MOBILE IDENTIFICATION SYSTEM

SEQUENCE TONE DECODER

CAF 680-2005/x 3
CAF 680 2005/ x 3a

Storno

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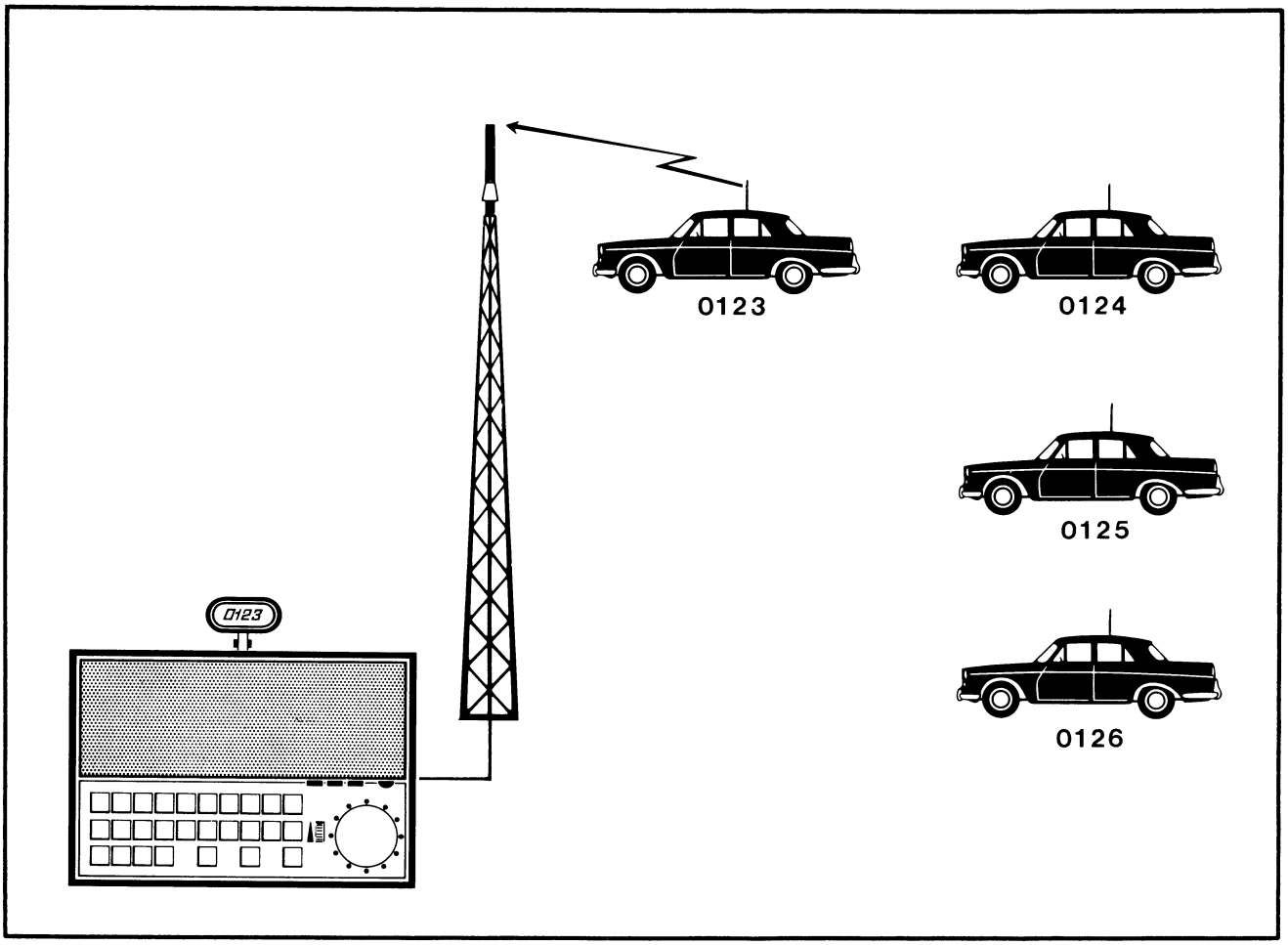
INDEX :

CAF 680 - 2005

Storno
RADIO COMMUNICATION SYSTEMS

Mobile Identification System



General

The STORNO Mobile Identification (MI) system provides automatic identification of mobile radio units. It has been developed to save valuable operator and channel time as well as to provide absolute identification. The flexibility and reliability of the system is demonstrated by its excellent acceptance in a wide variety of applications by police, public transportation, taxi, railway and electric power authorities.

While the applications of MI are limited only by the imagination of the system planner, several which have proved most advantageous include:

- Automatic identification of vehicles with which communications is established. Assuring that tasks and instructions are acknowledged by the desired unit without accidental or malicious misdirection.
- Savings in valuable operator and channel time by eliminating the need for verbal identification during each transmsision. Letting the vehicle driver concentrate his main attention on getting his job done.
- Identification of automatic or unattended equipment as it transmits status reports or is remotely interrogated. Permitting data communication to establish positive identity.

The MI Principle

The heart of the MI system is the sequential tone signalling principle. Each numeric digit 0–9 is represented by its own discrete tone frequency. By combining tones in sequence, multidigit numbers can be produced. For practical purposes the STORNO MI system has been limited to 5 digits providing a total capacity of 100,000 discrete codes. This capacity is enormous when compared with traditional systems such as the double tone system where twelve frequencies provide only 66 individual codes. All tones fall within the audible band and can therefore be transmitted over normal telephone connections.

The tones are automatically transmitted in very rapid succession at the beginning of each transmission from the mobile unit. In fact, the transmission time is so fast (only about half a second) that identification is completed even before the first words can be spoken by the mobile user. When the identification is received at the base station, it can be visually displayed or recorded in practically any manner required.

In practice, MI has been extensively used in conjunction with the STORNO five tone selective calling system. This provides a high degree of system continuity since the same number assignment can be used for both selective calling and mobile identification.

Technical Description

As previously mentioned, the MI system utilizes sequential tone signaling. These tone frequencies, as recommended by CCIR, are found in fig. 1. Note that the basic system includes an extra tone, the "R" tone. It is automatically encoded to avoid difficulties in decoding identical digits when they follow each other in sequence. For example, if the number of a particular unit is "17733", it will be transmitted as "17R3R". The decoder at the receiver end will automatically convert the transmitted number back to the original "17733". Several auxiliary tones can also be provided for special purposes such as emergency signalling or vehicle status.

Figure 1

Figure	Tone Frequency (Hz)
1	1124
2	1197
3	1275
4	1358
5	1446
6	1540
7	1640
8	1747
9	1860
0	1981
R	2110

Note: Encoders/Decoders can also be supplied for operation on the traditional STORNO (German ZVEI approved) or other frequencies.

When the MI encoder is activated, a multivibrator "clock" immediately initiates a very precise sequence of events with timing pulses. The first two pulses key the transmitter and leave it unmodulated to permit it to rise to full power and unsquelch the base station receiver. The next five timing pulses activate the individual tone frequency elements in proper sequence. These tone frequency elements are of a universal type which can be field-modified through strapping to any of the required frequencies. They provide high stability outputs and once set retain better than 1 % frequency accuracy. If the unit remains keyed, the next pulse enables the regular audio circuitry to transmit a speech or data message. If only identification is required, the unit need only be keyed momentarily as it will hold the keyline until the end of the identification. The entire identification process is accomplished in about half a second.

On the base station end, the received identification signal is decoded in the tone receiver. This decoder is activated as the incoming signal unsquelches the receiver. The actual decoding is done by comparing the incoming audio tones with a crystal controlled reference frequency in IC gates and counters. This circuitry provides TTL binary outputs which can be used in conjunction with the proper interface for either a visual display or for permanent recording on a printer or tape.

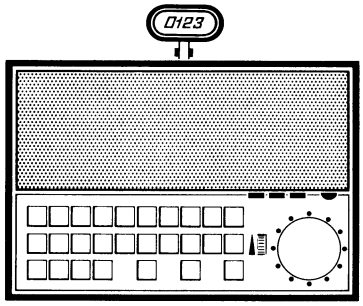
The reliability of the tone signalling system which is used for MI is very good. To maintain a very fast signalling speed and at the same time assure good immunity from noise and flutter, the tone duration has been optimized at 70 ms. A high receiver signal to noise ratio is assured by modu-

lating the transmitter at 70 % of maximum deviation. And, unlike some sequential systems, no complicated parity checking or synchronizing circuitry is necessary since lost pulses or tones due to signal drop-outs result in automatically recognized incomplete messages, **not** incorrect messages.

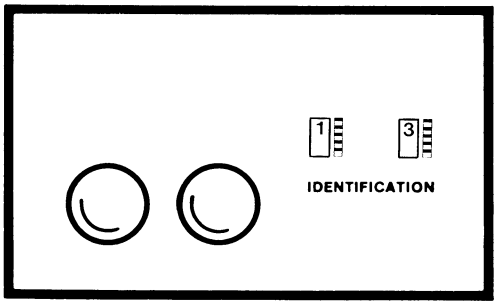
System Variations

Both the encoder and decoder units have been designed for maximum flexibility. This permits considerable variation in the system operation. Some possible applications and variations include:

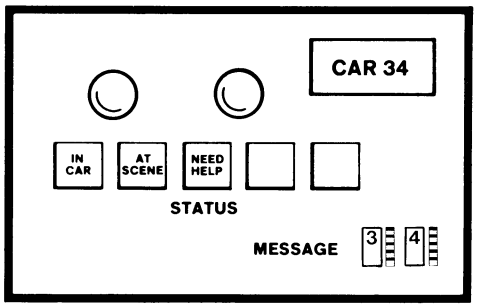
Visual Displays – Display momentarily, display until cleared or display until another identification number is received.



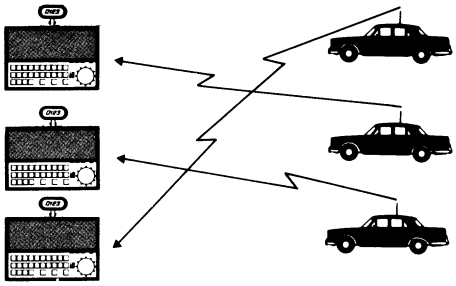
Changeable Identification – Thumbwheel dials or a slot for punched cards so that the identification will denote a specific operator rather than the unit.



Identification + Status – By using the first 2, 3 or 4 digits for identification (for a capacity of 100, 1,000 or 10,000 units respectively), the last 1, 2 or 3 digits can be programmed to provide a status readout either through manual push buttons, thumbwheel dials or automatic analogue to digital devices.

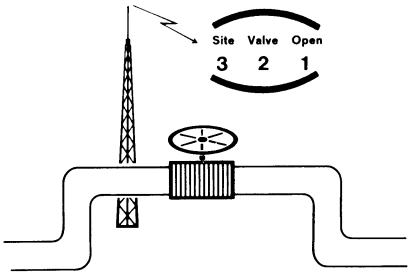


Control Center Routing – Based on a selected characteristic of an identification (i.e. the first digit, etc.), incoming calls can be routed to specific operators in a multiposition base station.



Printers – Connection to printers for "hard copy" documentation of date, time, vehicle number and status.

Identify on Request – If identification is not required each time a transmission is made, the mobile units can be modified so that they will identify upon request of either the operator or the base station.



We invite your inquiries on how the STORNO Mobile Identification system can be tailored to your particular applications.

E- 1125-1000-10-76

Storno

CAF680-2005/x3 and CAF680-2005/x3a

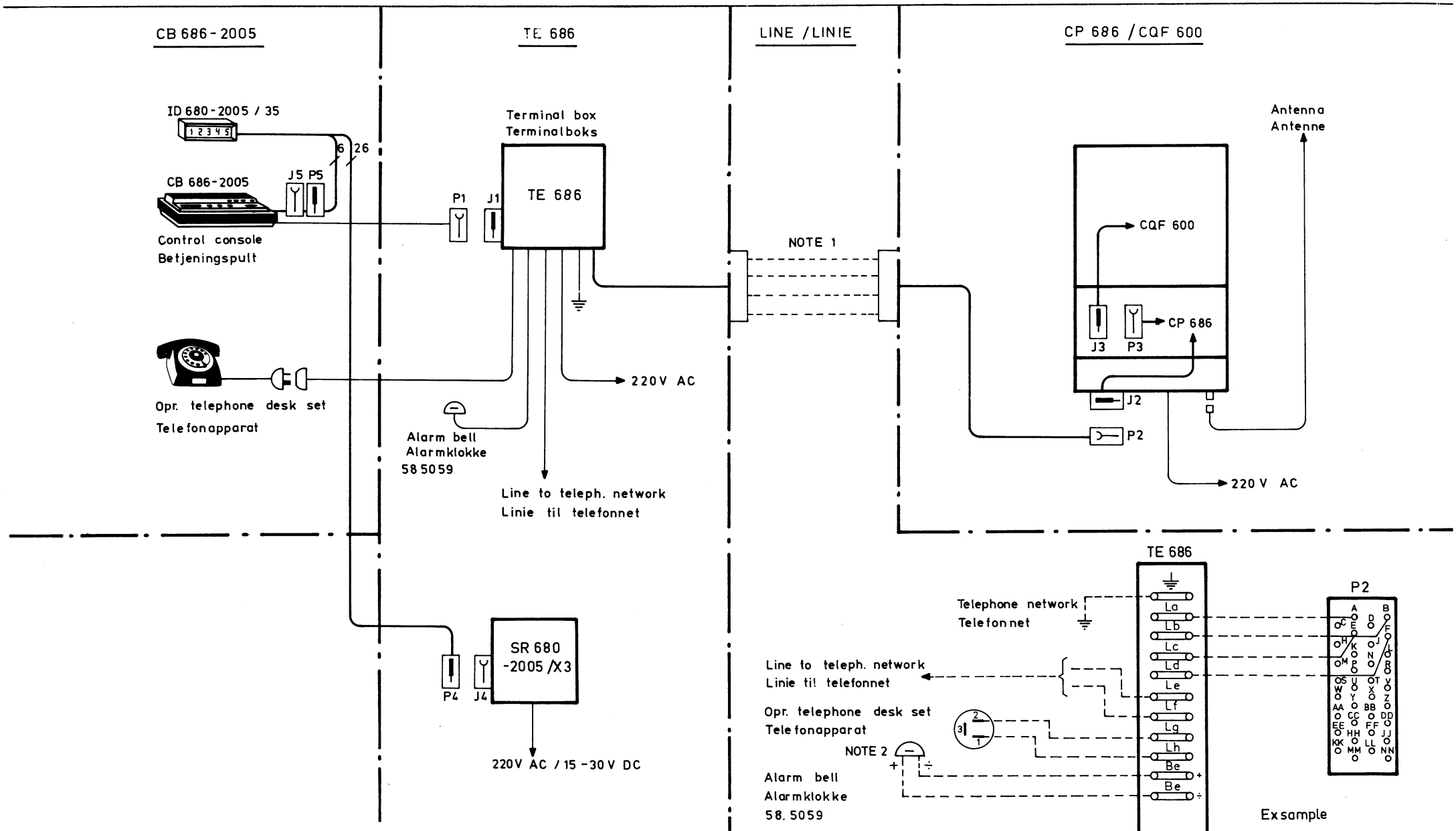
SECTION 1.

SECTION 2.

SECTION 3.

SECTION 4.

SECTION 5.



NOTE 1. : 2 telephone lines, (4 cores) with two junction boxes installed by a telephone company.

2 telefonlinier (4 ledere) med to samledåser installeret af et telefonselskab.

NOTE 2. : Alarm on: 24 V DC between the terminals marked Be.
Ved alarm: 24V DC mellem punkterne mærket Be.

REV.	DESIGN/DRAWN	APPR.	COMP. LIST		DATE
	NN / LMa			LAY - OUT REMOTE CONTROL FOR FIXED STATION CQF 600 MONTERINGSOVERSIGT FJERNSTYRING FOR FAST STATION CQF 600 CAF 687 - 2005	13 -5 - 74
	Storno RADIO COMMUNICATION SYSTEMS				A3 DRWG NO D 115 621

Sequence Decoder SR680-2005/xx.
Brief Description of the system.

1. General.

The sequence decoder SR680-2005/xx is a fully electronic unit intended for the detection of sequential tone signals of up to five tones in the sequence. The unit may be used in VHF/UHF systems for the mobile identification or detection of other types of numerical information.

2. Construction.

In its standard version the sequence decoder system consists of the decoder unit SR680-2005/xx itself and a display ID680-2005/xx.
This type can be used in all VHF/UHF systems which have sequential tone signalling provided signalling time and audio levels are kept within reasonable limits.
The sequence decoder is usually contained in a TE-cabinet (CA607) designed for wall mounting.
The display unit ID680-2005/xx is a small solid-state display for numerical information. (And the connection is effected via a standard 34-pin multiple plug.)
The display can be constructed for a maximum of five digits.
The display is mechanically constructed in such a way that it can be fastened with screws to a standard control desk of the type CB680.
If less than five digits are used in the system, the number og digit units can be reduced and the front plate of the display is changed ac. accordingly.
The display is fed from the built-in power supply of the decoder.

3. Interface equipment - applications.

The sequence decoder is furnished with different interface equipment which makes the system more flexible and facilitates adaptation in connection with specific applications.

3.1 Connection to standard desks CB68x.

When the sequence decoder SR680-2005/xx is to be employed in connection with the standard control desks of the type CB68x, the inter-

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face unit SU680-2005/05 is used.
This provides for the following functions:

a) Mobile identification.
b) Switch on of desk loudspeaker.
c) Loudspeaker blocking during sequence transmitting.

In this case, the sequence decoder also functions as an ordinary tone receiver with loudspeaker IN function and ordinary call signal by means of AC681. The loudspeaker blocking signal appears 5ms after the beginning of the first tone in the sequential signal.
If desired, a total attenuation of the whole of the sequential signal may be obtained by using a voice control unit VC681 connected to SU680-2005/05.
The sequential signal will thus be totally attenuated, and voice voltage switches on the loudspeaker with a delay of 7ms only.

3.2 Special output functions.

If the loudspeaker IN function is desired for certain digit combinations only, one or more units of the type SU680-2005 are used.

For instance, in connection with parallel control desks where it is desirable to make the call to a certain control position, SU680-2005 is connected to the digit terminal or digit terminals on the SD680-2005/xx providing for the desired output signal.
On being activated, SU680-2005 normally gives loudspeaker IN signal. Similarly, SU680-2005 may, when special digit combinations are employed, be used for loudspeaker OUT signal or alarm (emergency); SU680-2005 may also form part of systems of a more complicated nature, but will usually in such cases require further logic circuit.

3.3 Interface for digit output.

The output functions of the decoder, digit, etc., are available in standard versions as TTL logic output. These functions may be con-

verted into other logic levels when suitable interface units are used.

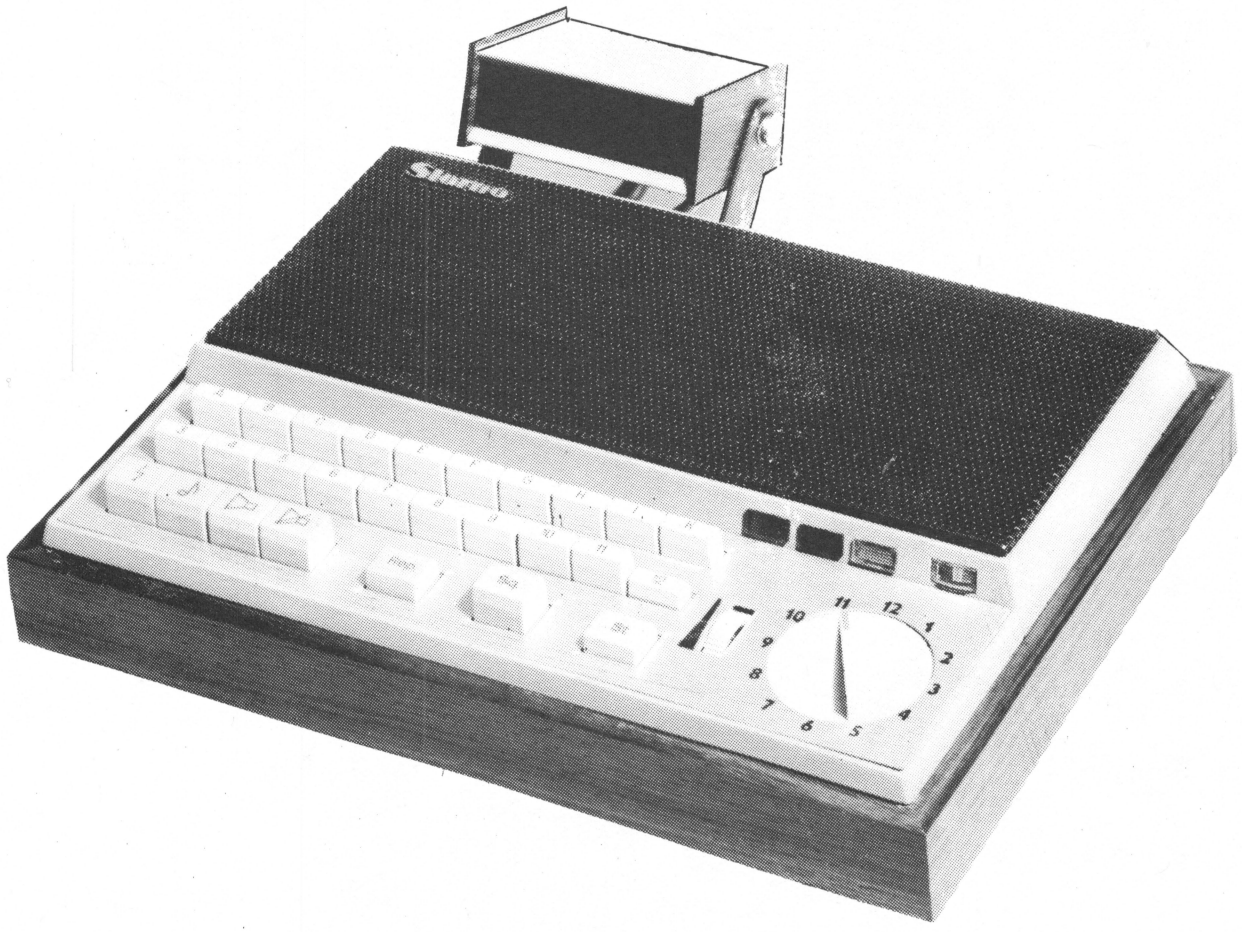
NU680-6196 is a 24 V relay unit converting BCD digits into decimal digits. The output terminals are neutral relay contacts with connection for 1 out of 11 and thus gives galvanic separation between the 5V and 24V systems.

Other possibilities for interface is the application of the TTL decoder/drivers or transistors.

As a general rule interface units should be placed as near as possible to the decoder terminal.

General technical specifications.

Operating voltage (internal):	5V DC ±0,25V.
Power consumption, max.:	1A except ID680-2005/xx
Operating voltage (external):	220V AC or 24V DC.
Temperature range: (guaranteed data)	0 to 50°C.
Working range:	-30 to +60°C.
Input impedance:	600Ω or 6kΩ asymmetric.
Output:	2 x (5 x 4) terminals with TTL logic output in BCD form and their inverted values.
Frequency series:	See type designation.
Size:	280 x 205 x 60mm.



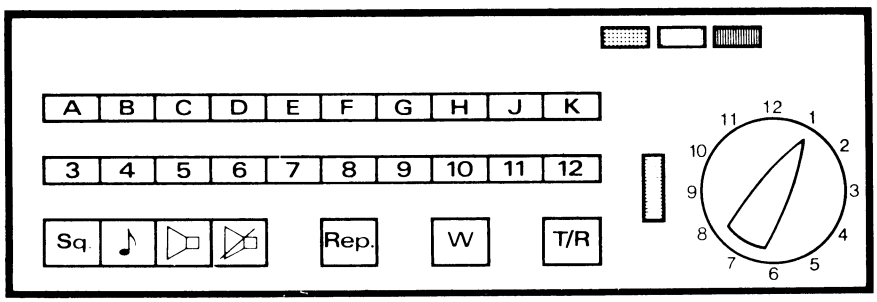
REV.	DESIGN/DRAWN	APPR.	COMP. LIST		DATE
	PV / LMa			STANDARD BETJENINGSPULT TYPE CB 68X MED DISPLAY TYPE ID 680 - 2005 / 35	20 - 6 - 74
	Storno RADIO COMMUNICATION SYSTEMS			NORMAL DESK CONTROL UNIT TYPE CB 68X WITH DISPLAY ID 680 - 2005 / 35	A4 DRWG. NO. D 124 931

OPERATING INSTRUCTIONS

Storno Base Station

Duplex with tone calling

Types CB 684-2005 and CB 686-2005 Control desk



Yellow lamp indicates that power is applied.

Green lamp is switched on when you are called.

Red lamp glows when you transmit.

Channel switch. Indicates which channel is in use for transmission and reception.

Loudspeaker volume control.

B / 6

Selection of calling numbers for mobile stations (numerals may be provided in both lines of buttons).

Tone button. To be used at first calling.

Loudspeaker cut-in. Before making a call, press this button to check if the channel is clear.

Loudspeaker cut-out. Press this button on termination of call. This will cut out the loudspeaker so that you will not be disturbed by calls not intended for you, and the display is erased.

Rep.

Repeater button. If the base station is equipped for operation as a repeater station – that is, for car-to-car communication via the base station, press this button to switch to repeater operation. You can monitor the traffic in the loudspeaker.

Sq.

Squelch button. If the received signal is very weak, reception can often be improved by depressing the squelch button.

T/R

This button is used to switch the telephone desk set between base station and telephone line.
In position T = up, the telephone desk set is used as an ordinary telephone desk set and in position R = down, the telephone desk set is used to control the base station.

W

This button is used to connect a telephone subscriber with a car.

Base station (operator) to cars:

Press button to cut in loudspeaker. Check if channel is clear.

B / 6

Depress call number of the car.

Depress tone call button. Red lamp will glow, and call will be transmitted. Await answer from called car.

T/R

Switch this button to position R = down, lift the handset and speak and listen. The red lamp glows. The loudspeaker is automatically cut out when the handset is liftet from the hook.

Cut out loudspeaker on termination of call and replace handset on hook.

Car to base station (operator):

Mobile identification is seen on the display.

Green lamp glows and bell rings. Loudspeaker is automatically cut in. Call from car is heard in loudspeaker.

Switch this button to position R = down, lift the handset from the hook and answer the call.

Cut out loudspeaker on termination of call replace handset on hook.

Operator to telephone subscriber:

Switch this button to position T = up. Lift the handset from hook and follow the normal telephone call procedure.
In case of a call from a car during the operator's telephone conversation, the call is indicated by a bell and the green lamp. On termination of the call the handset is replaced on hook.

Telephone subscriber to base station (operator):

A call from a telephone subscriber is indicated by the telephone bell. (T/R button in position T) or by the radio alarm bell (T/R button in position R).

Switch this button to position T = up, lift the handset from the hook an answer the call as usual.
On termination of the call handset is replaced on hook.

Call from car to telephone subscriber:

Mobile identification is seen on the display.

The green lamp glows and the bell rings. The loudspeaker is automatically cut in. Call from car is heard in loudspeaker.

Switch this button to position R = down, lift handset from hook and answer the call.

Switch this button to position T = up, call the desired telephone subscriber and inform the subscriber.

Press this button down.

Switch this button to position R = down, replace the handset on hook and car is connected with subscriber. The red lamp glows. The conversation is monitored in the loudspeaker.

On termination of call this button is depressed.

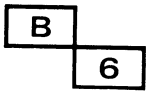
Depress this button.

Telephone subscriber to car:

Call from a telephone subscriber is indicated by the telephone bell. (T/R button in position T) or by the radio alarm bell (T/R button in position R).

Switch this button to position T = up, lift the handset from hook and answer the call.

Cut in loudspeaker and check that the channel is clear.



Press down the number of the car.

Press down the tone button, red lamp glows and call is transmitted.
Await answer from the called car.

Press down the W button.

Switch this button to position = down. Inform the called car. Replace handset on hook and subscriber is connected to car. The conversation is monitored in the loudspeaker.

On termination of call this button is depressed.

Depress this button.

DISPLAY.

SU680-2005/03

ID680-2005/35

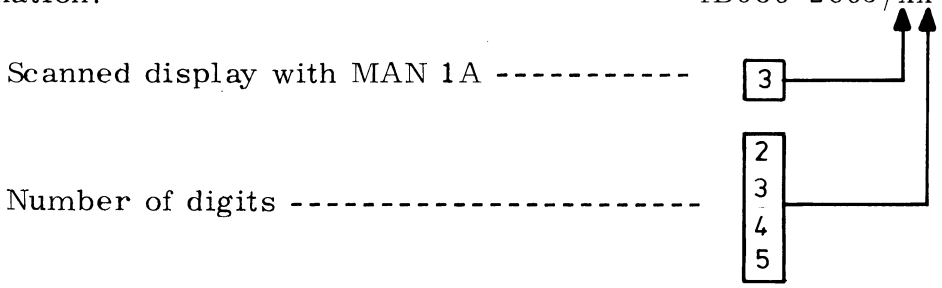
1. General.

1.1 Display ID680-2005/35 is intended for displaying of a 5-digit $\overline{\text{BCD}}$ signal in decimal form. The $\overline{\text{BCD}}$ signal is derived from the outputs of SD680-2005.

1.2 The display might be strapped to read out 4, 3 or 2 digits.

1.3 The display must be driven from a scanning unit SU680-2005/03 placed close to the SD680-2005.

1.4 Type designation: ID680-2005/xx



2. Technical data, SU680-2005/03

2.1	Supply voltage:	5V DC ± 0,25V.
2.2	Current consumption:	Max. 150mA.
2.3	Ambient temperature, working range:	0^{o} C to $+50^{o}$C.
	Ambient temperature, function range:	$\div 30^{o}$C to $+80^{o}$C.
2.4	Logic levels:	"1" ≥ 2,4V. "0" ≤ 0,4V.
2.5	Input:	5 digit $\overline{\text{BCD}}$.
2.6	Output:	BCD (4 terminals). +5 digit adress terminals.
2.7	Scanning frequency:	250Hz.
2.8	Dimensions:	80mm x 72mm.

3. Technical data, ID680-2005/35.

3.1	Supply voltage:	15V -30V DC.
3.2	Current consumption:	100 - 20mA.
3.3	Ambient temperature, working range:	0^{O}C to $+50^{O}$C.
	Ambient temperature, function range:	-30^{O}C to $+80^{O}$C.
3.4	Digit outline:	7-segment.
3.5	Logic levels:	"1" ≥ 2,4V.
		"0" ≤ 0,4V.
3.6	Max. cable length:	100m.
3.7	Scanning system:	5 1 3 2 4
3.8	Each digit, on-time:	4 mS.
	Each digit, off-time (5-digits):	16mS.
3.9	Dimension without mounting clip:	W 86m.
		D 60mm.
		H 39mm.

4. Mode of operation, SU680-2005/03.

4.1 Input is supplied with the digits to be displayed in $\overline{\text{BCD}}$.

4.2 Clockpulses from generator Q1 - Q2 (repetition rate 250Hz), are fed to decimal counter IC 5.

4.3 Output from the decimal counter is decoded in IC 3.

4.4 Outputs 0 - 1 - 2 - 3 - 4 from IC 3 are inverted in IC 1 and connected to the adress terminals a1 - a5. The outputs are via a strapping field and an inverter IC 1f returned to the reset terminals of the decimal counter.

4.5 By strapping it is then possible to determine the maximum count of IC 5 (i.e. the number of digits to be displayed).

4.6 Each adress terminal gates a $\overline{\text{BCD}}$ input.
When an adress terminal is "1":

a) the corresponding $\overline{\text{BCD}}$ input is inverted and "connected " to outputs ABCD.

b) all the other adress terminals are "0".

5. Mode of operation, ID680-2005/35.

5.1 Display ID680-2005/35 is supplied with:

a) supply voltage which is converted from 15 - 30V DC to 5V DC in VR680-2005/03.

b) 5 adress signals a1 - 15.

c) 4 cores with BCD signals.

5.2 "1" on one of the adress terminals is inverted in IC 2 and drive one of Q1 - 5 ON.

5.3 The BCD input on ABCD is decoded in IC 1 to 7-segment and drives the display diodes. Drive current is determined of R11-17.

5.4 All displays have 7-segment drive. The adressed display which also has V_{cc} via Q1 - 5 will be lit. By adressing (scanning) the displays with a suitable rate the eye will see this as if all displays were lit simultanously.

