Operating and service manual

TYPE TS - 1003 MK2

Mains and Batteryoperated 600MHz Frequency counter

TRITRON A/S
electronic measuring instruments.
P.O.Box 2114 - N-7001 Trondheim Norway - Tlf. (075) 20859.

Operating
and service manual

TYPE TS - 1003 MK2

Mains and Batteryoperated
600MHz
Frequency counter

TRITRON A/S
electronic measuring instruments.
P.O.Box 2114 - N-7001 Trondheim Norway - Tlf. (075) 20859.

TABLE OF CONTENTS

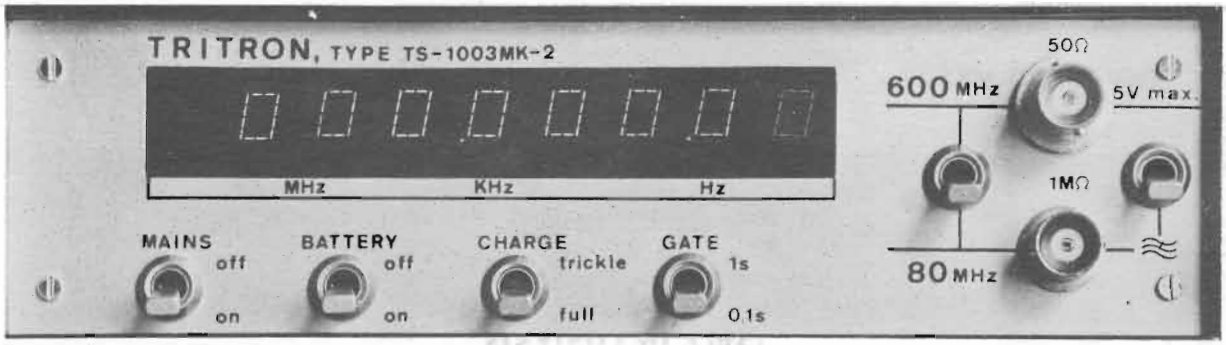


Figure 1–1, Type TS-1003MK-II

Table 1–1, Specifications

INPUT CHANNEL A:

Frequency range:	10Hz to 80MHz
Maximum sensitivity:	20mV to 100kHz 10mV to 40MHz 20mV to 80MHz
Low frequency counting:	The AF FILTER should always be used when counting signals below 150kHz.
Maximum input for safe counting:	3V rms.
Maximum input without damage:	250VAC to 100Hz (with filter) 25V rms to 80MHz (with filter)
AF filter/ attenuator:	When using the AF FILTER as an ATTENUATOR the specified MAXIMUM FOR SAFE COUNTING may be exceeded over the full specified range.
Resolution:	1Hz and 10Hz
Gate times:	1s and 0,1s
Decimal points:	Automatic positioned indicating MHz, kHz, Hz and parts of an Hz when a 10s optional gate-time is installed.
Impedance:	1M Ω parallelled with approximately 20pf.
Read out:	8 digits in-line LED indikators with build-in TTL-logic.

ACCURACY:

Internal time-base	± 1 count.
Time-base:	1MHz temp. compensated crystal oscillator, three parts 10^{-7}.
Aging:	1 part 10^{-7}pr. month.
External:	A 1MHz external time-base may be applied via a rear panel mounted BNC

INPUT CHANNEL B:

Frequency range:	20MHz to 600MHz
Sensitivity:	10mV to 400MHz 15mV to 500MHz 40mV to 600MHz
Resolution:	10Hz
Gate times:	1s and 0,1s
Attenuator:	Automatic
Impedance:	50 Ω nominal, SWR 1:1,8
Read out:	8 digits in-line LED indicators reads in MHz, KHz and Hz.

OPERATION:

Mains:	230VAC, 50Hz nominal
Battery:	5V (nominal) Nickel Cadimum rechargeable batteries of 4Ah. The batteries are recharged, in situ, through a build-in charging circuit. Recharging from a fully discharged condition takes 12–14 hours.
Physical:	H: 50mm, W: 180MM, d: 270mm. Weight: Approximately 2,8kg with the battery installed.

SECTION ONE
INTRODUCTION

1–1. DESCRIPTION

1–2. The TRITRON Type TS-1003 is a versatile, fully portable, mains and battery-operated frequency-counter. It is capable of measuring frequencies of very low signal levels from 10Hz to 600MHz. The TS-1003 has two input terminals of which one is covering the frequency range from 10Hz to 80Hz with a 1 Meg.ohm input impedance and the other have a 50 ohm (nominal) input impedance covering the frequency range from 20MHz to 600MHz.

