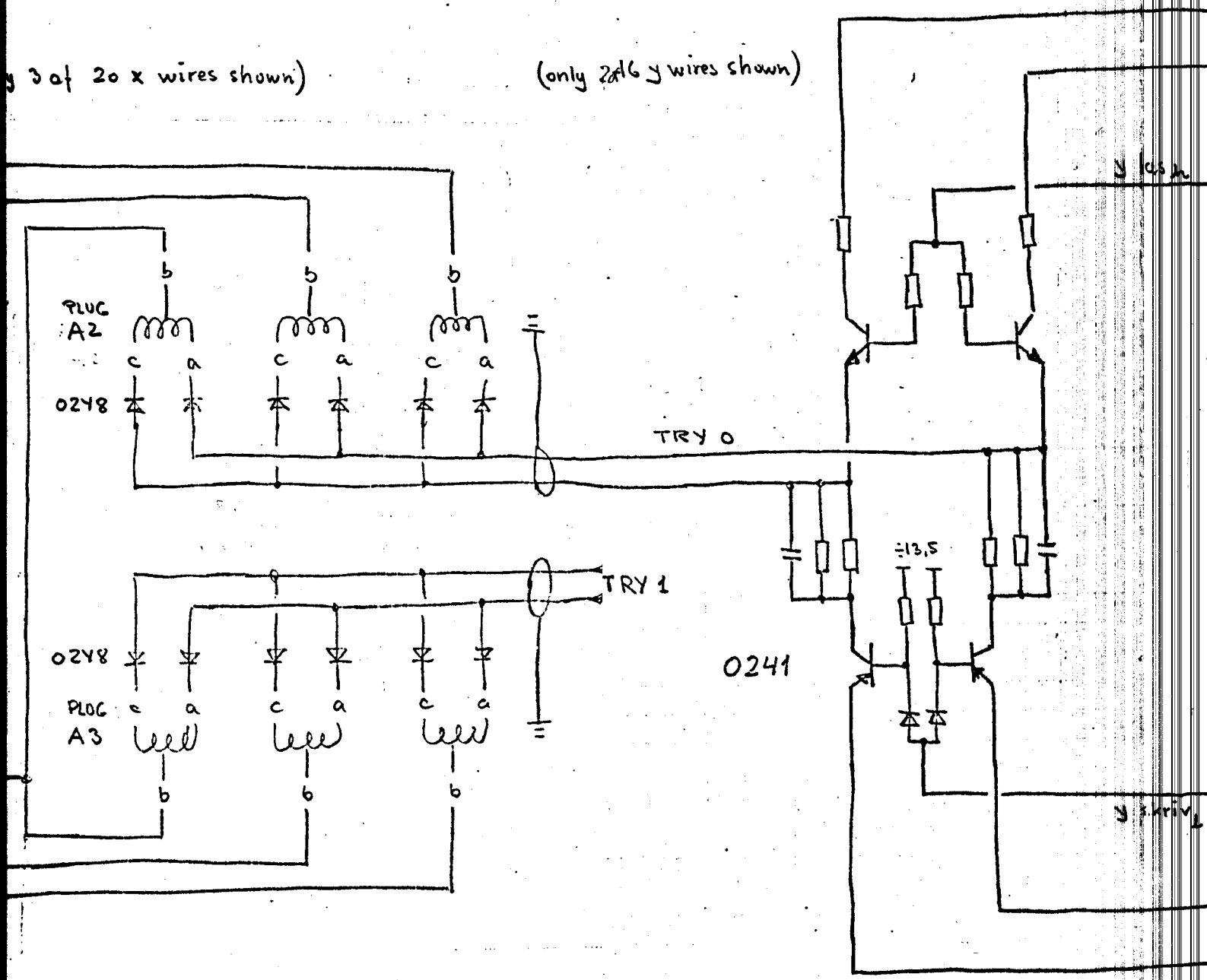


Unit: GIER 6	Designed H. I.	DRUM CLOCK PULSE AMPLIFIER	Drawing No
A/S REGNE CENTRALEN	Approved		Drawn by B. R. 23. 8. 6
	Checked 1. 2. 62.		Checked F. E. 22-2-6
	Last Revision		2 Sheets / Sheet 1
			C 5 / 257