6. Strapping of ID680-2005/3X and SU680-2005/03.

6.1 ID680-2005/3x will only be delivered with the required number of digits.

6.2 Position of the digits:

5 digits (ID680-2005/35)	X X X X X
4 digits (ID680-2005/34)	X X X X
3 digits (ID680-2005/33)	X X X
2 digits (ID680-2005/32)	X X

6.3 Strap for number of digits on SU680-2005/03.

6.4 When using a 4, 3 or 2 digit display, the following digits from a 5 tone or a 4 tone sequence will be displayed:

ID with 4 digits: { 5 tone sequence: 2.-3.-4.-5. tone.
4 tone sequence: 1.-2.-3.-4. tone.

ID with 3 digits:
- 5 tone sequence: 2.-3.-4. tone.
- 4 tone sequence: 1.-2.-3. tone

ID with 2 digits:
- 5 tone sequence: 2.-4. tone.
- 4 tone sequence: 1.-3. tone.

6.5 If it is wanted to display other digits or to drive two displays in parallel, kindly request Storno, Systems dept.

PS600-6450a

PS600-6450 a is a 5 V power supply intended for operation of 5 V TTL logic from 24 V DC (Storno standard). Logic 0, ground, GND has galvenic connection to -24 V.

The design of the power supply is based on the switching principle, resulting in large efficiency, small mechanical dimensions, large range of input voltages, and a good separation between output and input.

The power supply may be divided into four blocks:

Input filter, switching section, output filter and protective circuit.

The input filter consists of C1, C2, C3, C4, and L1 and serves the purpose of attenuating partly the radiation from the PS to the primary power supply, partly transients from the power supply.

The switching section consists in the main of IC 1, Q1, Q2, L2, L3, E2, E3, and C7 - 9. The purpose of the switching section is to pass current pulses with a duration of 3 - 5 µsec. through L2, L3 to C7 - 9 with a repetitioning frequency determined by the load, so as to maintain a constant output voltage of 5,0 V ±0,2 V.

E2 and E3 are catch diodes which increase the efficiency as the energy from L2 and L3 is passed on to C7 - 9 when Q1 and Q2 go off.

The output filter consisting of L4, C10 and C11 serves the dual purpose of preventing radiation from the PS and to operate as an "insulator" between the load and the PS so that sudden alterations of current - in case they have a certain size - are transformed to voltage alterations for the protective circuit.

The protective circuit consists of Q3 and Q4 which, in case of changes in load of >1.2 A turns off the bias to Q1 and Q2.

A diode, E1, in the input of the PS protects the power supply against incorrect battery voltage polarity, and a zenerdiode across the output short-circuits when Eout >6.8 V.

Technical Specifications PS600-6450a

E in	24 V
I in	5 mA to 400 mA at 1.5 A out
E out	5.0 V ±0.2 V
I out	Max. continuous load 1.5 A
Efficiency	> 70%
Switching frequency	Approx. 66 kHz at 1.0 A load
Radiation of noise	Conforms with "Størgrad N" (VDE NORM)
Output ripple	< 50 mV pp.
Fuses and protective circuits	The unit is protected against incorrect input voltage polarity by a diode and a safety fuse. The unit is protected against a steadily increasing current consumption by a safety fuse which cuts off at 1.7 - 3 A load. Finally the power supply is protected against sudden variations of load by means of a protecting circuit, which is activated at Δ I out 1.1 - 1.3 A. Resetting is performed by switching off E input for approx. 30 seconds.
NOTE:	When starting up the unit a comparatively slowly increasing E input is required in order not to activate the protecting circuit. I out max. at intermittent load 2.5 A, 1.5 A/10 minutes - 2.5 A/2 minutes. η /2.5 A ≈ 65%. E input may be within 35 and 12 V with due respect to I input and other specifications.

Sequence Decoder SD680-2005.

1. General.

1.1 The sequence decoder SD680-2005 constitutes together with the multitone receiver TR680-2005 and a digit display a decoder unit which can receive and read any combinations of a 4 or 5 digit sequential tone call with a total of 10.000 or 100.000 digit code combinations respectively.

1.2 The decoder is primarily intended for identification of mobile stations in VHF/UHF systems, where call systems according to the sequential tone principle SSFC: Sequential - Single - Frequency - Code are employed.

1.3 The unit can be employed in systems combining identification and data transmission or in systems using the unit solely for the reception of simple data or other information.

1.4 After reception of a correct 4 or 5 tone sequential signal, 4-bit reading is obtained from the identification or data signal digits received. The digit information received remains registered until another sequential call is received or until manually cancelled.

1.5 If one or more decoding hold circuits, type SU680-2005, are connected to the digit output terminal, many special output functions may be procuced.

1.6 Reading from the digital information received is obtainable from all types of digit indicators (displays) by connecting - either direct to SD outputs (f. inst. Hewlett Packard, Solid State Numeric Indicator type 5082-7000) - or via suitable interface circuits or decoder drivers.

1.7 The tone receiver unit can either be mounted on top of the decoder unit or placed next to the decoder on a standard mounting plate intended for a 19" chassis structure.

1.8 For the complete sequence tone decoder a 5 volt stabilized power supply must be employed. The consumption is about 1 ampere plus the power necessary for the interface and display equipment.

2. Tecnical data:

2.1	Supply voltage:	+5 volts D.C. ±0.25 volts
2.2	Power consumption: Stand-by: Activated:	550mA ±10%
2.3	Temperature range: Guaranteed minimum performance:	0 to +50° C.
	Operational:	-30 to +80° C.
2.4	Input signals from TR680-2005:	From TR680-2005 three signals are received: 1) BCD+DIG/CIF, which are 4-bit binary values of the numbers of the tone signals received. 2) BCD+ is logic 1' as long as one of the 12 tones is being received. 3) RESET IMP which is 2.5µs logic 1'pulses with repetition interval equal to the cycle periods of the received tones.
2.5	Activation signals:	4 or 5 binary digit values in sequence from the multitone receiver with t_{CIF} =70ms±15ms. Pause between each digit, maximum 15ms. (for CCIR tonesystem t_{CIF}=100ms ±15ms)
2.6	Voice reliability and safeguarding against interference:	1) Each digit tone to TR-input must be of constant frequency and without interruption for 5 ms before measuring of tone length is commenced. 2) After correct digit tone reception for 5ms, tone interruption or frequency deviation may be accepted for a maximum of 5ms. 3) The decoder is adjusted to register digits, the duration of which is longer than 50ms. If the duration of a digit signal is longer than 90ms ±5ms, any previously accepted digits will be cancelled. (for CCIR 80ms and 120ms ±5ms). 4) Output to the registers for the digit indicators (display) is available only if at least 4 correct digit signals in sequence with pauses between

digits less than 15 ms are received.
N.B.: There are no pauses between the digit signals from TR680-2005 in a normal sequential tone signal.

2.7 BCD+ CIF input:

TONE	-	1	2	3	4	5	6	7	8	9	0	R	A
A	1	1	0	1	0	1	0	1	0	1	0	1	0
B	1	0	1	1	0	0	1	1	0	0	0	1	0
C	1	0	0	0	1	1	1	1	0	0	0	0	1
D	1	0	0	0	0	0	0	0	1	1	0	1	1
BCD+	0	1	1	1	1	1	1	1	1	1	1	1	1

2.8 Logic input and output voltages:

Logic 1' $\geq$ 2.4 volts (type 3.3 volts at $I_1 \leq 0.4$ mA).
Logic 0' $\leq$ 0.4 volts (type 0.2 volts at $I_0 \leq 16$ mA).

2.9 Signal type:

The sequential tone signal received must in principle not contain two identical digits in succession.
If there are identical digits in succession, a repetition tone "R" = 11' tone will
be emitted. the control circuit of the decoder is so constructed that it will cause the repetition signal to be converted in such a way that it will be read as the preceding digit.
If the repetition tone "R" is received as the first tone or after tone "A", binary output "R" = 1011 is obtained. Tone "A" is always read as the binary value DCBA = 1100. Sequential tone signals of identical tones in succession may be accepted if there is a pause of 10 ms ±5 ms between digits.

2.10 Output terminals:

1) 2 x (5 x 4) terminals with TTL logic output for display, decoder- drivers or transistor switches. From the terminals are obtained the 4-bit binary values and their inverted values for the 5 digits which can be read.

Example: A display of inverted binary code for the third digit is connected to the terminals 55, 44, 35 and 24.

2) 0 volt CALL (30 volts/100 mA) transistor output for received call. Continuous 0 volt output is obtained as long as a sequential call is registered.

3) OUTPUT, IMP. 15 ms after reception of a 4 or 5 tone sequential signal, a 0.5 ms pulse (logic 1') is produced which can be used as gate-pulse for output to the external registers for parally connected displays or for special output circuits. This pulse is, i.a., used when connecting the decoding hold circuit SU680-2005 employed when it is desired that special output functions should be registered.
Output becomes also logic 1' when logic 0' is fed to terminal 1 by cancellation of the digits registered.

4) Special output signals are obtainable from the empty terminals 4, 5, 6, 7, 8, 9, 11 and 15 by mounting wire connections to the internal decoder circuits desired.

2.11 Cancellation:

Cancellation of digits on the display is accomplished by connecting 0 volt to the terminal 1, CANCELLATION IMP. When a loop connection from GND (0 volt) to terminal 1 is established, loop resistance must be less than 500Ω.

2.12 Mounting

1) It is recommended that each unit be connected to the 5 volt power supply separately, wiring being reduced to a minimum.

2) For +5 volt and 0 volt wires, wire of at least 0.75 mm^2 is used.

3) By connecting displays with TTL logic inputs or units with TTL-logic-circuits, the rules governing interface must be observed, see "Texas Instruments, Semiconductor and Components Data Book 1, 1968", pages 31 - 46.

2.13 Mechanical measurements: 180 x 80 mm.

3. Theory of Operation.

3.1 This description refers to the diagram of SD680-2005, D119436, and to the 2 pulse diagrams D114570 and D114579, showing the most important pulses in the circuits during the reception of a 4-tone sequential signal.

3.2 The input signal to TR680-2005 is shown with tone interruption between the tones 1' and 2' = 10 ms, and between the tones 2' and 3' being less than 5 ms. Tone 2' shows an interruption of the tone signal of less than 5 ms, and tone 3' shows a shift of frequency which is also less than 5 ms.
The change from tone 3' to tone 4' and the appearance of tone 4' are shown as if the signal received is ideal.
The sequential tone signal shown consists of the tones "7, 1, R, 4", which are to be read as 7114.
To illustrate the mode of operation of the sequence decoder in case the tone first received is the repetition tone "R" and the duration of the tone is too long, the mode of operation is shown after the 4 tone sequential signal.

3.3 The signal type shown makes it possible to demonstrate the circuit mode of function of the decoder in respect of all occurring signal inputs.

3.4 If no tone signal or speech is received, BCD+, CIF. input will be equal to binary 15 (DCBA = 1111). BCD+ and RESET IMP input will be logic 0'.
The binary output from the 5 digit-output-registers will also be equal to binary 15'. From the inverted output terminals, binary 0' = 0000 is obtained.

3.5 On reception of the sequential signal, the binary digit values of the received tones are obtained from TR680-2005. Logic 1' is fed to

the BCD+ terminal as long as one of the 12 tones is being received. To the RESET IMP. terminal is fed 2.5 μs logic 1' pulses with the repetition interval equal to the cycle periods of the tone signals.

3.6 The RESET IMP. pulses are, via the gates B3 and D4, fed to G4 and 13. Hereby the binary digit value of the first received tone in the register G is being read. Circuit F is a 4-bit binary comparator comparing input and output from the register G. After reading of the first digit value, input and output are identical, and logic 0' is obtained from the NAND circuit B11.

3.7 This signal ($\overline{\text{LIG} \cdot \text{BCD+}}$) is fed to a 5 ms time measuring circuit B8 and D1. After 5 ms without signal interruption, a circuit is activated. This results in constant output being given as long as signals with interruptions of less than 5 ms are being fed to input.

3.8 Output from this 5 ms "signal interruption circuit" is obtained from E6. The signal is fed to three circuits for the following functions:

1) To gate D5 in which the signal blocks the input pulses to the register G. This causes the binary value of the tone signal received during the first 5 ms to remain registered. The binary digit is fed to the B-inputs of the 4-bit comparator. It will then be possible to measure when tone 1' ceases and tone 2' starts, or to ascertain whether merely a shift of frequency occurs, which, i.a., happens when speech is being received. If this occurs or if the received signal is interrupted for a longer period than 5 ms, input to register G will be opened again.

2) To gate E10 which will cause the time measuring circuit with the transistors Q1 and Q2 to be activated. This circuit measures whether a constant tone frequency is being received for at least 50 ms.

3) To the gates E12 and H3, which form part of a 15 ms drop-out-circuit. An E6 signal cancels the signal which, from gate P8, gives preset signal to the digit-input-registers (M, S, V and Z). The preset signal sets all the terminals of the registers in logic 1' when no signal has been received from E6 for 15 ms.

3.9 After reception of a constant tone for about 50 ms, a signal is obtained from the transistor Q3c indicating that the signal received has been accepted. The signal is fed to Q4 and gate A4 forming a time measuring circuit of 40 ms. If the tone signal received is longer than 90 ms (50 ms + 40 ms), a signal is obtained from gate A1 to gate

P5 causing preset signal to be fed to the digit-input-registers. All previously received and read digits are thereby cancelled.
(other times for the CCIR code.)

3.10 The signal from Q3c is fed to the gates A12 and E1, forming a one shot circuit in conjunction with the inverter C12. From gate A13, a 1 ms pulse is obtained, READ DIGIT, which is being fed to the gates X4 and U9.

3.11 The 1 ms pulse to X4 causes the registered digit in register G to be fed to the register R. The pulse to U9 activates the one shot circuit X8 and U12, which from U2 produces a logic 0' pulse of 2 ms which is fed to the four input registers as a clock pulse. The digit read in register R is fed to the first register in the four input registers on the back edge of the 2 ms clock pulse. One bit is thus being registered in each of the 5-bit shift registers Z, V, S and M.

3.12 The application of the intermediate register, R, is due to the application of the 11 th tone "R" = 1011 in the sequence decoder. Tone "R" is used either as a first tone (key-tone) or as a repetition tone, in which identical digits follow one another in the code.
If tone "R" is received as the first tone, it should be read in the register R as digit information. If, on the other hand, tone "R" is received after one of the digits 0 - 9, it should not be read since the digit registered for tone "R" in register R is to be fed to the input registers.
These functions are controlled by using the two 3-input NAND-gates Y12 and Y8. Input reading of a digit to the register R thus only occur occurs if:

a) the digit signal from register G is not equal to digit 11' = 1011, or if

b) the digit signal from the register G is equal to the digit 11' and no digit has been read into the first register position of the shift registers.

3.13 Immediately after cessation of the first tone, the second tone of the sequential signal will be received. Digit input to the comparator, the A inputs of F, then becomes different from the digit fed to B inputs from register G. Output from C6 then becomes logic 0', and input to the circuit which allows interruptions or shifts of frequency for a maximum of 5 ms then becomes logic 1'.

3.14 After the lapse of 5 ms with the 2 nd digit of the tone code, logic 0' is obtained from gate E6 to gate D5. At the next RESET IMP, clock pulse to G4, 13, is obtained and the new digit is read into register G. The two digit inputs to the comparator are now identical, and input reading to register G is again blocked.

3.15 During the short period from the appearance of the signal from E6 for opening of gate D5 to the following RESET IMP, a logic 0' pulse is obtained. This serves the purpose of activating gate E10, which, together with H6, constitutes a 2 ms one shot circuit. During the 2 ms, the time circuit is reset and will now measure 50 ms for Storno code and 80ms for the CCIR tone code, with continuous tone signal. This is accomplished by Q1 going OFF for 2 ms whereby C7 is charged through R6. At the same time the 40 ms time measuring circuit (with the transistors Q3 and Q4) is reset.

3.16 50 ms

the four shift registers. The bit-values of the digit first received are moved one position in the shift registers.

3.17 In the same manner the subsequent 2 or 3 digits are received and registered. When the 4 th digit has been registered in the input registers, the first digit will have moved to the fourth register of the shift registers with output terminals marked D out. Logic 1' signal is then obtained from the 3-input NAND gate Y6 (CIF. REG-D). This signal is fed to the output gate X12 and indicates that at least 4 tones (digits) have been received.

3.18 After reception of a complete sequential tone signal of 4 or 5 tones, the input signals BCD+ and RESET IMP. will cease.
After the lapse of 5 ms, the signal from E6 to H3 and E12 becomes equal to logic 0'. 15 ms later, logic 0' is obtained from the NAND GATE, P3. Logic 1' is then obtained for both X12 and X13, which results in logic 0' from X11 to L9.

3.19 The signal from X11 activates two one shot circuits. For 2 ms a logic 0' pulse is obtained from H8 to P9. This pulse prevents the preset signal to P10 from cancelling the digits registered in the input registers during that period.
From H10, a 1 ms logic 0' pulse is obtained which activates the bistable flip-flop, L3 and L11 thereby that the signal is fed to L2.

From L3, logic 1' is obtained causing the transistor Q5 to go ON. The signal from terminal 17, 0 volt CALL/OPK., is received constantly after reception of a call; the signal may cause a call lamp or a loudspeaker in a control panel to be turned on.

3.20 The 1 ms pulse is also fed to L5. From the inverter J12 is obtained a logic 0' signal causing logic 1' to be fed to the clock inputs, CP, of the 5 output registers. The digits registered in the input registers are thereby fed to the output registers.

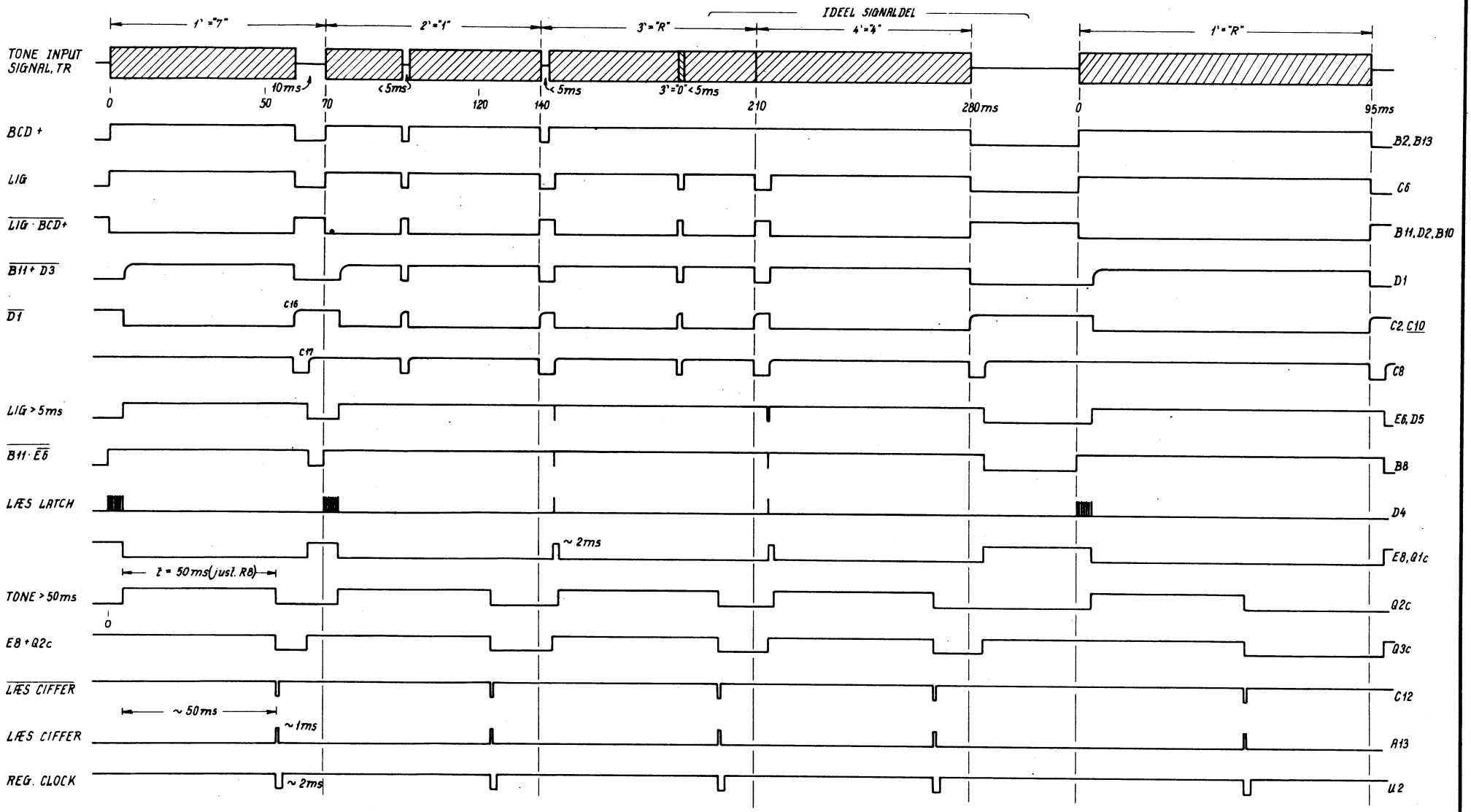
3.21 About 1 ms after reading of the received digits, the 2 ms pulse to P9 ceases. From the inverters U4 and U6, logic 1' is fed to the four shift registers, PRESET terminals; all outputs from the shift registers M, S, V and Z thereby become logic 1'. The input registers are thus emptied of digit information and are ready for another sequence code.

3.22 The registered digits in the output registers K, N, T, W and Å are cancelled by feeding logic 0' to terminal 1, ERASE/SLET, IMP. The clock-inputs to the output registers then become logic 1', and output from the input registers - all of which are logic 1' - is fed to the Q outputs of the output registers. Besides, 0 volt to the terminal 1 causes Q5 to go OFF.

3.23 By continuously feeding 0 volt to the terminal 1 and to gate P6, the decoder is brought into such a condition that it is possible to read the input of a received sequential tone signal on the connected digit display.
This serves the purpose of testing the decoder in connection with fault finding. If a single tone transmitter is connected to the audio input of the multitone receiver, most of the functions of the decoder can be tested by changing the frequency of the tone generator from about 1 - 3 kHz. On the display the digits 1, 2, ... 9, 0 will appear from right to left. If the frequency of the transmitter is changed to 3009 Hz, the digits 8, 9, 0, 0 and a blank space will be registered on a 5-digit display. The two zeroes appear because the repetition tone frequency obtained after tone "0" causes the digit 0' registered in register R to be fed to the input registers. By changing to the frequency for tone "12", the binary value for digit 12 is fed to the input registers and to the output registers. Since the digit indicators can only show the decimal digits 1 to 0 only, a blank space appears.

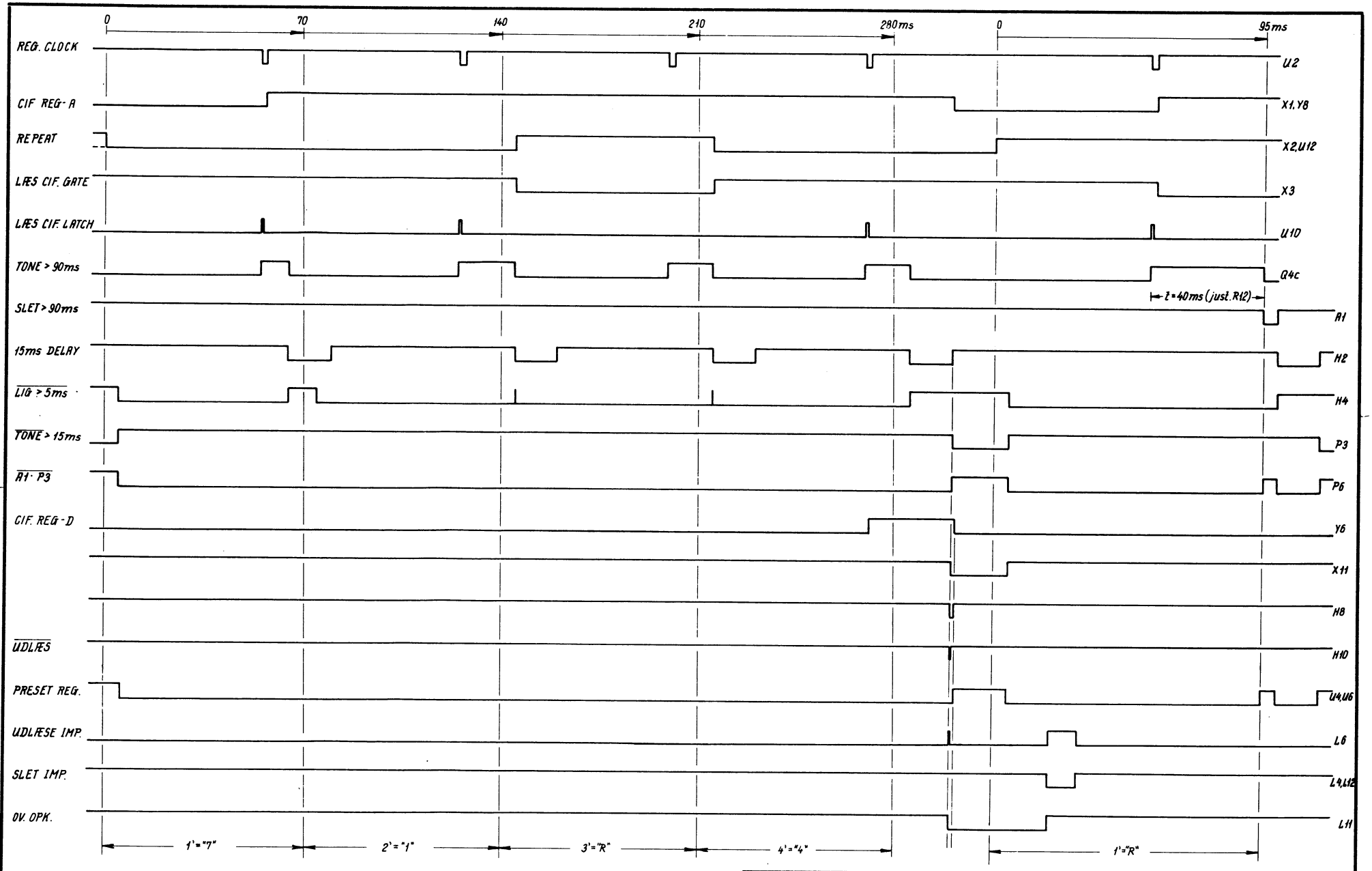
If the frequency of the transmitter is changed in direction of 1 kHz, one or two blank spaces will first appear, and then the digits 0, 9, 8 ..... 2, 1 in succession until the display shows 5, 4, 3, 2 and 1 at 1000 Hz.

3.24 In the sections 3.5 to 3.21 a relatively rough description of the function of the sequence decoder is given. Any real understanding of the functions of all the circuits necessitates a study of the specifications of the employed logic TTL units. Understanding of the functions of the decode circuits can best be acquired by studying the two pulse schedules and the diagram. It should be emphasized once more that a sequential signal received via radio will seldom appear as the ideal described in the sections 3.5 - 3.21. As shown on the pulse schedule 1, there will be short intervals of signal interruptions or shifts of frequency resulting from noise interference.



Storno	konstr./tegn. OG / KG 6 5 - 70	SIGNAL WAVEFORMS IMPULSSKEMA 1.	SD 680 - 2005 KODE
	godk.		
	komp.liste		TEGN. NR. D 114570 A3

Blanket 32.177



Storno	konstr./tegn. OG/KG 8-5-70	SIGNAL WAVEFORMS IMPULSSKEMA 2	SD 680-2005
	godk.		
	komp.liste	KODE	TEGN. NR. D 114579 A3

Blanket 32.177

Sequence Decoder SD680-2005.

Directions for test.

1. Instruments.

   1 power supply 5 volts 2 amperes
   1 multitone receiver TR680-2005
   1 sequential tone transmitter of variable times
   1 oscilloscope; with
   1 probe
   1 universal instrument
   1 resistance decade box
   1 4- or 5-digit BCD display
   1 tone transmitter.

2. Printed circuit.

   Supervise the PC-board for bad solderings, short circuits and superfluous flux.

3. Power consumption.

   Feed the decoder with 5.0volts ±0.25volts; check that power consumption is about 550mA ±10%.

4. Determination of R8 for min. tone length.

   Connect the decoder, the tone receiver TR680-2005 and the sequental tone transmitter together. Feed sequential signals of t > 55ms tone length for Storno tone systems and t > 85ms for CCIR tone system. Fit in resistance decade box as R8, and adjust to nearest standard value, which gives the mentioned times ±5ms, when measured with an oscilloskopeon Q2c. Remove the decade box, and place the found value for R8.

5. Test of registers.

   Connect the single tone transmitter to the set up instead of the sequential tone transmitter. 0volt is fed to the cancellation terminal (1) during the test. The tone receiver is activated with tone "1". (970, 1060, 1124Hz). On a digit display (decimal or binary) connected to the decoder, is, after

the lapse of 55 ms for Storno tonesystems or 85 ms for CCIR, received output of digit 1 on the last digit position of the display.
When the tone transmitter frequency has been changed to tone "2", digit 2 is read on the last position, and digit 1 is moved to the position of the last but one digit. At tone "3", output moves again one position, and so on. As the frequency changes, take care that the digits move correctly in the register, without alteration of their values.
Check that the same tone is read twice when succeeded by the repeat tone, tone "11". By changing to tone "12" indication appears on the last position on the display.

6. Determination of R12 for maximum tone length.

Replace the tone generator by a sequential tone transmitter with pulse length = 85 ms for Storno tone systems or 115 ms for CCIR tone system. Connect the resistance decade box instead of R12, and adjust to the nearest standard value, which gives an impuls of 40ms ±5ms measuared at Q4c. Remove the decade box, and place the found value for R12.

7. Test of decoder functions.

Take care that the decoder gives reading for correct sequential signals with tone lengths between 55 ms and 85 ms for Storno tone systems or 85 ms and 115 ms for CCIR tone system. Check that both 4 and 5 tone sequential signals are accepted and that 5 tone signals are not read until the 5th tone has been read into the registers. Check that signals with tone length less than 50ms and more than 90ms are not accepted (for CCIR 80ms and 120ms). Check that Q5 provides low-state function on terminal 17 during sequential signal.

Check also that output call can be cancelled by feeding 0volt to terminal 1.

8. Test of various pulse lengths.

Examine the following lengths on oscilloscope:

Measuring point		Trigger to scop. from:	time
D1	neg. pulse length after pos. flank on	E8	5 ms
C8		C2	5 ms
H6		E8	2 ms
H2		E11	15 ms
C12		E3	1 ms
U2		X8	2 ms
H8		L8	1 ms
H10		L8	0,5 ms

See also pulse diagrams 1 and 2 (D114570 and D114579).

Multitone Receiver TR680-2005.

1. General

1.1 The multitone receiver TR680-2005 is primarily designed as a selective tone receiver for the sequence decoder SD680-2005.

1.2 TR680-2005 is used for the detection of single tone signals lying within 12 frequency bands corresponding to the tones applied.

1.3 Each tone signal received releases a binary logic output signal which indicates the tone number of the tone frequency received.

1.4 The tone receiver is made for Storno's standard tone for sequential tone equipment $f_1 - f_{12}$ = 1060 - 2800 Hz, $f_1 - f_{12}$ = 970 - 2600Hz and the CCIR tonesystem $f_1 - f_{12}$ = 1124 - 2246Hz, but in principle the tone receiver is applicable for all existing tones within the frequency band 300-3400Hz.

1.5 Adaption of the multitone receiver to desired tones can be made by choosing a suitable crystal frequency and by the soldering of straps.

1.6 The tone receiver is not equipped with time measurement circuits for the output signal; the latter will therefore appear after the lapse of one input signal period.

1.7 The output signal will cease if, during an interval corresponding to the longest occurring cycle period of the tones, no tone signal is received.

2. Technical data

2.1	Supply voltage:		5 volt DC ±0.25 volts.
2.2	Power consumption:	Stand by:	345 mA ±10%.
		Activated	325 mA ±10%.
2.3	Temperature range:	Standard minim. performance:	0 to +50° C.
		Operational:	-30 to +80° C.
2.4	Input impedance:		Approx. 600Ω asymmetric with straps ≥ 6 kΩ asymmetric without straps.