The TS-1003 may be powered either by a 230 volt AC line, or by a internal 5V (nominal) Cadimum-Nickel, rechargable battery. The charger is also build-in.

1–3. The TS-1003 provides a wide coverage from 10Hz to 600MHz to include mobile radio services, VHF/UHF TV, Telemetry and FM transmitters as well as low frequency, general laboratory and industrial applications.

1–4. The readout is displayed in MHz, KHz and Hz on eight decades of in-line LED digital display indicators with automatically positioned decimal points. Stored display is featured with updating automatically at the end of each measurement. A battery-level indicator is also incorporated.

1–5. The throughout use of Schottky TTL, ECL and the highly integrated LED displays gives TS-1003 both ruggedness and reliability. Battery operation makes the instrument ideal for field use or isolation from line noise.

1–6. Figure 1–1 shows the TS-1003, and Table 1–1 contains a list of the TS-1003 specifications.

1–7. CaNi BATTERY

The battery used in the TS-1003 consist of four 1,2V CdNi cells of the SAFT Type 4Ah. This battery gives two hours of continously operation from a fully charged condition. Recharging from a completely dischared condition is done overnight-or in approximately 14 hours when using the FULL position of the front panel switch marked CHARGE.

1–8. OPTIONS

1–9. The following options are available:

Option 1003-1001, Leather Carrying Case.
Option 1003-1003, 1MHz time base oscillator with an ageing rate of 1 part 10-9/day.

OPTION 1003-1003

The option 1003-1003 exclude the use of internal batteries since the physical dimensions of this high stability, oven controlled oscillator does not permit battery operation.

SECTION TWO
INSTALLATION

2– 1. INITIAL CONTROL

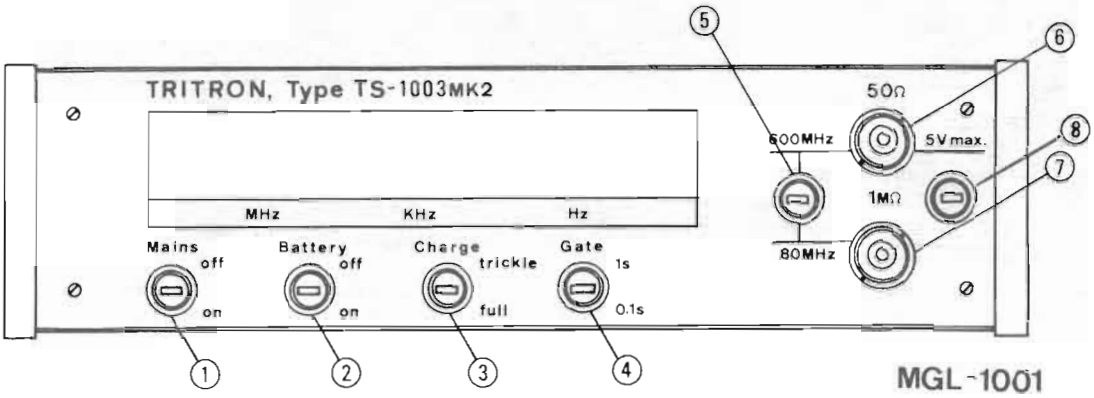
Type TS-1003 was carefully inspected both electronically and mechanically before shipment. It should, therefor, meet all specifications given. To confirm this, the instrument should be tested according to the procedure given under SECTION FIVE.

2– 2. GROUNDING

In order to protect operating personnel, the NEMKO (the Norwegian Electrical Material Control Organisation) recomends that the instrument should be grounded. The TS-1003 is equipped with the so called "EURO" mains plug with a three-conductor power cable. Therefore, when plugged into the appropriate wall outlet, the instrument is grounded.