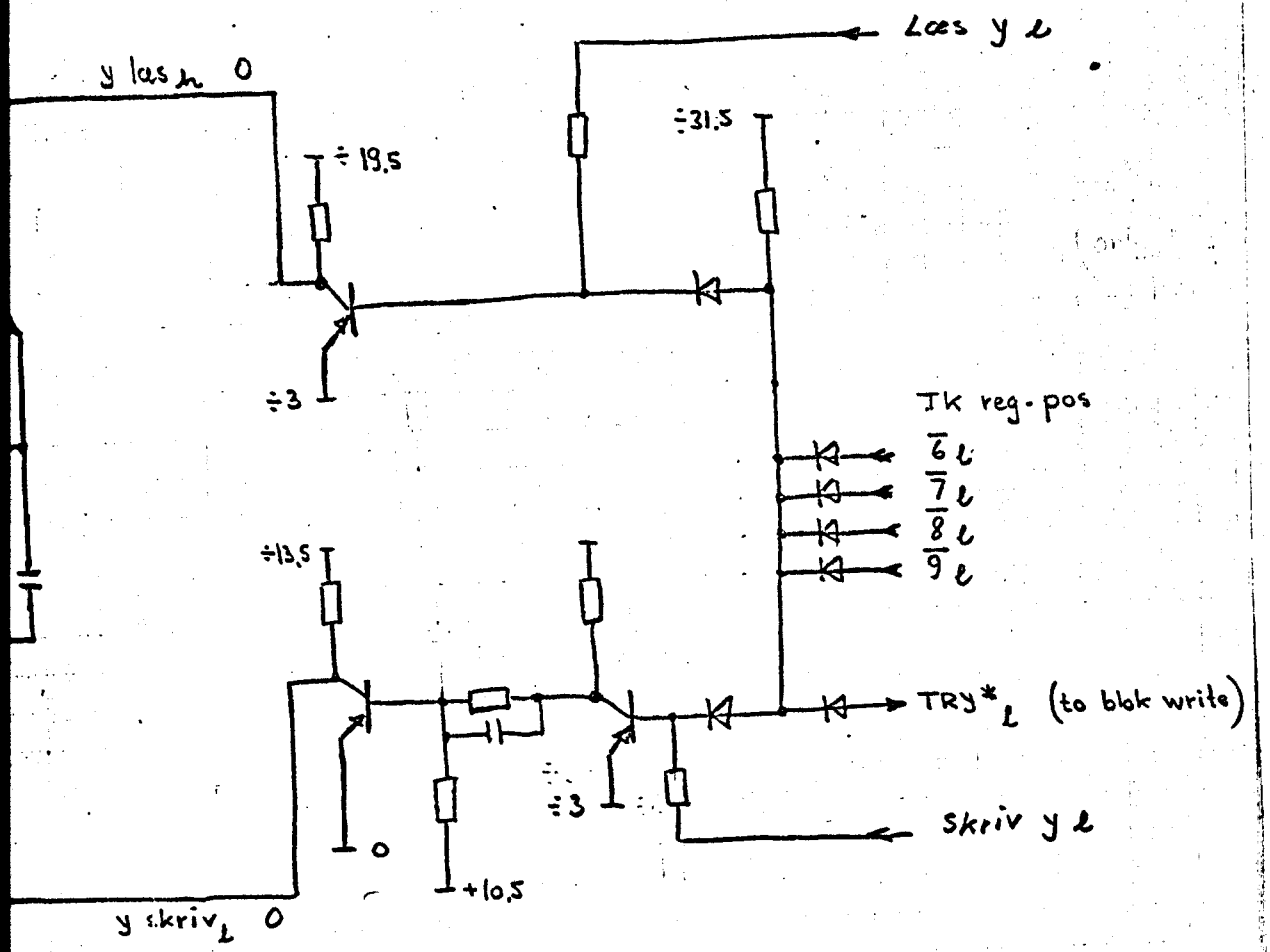

÷31.5
÷13.5
TK.reg.pos. 1 ℓ
2 ℓ
3 ℓ
4 ℓ
5 ℓ
0240
÷1.5
+10.5
0
TRX 0 ℓ
(only 2 of 20 x decodn. shown)
TRX n ℓ
÷31.5
÷13.5