2.5 Frequencies:

Storno system
970 - 1060 - 1160 - 1270 - 1400 - 1530 - 1670 - 1830 - 2000 - 2200 - 2400 - 2600Hz.

CCIR system
1124 - 1197 - 1275 - 1358 - 1446 - 1540 - 1640 - 1447 - 1860 - 1981 - 2110 - 2246Hz.

2.6 Selection:

The tone receiver gives correct binary indication of tone number within a band width of ±1% of the nominal tone frequency.

2.7 Activation level:

Nominal input level at 1 kHz: +3dBm. The tone receiver can be activated within ±6 dB from the nominal level from 970-2800 Hz.

2.8 Frequency response:

The frequency response for the input amplifier follows an RC function with cross-over frequency at 1 kHz, and the higher the frequency, the greater the sensitivity $A = A_o\sqrt{1 + (f:f_o)^2}$, f_o = 1 kHz.

2.9 Cross-over frequencies:

The 12 frequency bands are placed between the cross-over frequencies indicated in the strapping list.

2.10 Output functions:

Indication of tone frequency received is obtained as binary values as per the diagram in section 2.13. From terminal 12, BCD+, logic 1' value is obtained as long as one of the 12 tones is being received.
From terminal 4, RESET IMP., is obtained a 2.5µs positively running pulse with repetition frequency equal to the input signal frequency.

2.11 Logic output voltages:

Logic 1' ≥ 2.4volts (type 3.3 volts at $1_1 \leq$ 0.4 mA).
Logic 0' ≤ 0.4 volts (type 0.2 volts at $1_o \leq$ 16 mA).

2.12 Binary output code:

The output code used is termed BCD+, as BCD- logic values are used "+" the binary values for 11 and 12. Without tone input, output equal to binary 15 = 1111 is obtained.

2.13 Table, BCD+:

TONE	-	1	2	3	4	5	6	7	8	9	0	R	A
A	1	1	0	1	0	1	0	1	0	1	0	1	0
B	1	0	1	1	0	0	1	1	0	0	0	1	0
C	1	0	0	0	1	1	1	1	0	0	0	0	1
D	1	0	0	0	0	0	0	0	1	1	0	1	1
BCD+	0	1	1	1	1	1	1	1	1	1	1	1	1

2.14 Terminals: Besides the input and output terminals, there are three extra terminals (term. 5, 6 and 7) to be used for taps of special pulse signals.

2.15 Size: 144 x 80 mm.

3. Example: Calculation of cross-over frequencies ref. to Storno tone system 1060-2800Hz.

3.1 Since the detection principle of the tone receiver is based on measuring the time elapsing between the zero-crossings of the signal received, a conversion is made of the nominal frequencies, f_N, of the tones to the respective cycle periods, t_N, (see table, section 4).

3.2 The theoretically correct cross-over cycle periods for the tones are then calculated. By a cross-over period is understood the cycle period between the nominal cycle period of tones at the same percentage deviation from the nominal values.

$t_S = t_N + t_N \cdot X = t_{N+1} - t_{N+1} \cdot X$; $X = (t_{N+1} - t_N) : (t_{N+1} + t_N)$

$t_S = (2 \cdot t_N \cdot t_{N+1}) : (t_N + t_{N+1}) = t_N (1 + X) = t_{N+1} (1 - X)$

The cross-over cycle periods for the lowest and highest frequencies of the tones are calculated from the following expression:

$t_{S-0} = t_1 (1 + X_1)$ and $t_{S-12} = t_{12} (1 - X_{12})$

3.3 The crystal frequency of the tone receiver is taken as a suitable value of the following expression:

f_{OSC} $(2 \cdot 100) : t_{S-0} = 200 : 985 \cdot 10^{-6} = 203\,kHz.$

Choose $f_{OSC} = 200\,kHz$ $t_{OSC} = 5\,\mu s.$

3.4 The cycle period of the counting pulses (CLOCK) to the X100-counter then is:

$t_{CLOCK} = 2 \cdot t_{OSC} = 10\,\mu s.$

Due to the mode of operation, the counting positions for the production of the cross-over cycle periods are calculated from the following expression:

Counter pos. = $t_S : t_{CLOCK} + 0,5$ (integer of two digits).

3.5 The resultant cross-over frequencies for the tone receiver are calculated from:

$f_S = 1 : ((\text{counter pos.} - 0,5) \cdot t_{CLOCK})$ (tol. $< \pm 1$ Hz)

4. Example: Calculation of cross-over frequencies ref. to Storno tone system 1060-2800Hz.

Specification of band pass frequencies.

4.1 f_N	t_N (µs)	t_S (µs)	Counter pos. → Codegate	f_S (Hz)
		$t_{S-0} = 985$	99 → 0'	$f_{S-0} = 1015$
$f_1 = 1060$	$t_1 = 943$			
		$t_{S-1} = 902$	91 → 1'	$f_{S-1} = 1105$
$f_2 = 1160$	$t_2 = 862$			
		$t_{S-2} = 822$	83 → 2'	$f_{S-2} = 1212$
$f_3 = 1270$	$t_3 = 787$			
		$t_{S-3} = 748$	76 → 3'	$f_{S-3} = 1324$
$f_4 = 1400$	$t_4 = 714$			
		$t_{S-4} = 682$	69 → 4'	$f_{S-4} = 1460$
$f_5 = 1530$	$t_5 = 653$			
		$t_{S-5} = 625$	63 → 5'	$f_{S-5} = 1600$
$f_6 = 1670$	$t_6 = 599$			
		$t_{S-6} = 571$	58 → 6'	$f_{S-6} = 1739$
$f_7 = 1830$	$t_7 = 546$			
		$t_{S-7} = 522$	53 → 7'	$f_{S-7} = 1904$
$f_8 = 2000$	$t_8 = 500$			
		$t_{S-8} = 476$	48 → 8'	$f_{S-8} = 2105$
$f_9 = 2200$	$t_9 = 455$			
		$t_{S-9} = 435$	44 → 9'	$f_{S-9} = 2299$
$f_{10} = 2400$	$t_{10} = 417$			
		$t_{S-10} = 400$	41 → 10'	$f_{S-10} = 2469$
$f_{11} = 2600$	$t_{11} = 384$			
		$t_{S-11} = 370$	38 → 11'	$f_{S-11} = 2665$
$f_{12} = 2800$	$t_{12} = 357$			
		$t_{S-12} = 344$	35 → 12'	$f_{S-12} = 2900$

4.2 Cross-over frequencies are measured by connecting an oscilloscope to the terminal 11 (BCD+, A). By changing the frequency of a connected tone oscillator from 1000 - 3000 Hz, a square wave signal is obtained when going from one tone band to the following one.
By a symmetric square wave signal, half the cycle period is equal to the cross-over cycle period, t_S. The cross-over frequency is read from a connected frequency counter (e.g. Racal SA535).
The cross-over frequency area provides for alternate tone number output reading of the two tone bands separated by the cross-over frequency concerned.

4.3 Unambiguous tone number reading is obtainable among the following frequencies: ref. point 4.

"1" = 1020 - 1099 Hz, "2" = 1112 - 1204 Hz, "3" = 1220 - 1315 Hz
"4" = 1333 - 1449 Hz, "5" = 1470 - 1587 Hz, "6" = 1613 - 1723 Hz
"7" = 1754 - 1886 Hz, "8" = 1925 - 2083 Hz, "9" = 2128 - 2272 Hz
"10" = 2327 - 2439 Hz, "11" = 2504 - 2631 Hz, "12" = 2704 - 2857 Hz.

4.4 From the terminal 12 (BCD+), continuous output = logic 1' is obtained for the signal frequencies between 1020 - 2857 Hz. BCD+ output is logic 0' for frequencies lower than 1010 Hz and higher than 2942 Hz.

Example:

5. Strapping of TR680-2005 for Storno's Standard tones 1060-2800Hz.

5.1 The tone receiver is adjusted to the correct tone frequencies by connecting straps between the terminals marked: "0 - 9, 00 - 90 x t_{CLOCK}" and "0 - 12".

5.2 The connection are shown in table 4.1 in the column with the heading "Counter pos. → code gate". The mounting is shown on the strap list.

5.3 An example of cross-over frequency, f_{S-5} = 1600 Hz: Counter pos. 63 → code gate 5'. From the terminal (60 x t_{CLOCK}) a strap is soldered to one of the strap terminals marked 5'. From the terminal -(3 x t_{CLOCK}) a strap is connected to the other terminal 5'.

5.4 The capacitances C_A - C_M = 1 nF can be mounted to the terminals of the 12 code gates marked 1' - 12', but they will only be mounted if input to the gates is fed to the terminal "8 x t_{CLOCK}". In respect

of Storno tones, C_F, C_H and C_L are mounted.

6. Function

6.1 The construction of the input stage of the multitone receiver comprises a linear-integrated amplifier Q1, TAA151 (see D114393).

6.2 The first stage comprising the transistor Q1a is used as audio input amplifier. The latter serves the purposes of compensating for any after-emphasis in the radio receiver (phase modulation) and limiting the amplified signal at input levels larger than the nominal input level (+3 dBm at 1 kHz, approx. -3 dBm at 2800 Hz).

6.3 Limitation of the amplified signal on Q1a-8 is obtained when the signal voltage exceeds the guide direction voltage of the back-to-back fed specified diodes (E1, E2), by means of which voltage feedback via C2 to the base of Q1a is obtained. Weak feedback sets in for input levels equal to -3.5 dBm at f = 1 kHz and -10 dBm at 2800 Hz.

6.4 The transistors Q1b and Q1c operate as a Schmitt-Trigger (DC amplifier with pos. feedback). The circuit is employed as zero crossing detector for the transformation of the signal from Q1a-8 to a square wave signal. The output signal from Q1c-5 will in one half period be logic 0', and in the other logic 1'. The signal voltages in the input stage are shown on the pulse schedule 1, D114640.

6.5 The resistors R6, R7 and R8 affect the S.T. circuit in the following way:

R7 determines the symmetry of the square wave output signal. Without any input signal to TR, the logic output from S.T. will be either logic 0' or logic 1'. A minor deviation of R7's resistance value will cause the output to shift. The reason why the value R7 = 56 kΩ has been chosen, is that this value will cause the input to S.T. to be fed with a current which will cause the circuit to be in the shift area.

R6 determines the trigger level of the tone receiver by shunting R7 via C4. The value of R6 has been so chosen that within the specified temperature range and at the component tolerances of the circuit is obtained activation at input levels larger than -3 dBm (f = 1 kHz).

R8's value determines the back-lash of the S.T. circuit; this back-lash becomes smaller the higher the R8-value is.

6.6 The output signal from the Schmitt-Trigger is fed to a control circuit (see pulse diagram 3, D114652), whose putpose is to produce two control pulses for the cycle period measuring circuit.
RESET IMP resets a binary counter (00 - 99). HOLD LATCH (HOLD IMP) gives output of the measured cycle period in values corresponding to the tone numbers.

6.7 The control circuit and the counter circuit are fed with crystal controlled square wave signals as shown on the pulse diagram 2, D114641. From this diagram also appears the mode of function of the logic circuits in the control circuit.
Each time the input signal, SIGNAL, goes from logic 0' to logic 1' a 2.5 μs HOLD IMP is first obtained; after the lapse of 2.5 μs, it is succeeded by a 2.5 μs RESET IMP.

6.8 The CLOCK pulses are fed to the counter circuit (IC, C and F) which consists of 2 BCD-counters. Output from the counters is fed to the 2 BCD/DEC converter circuits (IC, H and J). From the 20 output terminals marked (0-9) x t_{CLOCK} and (00 - 90) x t_{CLOCK} is obtained logic 0' from the two terminals which state the decimal values of the counter's position from 00 - 99.

6.9 Supposing the frequency of the input signal is 2000 Hz, intervals between the signals HOLD IMP and RESET IMP will be 500 μs. As t_{CLOCK} = 10 μs, the counter will thus count to 50 between any two successive cycle periods.

6.10 The frequency 2 kHz corresponds to tone "8" of the tones. According to the table in section 4.1, the tone receiver will indicate the reception of tone "8" between the cross-over frequencies 1904 Hz to 2105 Hz. On reception of these 2 frequencies, the counter positions will be 53 and 48, respectively. Output from TR should thus be 8 for the counter positions 48, 49, 50, 51 and 52. At counter position 53, output changes to indicate reception of tone 7, etc.

6.11 As described in section 5, the BCD/DEC converters are connected to 12 code gates with straps. The terminals from the 12 code gates are connected to an OR circuit, from which 12 pulses are obtained (COUNTER IMP, BINARY COUNTER), as shown on the pulse diagram 4, D114670. The positive flank of the pulses is obtained for a period corresponding to the cross-over frequencies intended for the

tone receiver.

6.12 The code gate pulses are fed to a 4 bit binary counter as counter pulses. The binary counter (IC U and V) serves the purposes of transforming the measured period intervals to binary values of the tone numbers "1"-"12" ("1" = f_1 = 1060 Hz ---).

6.13 RESET IMP sets the period counter to position 00 and, at the same time, the binary tone number counter to binary position 13. When counter position 35 has been obtained after about 350 µs of the measurement period, the first counter pulse is received from code gate 12'. The binary counter for tone number indication is then set to binary position 12. At the next pulse coming from tonegate 11' after about 380 µs, a change to position 11, etc., down to position 1 is made.

6.14 For instance, if tone 8 is received, HOLD IMP is obtained at counter position 50; HOLD IMP will, as HOLD LATCH, open for 2.5 µs for input reading of the binary tone number value from the tone number counter to the output register BCD+, LATCH. The subsequent RESET IMP will cause the counters to be 00 and 13 set, respectively, and renewed period counting is then commenced.

6.15 Without tone signal input, the binary tone number counter is continuously in position 13, and the output register opened (HOLD LATCH = logic 1'). In the circuit BINARY/BCD+, the binary values of 13 to 1 are converted into the special code termed BCD+, of the output function.

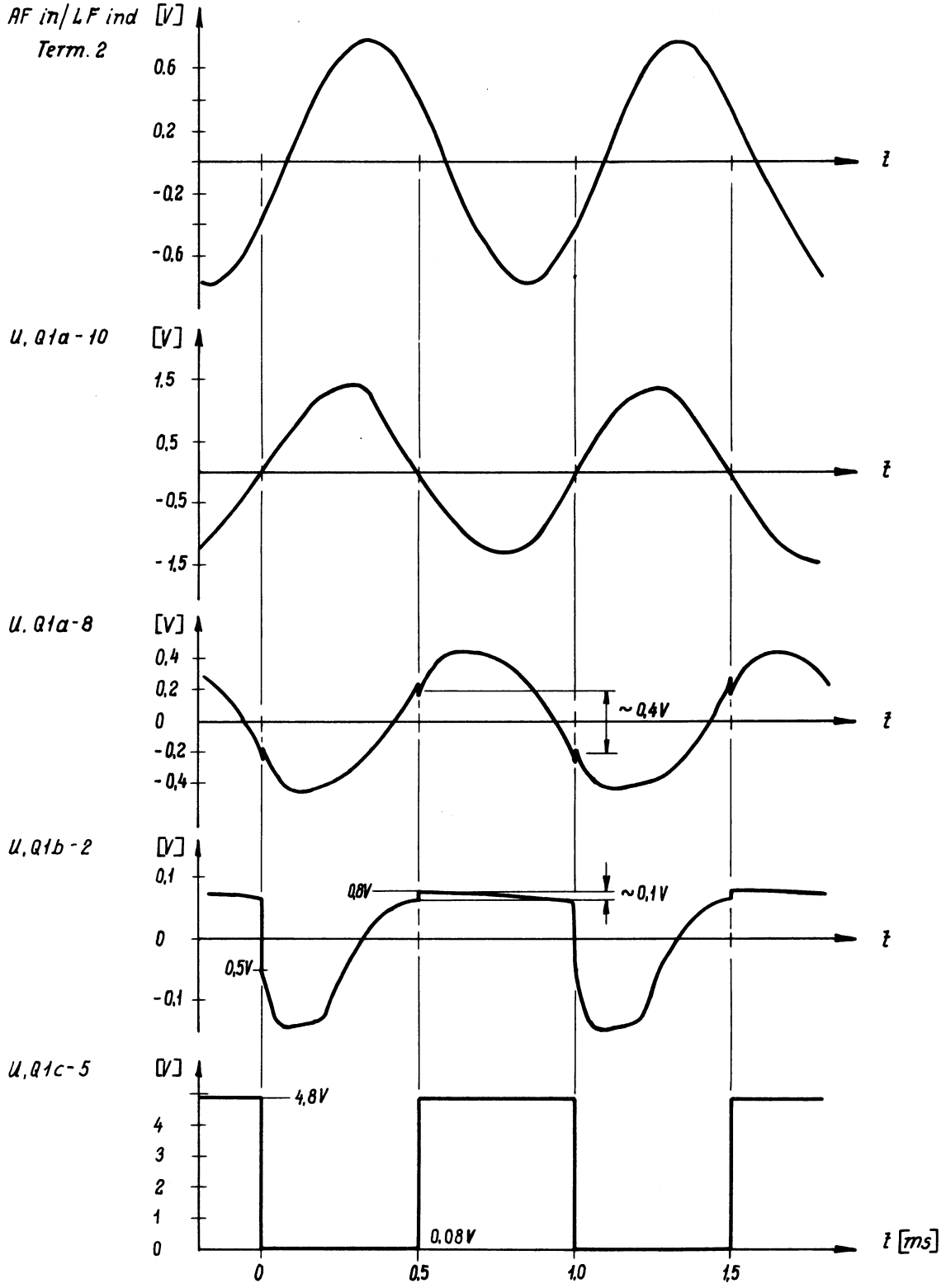
Binary 13 is converted into binary 15 = 1111 indicating "no tone signal received". Binary 10 is converted into binary 0 so that the output code corresponds to the BCD-code plus the binary values of decimal 11 and 12.

6.16 When no tone signal is received, logic 0' value is obtained from a special output terminal termed BCD+.
On reception of an arbitrary tone out of the 12 tones, logic 1' value is obtained from the BCD+ terminal.

6.17 In the block diagram of TR680-2005 shown on the pulse diagram 3, a circuit detail with logic NAND and NOR circuits is shown. This circuit secures that output is obtained only when proper tone frequencies between 1010 Hz to 2942 Hz (allotted to Storno Standard tone

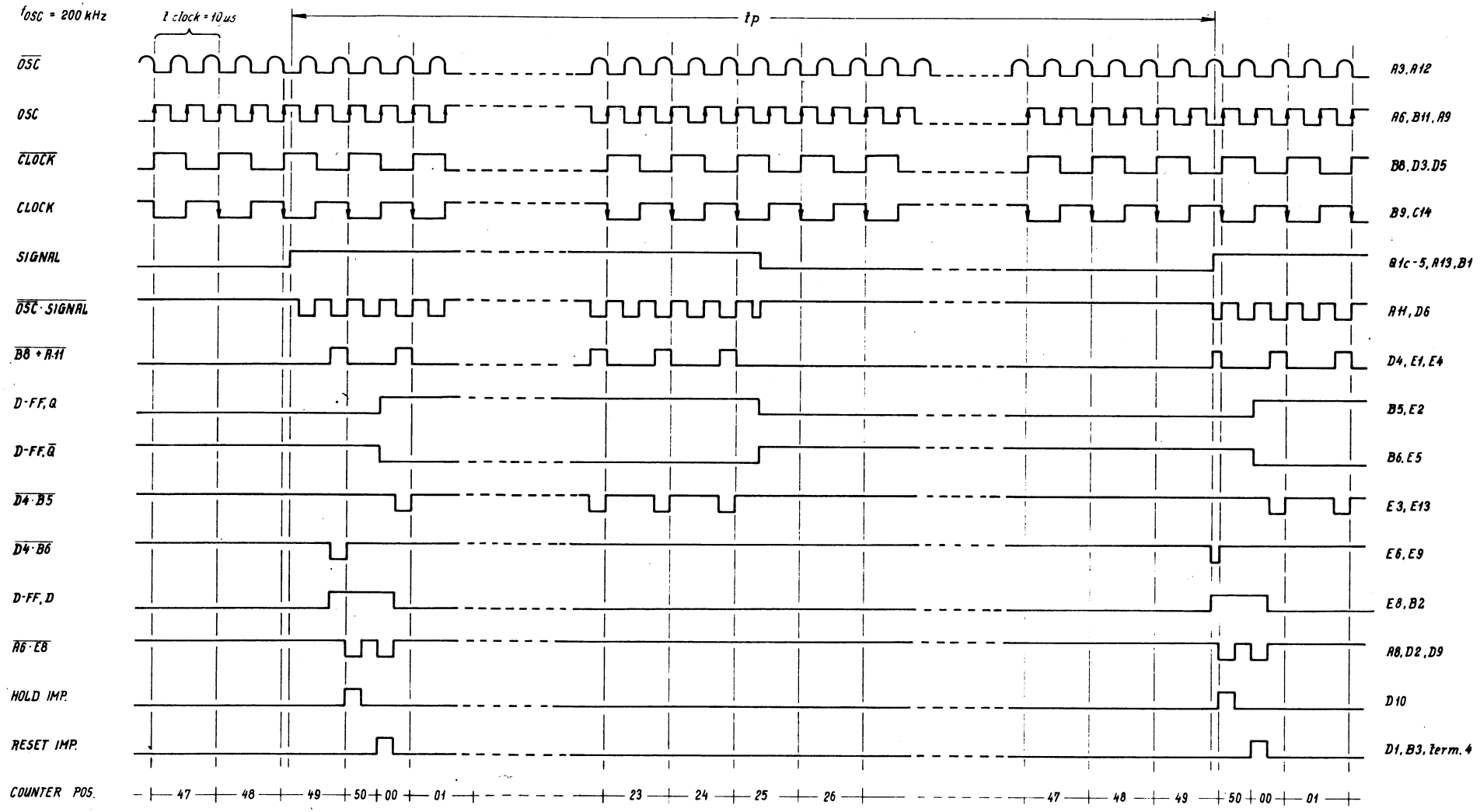
frequencies) are received.

If a tone frequency of a longer cycle period than 990 μs or a shorter cycle period than 340 μs is received, output of binary digit 15 and BCD+ = 0 is obtained.



Signalspændinger i indgangsforstærker for Vind = -3dBm, f = kHz.

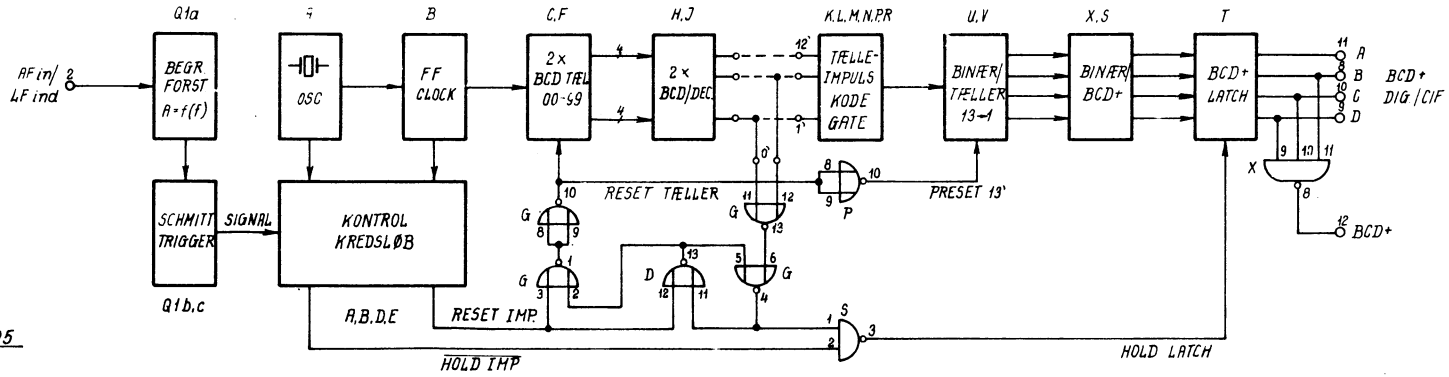
Storno	konstr./tegn. OG / KG 25-5-70 godk. komp.liste	SIGNAL WAVEFORMS IMPULSSKEMA 1.	TR680-2005 KODE TEGN.NR. D 114640 A4



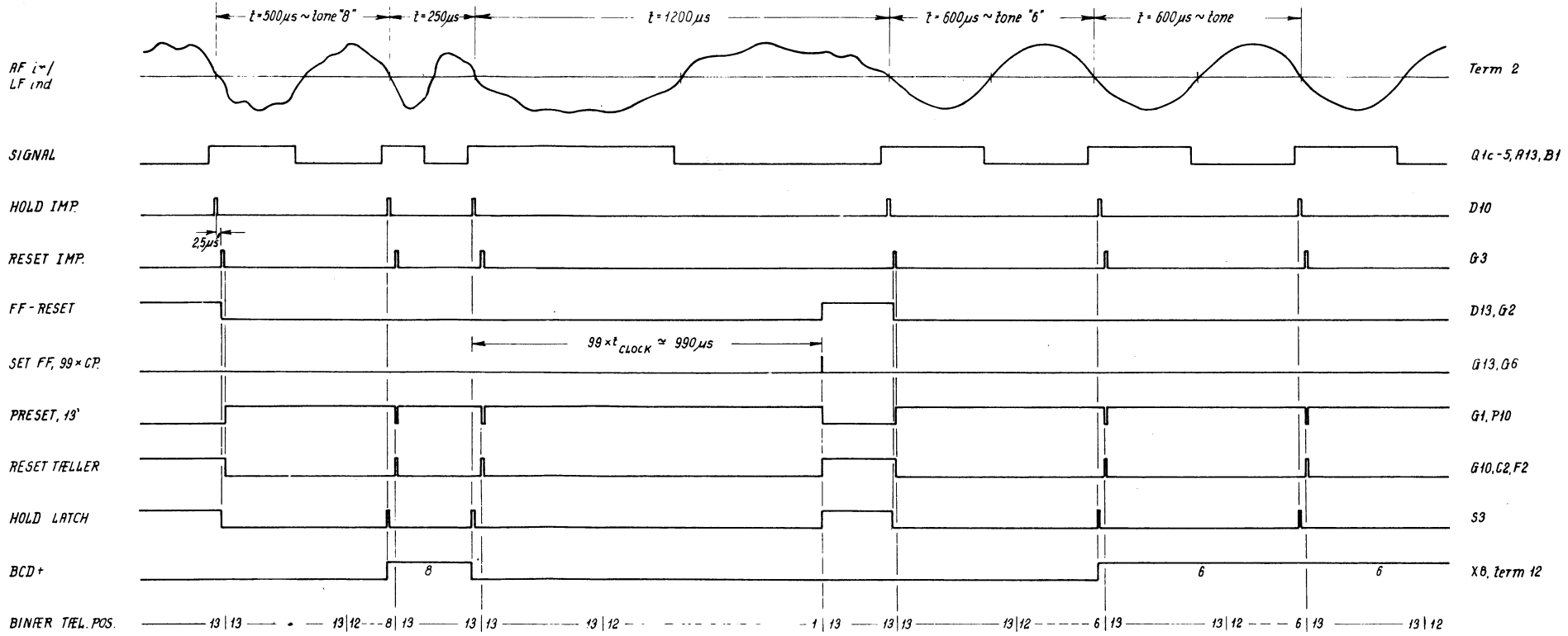
Note. COUNTER POSITION shown/visi for f signal ≃ 2KHz ; tp ≃ 500 µs ~ 50 × t clock.

Storno	konstr./tegn. OG/KG 22-5-70	SIGNAL WAVEFORMS	TEGN. NR. D 114641 A3
	godk.	TR 680-2005	
	komp. liste	IMPULSSKEMA 2	
		KODE	

Blanket 32.177

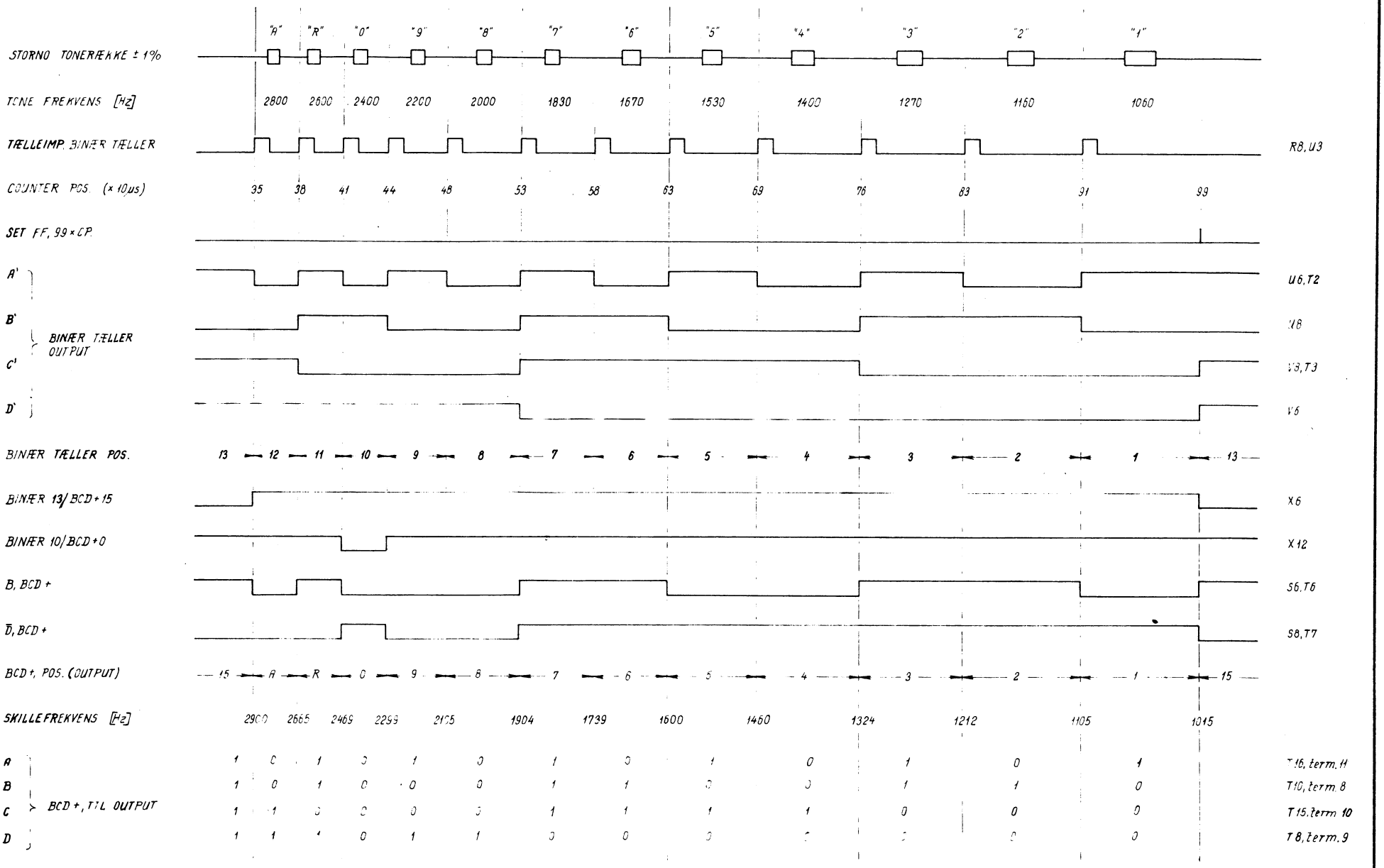


BLOKDIAGRAM TR680-2005



Storno	konstr./tegn. OG/KG 27-5-70	SIGNAL WAVEFORMS IMPULSSKEMA 3.	TR680-2005 KODE
	godk.		
	komp.liste		TEGN. NR. D 114652 A3

Blanket 32.177



Note Logisk 0 ≤ 0,4V og Logisk 1 ≥ 2,4V.

Storno

konst. tegn. 06 VZ 1-6-70	SIGNAL WAVEFORMS	TR 680-2005	TEGN NR D 114670 A3
godk.	IMPULSSKEMA 4.	KODE	

Strapping Arrangement in TR680-2005/0X

for Storno Tone Series 1060-2800 Hz, (/01a)
for Storno Tone Series 970-2600 Hz, and (/03)
for CCIR Tone Series 1124-2246 Hz. (/02)

The choise of the crystal frequencies 197 kHz for the Storno tone series 1060-2800 Hz, 182 kHz for the Storno tone series 970-2600 Hz, and 202 kHz for the CCIR tone series ensures an optimum dispension of cross-over frequencies in the above series provided the prescribed strapping arrangements are used.