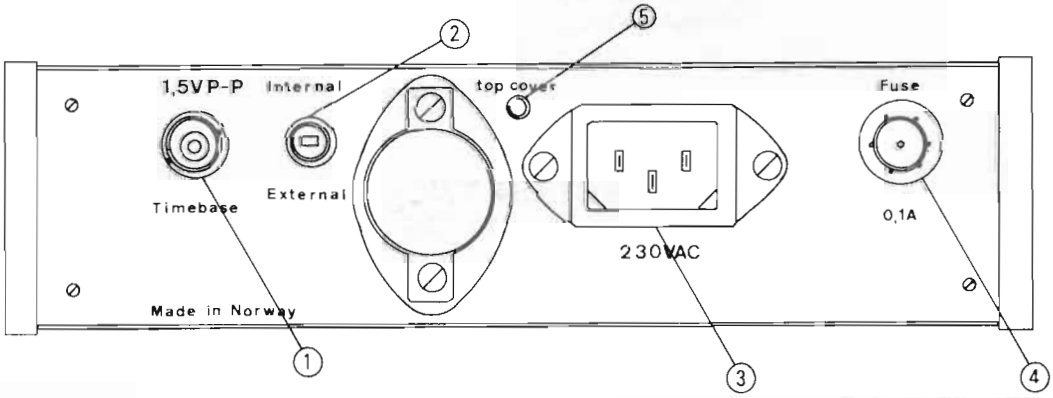
2– 3. POWER REQUIREMENTS

The TS-1003 is operated from any source giving 230VAC, 50Hz (nominal) ∓ 10%. With the instrument disconnected from the 230VAC source, switch panel control marked "Battery" to ON in order to operate from the internal, rechargable batteries.



Type TS-1003MK-II front panel.

1. MAINS Switch, for line operation.
2. BATTRY Switch, for operation from internal CaNi-battery.
3. CHARGE Switch, selects the appropriate charging current according to the use of the battery.
4. GATE Switch, selects the appropriate resolution. 1s gate-time is giving maximum resolution.
5. RANGE Switch, selects either the range from 20MHz to 600MHz (upper position) - or from 10Hz to 80MHz (the lower position).
6. 50 Ω input BNC connector for 20MHz to 600MHz operation.
7. 1M Ω input BNC connector for 10Hz to 80MHz operation.
8. AF-filter/attenuator.



TYPE TS-1003-MKII rear panel

1. TIMEBASE, for input of external timebase signal.
2. INTERNAL/EXTERNAL Switch, selects appropriate timebase signal.
3. 230VAC input socket for mains receptacle
4. FUSE, 0,5A fast blow.
5. TOP COVER, screw to remove Top Cover.

Figure 3-1. Front and Rear Panel Controls.

2– 4. The internal CdNi-battery is being either trickle-charged or full-charged, manually controlled from the front panel switch marked "CHARGE". The battery consist of four serial-coupled 1,2V CdNi cells of the SAFT type 4Ah.

2– 5. **BENCH MOUNTING**

Type TS-1003 is fitted with strong metal feet and the pair in the front may be tilted in order to give an satisfactorly viewing angle.

2– 6. **REPACKING**

If the instrument is to be returned for service or repair, please, indentify the owners name and address, and also the service or repair to be accomplished.

2– 7. It is preferable that the original packaging container is being used. If the original container is not to be used, wrap the TS-1003 in strong paper, or other chock absorbing material. Use a suitable carton and seal the carton properly. Mark the carton clearly with "FRAGILE","GLAS", etc....

SECTION THREE
OPERATION

3– 1. The TS-1003 may be operated from 230VAC (nominal), or from its internal, rechargable CdNi-battery, selectable by means of two switches located on the front panel.

3– 2. **FRONT AND REAR PANEL CONTROLS**

3– 3. Figure 3–1 shows the location of all the TS-1003 controls and explains the function of each.

3– 4. **OPERATING INSTRUCTIONS**

CAUTION

DO NOT APPLY MORE THAN 5V RMS TO THE 50 OHM INPUT

3– 5. Before turning-on the instrument make sure that the "internal/external"-switch, located at the rear panel, is in the "internal" position.

3– 6. **TURN-ON PROCEDURE**

3– 7. Switch the MAINS switch to ON and allow some seconds to pass until the display shows 00.000.000 ∓1 1sd. The RANGE switch in the 80MHz position.

NOTE

Due to the high sensitivity pick-up may occur in the two-three last significant digits. This does not influence your measurement.

3– 8. **THE 80MHz INPUT**

Switch the RANGE Switch to the 80MHz position and the GATE Switch to 1s. The BATTERY Switch should be in the OFF position and the CHARGE Switch in the TRICKLE or FULL position.

3– 9. Apply a signal with a frequency between 10Hz and 80MHz to the input BNC terminal. (See table 1–1 for the signal level needed to obtain a stable counting.)

NOTE

When using a coaxial cable be aware of the capacitive loading which can influate the input impedance of the 80MHz amplifier.

Always use a coaxial cable of high quality, i.e. type RG58/U or a similar low-loss type.

3–10. The eight in-line LED indicators should now indicate the signal applied to the input BNC. The indicators not in use should indicate. "0" i.e. 00.100.000. (∓1 1sd) if a 100KHz signal was applied.

3–11. Maximum resolution of 1Hz is obtained when using the GATE Switch in the 1s position.

3–12. When tuning in i.e. a generator the 0,1s gate-time is to be prefered since the conversion time in this position is being multiplied by ten making it more convenient to adjust for a wanted frequency.