TK reg.pos. 1 ℓ
2 ℓ
3 ℓ
4 ℓ
5 ℓ
0240
÷1.5
+10.5
0
TRX 7 ℓ
(only 2 of

y 3 of 20 x wires shown)

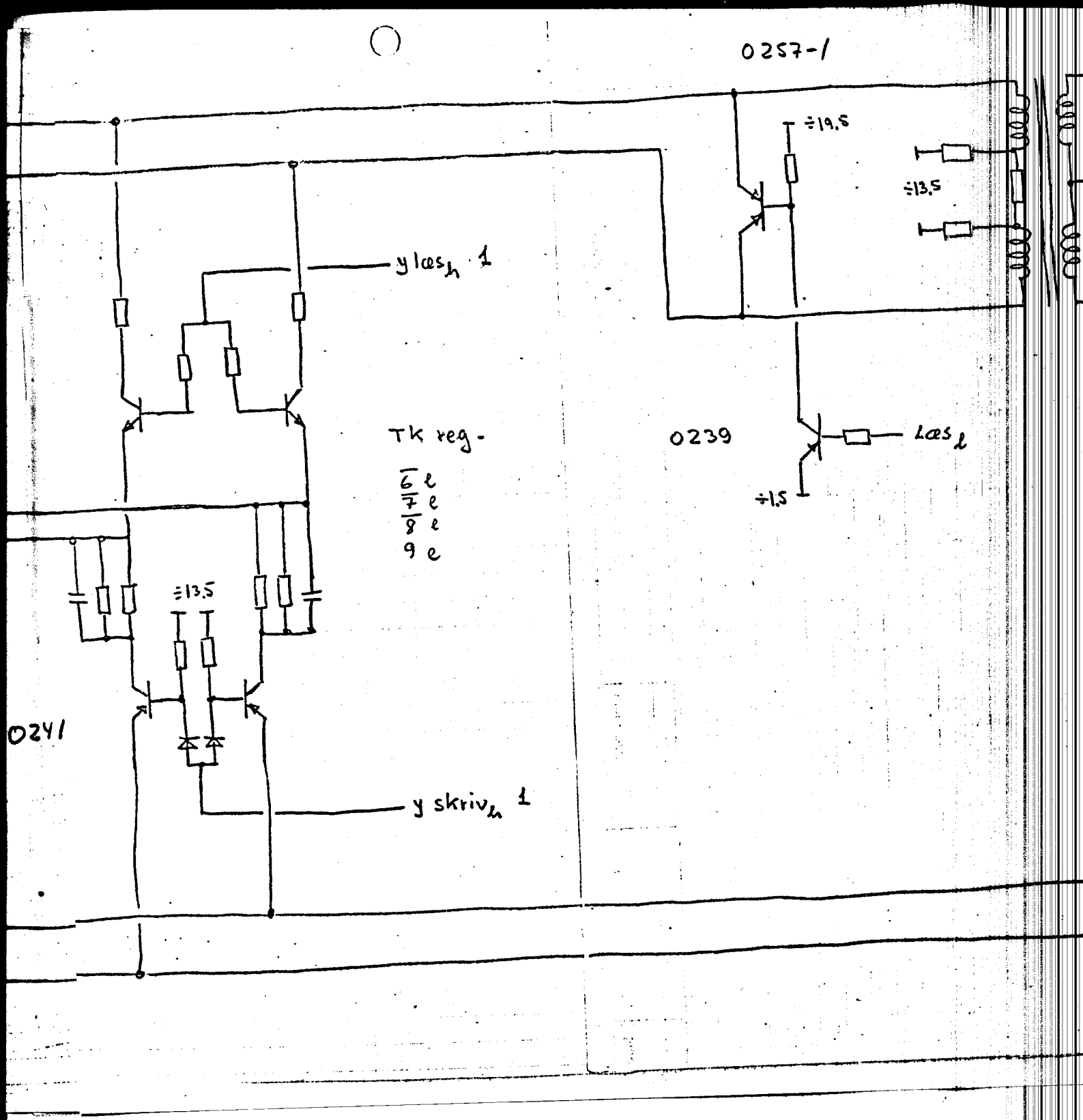
(only 2 of 16 y wires shown)