When Storno tone series are employed the tone periods should be adjusted in SD680-2005 as prescribed in the test procedure for sequence decoder SD680-2005 (T114998, paragraph 4 and 6).

If Storno tone series 970-2600 Hz is used, make sure that f_{11} (2400 Hz) is used as repeat tone and f_{12} (2600 Hz) is used as alarm tone.

When using the CCIR tone series the tone periods should be adjusted in SD680-2005 for a minimum tone length of 80 msec. and a maximum tone length of 120 msec.

Omskrevet den 20/6-72 HNi

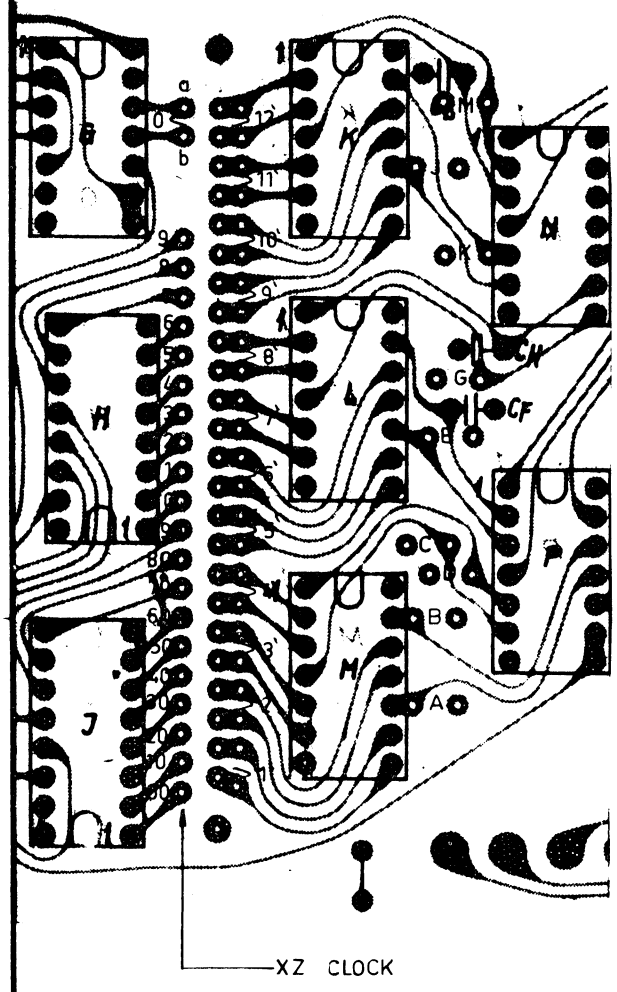
Calculations of Crossover Frequencies for Storno Tone Series 1060-2800 Hz, F_X = 197 kHz

f_N (Hz)	t_N (µsec.)	t_s (µsec.)	Counter Pos. → Code gate	f_s (Hz)
		t_s-0 = 990	98 → 0'	f_s-0 = 1010
f_1 = 1060	t_1 = 943.4			
		t_s-1 = 885	89 → 1'	f_s-1 = 1113
f_2 = 1160	t_2 = 862.1			
		t_s-2 = 775	82 → 2'	f_s-2 = 1209
f_3 = 1270	t_3 = 787.4			
		t_s-3 = 746	74 → 3'	f_s-3 = 1340
f_4 = 1400	t_4 = 714.3			
		t_s-4 = 685	68 → 4'	f_s-4 = 1459
f_5 = 1530	t_5 = 653.6			
		t_s-5 = 618	62 → 5'	f_s-5 = 1602
f_6 = 1670	t_6 = 598.8			
		t_s-6 = 574	57 → 6'	f_s-6 = 1743
f_7 = 1830	t_7 = 546.4			
		t_s-7 = 523	52 → 7'	f_s-7 = 1913
f_8 = 2000	t_8 = 500.0			
		t_s-8 = 468	47 → 8'	f_s-8 = 2118
f_9 = 2200	t_9 = 454.5			
		t_s-9 = 428	43 → 9'	f_s-9 = 2318
f_{10} = 2400	t_{10} = 416.7			
		t_s-10 = 401	40 → 10'	f_s-10 = 2494
f_{11} = 2600	t_{11} = 384.6			
		t_s-11 = 371	37 → 11'	f_s-11 = 2699
f_{12} = 2800	t_{12} = 357.1			
		t_s-12 = 340	34 → 12'	f_s-12 = 2940

Strapning af TR680-2005/01

til Storno tonerække 1060-2800 Hz.

Med Fx = 197 kHz skal tonemodtageren strappes efter nedenstående terminalplaceringstegning og strappeliste med 0.23mm PVC isoleret 3-coret (grøn) tråd.



Der strappes fra 90 til 0'a
4'b. - 0'b
2'a - 1,a
9 - 1,b
80 - 2,a
5'b - 2,b
70 - 3,a
12'b - 3'b
5'a - 4'a
8 - 4'b
60 - 5'a
7'b - 5'b
7'a - 6,a
8'b - 6'b
50 - 7'a
2 - 7'b
9'a - 8,a
11'b - 8'b
10'a - 9'a
3 - 9'b
40 - 10'a
0 - 10'b
12'a - 11'a
7 - 11'b
30 - 12'a
4 - 12'b

Del af underprint set fra komponentsiden.

Det påses at CB, CC, CD, CE, CF, CH og CM (1nF polyester 50V kondensatorer) er monterede.

Note: Den angivne strapning kan evt. erstattes af færdig monteret strappeplade.

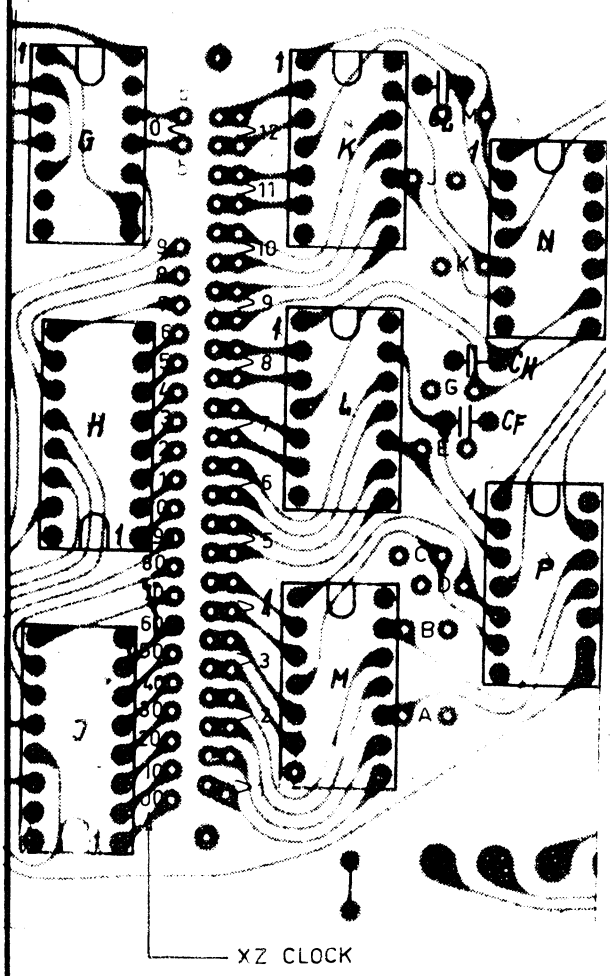
Storno	konstr./tegn. AIC/NF 12.1.72 godk. komp.liste	Multitonemodtager TR680-2005 Multi-tone receiver KODE	TEGN.NR. TT 18081 side 3

Calculation of Crossover Frequencies for Storno Tone Series 970-2600 Hz. F_x=182 kHz.

f_N (Hz)	t_N (µsec.)	t_s (µsec.)	Counter Pos. → Code Gate	f_s (Hz)
		1070	98 → 0'	933
f_1 = 970	t_1 = 1030.9			
		983	90 → 1'	1017
f_2 = 1060	t_2 = 943.4			
		896	82 → 2'	1117
f_3 = 1160	t_3 = 862.1			
		317	75 → 3'	1221
f_4 = 1270	t_4 = 787.4			
		753	69 → 4'	1328
f_5 = 1400	t_5 = 714.3			
		687	63 → 5'	1456
f_6 = 1530	t_6 = 653.3			
		620	57 → 6'	1611
f_7 = 1670	t_7 = 598.8			
		577	53 → 7'	1733
f_8 = 1830	t_8 = 546.4			
		522	48 → 8'	1916
f_9 = 2000	t_9 = 500.0			
		478	44 → 9'	2092
f_{10} = 2200	t_{10} = 454.5			
		427	40 → 10'	2304
f_{11} = 2400	t_{11} = 416.7			
		401	37 → 11'	2493
f_{12} = 2600	t_{12} = 384.6			
		366	34 → 12'	2716

Strapning af TR680-2005/03
til Storno toneraekke 970-2600 Hz.

Med Fx = 182 kHz skal tonemodtageren strappes efter nedenstående terminalplaceringstegning og strappeliste med 0,23mm PVC isoleret 3-coret orange tråd.



Der strappes fra 1'a til 0'a
8'b - 0'b
90 - 1'a
10'b - 1'b
80 - 2'a
2 - 2'b
70 - 3'a
5 - 3'b
5'a - 4'a
9 - 4'b
60 - 5'a
7'b - 5'b
7'a - 6'a
11'b - 6'b
50 - 7'a
3 - 7'b
9'a - 8'a
8 - 8'b
10'a - 9'a
12'b - 9'b
40 - 10'a
0 - 10'b
12'a - 11'a
7 - 11'b
30 - 12'a
4 - 12'b

Del af underprint set fra komponentsiden.

Det påses, at CA, CB, CH, CK, CJ og CM (1nF polyester 50V kondensatorer) er monterede.

Note: Den angivne strapning kan evt. erstattes af færdig monteret strappeenhed.

Calculations of Crossover Frequencies for CCIR Tone Series, F_x = 202 kHz.

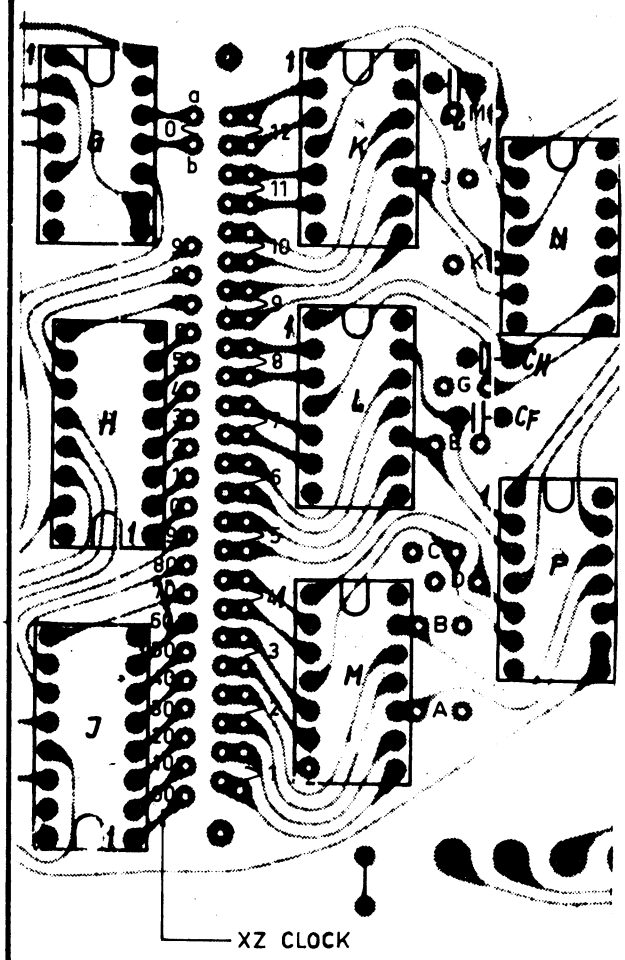
f_N (Hz)	t_N (μsec.)	t_s (μsec.)	Counter Pos. → Code Gate	f_s (Hz)
f_1 = 1124	t_1 = 889.7	t_s-0 = 916	93 → 0'	f_s-0 = 1092
f_2 = 1197	t_2 = 835.4	t_s-1 = 866	88 → 1'	f_s-1 = 1154
f_3 = 1275	t_3 = 784.3	t_s-2 = 809	82 → 2'	f_s-2 = 1239
f_4 = 1358	t_4 = 736.4	t_s-3 = 757	77 → 3'	f_s-3 = 1320
f_5 = 1446	t_5 = 691.6	t_s-4 = 716	73 → 4	f_s-4 = 1393
f_6 = 1540	t_6 = 649.4	t_s-5 = 669	68 → 5'	f_s-5 = 1496
f_7 = 1640	t_7 = 609.8	t_s-6 = 638	64 → 6'	f_s-6 = 1591
f_8 = 1747	t_8 = 572.4	t_s-7 = 590	60 → 7'	f_s-7 = 1697
f_9 = 1860	t_9 = 537.6	t_s-8 = 559	57 → 8'	f_s-8 = 1788
f_{10} = 1981	t_{10} = 504.8	t_s-9 = 520	53 → 9'	f_s-9 = 1924
f_{11} = 2110	t_{11} = 473.9	t_s-10 = 494	50 → 10'	f_s-10 = 2040
f_{12} = 2246	t_{12} = 445.2	t_s-11 = 461	47 → 11'	f_s-11 = 2172
		t_s-12 = 430	44 → 12'	f_s-12 = 2322

The duration of min. tone length should be adjusted by R8 for 80msec. +0/-5msec. See Test Procedure for Tone Sequence Decoder, T114998, paragraph 4.

The duration of max. tone length should be adjusted for > 120msec. by inserting the correct value of R12. See T114998, paragraphs 6 and 7.

Strapning af TR680-2005/02
til CCIR tonerække. Note.

Med Fx = 202.00 kHz skal tonemodtageren strappes efter nedenstående terminalplaceringstegning og strappeliste med 0,23mm PVC isoleret (rød) tråd.



Der strappes fra	90	til 0'a
	4'b	- 0'b
	80	- 1'a
	8	- 1'b
	1'a	- 2'a
	2	- 2'b
	70	- 3'a
	7	- 3'b
	3'a	- 4'a
	9'b	- 4'b
	60	- 5'a
	1'b	- 5'b
	5'a	- 6'a
	4	- 6'b
	6'a	- 7'a
	0	- 7'b
	50	- 8'a
	3'b	- 8'b
	8'a	- 9'a
	3	- 9'b
	9'a	- 10'a
	7'b	- 10'b
	40	- 11'a
	8'b	- 11'b
	11'a	- 12'a
	6'b	- 12'b

Del af underprint set fra komponentsiden.

Det påses, at CA, CB, CE, CG og CK (1nF polyester 50V kondensatorer) er monterede.

Note: Den angivne strapning kan evt. erstattes af færdig monteret strappeenhed.

MULTITONE RECEIVER TR680-2005.

Directions for Test.

1. Instruments

1 power supply 0 - 5.5 volts 3 amperes
1 oscilloscope (telequipment b54)
1 probe (tektronix P6006)
1 tone transmitter (HP204c)
1 voltmeter (HP327A)
1 universal instrument (Metrix MX202b)
1 indicator unit (HP10528A logic clip) or mounting shown on page 3.

2. Printed circuit.

Supervise the PC-board for bad solderings, short-circuits and superfluonus flux.

3. Power consumption.

Check current consumption at Vcc of 5.0 volts. Without audio input, consumption is 345 mA ±10%. With audio (1060 Hz at a level of +3 dBm) consumption will be 325 mA ±10%.

4. Test of oscillator.

Connect the oscilloscope to ic A-12 via probe, and check that the oscillator operates. Reduce supply voltage to less than 4 volts and cut off for a moment. When voltage is re-established, increase slowly towards 5.0 volts; make sure that the oscillator starts at 3.8 to 4 volts. Increase voltage to 5.5 volts (this voltage value should not be exceeded). Cut off voltage again for a short time, and, after voltage being re-established, reduce towards 5.0 volts. The oscillator should now start at 5.4 to 5.5 volts. If starting of the oscillator does not take place exactly at the values stated, adjust R13 in such a way that the oscillator starts at 5.0 volts ± 0.25 volts ± as much safety as possible. However, VVc should not exceed 5.5 volts.

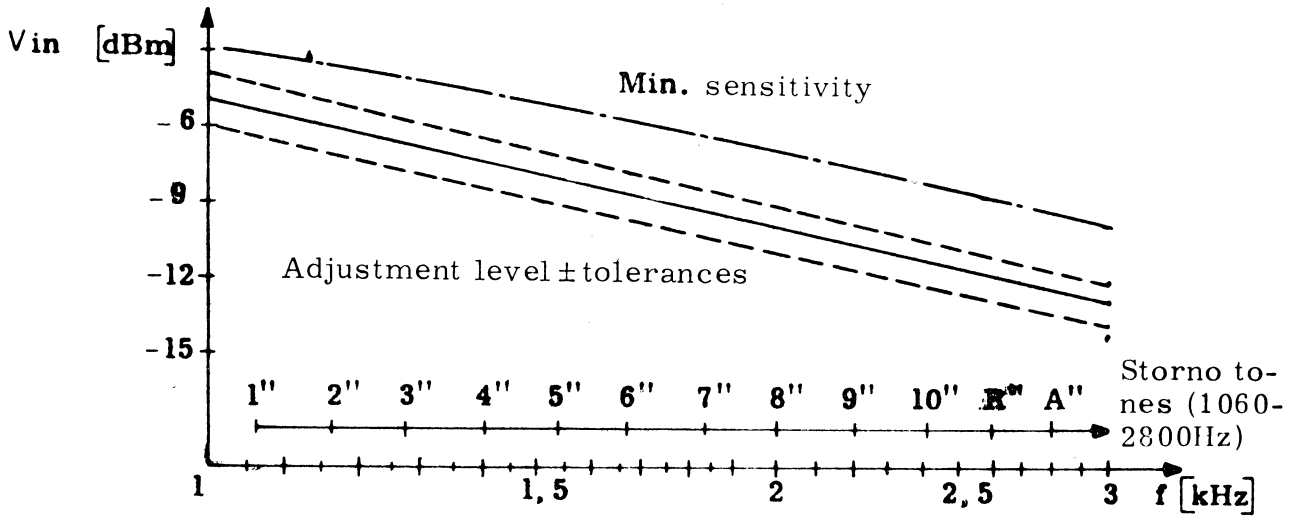
5. Test of Schmitt-trigger.

Connect oscilloscope to Ic A-13; connect tone transmitter and voltmeter to audio input and control that activation level of the Schmitt-trigger is in conformity with the schedule on page 3 (÷5 dBm ±1 dB at 1060 Hz). Control is carried out within the supply voltage range of 5.0 volts ±0.25 volts. If sensitivity is outside the tolerance range, adjust R6.

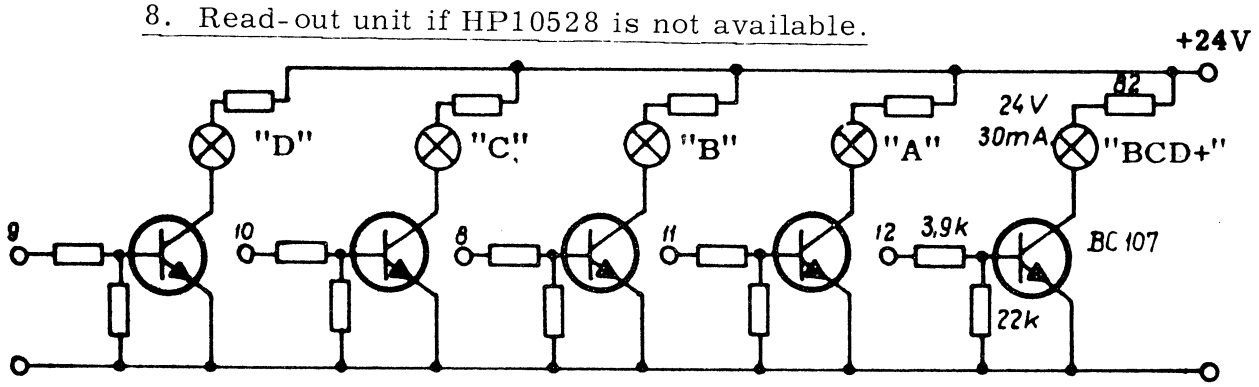
6. Test of output.

The indicator unit HP10528 is placed over Ic T, or output unit as indicated on page 3 is connected to the terminals 8, 9, 10 and 11. Connect the oscilloscope to terminal 12. Vary the audio signal from the tone transmitter from 900Hz to 3000Hz, and control for the used tonecode's nominal tone frequencies ±1%, cf. the schedule on page 3.

7. Trigger level for Schmitt trigger.



8. Read-out unit if HP10528 is not available.



9. BCD table

Tone -: tones outside range from "1" to "A".
Lamps illuminated corresponds to ■.

tone nr. / Term. nr.	"A"	"R"	"10"	"9"	"8"	"7"	"6"	"5"	"4"	"3"	"2"	"1"	-
T-16 [11] A		■		■		■		■		■		■	■
T-10 [8] B		■				■	■			■	■		■
T-15 [10] C	■					■	■	■	■				■
T -8 [9] D	■	■		■	■								■
[12] BCD+	■	■	■	■	■	■	■	■	■	■	■	■	

ELECTRICAL DESCRIPTION
TR680-2005/10.

The multitonereceiver TR680-2005/10 may in the principle be separated into the following functions:

Frequency compensation
Limiter
Constant current generator
Selective part
Amplifier
Comparator
Multiplexer
Output gates.

Further there are the following auxiliary circuits:

Retriggerable one shot
Oscillator
Counter.

The purpose of the frequency compensation network (R_1, C_1, C_2, Rest input impedance) is partly to give constant amplification as function of the used tonefrequencies partly to give max. cut off for frequencies outside the tonefrequency band to reduce influence of noise. From the limiter the signal is feed to Q2 which act as a constant current generator and excite the series connection of the 12 parallel circuits. With connections underneath the printed circuitboard selection can be made of one of the three tone series: 970Hz - 2600Hz, 1060Hz - 2800Hz or 1124Hz - 2246Hz.

From the secondary of the coil the signal is connected to one of the amplifiers IC9-IC11 and further to the positive input of one of the comparators (IC6 - IC8). Output of the comparators are normaly "0" but will, when the input signal exceeds the activating level (V_2) adjusted with R11, go to "1".

From the oscillator IC 1 c and d a 300 kHz square wave signal is used to step the counter (IC 2) forward. Output from the counter determine which of the 16 inputs to the multiplexer (IC 5) shall be connected to the retriggerable one shot (IC 4). Receiving a negative going impulse to IC 4 term. 1 results in a one shot which locks the counter to the BCD information which gave the input to the one shot and at the same time the output gates are opened and the BCD information from the counter transferred to the output terminals. Once triggered the pulse signal may disappear for approximately 2 mseconds before the counter is "unlocked" and the multiplexer takes up again the searching between the inputs.

1. Generel Description.

1.1 The multitone receiver TR680-2005/10 is primarily intended as selective tonereceiver for the sequence decoder SD680-2005.

1.2 The tonereceiver may by simple connections underneath the printed circuit board be connected for one of the three tone-series:

Low Storno: 970 - 1060 - 1160 - 1270 - 1400 - 1530 - 1670 - 1830 -
TR680-2005/13 2000 - 2200 - 2400 - 2600.

High Storno: 1060 - 1160 - 1270 - 1400 - 1530 - 1670 - 1830 - 2000 -
TR680-2005/11 2200 - 2400 - 2600 - 2800.

CCIR: 1124 - 1197 - 1275 - 1358 - 1446 - 1540 - 1640 - 1747
TR680-2005/12 1860 - 1981 - 2110 - 2246.

Similarly output for tone 10 may either be choosed as 0 - 0 - 0 - 0 or 0 - 1 - 0 - 1 for the outputs A - B - C - D respectively.

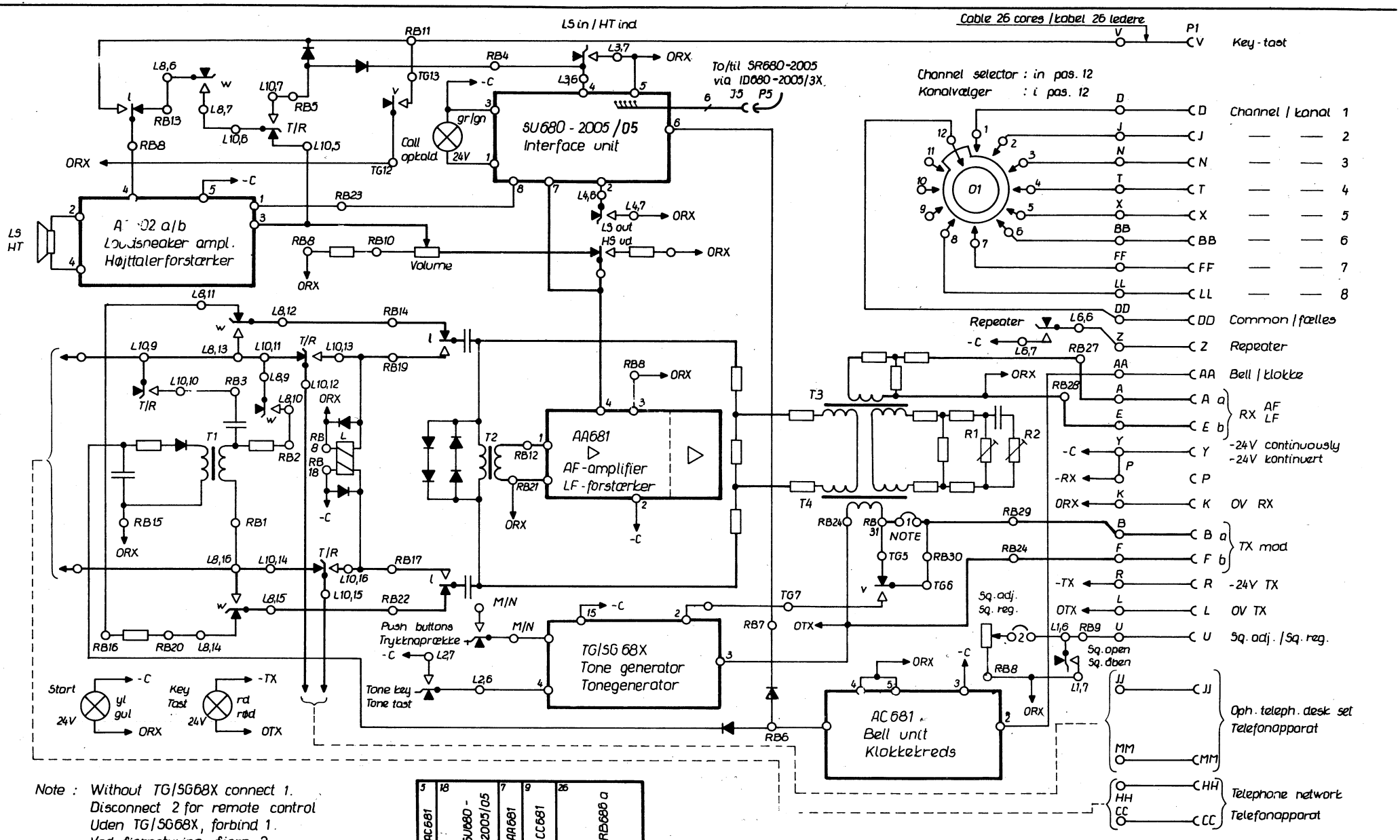
1.3 When the tonereceiver is driven by a low impedanced generator (max. 1 kΩ) with a characteristic as for a 1. order lowpass with cutoff frequency 1 kHz, the amplitude versus frequency response measured on Q1 collector gives a nearly constant value inside the tone-signaling band and maximum cut off outside this band.

1.4 Output signals are true TTL levels on terminals RESET IMP, BCD+, A, B, C, D. Terminals A, B, C, D gives binary coded decimal with the possibility for read out as stated above. BCD+ gives a high signal when a valid tone is received and RESET IMP gives high pulses of the same frequency as the accepted tone.

With square wave pulses to the terminals 5, 6, 8, 9 the corresponding binary value (15, 14, 13 and 10 or 0) will emerge on the output terminals. To terminal 3 further parallel circuits may be connected, and thus expand the tone capability of the receiver. In that case the voltage V_1 may be used to bias the external amplifiers and V_2 may be used to set the triggerlevel for the external comparators.

Data TR680-2005/10

Supply voltage:	5V DC ±0,25V.
Current consumption; stand by:	110mA.
activated:	120mA.
Operating temperature range:	0 til +50°C.
Input impedance:	> 6kΩ.
Tone-series:	2005/13: 970Hz - 2600Hz Low Storno. 2005/11: 1060Hz - 2800Hz High Storno. 2005/12: 1124Hz - 2246Hz CCIR. Decided tone-series are chosen by soldered connections at rear of PC-board.
Input level:	+3dBm/1000Hz. (nominel) (-6dB/octave over 1000Hz.)
Signal/noise ratio $\frac{S+N}{N}$	> 6dB.
Output signals:	TTL, Binary-Coded Decimal. Tone 10 may be chosen as "0 - 0 - 0 - 0" or "0 - 1 - 0 - 1" (see note 1 in D124562).
Dimension:	144 x 80mm (38 modules).
Weight:	100g.



Note : Without TG/SG68X connect 1.
Disconnect 2 for remote control
Uden TG/SG68X, forbind 1.
Ved fjernstyring, fjern 2

5	18	7	9	26	
AC681	SU680-2005/05	AA681	CC681	RB686 a	
				7	AA602 a/b
N M L	SG/TG68X				

REV.	DESIGN/DRAWN	APPR.	COMP. LIST
	NN / IBa		

Storno
RADIO COMMUNICATION SYSTEMS

Control console
Betjeningspult
CB686-2005

DATE 20-6-74

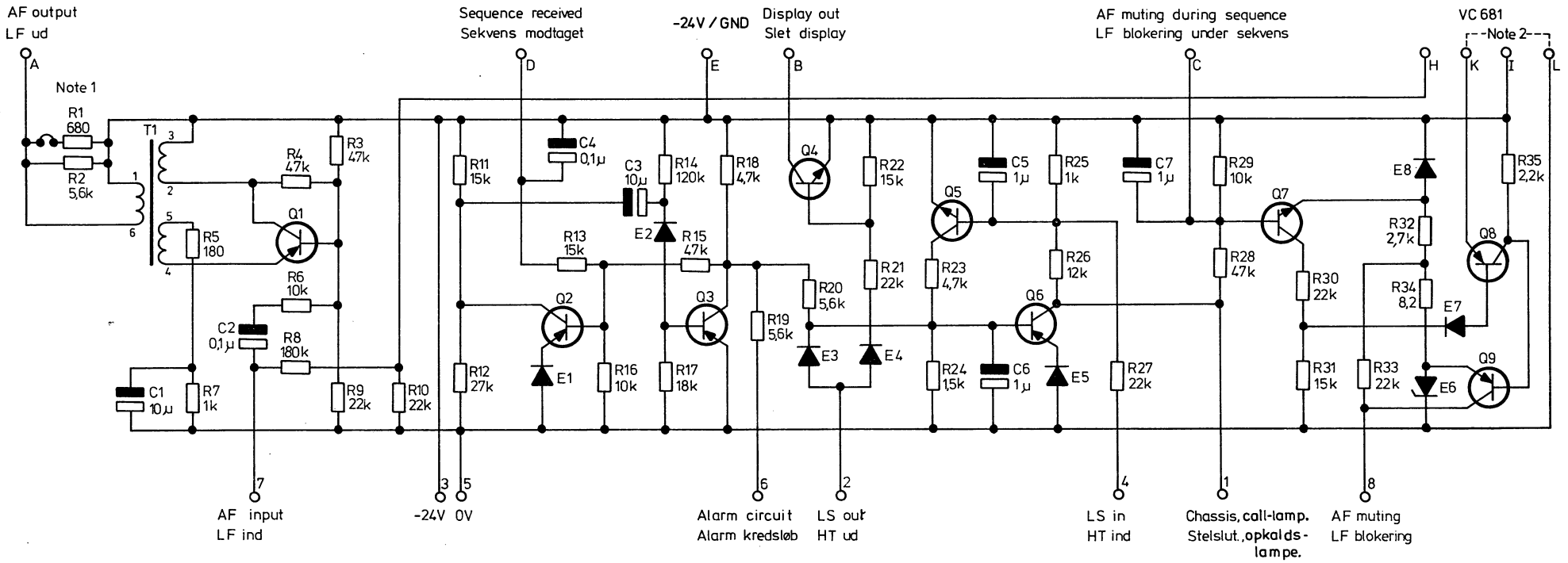
A3 DRWG. NO. D 115 620

AF CIRCUIT
LF KREDSLØB

MONOSTAB.