NOTE

When making measurements with low frequencies ensure to have as short connections as possible from the coaxial cable in order to avoid unwanted RF pick-up.

3–13. **EXTERNAL TIME BASE**

If a higher accuracy than the internal time-base oscillator gives an external 1MHz signal may be applied to the rear panel mounted BNC. The INTERNAL/EXTERNAL switch should then be left in the EXTERNAL position. The external signal applied to the time-base circuitry must be of not less than 1V RMS.

3–14. **THE 600MHz INPUT**

3–15. The 20MHz to 600MHz input is selected by the RANGE Switch and have a 50 ohm (nominal) input impedance.

3–16. The initial procedure is similar to the procedure given under paragraph 3–5 and 3–8 except that the RANGE Switch should be in the 600MHz position - the upper position.

3–17. Apply the signal to the 50 ohm input terminal. (See Table 1–1 for the signal level needed to obtain a stable counting.)

CAUTION

Damage to the TS-1003 Input Circuit may result if more than 5V RMS is applied to the 50 ohm input terminal.

3–18. The 50 ohm input is prescaled by 10 and as thus giving a maximum resolution of 10Hz when using the 1s gate-time.

3–19. When tuning i.e. a signal generator the 0,1s gate-time is to be preferred since the conversion time in this position is being multiplied by ten, making it more convenient to adjust for a wanted frequency.

3–20. **BATTERY OPERATION**

The TS-1003 is equipped with internally mounted, rechargable Cadmium Nickel battery of 4ah. The Charging Circuit is build-in.

3–21. The operation procedure given in paragraph 3–5 to paragraph 3–18 should be followed except for paragraph 3–7.

3–22. **TURN-ON PROCEDURE FOR BATTERY OPERATION**

Remove the mains cable from the instrument and turn the BATTERY Switch to ON. The display will then show 00.000.000 1 1sd, and the LED indicator will be brightly illuminated. If the LED indicator is not being illuminated, see paragraph 3–23 to 3–24 for the recharging procedure.

NOTE

When the instrument is turned-on with a fully charged battery random counting may occur when in the 600MHz RANGE. This is normal, due to too high voltage (approx. 5, 2V from the battery) the first minute after turn-on, and will not influate the measurement.

3–23. **RECHARGING OF THE BATTERY**

The internal charger is giving either trickle charging or full charging (400mA) to the battery. This functions are controlled by means of the front panel mounted switch marked CHARGE.

3–24. When the TS-1003 is regularly being operated from the battery the CHARGE Switch could be left in the FULL position when the instruments is operated from the mains. Recharging from a fully discharged condition is performed overnight - or in approximately 14 hours. The CHARGE Switch should then be in the FULL position.

3–25. In order to maintain maximum capasity on a charged battery the CHARGE Switch should be left in the TRICKLE position when operating the instrument from the mains.