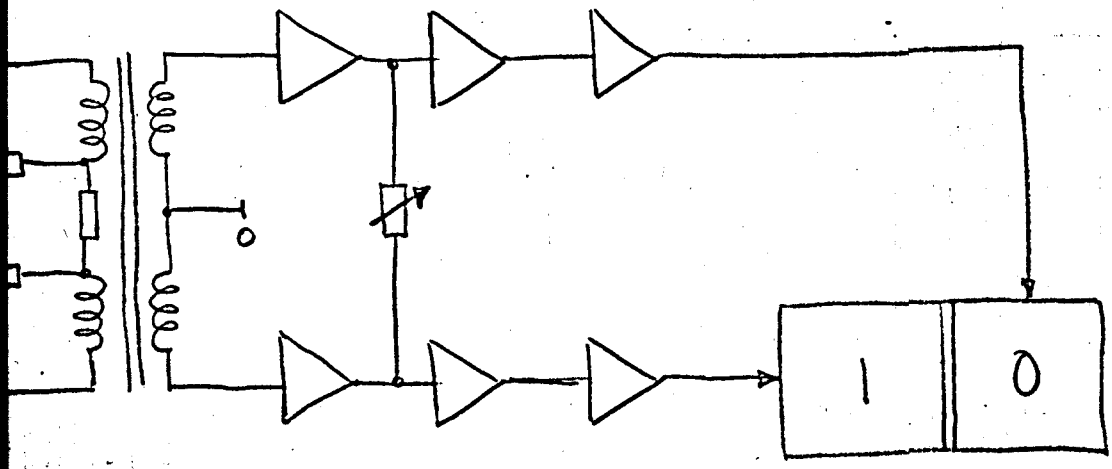


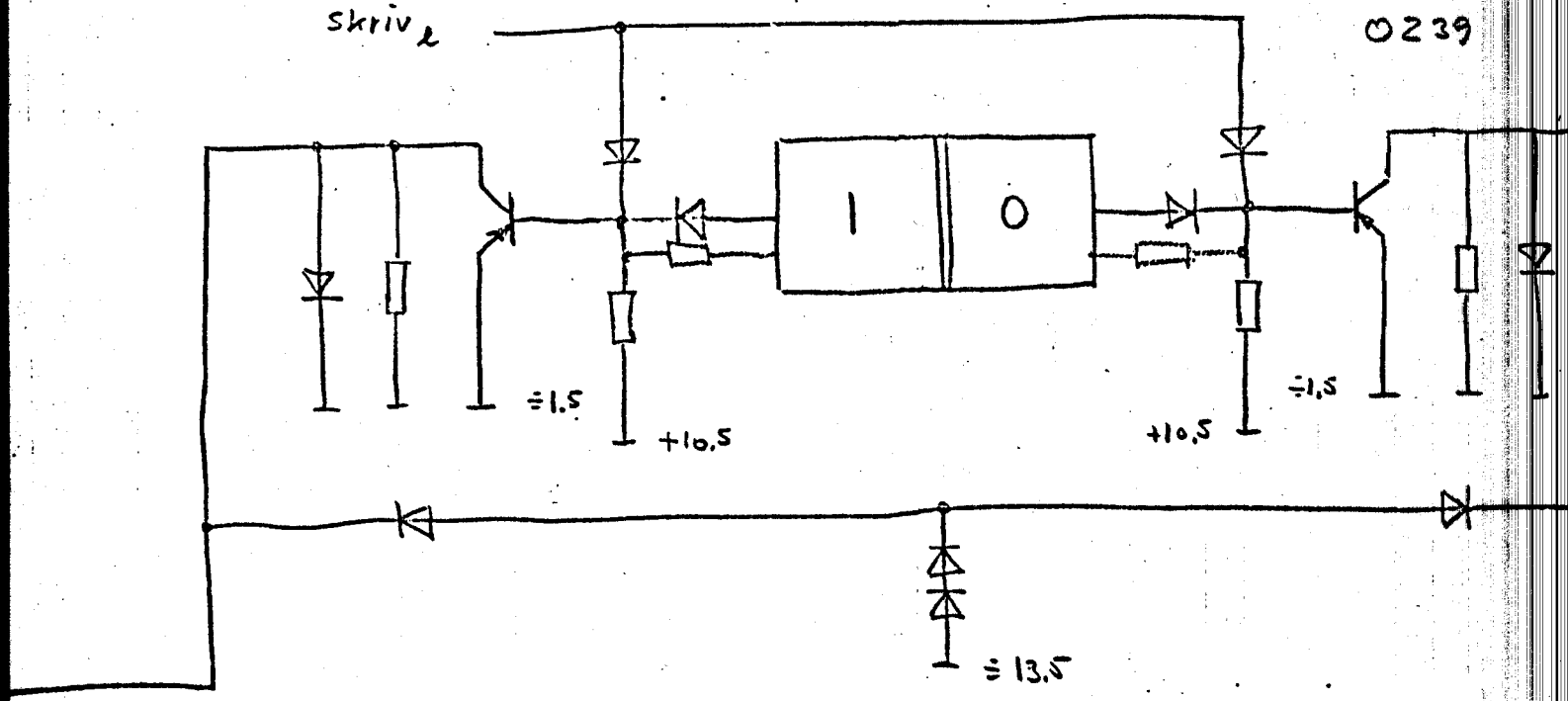
y 3 of 8 heads shown on each plug)


Læs y ℓ
y las h 0
÷31.5
÷19.5
÷3
Tk reg-pos
6 ℓ
7 ℓ
8 ℓ
9 ℓ
TRY 1
÷13.5