BISTAB.

MUTING CIRCUIT
BLOKERINGSKREDSLØB



Note 1: RB = 600 Ω R1 off / RB > 6kΩ R1 connected.
RB = 600 Ω R1 afbrudt / RB > 6kΩ R1 tilsluttet.

Note 2: K is to be strapped to L without VC681 connected.
K skal strappes til L uden VC681 tilsluttet.

Bottom view
Set fra bunden

Storno	konstr./tegn. ALe/MJe 16.6.72 godk. komp.liste X119430 I119435	INTERFACE UNIT SAMMENKOBLINGSENHED SU680-2005/05 KODE

TEGN. NR. D119434 A3

no	code	data	no	code	data
R1	80.5247-00	680Ω 1/8W carb.film	C1	73.5109-00	10µF/16v Tantal
R2	80.5258-00	5,6K1/8W carb.film	C2	73.5089-00	0,1µF/30v tantal
R3	80.5269-00	47K 1/8W carb.film	C3	73.5109-00	10µF/16v Tantal
R4	80.5269-00	47K 1/8W carb.film	C4	73.5089-00	0,1µF/30v Tantal
R5	80.5240-00	180Ω 1/8W carb.film	C5	73.5114-00	1µF/30v Tantal
R6	80.5261-00	10K 1/8W carb.film	C6	73.5114-00	1µF/30v Tantal
R7	80.5249-00	1K 1/8W carb.film	C7	73.5114-00	1µF/30v Tantal
R8	80.5276-00	180K 1/8W carb.film			
R9	80.5265-00	22K 1/8W carb.film			
R10	80.5265-00	22K 1/8W carb.film	E1	99.5028-00	1N 914 Diode
R11	80.5263-00	15K 1/8W carb.film	E2	99.5028-00	1N 914 Diode
R12	80.5266-00	27K 1/8W carb.film	E3	99.5028-00	1N 914 Diode
R13	80.5263-00	15K 1/8W carb.film	E4	99.5028-00	1N 914 Diode
R14	80.5274-00	120K 1/8W carb.film	E5	99.5020-00	1N 4004 Diode
R15	80.5269-00	47K 1/8W carb.film	E6	99.5075-00	1N 711 7,6v Zener
R16	80.5261-00	10K 1/8W carb.film	E7	99.5028-00	1N 914 Diode
R17	80.5264-00	18K 1/8W carb.film	E8	99.5028-00	1N 914 Diode
R18	80.5257-00	4,7K 1/8W carb.film			
R19	80.5258-00	5,6K 1/8W carb.film	Q1	99.5144-00	BC 214L Transistor
R20	80.5258-00	5,6K 1/8W carb.film	Q2	99.5144-00	BC214L Transistor
R21	80.5265-00	22K 1/8W carb.film	Q3	99.5144-00	BC214L Transistor
R22	80.5263-00	15K 1/8W carb.film	Q4	99.5121-00	BC107 Transistor
R23	80.5257-00	4,7K 1/8W carb.film	Q5	99.5121-00	BC107 Transistor
R24	80.5251-00	1,5K 1/8W carb.film	Q6	99.5144-00	BC214L Transistor
R25	80.5249-00	1K 1/8W carb.film	Q7	99.5121-00	BC107 Transistor
R26	80.5262-00	12K 1/8W carb.film	Q8	99.5144-00	BC214L Transistor
R27	80.5265-00	22K 1/8W carb.film	Q9	99.514400	BC214L Transistor
R28	80.5269-00	47K 1/8W carb.film			
R29	80.5261-00	10K 1/8W carb.film			
R30	80.5265-00	22K 1/8W carb.film	T1	60.5134-00	Transformer
R31	80.5263-00	15K 1/8W carb.film			
R32	80.5254-00	2,7K 1/8W carb.film			
R33	80.5265-00	22K 1/8W carb.film			
R34	80.5224-00	8,2Ω 1/8W carb.film			
R35	80.5253-00	2,2K 1/8W carb.film			

Storno

udarb. af ALe/LAP 26.5.72

kontrol af KHO

tilh. diagr D119434

Interface Unit

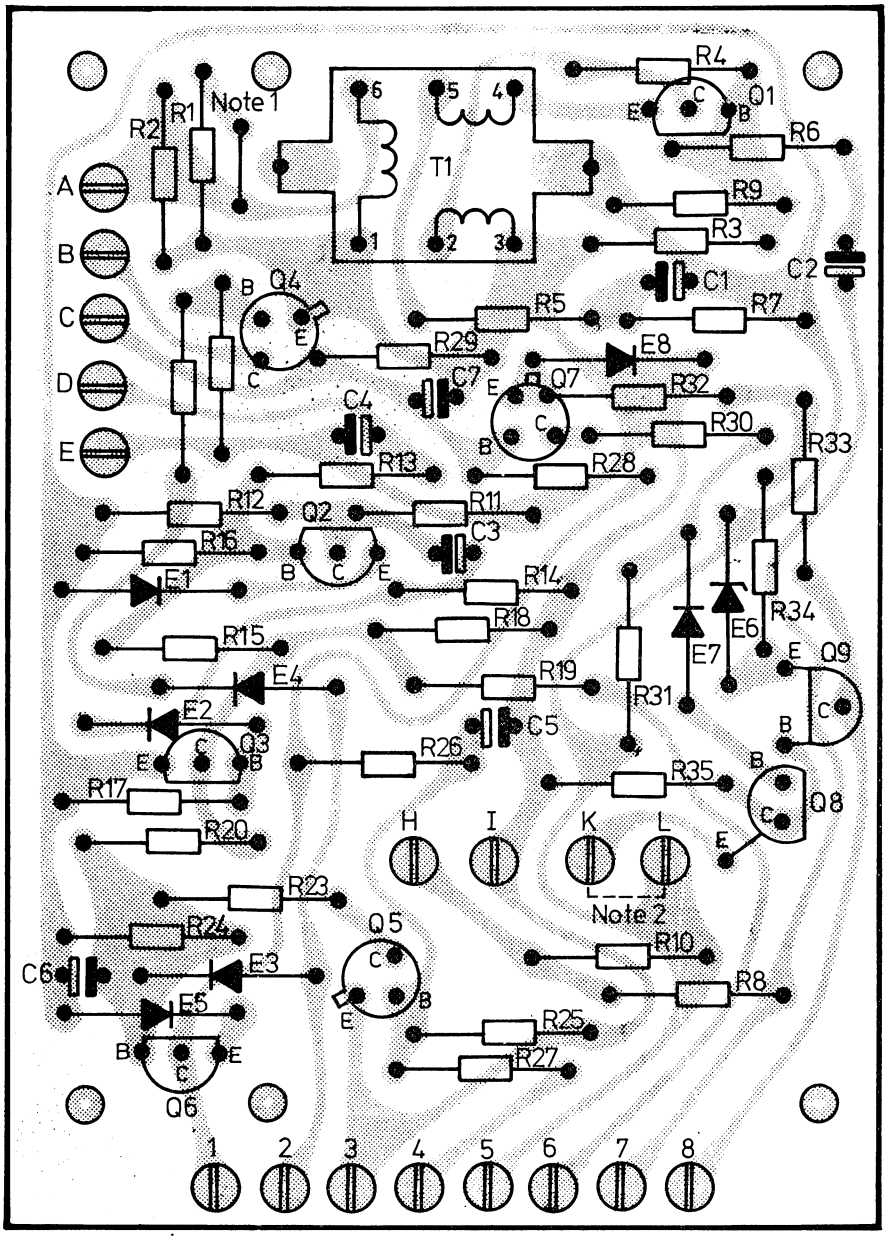
SU680-2005/05

komp liste X119430

blad no 1 af 1

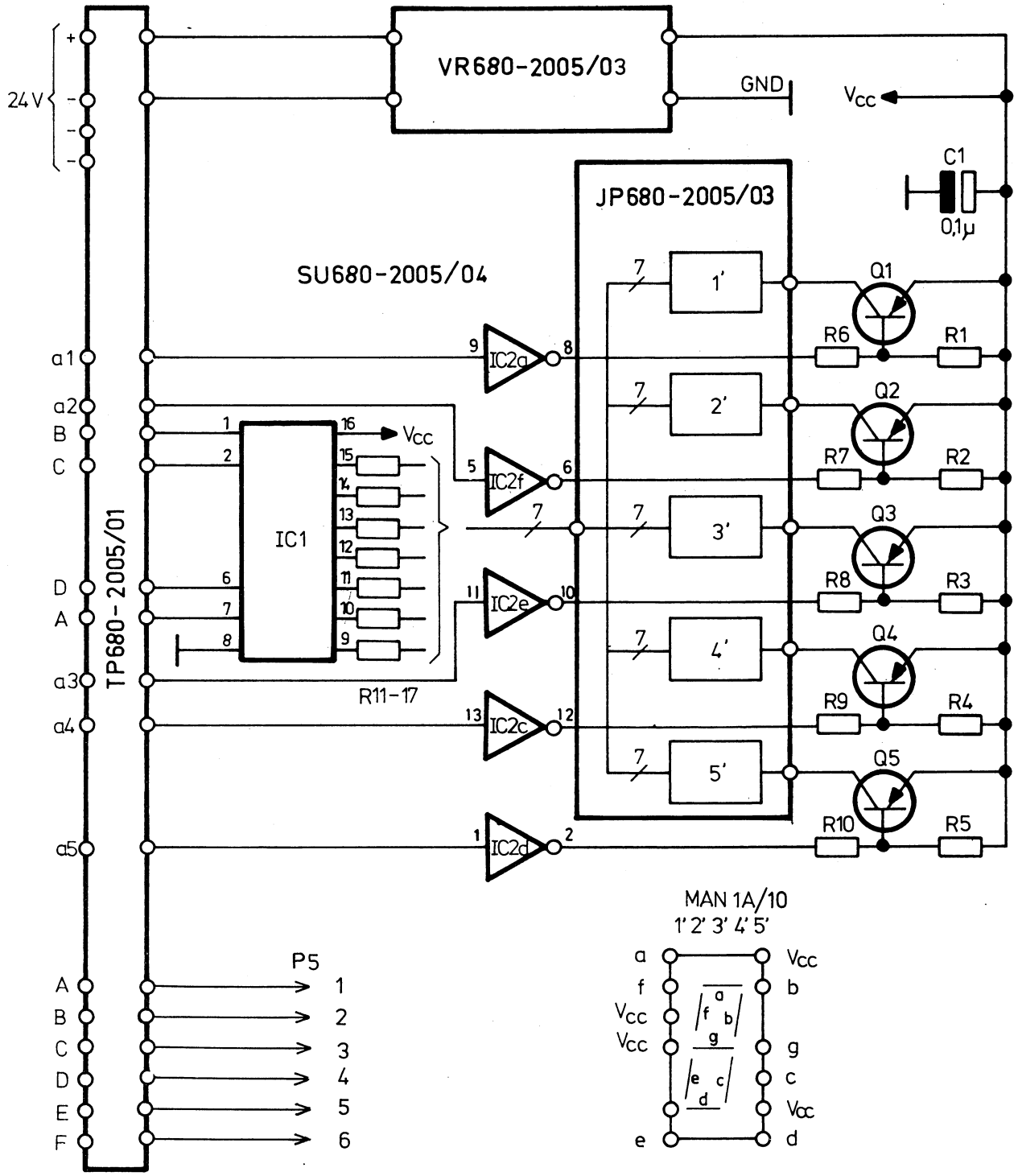
VIEWED FROM COMPONENT SIDE

SET FRA KOMPONENTSIDEN



Storno	konstr 'tegn ALe/MJe 16.6.72	LAY-OUT	TEGN NR I119435 A4
	godk	PLACERINGSTEGNING	
	kompl ste X119430 D119434	SU680-2005/05	

rev. 6·12·73 LeH



IC nr.	SN nr.	Vcc	GND
1	SN6447N	16	8
2	SN6405N	14	7

konstr./tegn. ALe/MJe 29.5.72
godk.
komp.liste

ID680-2005/35

KODE

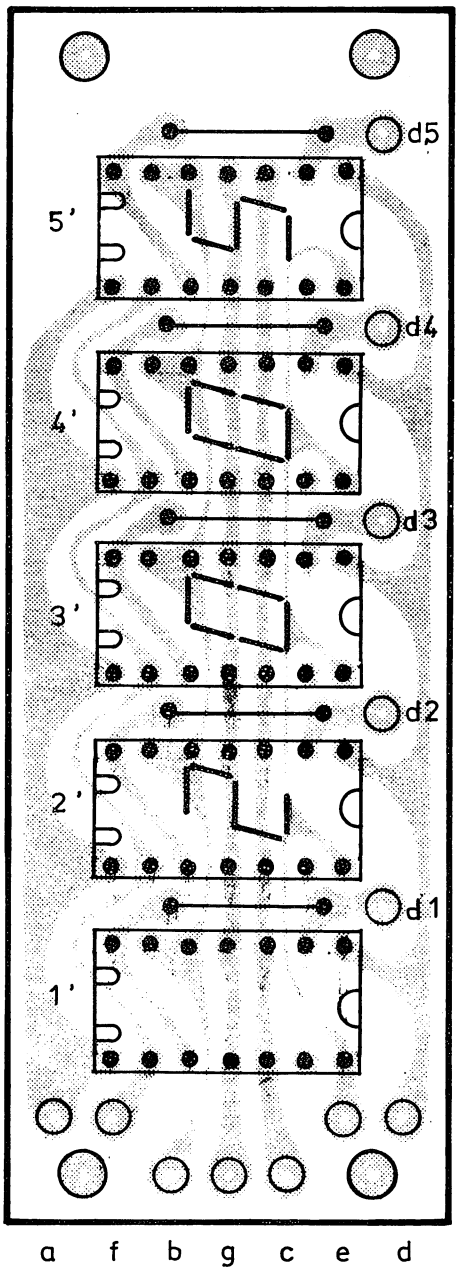
TEGN. NR. D119432 A4

no	code	data	no	code	data
1'	000-0922-00	Man 1A Indikator			
2'	000-0922-00	Man 1A Indikator			
3'	000-0922-00	Man 1A Indikator			
4'	000-0922-00	Man 1A Indikator			
5'	000-0922-00	Man 1A Indikator			

REV.	DESING DRAWN	APPR.	Drwg.no.		DATE
30/1-75	ALe/LAP			Fatningspanel JP680-2005/03 (ID680-2005/35	26.5.72
	Storno RADIO COMMUNICATION SYSTEMS				Comp.list X119428

VIEWED FROM COMPONENT SIDE

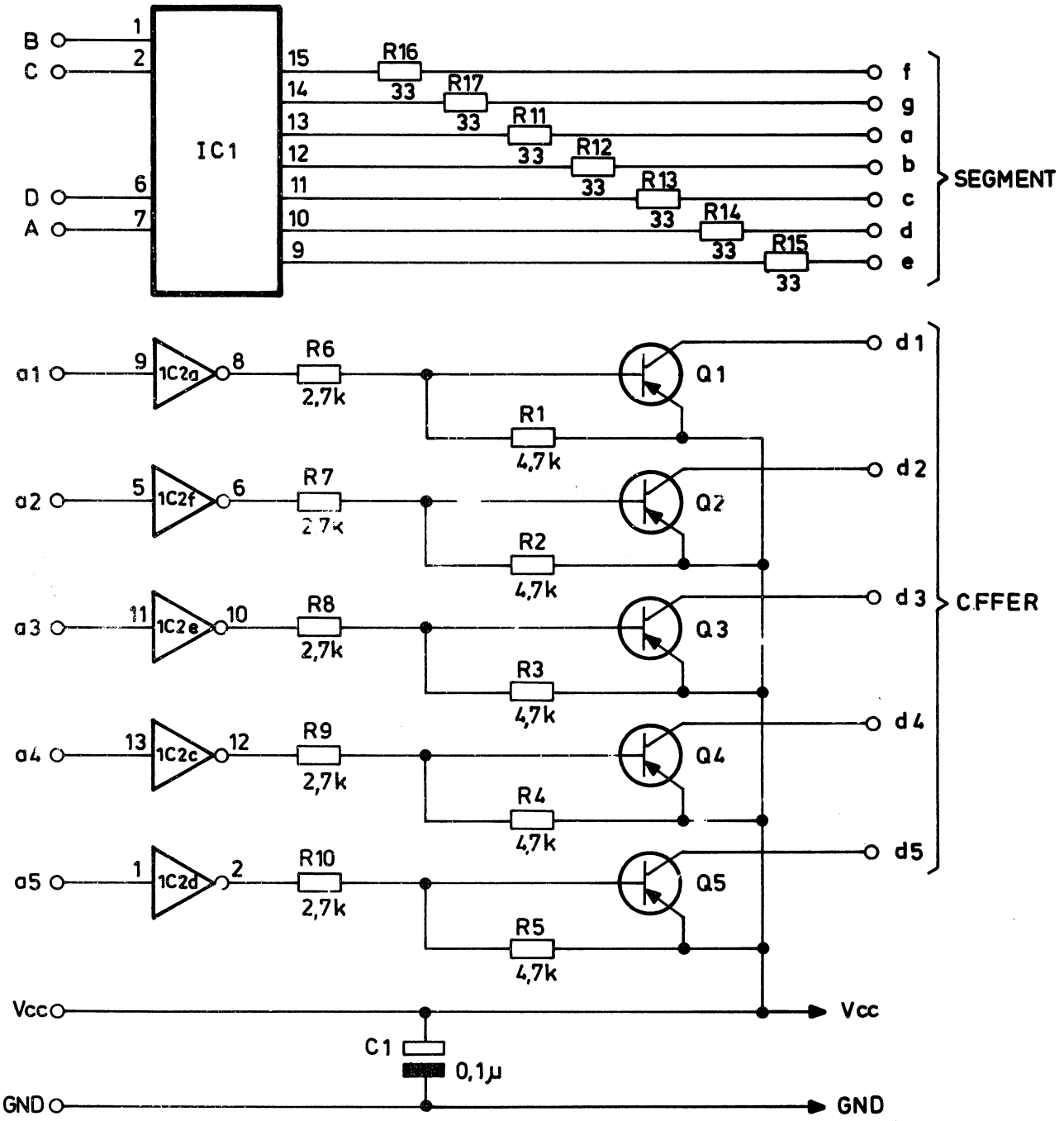
SET FRA KOMPONENTSIDEN



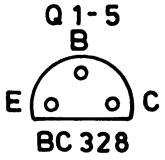
Storno	konstr./tegn. ALe/MJe 18.7.72	LAY-OUT PLACERINGSTEGNING JP680-2005/03 (ID680-2005/35)	TEGN. NR. I119632 A4
	godk.	KODE	
	komp.liste		

FROM / FRA
TP 680-2005/01

TO / TIL
JP680-2005/03



IC nr	SN nr.	Vcc	GND
1	SN 6447N	16	8
2	SN 6405N	14	7



REV.	DESIGN/DRAWN	APPR.	COMP. LIST		DATE
	KHo / LMa		X 119427 I 119633	SU 680 - 2005 / 04 (ID 680 - 2005 / 35)	31 - 10 - 73
	Storno RADIO COMMUNICATION SYSTEMS				A4 DRWG. NO. D 123939

no	code	data	no	code	data
R1	80.5257-00	4,7K 1/8W carb.film			
R2	80.5257-00	4,7K 1/8W carb.film			
R3	80.5257-00	4,7K 1/8W carb.film			
R4	80.5257-00	4,7K 1/8W carb.film			
R5	80.5257-00	4,7K 1/8W carb.film			
R6	80.5254-00	2,7K 1/8W carb.film			
R7	80.5254-00	2,7K 1/8W carb.film			
R8	80.5254-00	2,7K 1/8W carb.film			
R9	80.5254-00	2,7K 1/8W carb.film			
R10	80.5254-00	2,7K 1/8W carb.film			
R11	80.5231-00	33Ω 1/8W carb.film			
R12	80.5231-00	33Ω 1/8W carb.film			
R13	80.5231-00	33Ω 1/8W carb.film			
R14	80.5231-00	33Ω 1/8W carb.film			
R15	80.5231-00	33Ω 1/8W carb.film			
R16	80.5231-00	33Ω 1/8W carb.film			
R17	80.5231-00	33Ω 1/8W carb.film			
C1	73.5089-00	0,1µ/30v Tantal			
Q1	99.5305-00	BC328 Transistor			
Q2	99.5305-00	BC328 Transistor			
Q3	99.5305-00	BC328 Transistor			
Q4	99.5305-00	BC328 Transistor			
Q5	99.5305-00	BC328 Transistor			
IC 1	14.5058-00	SN 6447 N TTL			
IC 2	14.5025-00	SN 6405 N TTL			

Rett.
22.5.73

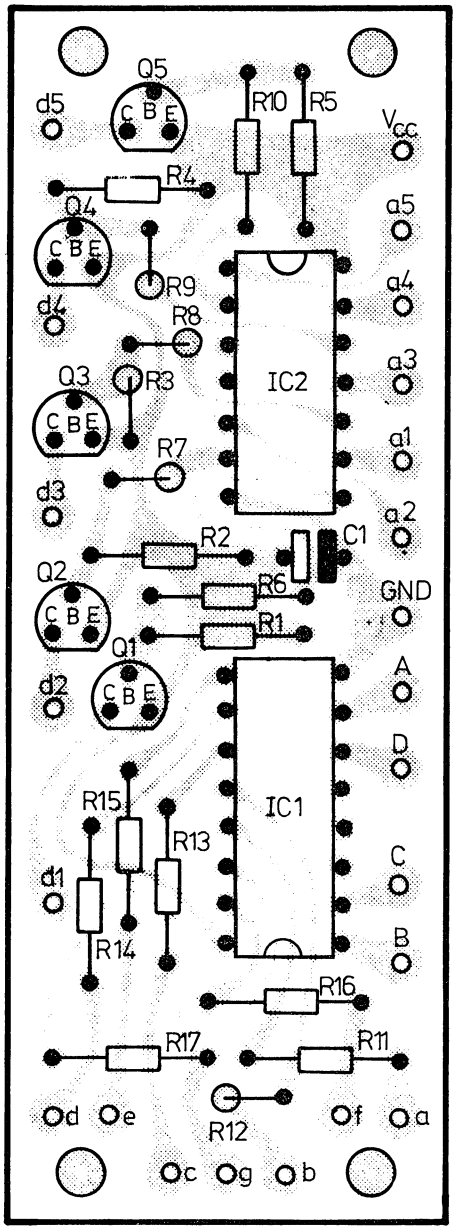
Storno

ALe/LAP
26.5.72
kontrol af

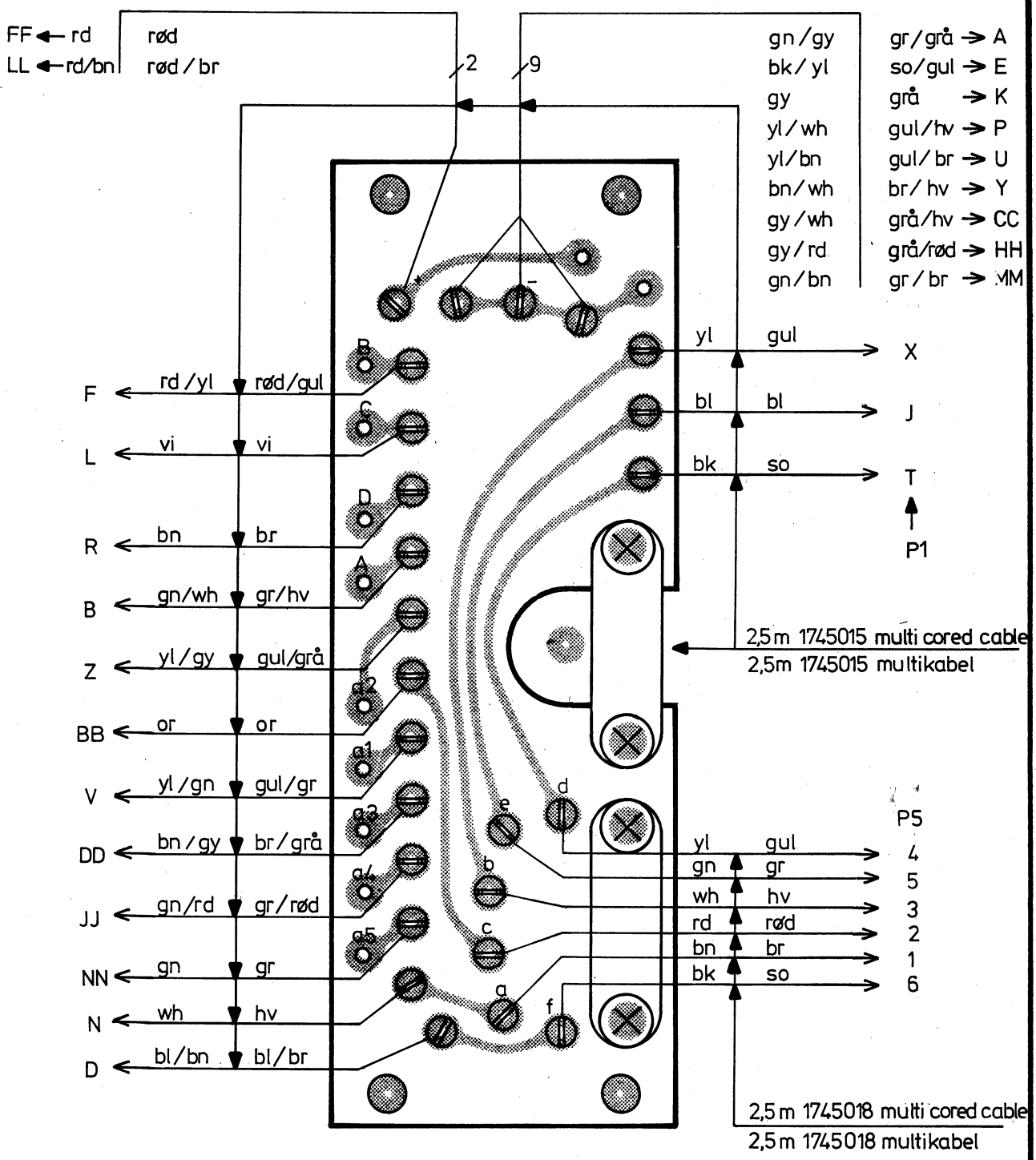
Display driver
SU680-2005/04
(ID680-2005/35)

X119427
stykliste
blad no 1 af 1

VIEWED FROM COMPONENT SIDE
SET FRA KOMPONENTSIDEN



Storno	konstr./tegn. ALe/MJe 18.7.72 godk. komp.liste	LAY-OUT PLACERINGSTEGNING SU680-2005/04 (ID 680-2005/35)	KODE TEGN. NR. I119633 A4



VIEWED FROM COMPONENT SIDE

SET FRA KOMPONENTSIDEN

Sterno	konstr./tegn. ALe/MJe 19.7.72 godk. komp.liste	LAY-OUT PLACERINGSTEGNING TP680-2005/01 (ID 680-2005/35) KODE	TEGN. NR. I119636 A4

Storno

konstr./tegn. ALe/Mje 29.5.72

godk.

komp.liste X119429

VR680-2005/03

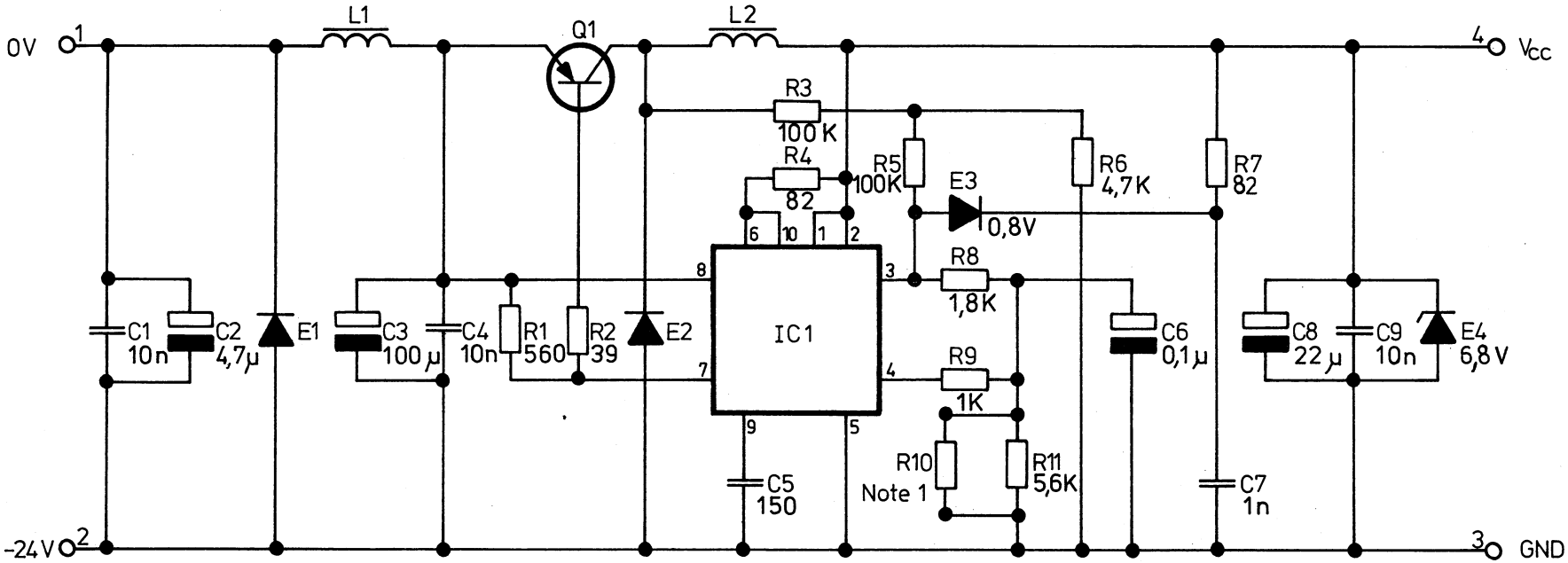
(ID680-2005/35)

KODE

TEGN. NR.

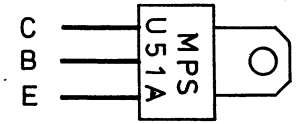
D119433

A4



Note 1: Is to be adjusted to 5V out.

Note 1: Skal justeres til 5V ud.