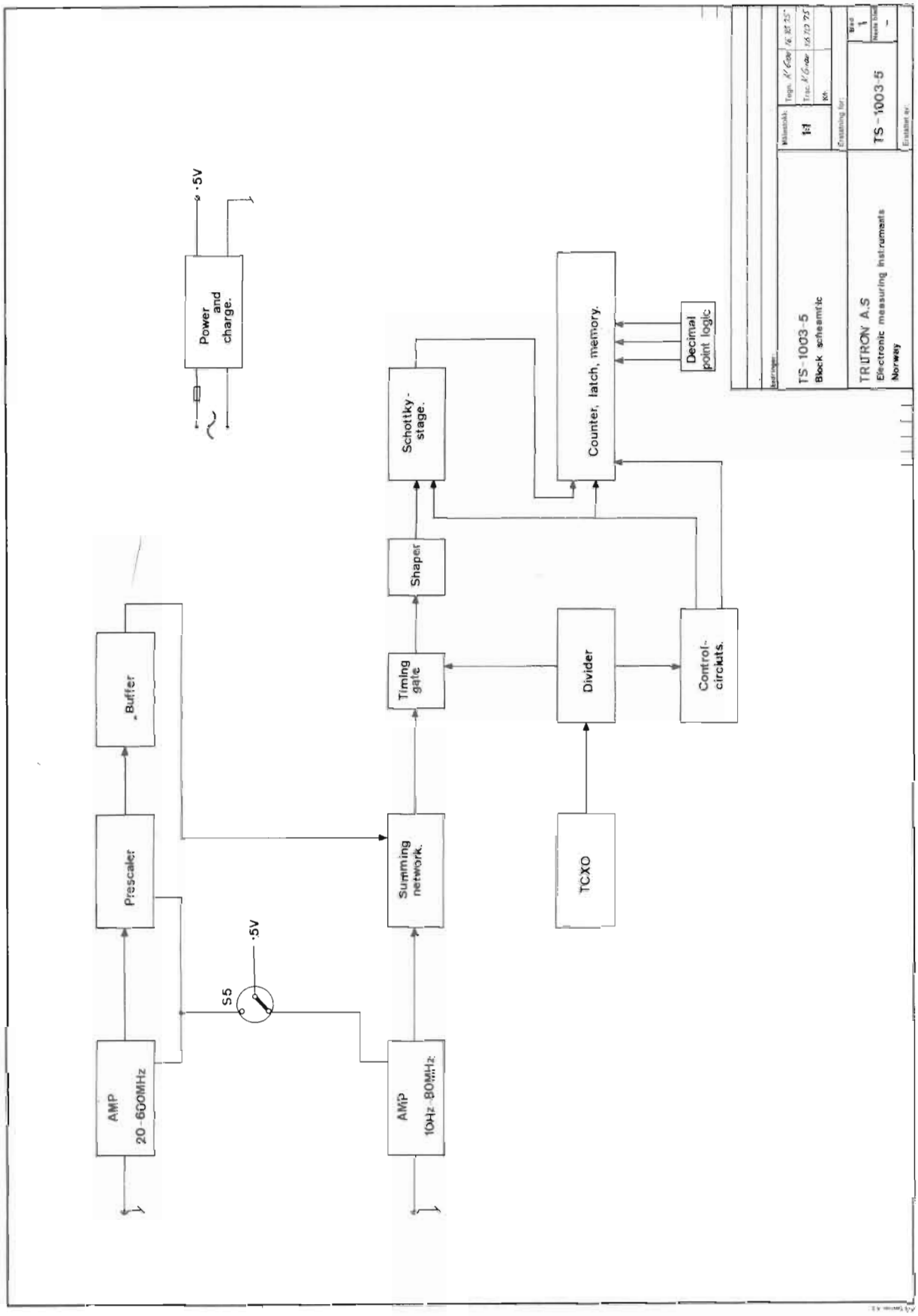


Figure 4-1. Simplified Block Schematic.

SECTION FOUR
THEORY OF OPERATION

4– 1. GENERAL

Figure 4–1 shows a simplified block diagram of the TS-1003.

4– 2. The TS-1003 measures frequencies from 10Hz to 600MHz. It is both mains and battery-operated. Battery-operation is from its own internal, rechargable Cadimum-Nickel battery. The charger is build-in as a part of the 230VAC power supply giving approximately 80mA for trickle-charging and approximately 400mA for full charging of the battery. The 230VAC is transformed and regulated to approximately 4,8 VDC in order to optimize the reliability.

The TS-1003 uses two preamplifiers, the high impedance amplifier and the 50 ohm (nominal) amplifier.

The throughout use of Schottky TTL, ECL and the highly integrated LED numerical indicators are giving a highly reliable, compact and rugged instrument, aspecially suitable for field use.

4– 3. THEORY

4– 4. The high impedance input from 10Hz to 80MHz can be switched on and off by a switch, SI, on the front panel. From the high impedance input the signal is fed into a broadband amplifier, then into a summing network and into the timing gate. There is no Smith-trigger in the circuit. The amplifiers behave very much like a zero-crossing detector. In order to avoid saturation Schottky Diode technique is used. After the gate, and before the first Schottky counter-stage, it is inserted a shaper-circuit in order to remove "grass" from the signal and to use only the steepest and cleanest part of the signal.

4– 5. After passing the shaper-circuit the signal is fed into the first Schottky counter stage consisting of two dual Schottky Divide-By-Two counters. The circuit is in fact of the same type as a SN7490 Divide-By-Ten stage. The transistor T8 is the reset gate. After being divided by ten in the Schottky-counter the signal is fed into a monostable trigger, (IC14), through the derivating network C18 and R31.

4– 6. The number of counts in the Schottky counting stage is fed into the TIL308 display by the BCD coded signals A, B, C and D. The pulses from the monostable multivibrator is now fed into ordinary counting stages consisting of the highly integrated LED displays containing both counting, decoding, memory and latch - the TIL306. In this counter-chain the gated time input is counted in succesive "Count-To-Ten" circuits.

4– 7. The clock generator consists of a TCXO - 1MHz precision-oscillator. The oscillator is actually running at 3MHz, but one Divided-By-Three stage is incorporated in the oscillator itself. The 1MHz signal is divided in a chain of 7490-counters, IC1-IC7, down to 0,1s or 1s signals switch-selectable with S4. The 1s-0,1s output of the dividing chain is then fed into IC8.