TRY* ℓ (to blok write)
÷3
Skriv y ℓ
0
+10.5
y skriv L 0

0257-1

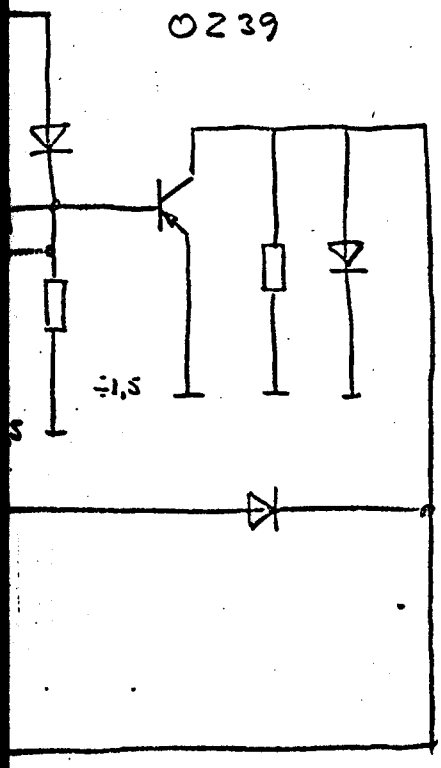

÷19.5
÷13.5
y læs$_h$ 1
Tk reg-
6 e
7 e
8 e
9 e
0239
Læs$_l$
÷1.5
÷13.5
0241
y skriv$_h$ 1