Q1

no	code	data	no	code	data
R1	80.5246-00	560Ω 1/8W carb.film			
R2	80.5232-00	39Ω 1/8W carb.film			
R3	80.5273-00	100K 1/8W carb.film			
R4	80.5236-00	82Ω 1/8W carb.film			
R5	80.5273-00	100K 1/8W carb.film			
R6	80.5257-00	4,7K 1/8W carb.film			
R7	80.5236-00	82 Ω 1/8W carb.film			
R8	80.5252-00	1,8K 1/8W carb.film			
R9	80.5249-00	1K 1/8W carb.film			
R10	justeres	1/8W carb.film			
R11	80.5258-00	5,6K 1/8W carb.film			
C1	76.5070-00	10nf 50V Polyester			
C2	73.5126-00	4,7µf 35V Tantal			
C3	73.5071-00	100µf 40V El-lyt			
C4	76.5070-00	10nf 50V Polyester			
C5	76.5103-00	150pf Polystyren.			
C6	73.5089-00	0,1µf 35V Tantal			
C7	76.5069-00	1nf 50V Polyester			
C8	73.5127-00	22µf 16V Tantal			
C9	76.5070-00	10nf 50V Polyester			
E1	99.5020-00	1N 4004 Diode			
E2	000-0923-00	1N 4933 Diode			
E3	99.5211-00	CO8V Diode			
E4	99.5146-00	ZF 6,8V Zener			
L1	000-0849-00	coil 400µH			
L2	000-0849-00	coil 400µH			
Q1	000-0944-00	MPS U51A Transistor Motorola			
Ic1	000-0941-00	L 123 T2 SGS IC			

Storno

tegnet af ALe/LAP 26.5.72

kontrol af X

tilh. diagr D119433

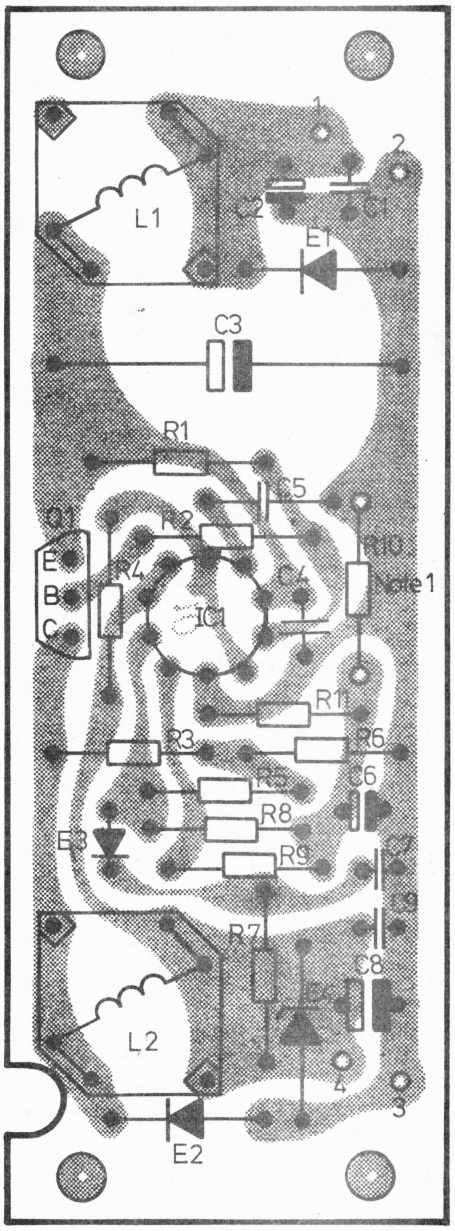
VR680-2005/03

(ID680-2005/35)

komp liste X119429

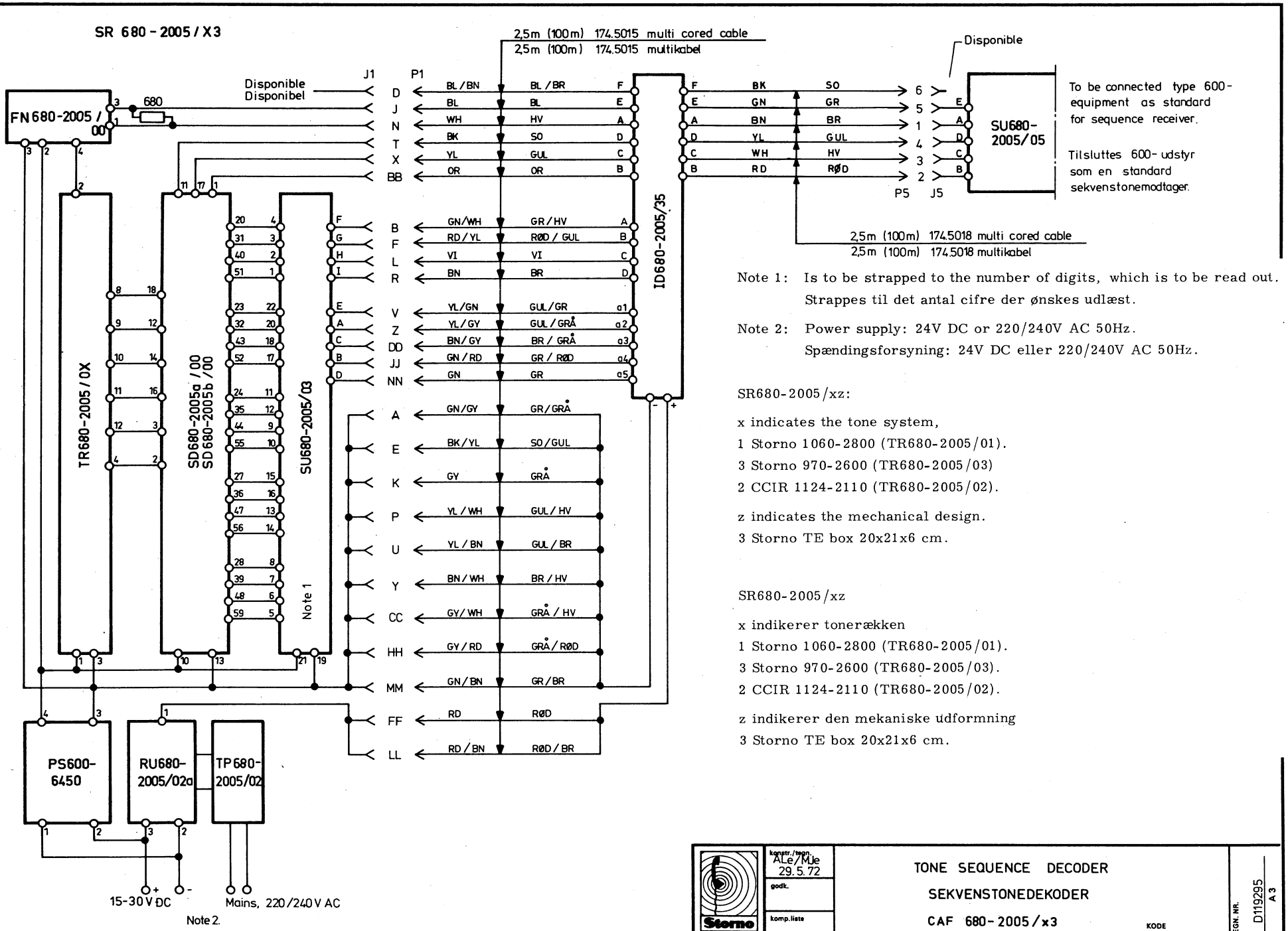
blad no 1 af 1

VIEWED FROM COMPONENT SIDE
SET FRA KOMPONENTSIDEN



1: 0V
2: -24V
3: GND
4: V_{CC}

Storno	konstr./tegn. ALe/MJe 18.7.72 godk. komp.liste	LAY- OUT PLACERINGSTEGNING VR680-2005/03 (ID 680-2005/35) KODE	TEGN. NR. I119634 A4



Note 1: Is to be strapped to the number of digits, which is to be read out.
Strappes til det antal cifre der ønskes udlæst.

Note 2: Power supply: 24V DC or 220/240V AC 50Hz.
Spændingsforsyning: 24V DC eller 220/240V AC 50Hz.

SR680-2005/xz:

x indicates the tone system,
1 Storno 1060-2800 (TR680-2005/01).
3 Storno 970-2600 (TR680-2005/03)
2 CCIR 1124-2110 (TR680-2005/02).

z indicates the mechanical design.
3 Storno TE box 20x21x6 cm.

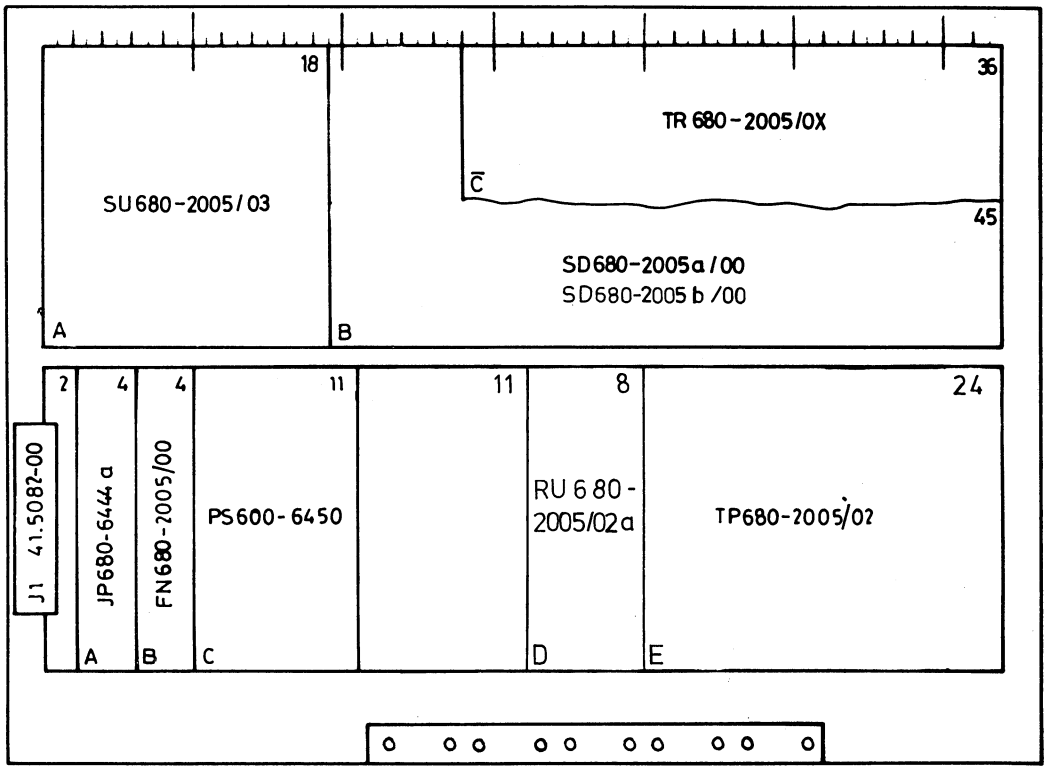
SR680-2005/xz

x indikerer tonerækken
1 Storno 1060-2800 (TR680-2005/01).
3 Storno 970-2600 (TR680-2005/03).
2 CCIR 1124-2110 (TR680-2005/02).

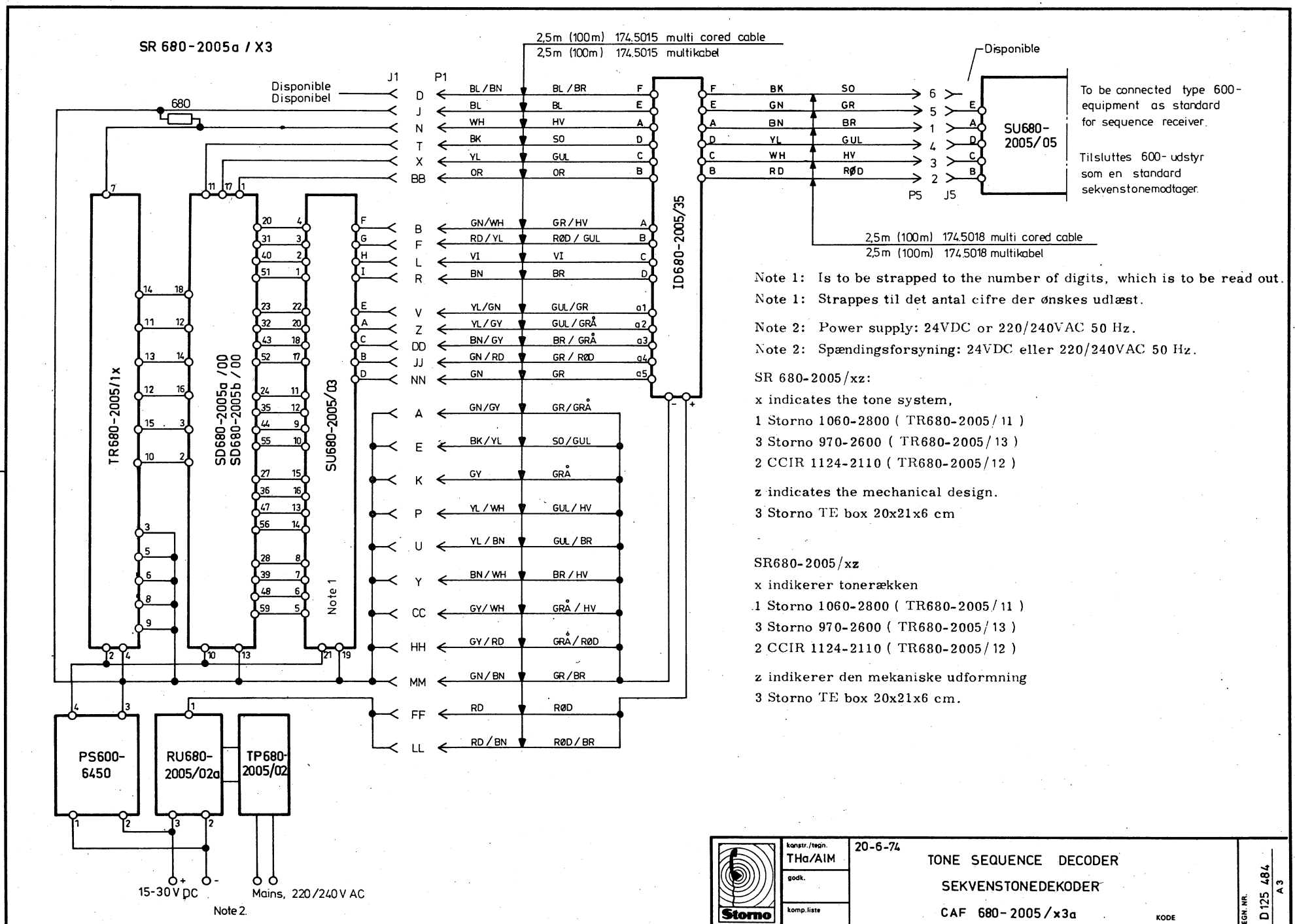
z indikerer den mekaniske udformning
3 Storno TE box 20x21x6 cm.

Storno	konstr./tegn. ALe/Mje 29.5.72	TONE SEQUENCE DECODER SEKVENSTONEDEKODER CAF 680-2005/x3 KODE	TEGN. NR. D119295 A3
	godk.		
	komp.liste		

64 del. à 4 mm.



Sterno	konstr. ferr. KHo/IH 8-1-74 godk komp. ste	LAY - OUT PLACERINGSTEGNING SR 680-2005/x3	I 124240



Note 1: Is to be strapped to the number of digits, which is to be read out.

Note 1: Strappes til det antal cifre der ønskes udlæst.

Note 2: Power supply: 24VDC or 220/240VAC 50 Hz.

Note 2: Spændingsforsyning: 24VDC eller 220/240VAC 50 Hz.

SR 680-2005/xz:

x indicates the tone system,

1 Storno 1060-2800 (TR680-2005/11)

3 Storno 970-2600 (TR680-2005/13)

2 CCIR 1124-2110 (TR680-2005/12)

z indicates the mechanical design.

3 Storno TE box 20x21x6 cm

SR680-2005/xz

x indikerer tonerækken

1 Storno 1060-2800 (TR680-2005/11)

3 Storno 970-2600 (TR680-2005/13)

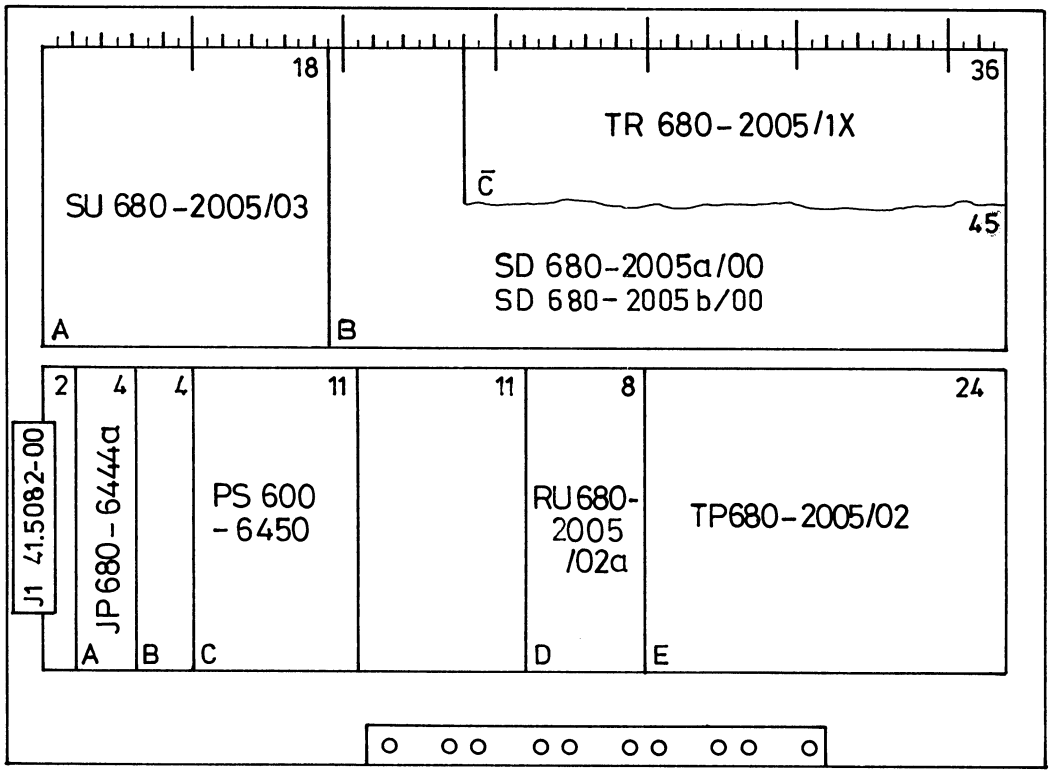
2 CCIR 1124-2110 (TR680-2005/12)

z indikerer den mekaniske udformning

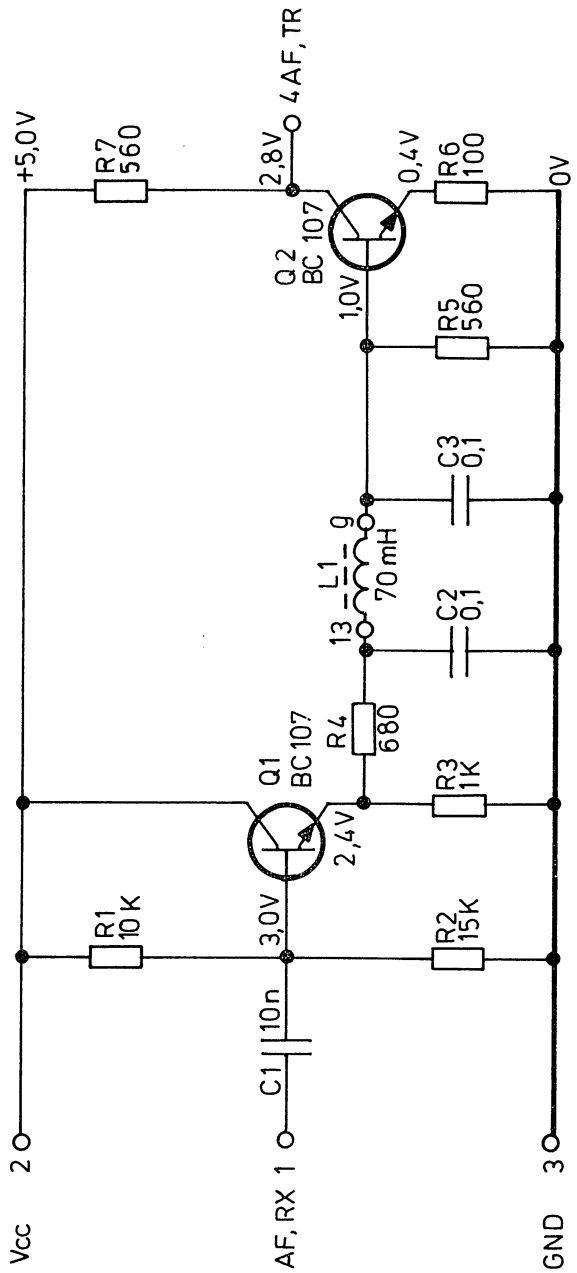
3 Storno TE box 20x21x6 cm.

Storno	konstr./tegn. THa/AIM	20-6-74	TONE SEQUENCE DECODER
	godk.		SEKVENSTONEDEKODER
	komp.liste		CAF 680-2005/x3a KODE
			TEGN. NR. D 125 484 A3

64 del. à 4 mm.



REV.	DESIGN/DRAWN	APPR.	COMP. LIST		DATE
	THa/AlM			LAY-OUT PLACERINGSTEGNING SR 680-2005-x3a	20-6 74
	Storno RADIO COMMUNICATION SYSTEMS				A4 DRWG. NO. I 125 483



L1: Storno standard coil: 61.840

Storno	konstr./tegn. KHo 19.12.73 godk. komp.liste X116 114	LOW PASS FILTER LAVPASFILTER FN 680 - 2005/00 KODE	TEGN.NR. D116 113/1 A4

no	code	data	no	code	data
C1	76.5070-00	10nF 10% polyest. 50V			
C2	76.5073-00	0,1 µF 10% polyest. TB 100V			
C3	76.5073-00	0,1 µF 10% polyest. TB 100V			
R1	80.5261-00	10 kΩ 5% carbon film 1/8W			
R2	80.5263-00	15 kΩ 5% carbon film 1/8W			
R3	80.5249-00	1 kΩ 5% carbon film 1/8W			
R4	80.5247-00	680Ω 5% carbon film 1/8W			
R5	80.5246-00	560Ω 5% carbon film 1/8W			
R6	80.5237-00	100Ω 5% carbon film 1/8W			
R7	80.5246-00	560Ω 5% carbon film 1/8W			
L1	61.0840-00	Tone Coil			
Q1	99.5121-00	Transistor BC107			
Q2	99.5121-00	Transistor BC107			

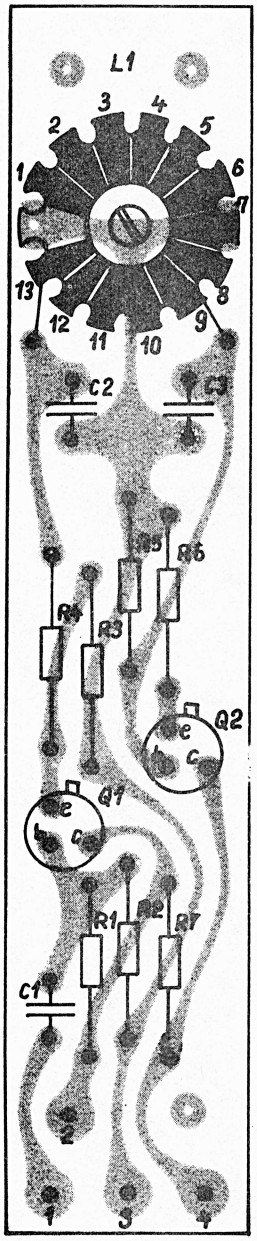
Storno

udarb af OG/HNi 24.2.71
kontrol af
tilh. diagr D116113

LOW PASS FILTER
LAVPASFILTER

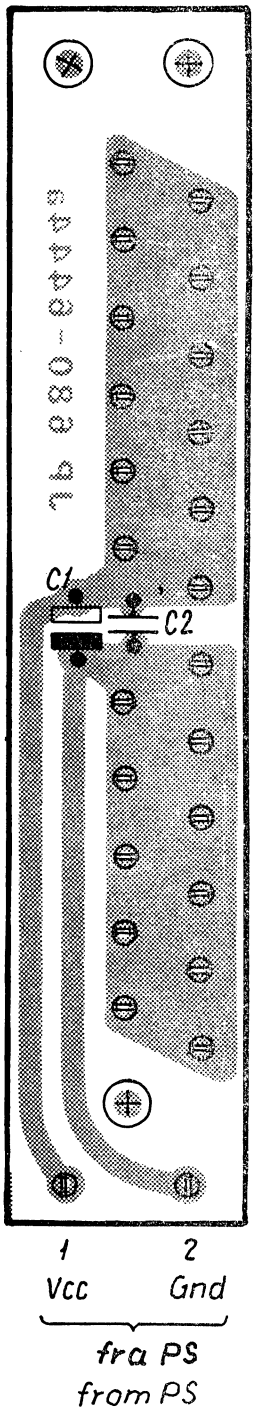
FN680-2005 /00

komp liste X116114 /1
blad no af



Viewed from component side
Set fra komponentsiden

Storno	konstr./tegn. KHo 18.12.73	LAY-OUT Placeringstegning	FN680-2005/00 KODE
	godk.		TEGN. NR. I116265/1 A4
	komp.liste		



C1: 73.5106 68 µF 15V tantal
C2: 74.5109 10 nF 63V

Storno	konstr./tegn. J.En/Meng 14.1.72.	5V DISTRIBUTION PRINT 5V FORDELINGS PRINT JUNCTION BOARD JP 680 - 6444a KODE	TEGN.NR. D118163 A4
	godk. A.H.		
	komp.liste		

E5 rev. d. 10.12.73.

Storno

konstr./tegn. JEN/EBH 12.7.72.

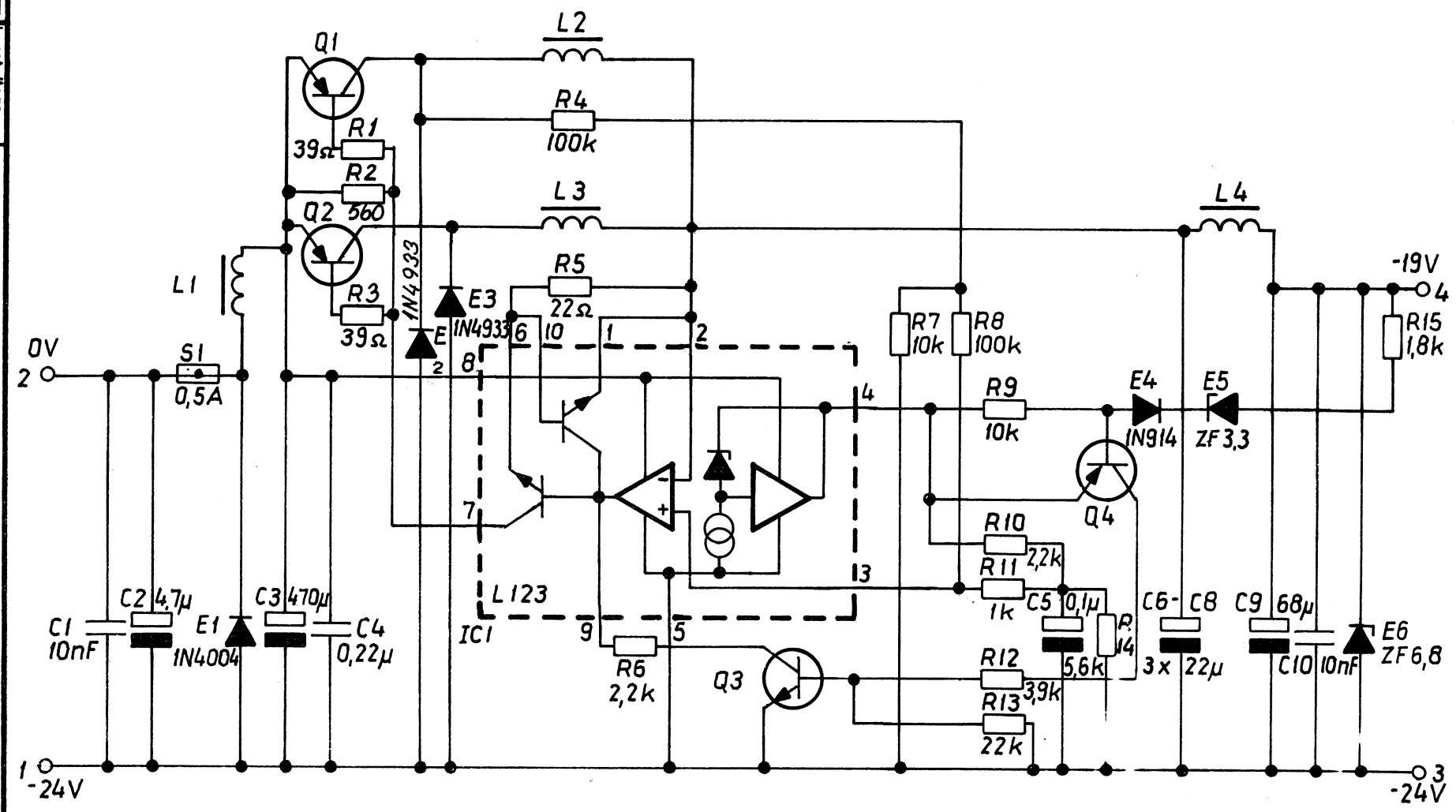
godk.

kompl.liste I120209 X119537

POWER SUPPLY
STRØMFORSYNING
PS 600 - 6450a

KODE

TEGN. NR.
0119537
A4



no	code	data
C1	74.5109-00	10nF-20+80% Cer. 20V.
C2	73.5126-00	4,7µF 20% tantal 35V
C3	000-0798-00	470µF 35V FRAKO
C4	76.5074-00	0,22µF 10% 100V
C5	73.5089-00	0,1µF 20% tantal 35V
C6	73.5127-00	22µF 20% tantal 16V
C7	73.5127-00	22µF 20% tantal 16V
C8	73.5127-00	22µF 20% tantal 16V
C9	73.5106-00	68µF 20% tantal 16V
C10	74.5109-00	10nF -20+80% Cer. 20V
R1	80.5232-00	39Ω 5% carb.film 1/8W
R2	80.5246-00	560Ω 5% carb.film 1/8W
R3	80.5232-00	39Ω 5% carb.film 1/8W
R4	80.5273-00	100KΩ 5% carb.film 1/8W
R5	80.5229-00	22Ω 5% carb.film 1/8W
R6	80.5253-00	2,2KΩ 5% carb.film 1/8W
R7	80.5261-00	10KΩ 5% carb. film 1/8W
R8	80.5273-00	100KΩ 5% carb.film 1/8W
R9	80.5261-00	10KΩ 5% carb.film 1/8W
R10	80.5253-00	2,2KΩ 5% carb.film 1/8W
R11	80.5249-00	1KΩ 5% carb.film 1/8W
R12	80.5256-00	3,9KΩ 5% carb.film 1/8W
R13	80.5265-00	22KΩ 5% carb.film 1/8W
R14	80.5258-00	5,6KΩ 5% carb.film 1/8W
R15	80.5252-00	1,8KΩ 5% carb.film 1/8W
E1	99.5020-00	diode 1N4004
E2	000-0923-00	diode 1N4933
E3	000-0923-00	diode 1N4933
E4	99.5028-00	diode 1N914
E5	99.5210-00	zenerdiode ZF3,3
E6	99.5146-00	zenerdiode ZF6,8
Q1	000-0944-00	trans. MPS U51 A
Q2	000-0944-00	trans. MPS U51 A
Q3	99.5121-00	trans. BC107
Q4	99.5144-00	trans. BC 214L
Ic1	000-0941-00	integr. circuit L123
L1	000-0824-00	spole 250µH
L2	000-0825-00	spole 225µH
L3	000-0825-00	spole 225µH
L4	000-0826-00	spole 30µH
S1	92.5077-00	sikring, flink 0,5A

E5 rev. d. 10.12.73.