4– 8. IC11 and IC12 are belonging to the control circuit together with the transistors T5 and T6 and the chaping gate of IC8.

4– 9. The monostable multivibrators IC11 - 12 are delaying the signals of the clock so that the clear and latch pulses comes into the counter-display at the correct intervals.

4–10. The 50 ohm high frequency input is used to measure frequencies from 20MHz up to 600MHz. The prescaler has a four stage preamplifier and a Divide-By-Ten ECL circuit. After the signal is fed into the summing network, normal counting takes place.

4–11. DESCRIPTION OF THE AMPLIFIERS.

4–12. The high impedance amplifier is a three stage amplifier using a MOST input stage and two transistor stages. The amplification is set by the potentiometer P1. As previously mentioned, Schottky-techniques are being used in order to avoid saturation. The bandwith of the amplifier is well over 120MHz, but the counting is limited by the Schottky counting stage to approx. 80 MHz.

4–13. The low impedance amplifier consists of four stages. The input impedance of transitor amplifiers over the range from 20MHz up to 600MHz varies. In order to ensure a 50Ω input with a standing wave ratio (SWR) of 1:1,8 a L-pad is being used. The L-pad attenuates the signal about 10dB. Two stages of emitter-peaked transistors mainly determines the high frequency response. The amplification of the stages is set limited by two potentiometers. The bandwidth is limited by the ECL circuit to approx. 600MHz. Scottky-technique hav been used to avoid saturation.

SECTION FIVE
MAINTAINANCE AND CALIBRATION

1 INTRODUCTION

This section contains the information necessary to maintain and calibrate the TS-1003.

2. PERFORMANCE CHECK

The Performance checks are "in cabinet" tests that compare the TS-1003 with its specifications. These checks can be performed both for incoming inspection and periodic inspection.

3. SENSITIVITY CHECK

The sensitivity checks require a testgenerator with a variable attenuator giving an output down to 10mV.

a) Apply a 10Hz signal into the 80MHz input terminal and attenuate the signal to 20mV. The display should indicate 00.000.010. (∓1 1sd).

b) Apply a 100KHz signal into the 80MHz input terminal and attenuate the signal to 10mV. The display should indicate 00.100.00 (±1 1sd).

c) Apply a 40MHz signal into the 80MHz input terminal and attenuate the signal to 10mV. The instrument should now indicate 40.000.000, (± time-base accuarcy ±1 1sd).

d) Apply a 80MHz signal into the 80MHz input terminal and attenuate the signal to 20mV. The display should indicate 80.000.000, (± time-base accuarcy ±1 1sd.)

4. Switch the RANGE Switch to the 600MHz position and perform the checks as follows:

a) Apply a 20MHz signal into the 600MHz input terminal and attenuate the signal to 10mV. The display should indicate 020.000.00. (± time-base accuarcy ±1 1sd.)

b) Apply a 500MHz signal into the 600MHz input terminal and attenuate the signal to 10mV. The display should read: 500.000.00 (± time-base accuarcy ±1 1sd.)

c) Apply a 600MHz signal into the 600MHz input terminal and attenuate the signal to 40mV. The display should read: 600.000.00 (± time-base accuarcy ±1 1sd.)

5. ACCURACY CHECK

To perform this test a 10MHz frequency standard of an accuarcy of better than 1 part 10^{8} is neccesary. The output must be 10mV – or more.

a) Set the RANGE Switch to 80MHz and the GATE Switch to 1s. Switch the MAINS Switch to ON and allow a warm-up period of not less than 15 minutes.

b) Apply the 10MHz test-signal into the 80MHz input terminal. The display should read: 010.000.000 ± 2 digits (±1 1sd).

NOTE

If the TS-1003 is equipped with option 1003-1003 a test signal of one decade better accuracy than the option should be used to perform the check under paragraph 5–5.

5– 6. MAXIMUM INPUT CHECK

To perform the maximum input check apply a 5V signal into the 80MHz input terminal as indicated under paragraph 5–3 section a), b), c), d).

5– 7. AC MAINS OPERATION CHECK

To perform this check a 200–250V, 0,5A variable line transformer is necessary.

a) Apply 207VAC to the instrument and perform all checks mentioned under paragrph 5–3, a), b), c) and d), paragraph 5–4, section a), b) and c), paragraph 5–5, section a) and b), and paragraph 5–6.

b) Apply 253VAC to the instrument and repeat the checks under section a) in this paragraph.