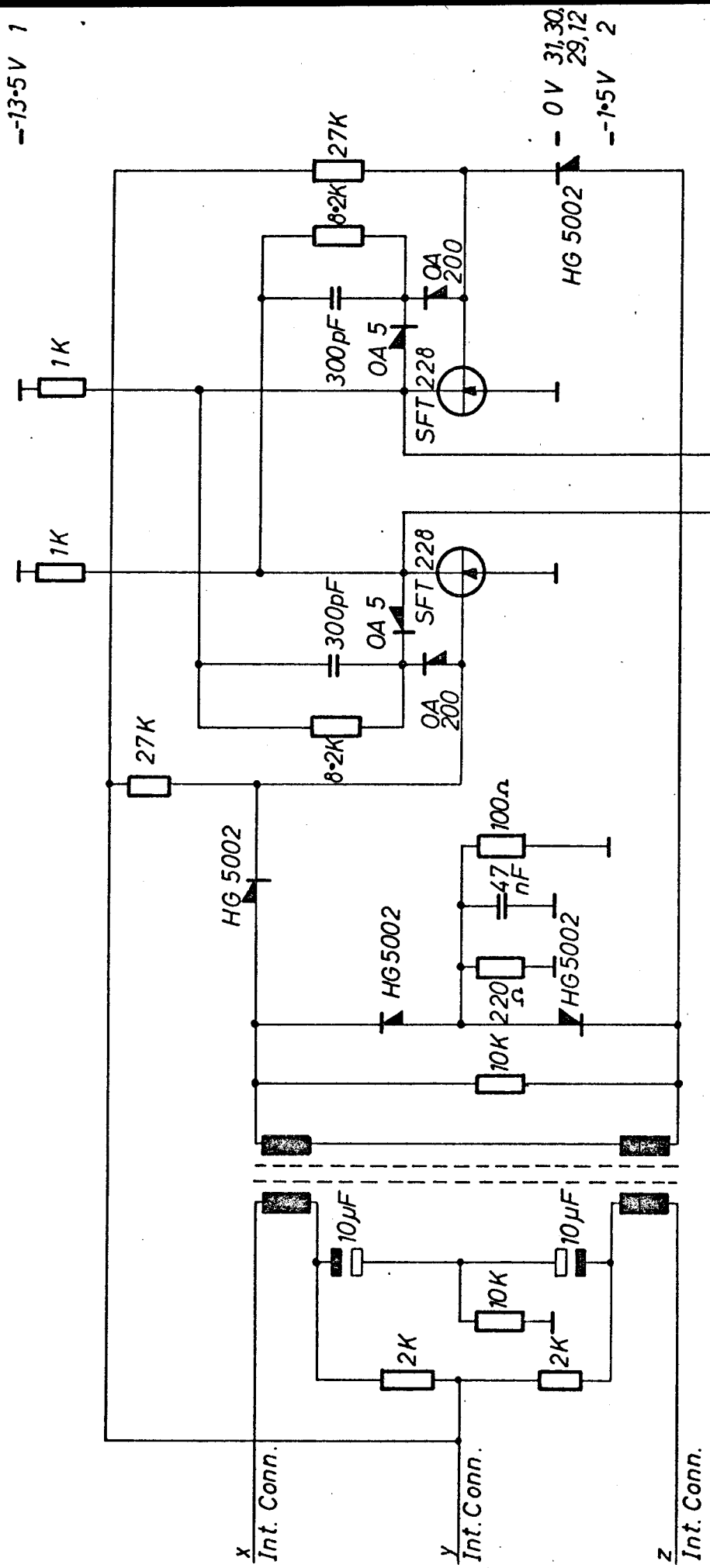


13/2-66 R. Ham

0239



R. Haun



Unit: GIER 6	Designed H.I.	DRUM SIGNAL AMPLIFIER	Drawing No
REGNE CENTRALEN	Approved		Drawn by B.R. 22.2.65.
	Checked 1. 2. 62.		Checked F.E. 22-2-67
	Last Revision		2 Sheets Sheet 2
			Pos. C5-25 0257-1