Storno

udarb. af KDM/LAP 12.7.72

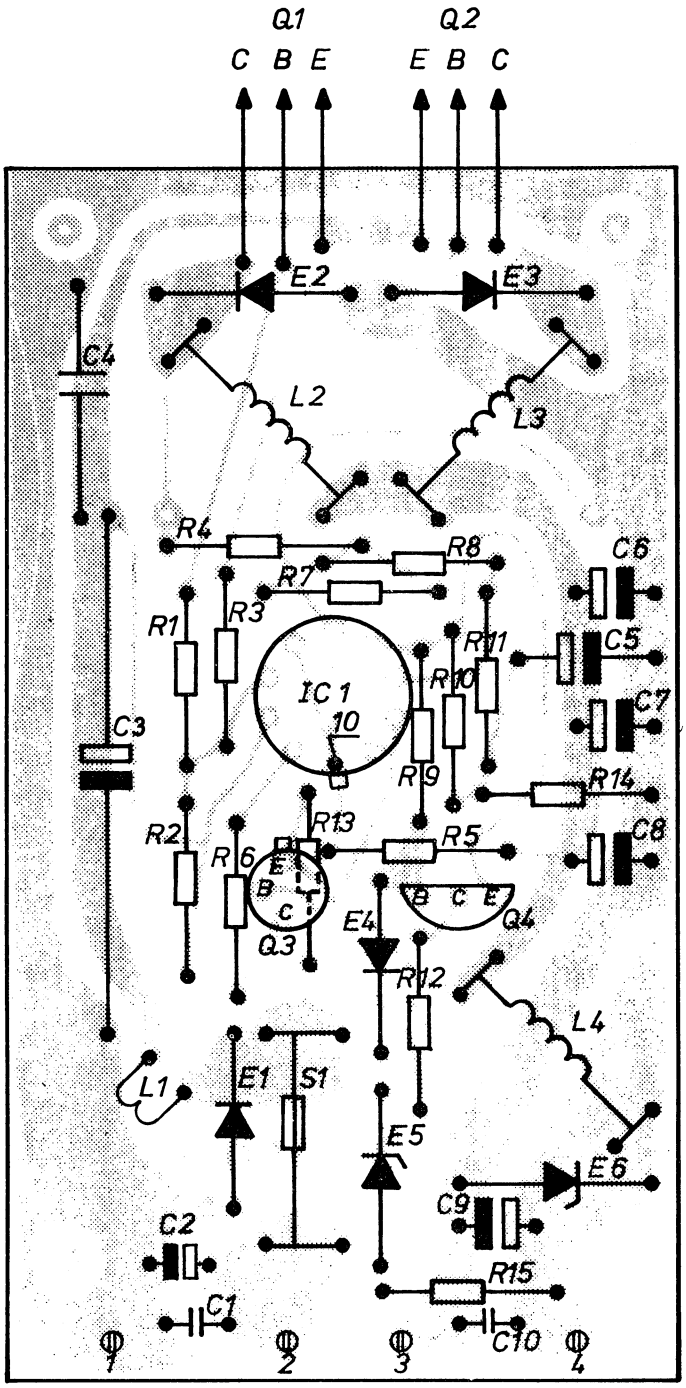
kontrol af JEn

tilh. diagr D119537 I120209

Part list
Stykliste

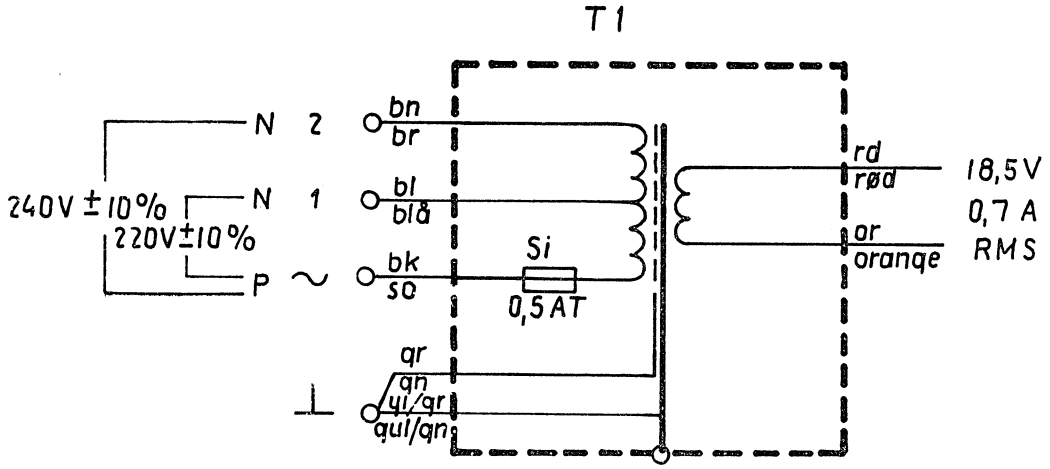
PS600-6450a

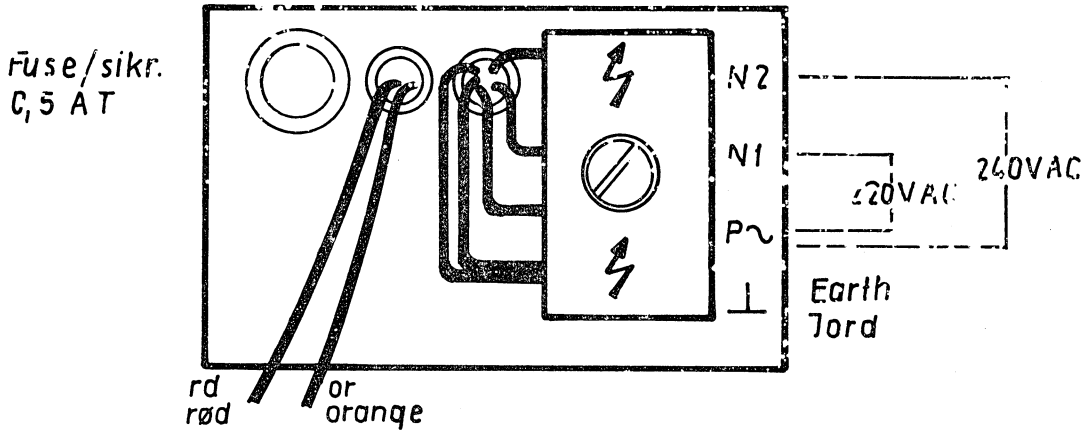
komp liste X119538 blad no 1 af 1



Viewed from component side
Set fra komponentsiden

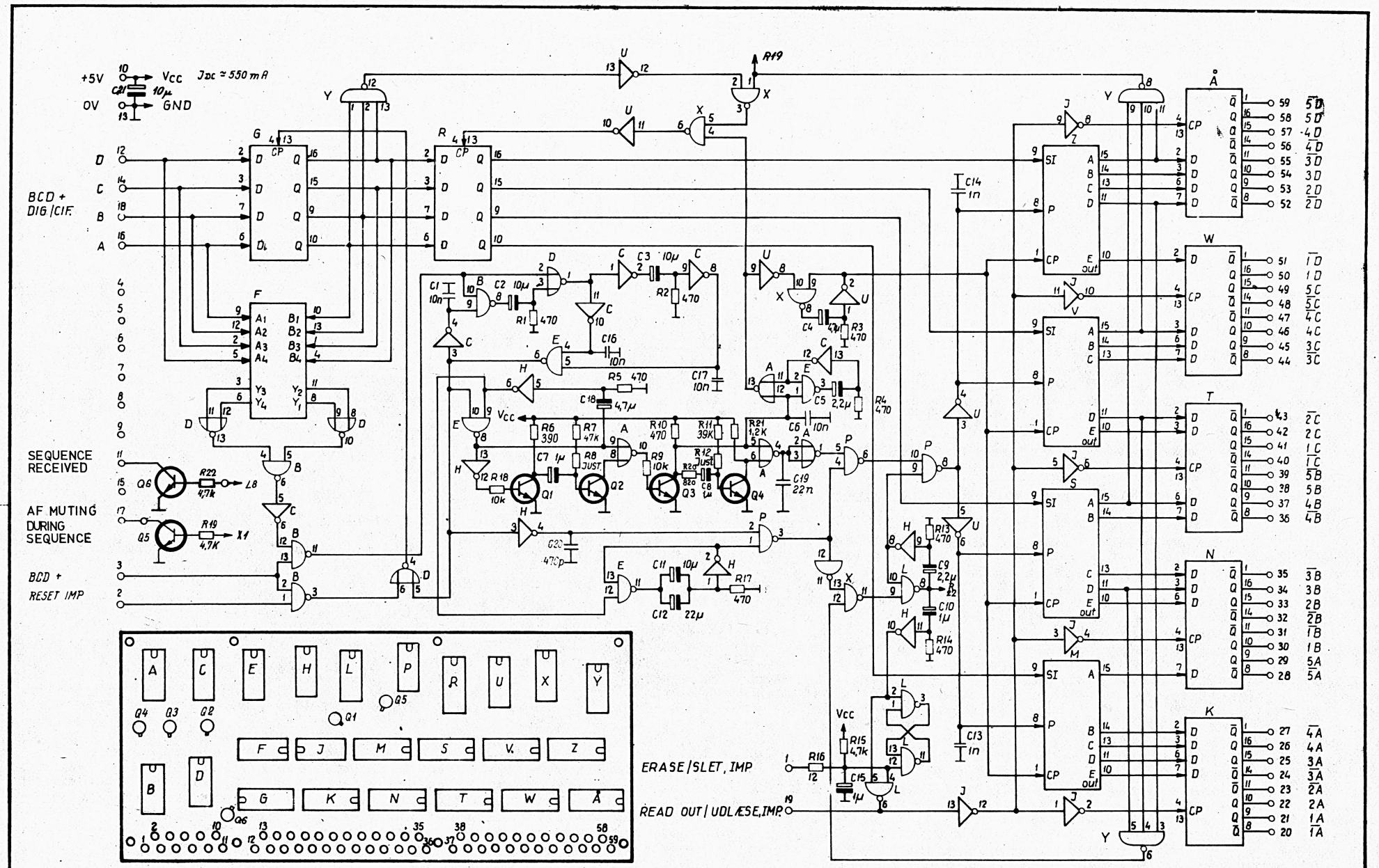
Storno	konstr./tegn KEM/MBP 1.9.72 godk komp. ste D119537 X119538	LAY OUT PLACERINGSTEGNING PS 600-6450a KODE	TEGN NR I 120209 A4





S1: 92.5030 00 Fuse 0,5A (T) 250V 5Ø x 20
T1: 60.5162 00 Transformer 220-240V/18,5V 50Hz.

REV.	DESIGN/DRAWN	APPR.	COMP. LIST		DATE
	KHo/BO			TRANSFORMER PANEL TP 680-2005/02	15.3.74
	Storno RADIO COMMUNICATION SYSTEMS			10.2892-00	A4 DRWG. NO. D122801/1



IC	B, E, L, P, X	A, D	C, H, J, U	Y	G, K, N R, T, W, Å	F	M, S, V, Z
T.I. TTL TYPE	SN6400N	SN6402N	SN6404N	SN6410N	SN6475N	SN6486N	SN6496N
Vcc/GND	14/7	14/7	14/7	14/7	5/12	14/7	5/12

Storno

konstr./tegn. KMo 18.12.73
godk.
kompl.liste X119438 I119437

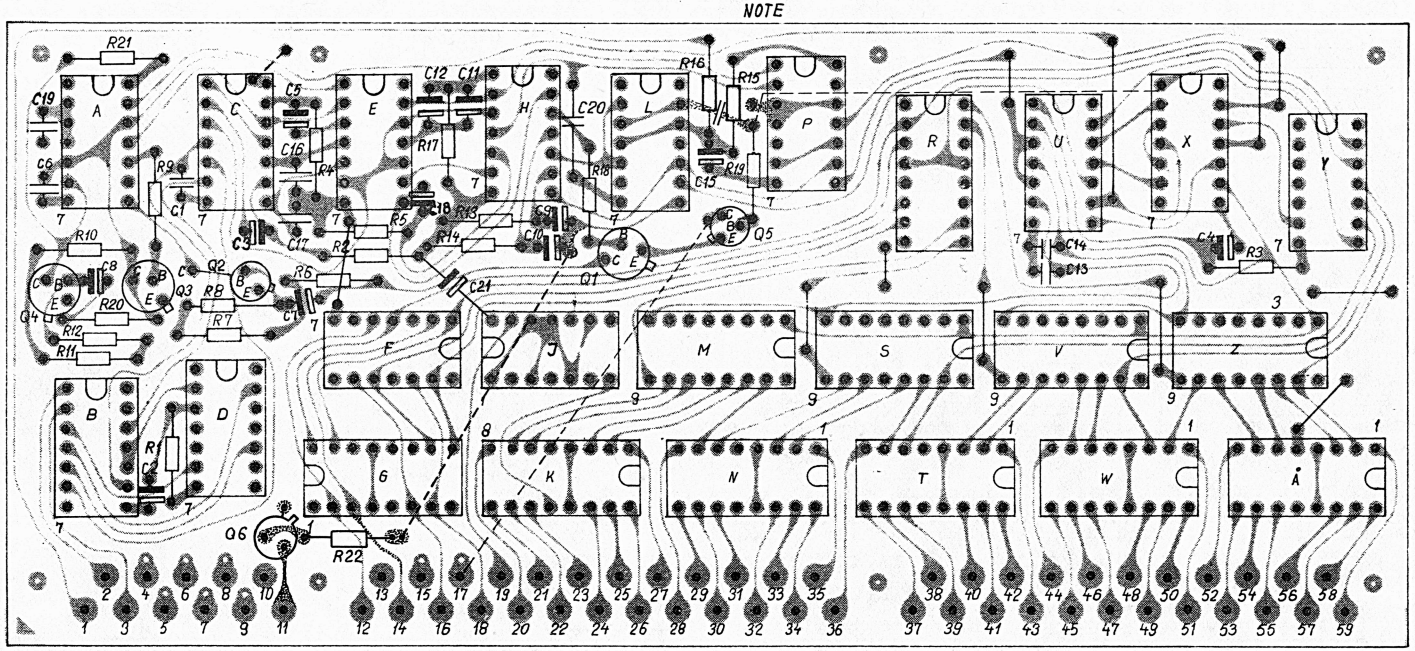
SEQUENCE DECODER
SEKVENS DEKODER

SD680-2005a
SD680-2005b

KODE

TEGN. NR. D 119436

NOTE

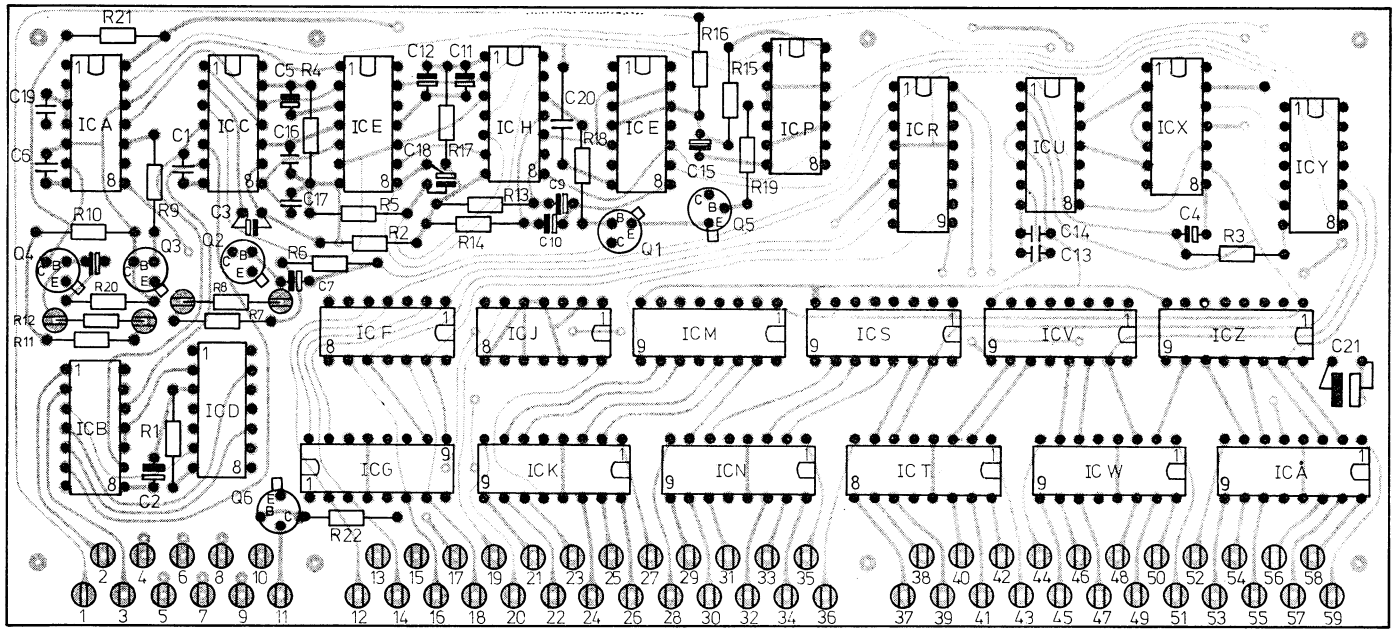


Printed circuit viewed from component side
Set fra komponentsiden.

NOTE: *Cut the printed connection to L3 and mount a wire from R 19 to X1.*

NOTE: *Afbryd printforbindelsen til L3 og forbind en ledning fra R 19 til X1.*

Storno	ALe/MJe 20.6.72	LAY-OUT PLACERINGSTEGNING	TEGN NR I119437 A3
	X119438 D119436	SD680-2005a KODE	



Viewed from component side
Set fra komponent side

REV	DESIGN/DRAWN	APPR	COMP LIST		DATE
	KDM/LMi		D 119 436 X 119 438	LAY - OUT PLACERINGSTEGNING SD680 - 2005b	11. 5. 76
	Storno RADIO COMMUNICATION SYSTEMS				A3 DRWG NO I 128372

no	code	data	no	code	data
C1	76.5070-00	10nF 10% polyest.	R14	80.5245-00	470Ω 5% kullag 1/8W
C2	73.5109-00	10µF 20% tantal 15V.	R15	80.5257-00	4,7kΩ 5% kullag 1/8W
C3	73.5109-00	10µF 20% tantal 15V.	R16	80.5226-00	12Ω 5% kullag 1/8W
C4	73.5126-00	4,7µF 20% tantal 35V	R17	80.5245-00	470Ω 5% kullag 1/8W
C5	73.5102-00	2,2µF 20% tantal 35V.	R18	80.5261-00	10kΩ 5% kullag 1/8W
C6	76.5070-00	10nF 10% polyest.50V	R19	80.5257-00	4,7kΩ 5% kullag 1/8W
C7	73.5114-00	1µF 20% tantal 35V	R20	80.5248-00	820Ω 5% kullag 1/8W
C8	73.5114-00	1µF 20% tantal 35V	R21	80.5250-00	1,2kΩ 5% kullag 1/8W
C9	73.5102-00	2,2µF 20% tantal 35V	R22	80.5257-00	4,7kΩ 5% kullag 1/8W
C10	73.5114-00	1µF 20% tantal 35V			
C11	73.5109-00	10µF 20% tantal 15V	Q1	99.5121-00	BC107 transistor.
C12	73.5127-00	22µF 20% tantal 15V	Q2	99.5121-00	BC107 transistor
C13	76.5069-00	1nF 10% polyrst.50V	Q3	99.5121-00	BC107 transistor
C14	76.5069-00	1nF 10% polyest.50V	Q4	99.5121-00	BC107 transistor
C15	73.5114-00	1µF 20% tantal 35V	Q5	99.5121-00	BC107 transistor
C16	76.5070-00	10nF 10% polyest.50V	Q6	99.5121-00	BC107 transistor
C17	76.5070-00	10nF 10% polyest.50V			
C18	73.5126-00	4,7µF 20% tantal 35V	IC-A	14.5032-00	SN6402N
C19	76.5071-00	22nF 10% polyest.50V	IC-D	14.5032-00	SN6402N
C20	76.5106-00	470pF 2,5 polystyr	IC-B	14.5024-00	SN6400N
C21	73.5109-00	10µF 20% tantal 15V	IC-E	14.5024-00	SN6400N
R1	80.5245-00	470Ω 5% kullag 1/8W	IC-L	14.5024-00	SN6400N
R2	80.5245-00	470Ω 5% kullag 1/8W	IC-P	14.5024-00	SN6400N
R3	80.5245-00	470Ω 5% kullag 1/8W	IC-X	14.5024-00	SN6400N
R4	80.5245-00	470Ω 5% kullag 1/8W	IC-C	14.5034-00	SN6404N
R5	80.5245-00	470Ω 5% kullag 1/8W	IC-H	14.5034-00	SN6404N
R6	80.5247-00	680Ω 5% kullag 1/8W	IC-J	14.5034-00	SN6404N
R7	80.5269-00	47kΩ 5% kullag 1/8W	IC-U	14.5034-00	SN6404N
R8	80.52xy-00	Justerbar 5% kullag 1/8W	IC-F	14.5041-00	SN6486N
			IC-G	14.5035-00	SN6475N
R9	80.5261-00	10kΩ 5% kullag 1/8W	IC-K	14.5035-00	SN6475N
R10	80.5245-00	470Ω 5% kullag 1/8W	IC-N	14.5035-00	SN6475N
R11	80.5268-00	39kΩ 5% kullag 1/8W	IC-R	14.5035-00	SN6475N
R12	80.52xy-00	Justerbar 5% kullag 1/8W	IC-T	14.5035-00	SN6475N
			IC-W	14.5035-00	SN6475N
R13	80.5245-00	470Ω 5% kullag 1/8W			

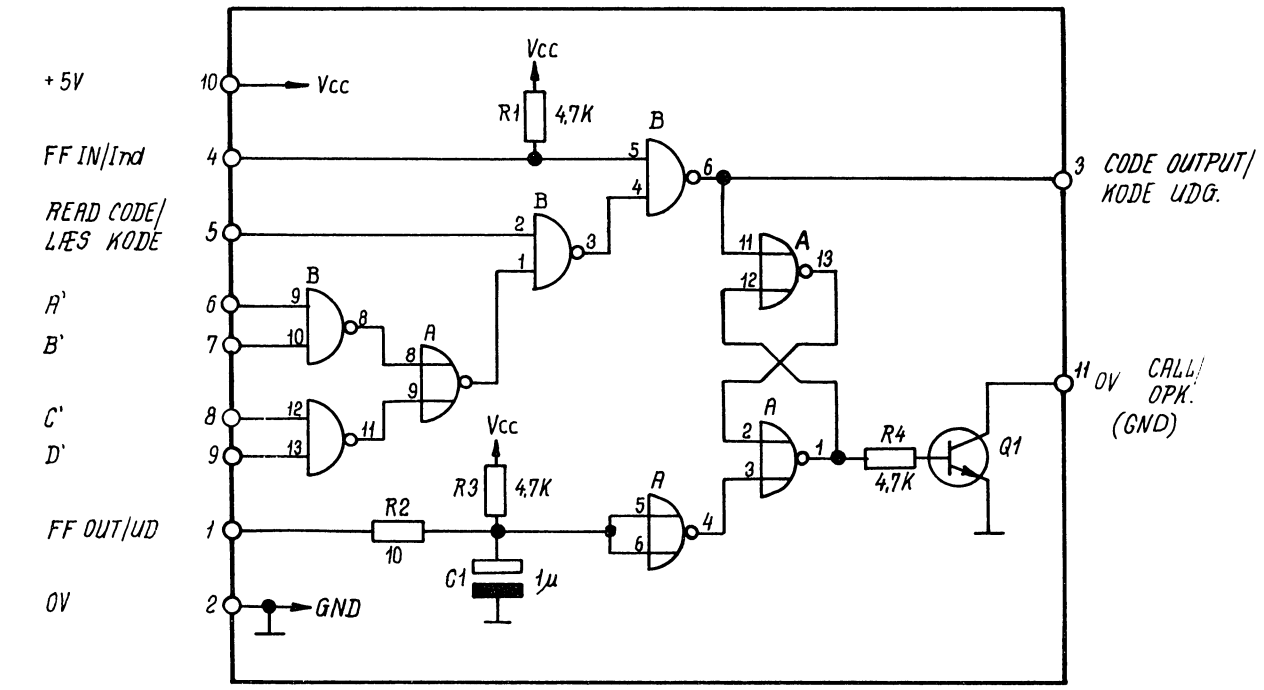
REV.	DESING DRAWN	APPR.	COMP. LIST		DATE
	KHb/MLy		D119436		20-12-73
	Storno RADIO COMMUNICATION SYSTEMS		SEQUENCE DECODER SEKVENS DEKODER	SD680-2005a SD680-2005b	A4 DRWG. NO. X 119438

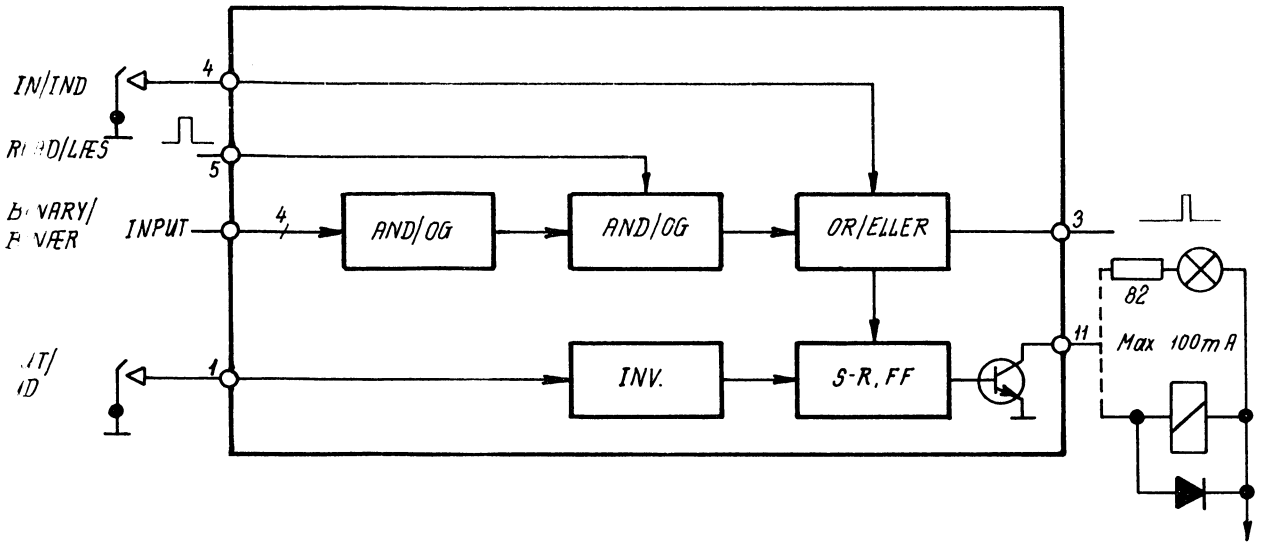
side 1 af 1

Rev.d.14-6-74 MLy

no	code	data	no	code	data
IC-Å	14.5035-00	SN6475N			
IC-M	14.5046-00	SN6496N			
IC-S	14.5046-00	SN6496N			
IC-Y	14.5046-00	SN6496N			
IC-Z	14.5046-00	SN6496N			
IC-Y	14.5004-00	SN6410N			

REV.	DESING DRAWN	APPR.	COMP. LIST		DATE
	KHb/MLy		D119436		20-12-73
	Storno RADIO COMMUNICATION SYSTEMS			SEQUENCE DECODER SEKVENS DEKODER SD680-2005a SD680-2005b	A4 DRWG. NO. X119438





DEC. DIG./CIF	1	2	3	4	5	6	7	8	9	0	R	A
A' →	A	$\bar{A}$	A	$\bar{A}$	A	$\bar{A}$	A	$\bar{A}$	A	$\bar{A}$	A	$\bar{A}$
BCD+ B' →	$\bar{B}$	B	B	$\bar{B}$	$\bar{B}$	B	B	$\bar{B}$	$\bar{B}$	$\bar{B}$	B	$\bar{B}$
DIG/CIF C →	$\bar{C}$	$\bar{C}$	$\bar{C}$	C	C	C	C	$\bar{C}$	$\bar{C}$	$\bar{C}$	$\bar{C}$	C
D →	$\bar{D}$	$\bar{D}$	$\bar{D}$	$\bar{D}$	$\bar{D}$	$\bar{D}$	$\bar{D}$	$\bar{D}$	D	$\bar{D}$	D	D

Storno

konstr./tegn. OG/KG 11.5.70

godk. THa

komp.liste X 114935

DECODER LATCH / AFKODNINGS HOLDEKREDS

SU 680-2005

KODE

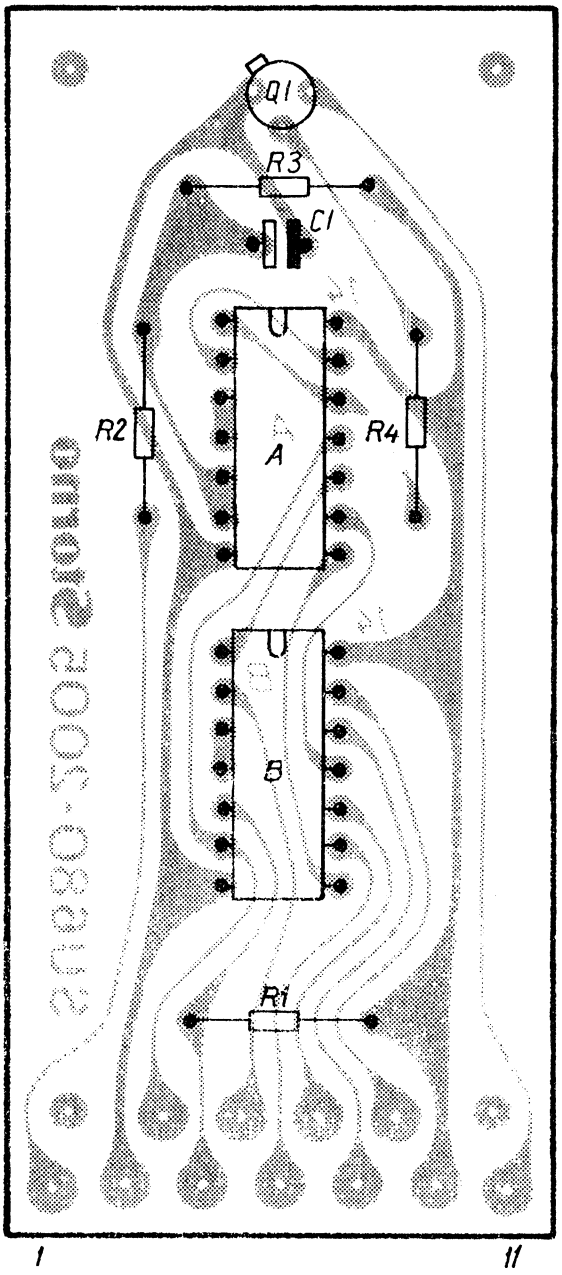
(Print D115004)

TEGN. NR. D114601 A4

no	code	data	no	code	data
C1	73.5114-00	1 µF 20% tantal 35V			
R1	80.5257-00	4,7 kΩ 5% carbon film 1/8W			
R2	80.5225-00	10Ω 5% carbon film 1/8W			
R3	80.5257-00	4,7 kΩ 5% carbon film 1/8W			
R4	80.5257-00	4,7 kΩ 5% carbon film 1/8W			
Q1	99.5121-00	BC107 transistor			
A	14.5032-00	SN 6402 N			
B	14.5024-00	SN 6400 N			

REV.	DESING DRAWN	APPR.	Drwg.no.		DATE
3/2-75	JEn/HNi 29/7-70		D114601 D115004	PART LIST STYKLISTE SU680-2005 Decoder latch/afkodningsholdekreds	29/7-70
	Storno RADIO COMMUNICATION SYSTEMS				A4 Comp. list X114935

PRINTED CIRCUIT SEEN FROM COMPONENT SIDE
TRYKT KREDSLØB SET FRA KOMPONENTSIDEN



Storno	konstr./tegn. NH/EBH 11.8.70.	LAY-OUT MONTERINGSOVERSIGT SU 680-2005 KODE	TEGN. NR D115004 A1
	godk. THa		
	komp.liste D114601 X114935		

Note 1: No signal condition.

Note 2: Main high stability oscillator plugged in.

Note 3: Main and Standby high stability oscillators plugged in.

With Main high stability oscillator plugged in the voltage on the positive end of C402 is 1.9 V.

With Standby high stability oscillator plugged in the voltage on the positive end of C404 is 1.9 V.

6.4.5 Drive Frequency Generator Board

Transistor	Emitter	Base	Collector
VT101	2.1V	2.7V	8V
VT102	0.8V	0.15V	0V Output of X102 10W.

When the output of X102 is high the Avo affects the readings.