5– 8. BATTERY OPERATION CHECK

To perform this check the battery should be fully charged.

a) Turn on the BATTERY Switch and leave the instrument on for approx. One half hour.

b) Perform the checks mentioned under paragraph 5–3, section a), b), c) and d), paragraph 5–4, section a), b) and c), paragraph 5–5, section a) and b), and paragraph 5–6.

NOTE

Instruments delivered to territories with i.e. 220VAC mains (nominal) will be equipped with a mainstransformer accordingly. The specification with regard to ± 10% mains, variation will therefore be met and the check should be performed accordingly.

5– 9. ADJUSTMENT AND CALIBRATION PROCEDURES

The following adjustment and calibration procedures should be used only if it has been determined through the performance checks in paragraphs 5–3 through 5–8 that the TS-1003 is not performing within its specifications. Location of the internal adjustments are shown in Figure 5–1.

5–10. COVER REMOVAL

a) To remove the top cover, remove the one Phillips screw at the rear panel, marked "Top Cover", lift the cover upwards 15 mm in the back and slide it off backwards by pressing the thumbs at the front of the cover.

b) To remove the bottom cover, remove the four Phillips screw and pull off the cover.

5–11. In order to make calibration and adjustment as simple as absolutely possible, adjustment and calibration points have been kept to a minimum, namely five.

5–12. CALIBRATION

To calibrate the accuarcy of the TS-1003 only one adjustment have to be performed. Proceed as follows.

a) Unscrew the cover-nut over Cl-1 located at the oscillator C0-251-2119.

b) Turn-on the instrument and allow a minimum warm-up period of fifteen minutes.

c) Apply a 10MHz calibration signal with an accuracy of 1 part 10-8 into the 80MHz input terminal.

d) Adjust CL-1 until a reading of 010.000.000, ±2Hz, ±1 1sd, is obtained.

e) Replace the top – and bottom cover and check for a stable reading.

5–13. ADJUSTMENT

The only adjustments possible to perform are to peak the amplification of the two amplifiers and to adjust the cutoff off voltage of the battery LED indicator.

5–14. ADJUSTMENT OF THE 50 OHM AMPLIFIER

The amplification of the 50 ohm amplifier may be adjusted by means of P-101 and P-102. If the sensitivity have decreased apply a 600MHz signal with a output of not less than 100mV to the 600MHz input terminal, use 0,1s gate-time, and proceed as follows:

a) Adjust P-101 to minimum counter-clockwise position and P-102 clockwise to approximately 75% of f.s.

b) Then slowly adjust P-101 clockwise until a counting with the highest possible figures is obtained.

c) Slowly adjust P-102 until the correct value is obtained and so that the reading is stable.

d) Attenuate the test signal to 40mV and carefully readjust until the stable reading is obtained again.

e) If it is impossible to obtain the specification given, ordinary service must be performed.

5–15. ADJUSTMENT OF THE HIGH IMPEDANCE AMPLIFIER

The amplification of the high impedance amplifier may be adjusted by means of P-1. If the sensitivity have decreased apply a 80MHz signal with an output of approximately 100mV, into the 80MHz input terminal, use 0,1s gate-time and proseed as follows:

a) Slowly adjust P-1 from its counter-clockwise position, until a stable reading is obtained. figures are obtain.

b) Then attenuate the input signal to 20mV and carefully readjust until the highest possible figures are obtain and peak the frequency response by means of C-6 until the correct and stable reading is obtained again.

c) Change the input signal frequency to 10Hz and check that the specification is met. If not, carefully adjust P-1 and again recheck at 80MHz.

5–16. ADJUSTMENT OF THE LED BATTERY INDICATOR

The battery LED indicator should be adjusted to cut-off when the battery-voltage has dropped to 4,3V.

a) Turn-on the TS-1003 on battery and continously monitor to the DC voltage have reached 4,5V and adjust the LED indicator to cut-off by means of P-01 located at the display-board.

5–17. BATTERY REPLACEMENT

Since the use of rechargeable, high quality CaNi-battery has been choosen, the need for replacement of the battery is very limited. However, to replace the battery, unsolder the positive and negative supply-lead, unscrew the two screws located on the top of the battery compartment and lift the whole compartment carefully out of the cabinet.

CAUTION

Serious damage to the circuit will result if wrong polarity is connected when replacing the battery.

5–18. When inserting new CdNi-cells into the battery compartment it is prefered that the cells are being soldered together. When the compartment has been replaced, tighten the screws carefully and switch the CHARGE Switch to FULL and fully charge the new battery. Then discharge the battery again and perform the adjustment mentioned under paragraph 5–16.

CAUTION

NEVER shortcircuits the batteries.