VT103	8.3V	8.8V	18V
VT104	9.3V	10V	18V
VT105	8.2V	8.6V	18V

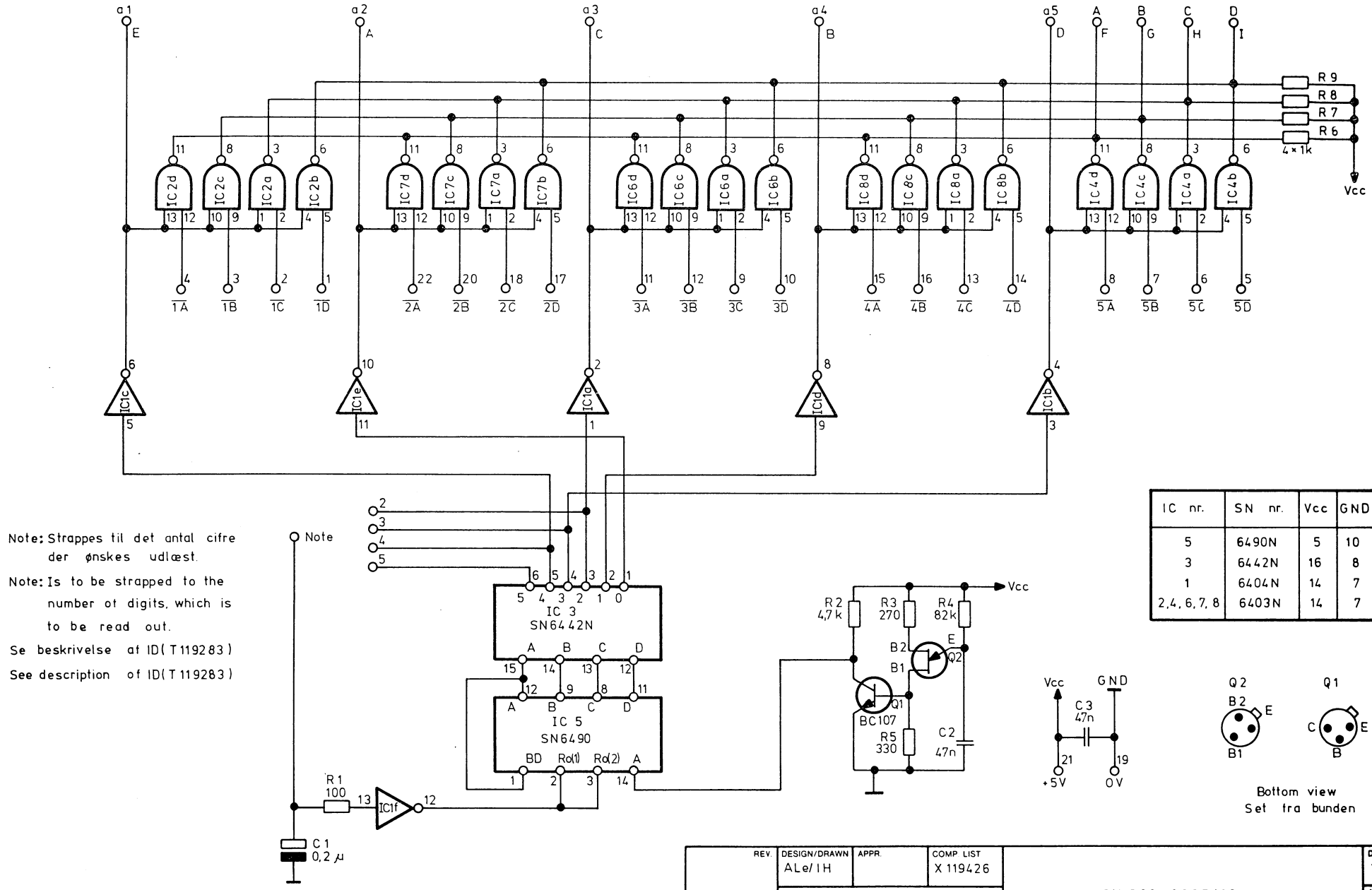
Circuits

X101 No meaningful values can be obtained because of the loading effect of the Avo.

	1	2	3	4	5	6	7	8	9	10
X107	9.2V	8.5V	8.5V	9.2V	4.5V	15V	11.8V	11.8V	15V	0

X102	Positive	supply-pin	14	negative-	supply	pin	7		
X103	"	"	"	4	"	"	"	11	
X104	"	"	"	14	"	"	"	7	
X105	"	"	"	16	"	"	"	8	
X106	"	"	"	16	"	"	"	8	
X108	"	"	"	16	"	"	"	8	
X109 *)	"	"	"	14	"	"	"	7	
X110	"	"	"	16	"	"	"	8	

*) X109 Pin 1 1.2V



Note: Strappes til det antal cifre der ønskes udlæst.

Note: Is to be strapped to the number of digits, which is to be read out.

Se beskrivelse af ID(T 119283)

See description of ID(T 119283)

IC nr.	SN nr.	Vcc	GND
5	6490N	5	10
3	6442N	16	8
1	6404N	14	7
2, 4, 6, 7, 8	6403N	14	7

Bottom view
Set fra bunden

REV.	DESIGN/DRAWN	APPR.	COMP LIST
	ALe/IH		X 119426

Storno
RADIO COMMUNICATION SYSTEMS

SU 680-2005/03

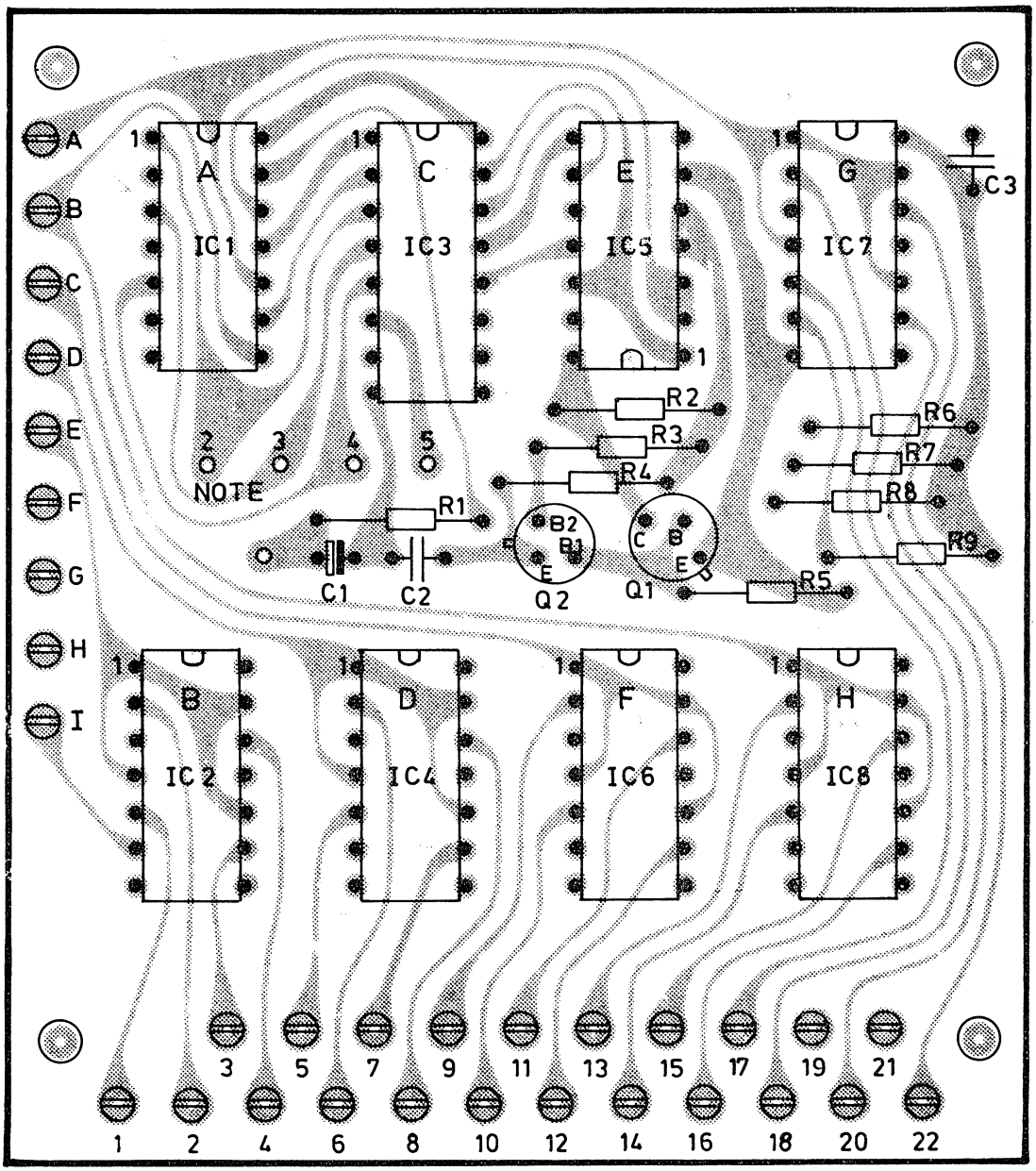
DATE 11 - 1 - 74

A3 DRWG. NO. D 119431

no	code	data	no	code	data
R1	80.5237-00	100Ω carb. film 1/8W			
R2	80.5257-00	4,7K carb. film 1/8W			
R3	80.5242-00	270Ω carb. film 1/8W			
R4	80.5272-00	82 K carb. film 1/8W			
R5	80.5243-00	330Ω carb. film 1/8W			
R6	80.5249-00	1K carb. film 1/8W			
R7	80.5249-00	1K carb. film 1/8W			
R8	80.5249-00	1K carb. film 1/8W			
R9	80.5249-00	1K carb. film 1/8W			
C1	73.5118-00	0,22 µ/30V Tantal			
C2	76.5072-00	47 n/50V Polyester			
C3	76.5072-00	47 n/50V Polyester			
IC 1	14.5034-00	SN 6404 N TTL			
IC 2	14.5072-00	SN 6403 N TTL			
IC 3	14.5042-00	SN 6442 N TTL			
IC 4	14.5072-00	SN 6403 N TTL			
IC 5	14.5044-00	SN 6490 N TTL			
IC 6	14.5072-00	SN 6403 N TTL			
IC 7	14.5072-00	SN 6403 N TTL			
IC 8	14.5072-00	SN 6403 N TTL			
Q1	99.5121-00	BC107 Transistor			
Q2	99.5194-00	2N 2646 UJT			

REV.	DESING DRAWN	APPR.	Drwg. no.		DATE
	ALe/HNi 21/12-73		D119431	SU680-2005/03	21/12-73
	Storno RADIO COMMUNICATION SYSTEMS				Comp. list X119426

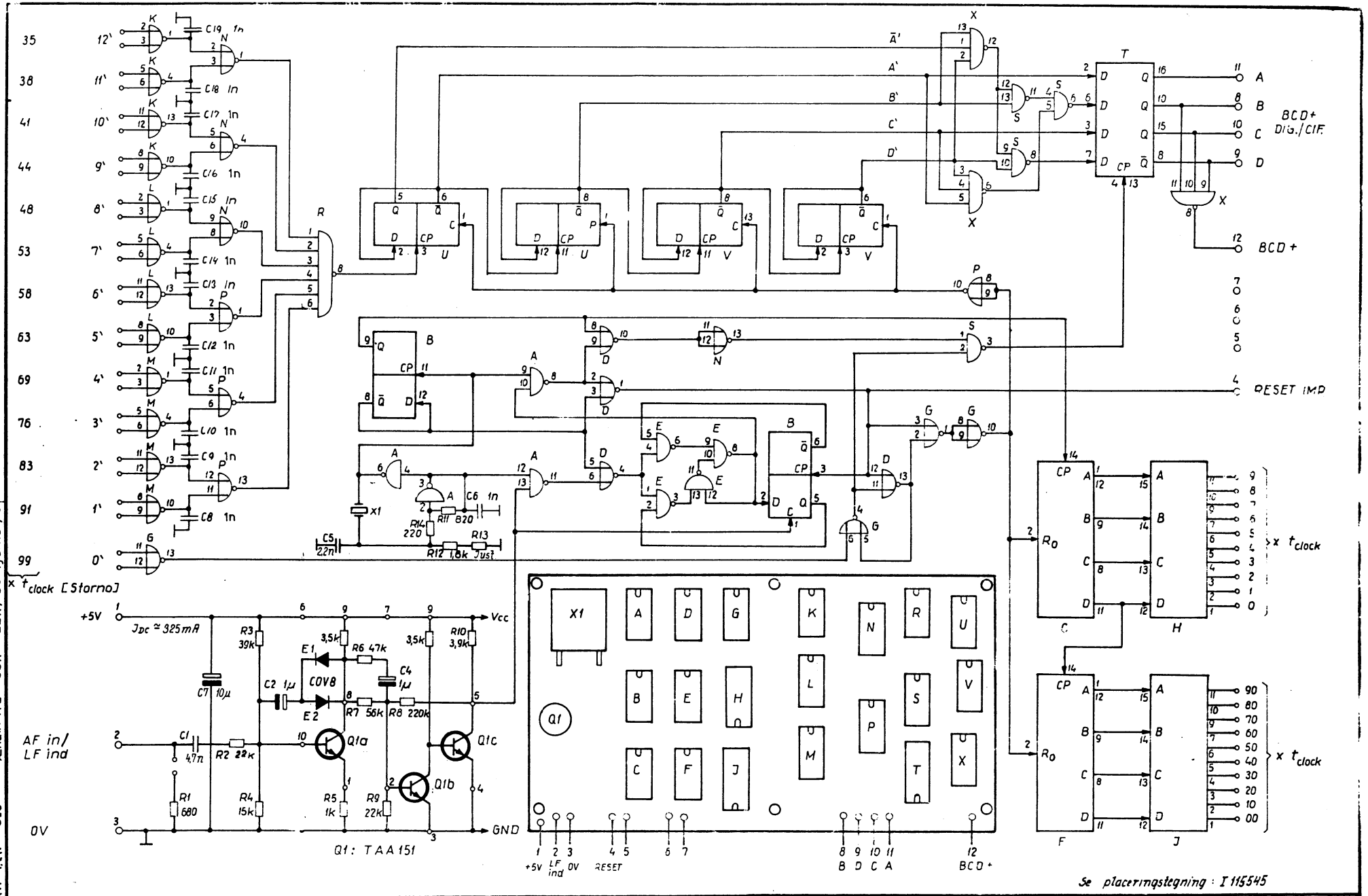
VIEWED FROM COMPONENT SIDE
SET FRA KOMPONENTSIDEN



NOTE: Strappes til det antal cifre, der ønskes udlæst.

Is to be strapped to the number of digits, which is to be read out.

Storno	konstr./tegn. ALe / LMa 17-7-72 godk kompl.liste	LAY - OUT PLACERINGSTEGNING SU 680 - 2005 /03 KODE	TEGN. NR. I 119635



I. C	A, E, S	D, G, K, L M, N, P	X	R	H, J	B U, V	T	C, F
T.I, TTL, TYPE	SN6400N	SN6402N	SN6410N	SN6430N	SN6442N	SN6474N	SN6475N	SN6490N
Vcc/GND	14/7	14/7	14/7	14/7	16/8	14/7	5/12	5/7,10

Storno

Kompl.liste X114933

MULTI TONE RECEIVER
MULTI TONE MODTAGER

TR680-2005/0X

KODE

TEGN. NR. D 114393 A3

Ændr. 16.3.71. R11 1.2k → 820 Ændr: R2 33k = 22k, C3 fjernet, C7 - 19 isat.

no	code	data
C1	76.5061-00	4,7nF 10% polyest 50V
C2	73.5114-00	1µF 20% tantal 35V
C3		
C4	73,5114-00	1µF 20% tantal 35V.
C5	76.5059-00	2,2nF 10% polyest. 50V
C6	76.5069-00	1nF 10% polyest. 50V
C7	73.5109-00	10µF 20% tantal 16V.
C8	76.5069-00	1nF 10% polyest. 50V
C9	76.5069-00	1nF 10% polyest. 50V
C10	76.5069-00	1nF 10% polyest. 50V
C11	76.5069-00	1nF 10% polyest. 50V
C12	76.5069-00	1nF 10% polyest. 50V
C13	76.5069-00	1nF 10% polyest. 50V.
C14	76.5069-00	1nF 10% polyest. 50V.
C15	76.5069-00	1nF 10% polyest. 50V.
C16	76.5069-00	1nF 10% polyest. 50V.
C17	76.5069-00	1nF 10% polyest. 50V
C18	76.5069-00	1nF 10% polyest. 50V
C19	76.5069-00	1nF 10% polyest. 50V
R1	80.5247-00	680Ω 5% kullag 1/8W
R2	80.5265-00	22kΩ 5% kullag 1/8W
R3	80.5268-00	39kΩ 5% kullag 1/8W
R4	80.5251-00	15kΩ 5% kullag 1/8W
R5	80.5249-00	1kΩ 5% kullag 1/8W
R6	80.5269-00	47kΩ 5% kullag 1/8W
R7	80.5270-00	56kΩ 5% kullag 1/8W
R8	80.5277-00	220kΩ 5% kullag 1/8W
R9	80.5265-00	22kΩ 5% kullag 1/8W
R10	80.5256-00	3,9kΩ 5% kullag 1/8W
R11	80.5248-00	820kΩ 5% kullag 1/8W
R12	80.5252-00	1,8kΩ 5% kullag 1/8W
R13	80.	just. 5% kullag 1/8W
R14	80.5241-00	22okΩ 5% kullag 1/8W
E1	99.5211-00	Diode C0 V8
E2	99.5211-00	Diode C0 V8

no	code	data
Q1	14.5003-00	TAA 151
IC-A	14.5024-00	SN 6400N
IC-E	14.5024-00	SN 6400N
IC-S	14.5024-00	SN 6400N
IC-B	14.5005-00	SN 6474N
IC-U	14.5005-00	SN 6474N
IC-V	14.5005-00	SN 6474N
IC-C	14.5044-00	SN 6490N
IC-F	14.5044-00	SN 6490N
IC-D	14.5032-00	SN 6402N
IC-G	14.5032-00	SN 6402N
IC-K	14.5032-00	SN 6402N
IC-L	14.5032-00	SN 6402N
IC-M	14.5032-00	SN 6402N
IC-N	14.5032-00	SN 6402N
IC-P	14.5032-00	SN 6402N
IC-H	14.5042-00	SN 6442N
IC-J	14.5042-00	SN 6442N
IC-X	14.5004-00	SN 6410N
IC-R	14.5037-00	SN 6430N
IC-T	14.5035-00	SN 6475N
X1	000-0916-00	X-tal. 200KHz:101
X1	000-0943-00	X-tal.197KHz:101a
X1	000-0939-00	X-tal.202KHz:102
X1	000-0935-00	X-tal.182KHz:103

Rett.d. 20-12-73 MLy

Storno

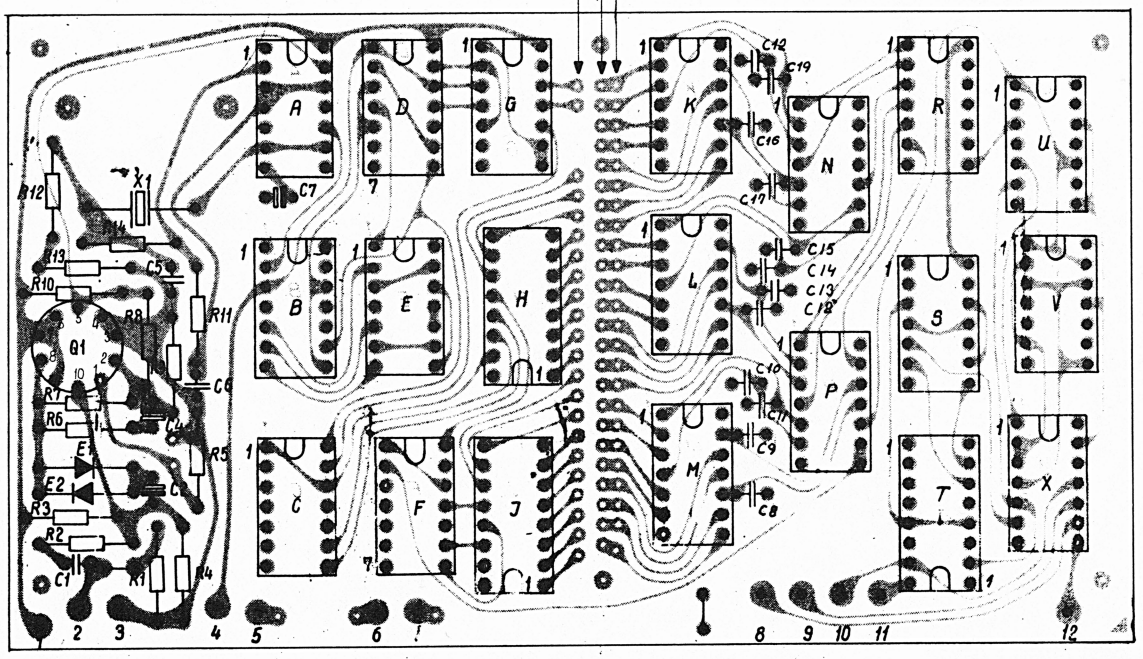
Tegn. JTE/HNi 20-12-73
kontrol af
Lib. dept. D114393 I 115545

MULTI TONE RECIEVER
MULTI TONEMODTAGER

TR680-2005/0x

norm/ test X114933 blad no af

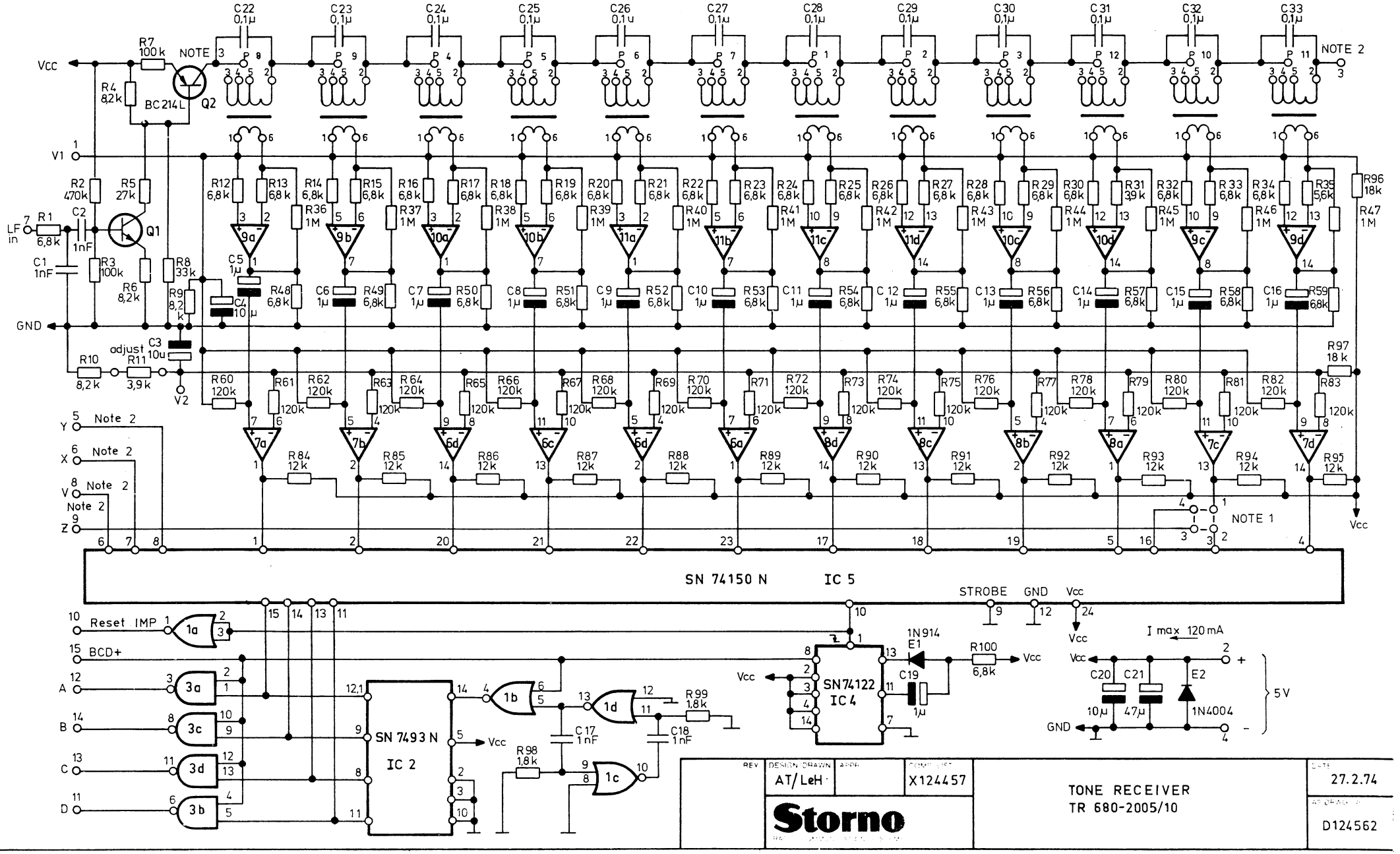
Strapning se diagram D114889 og T118081



Printed circuit viewed from component side.
Set fra komponentsiden.

Storno	MEJ/KJ 2-11-90	LAY-OUT PLACERINGSTEGNING	TR 680 - 2005/OX
	D114933 X114933	KODE	TEGN NR I 115545 A3

Note 1 : Connect 1 to 4 and 2 to 3 if tone 10 output equals 0-0-0-0 ; connect 1 to 2 and 3 to 4 if tone 10 output equals 0-1-0-1 (A-B-C-D)
Note 2 : Normaly connected to GND (terminal 4).
Note 3 TR 680-2005/11 (1060 Hz-2800 Hz) connect P to 4; TR 680-2005/12 (1124 Hz - 2246 Hz) connect P to 5 ; TR 680-2005/13 (970 Hz - 2600 Hz) connect P to 3.
Note 4 Storno tones : make R 11 3,9k, CCIR : make R11 5,6 k.



REV	DESIGN DRAWN	APPR	COMPONENT LIST
	AT/LeH		X124457

Storno

TONE RECEIVER
TR 680-2005/10

DATE 27.2.74

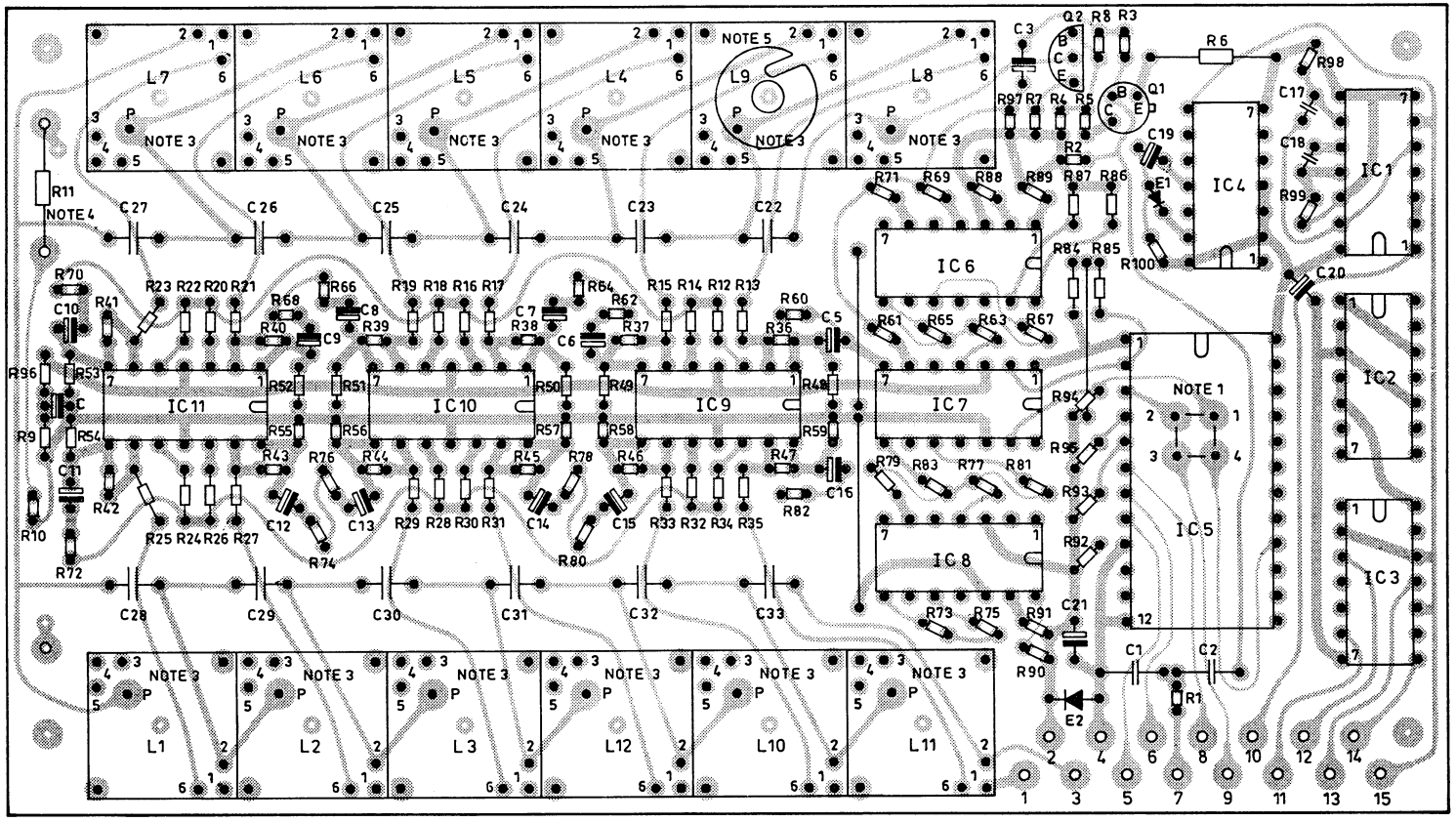
D124562

no	code	data	no	code	data
R1	80.5259	68 kΩ carbon film 1/8W	C1-C2	76.5069	1nF 10% polyest. 50V
R2	80.5281	470k carbon film 1/8W	C3-C4	73.5109	10µF 16V tantal
R3	80.5273	100k carbon film 1/8W	C5-C16	73.5114	1µF 35V tantal
R4	80.5260	8,2k carbon film 1/8W	C17-C18	76.5069	1nF 10% polyest. 50V
R5	80.5266	27 k carbon film 1/8W	C19	73.5114	1µF 35V tantal
			C20	73.5109	10µF 16V tantal
R6	80.5260	8,2k carbon film 1/8W	C21	73.5124	47µF 6,3V tantal
R7	80.5273	100k carbon film 1/8W	C22-C33	76.5111	0,1µF 1% polystyr. 20V (alternativt 76.5068)
R8	80.5267	33 k carbon film 1/8W	Q1	99.5121	BC107
R9-R10	80.5260	8,2k carbon film 1/8W	Q2	99.5144	BC 214L
			E1	99.5028	Diode 1N914
R11	80.52xx	Adjust	E2	99.5020	Diode 1N4004
R12-R30	80.5259	6,8k carbon film 1/8W	IC1	14.5032	SN7402N
			IC2	14.5043	SN7493N
R31	80.5256	3,9k carbon film 1/8W	IC3	14.5024	SN7400N
			IC4	14.5045	SN74122N
R32-R34	80.5259	6,8k carbon film 1/8W	IC5	000-0277-00	SN74150N
R35	80.5258	5,6k carbon film 1/8W	IC6-IC8	14.5019	MC3302P
R36-R47	80.5285	1 M carbon film 1/8W	IC9-IC11	14.5073	LM 324N
R48-R59	80.5259	6,8k carbon film 1/8W	L1	61.1260-00	Tone coil/spole
			L2	61.1261-00	Tone coil/spole
R60-R83	80.5274	120k carbon film 1/8W	L3	61.1262-00	Tone coil/spole
			L4	61.1263-00	Tone coil/spole
R84-R95	80.5262	12 k carbon film 1/8W	L5	61.1264-00	Tone coil/spole
			L6	61.1265-00	Tone coil/spole
R96-R97	80.5264	18 k carbon film 1/8W	L7	61.1266-00	Tone coil/spole
			L8	61.1267-00	Tone coil/spole
			L9	61.1268-00	Tone coil/spole
R98-R99	80.5252	1,8k carbon film 1/8W	L10	61.1269-00	Tone coil/spole
			L11	61.1270-00	Tone coil/spole
R100	80.5259	6,8k carbon film 1/8W	L12	61.1271-00	Tone coil/spole

REV.	DESING DRAWN	APPR.	Drwg.no.		DATE
	AT/HNi		D124562	Part list TR680-2005/10 Stykliste	25/2-74
	Storno RADIO COMMUNICATION SYSTEMS				A4 Comp.list X124457

Viewed from component side

Set fra komponentsiden



NOTE 1 : Connect 1 to 4 and 2 to 3 if tone 10 output equals 0-0-0-0; connect 1 to 2 and 3 to 4 if tone 10 output equals 0-1-0-1 (A B C D)

NOTE 2 : Terminal 3, 5, 6, 8, 9 are normaly conected to GND

NOTE 3 : TR 680-2005/11 (1060 Hz - 2800 Hz) connect P to 4; TR 680 - 2005/12 (1124 Hz - 2246 Hz) connect P to 5; TR 680 - 2005/13 (970 Hz - 2600 Hz) connect P to 3

NOTE 4 : Storno tones make R11: 3,9 k, CCIR tones make R11: 5,6 k

NOTE 5 : The slit in the coilformer is opposite to terminal 1.

RR / LMa

Storno

LAY-OUT
PLACERINGSTEGNING
TR 680 - 2005/10

DATE
14-2-74

A3 DRWG NO
I 124 411