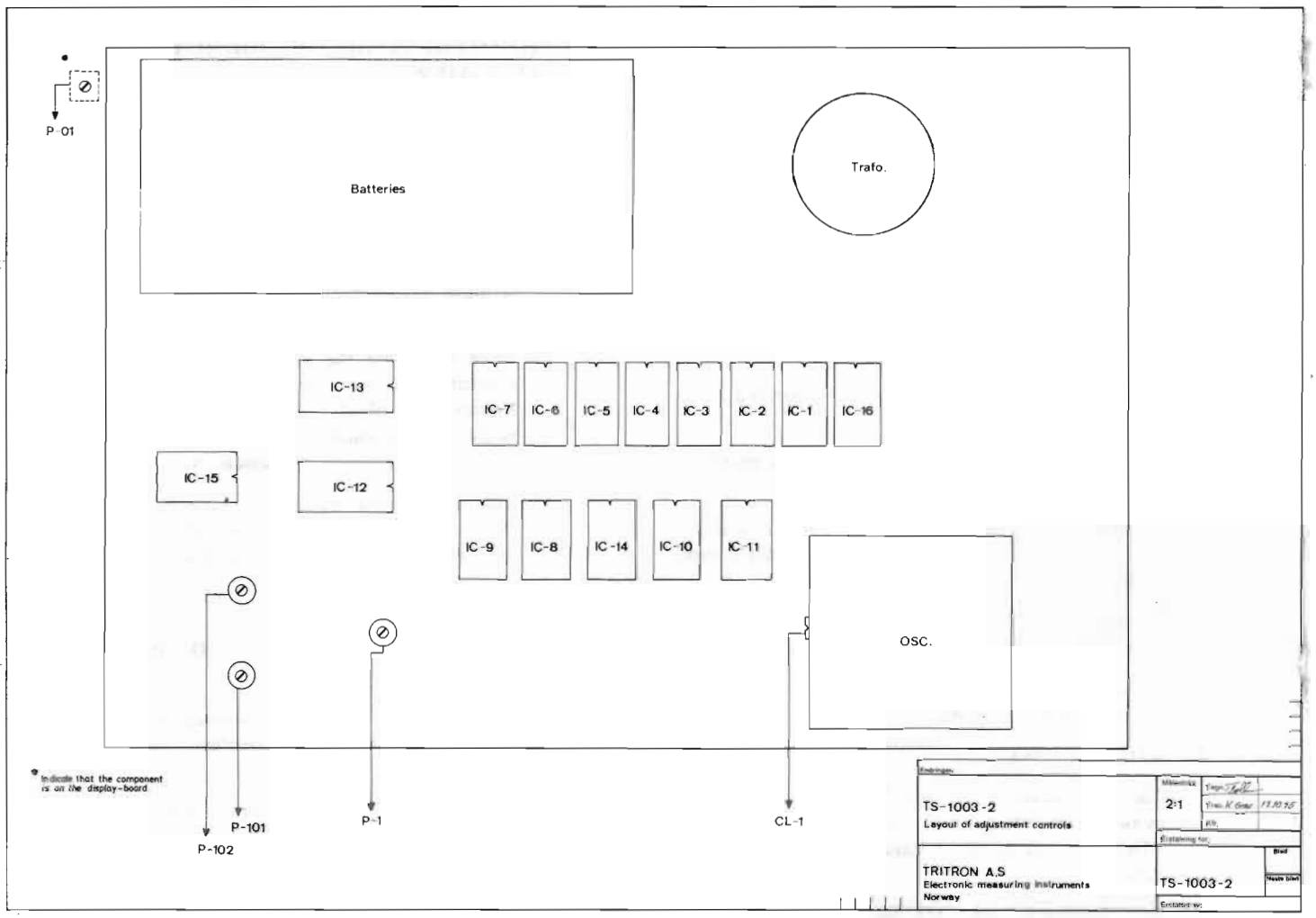


Figure 5-1. **Layout of A**justment Controls.

SECTION SIX
CIRCUIT DIAGRAMS

6– 1. INTRODUCTION

This section contains the component lay-out diagram and the circuit diagrams of the TS-1003. The switches are viewed from the bottom.

6– 2. Components placed on the leadside of the printed circuit boards are denoted by an asterisk (*) on the component lay-out diagram.

RECTIFIER ON SIDEFLANGE

+ ÷

Batteries.

To display & controls

Trafo.

ON FRONT PC

R207
R208
P101

D2D3

IC101-108 (LED)

IC 13 IC 15 IC 12 IC 9 IC 8 IC14 IC 10 IC 11 IC7 IC 6 IC 5 IC4 IC 3 IC 2 IC1 16

c201 c202

OSC.

A

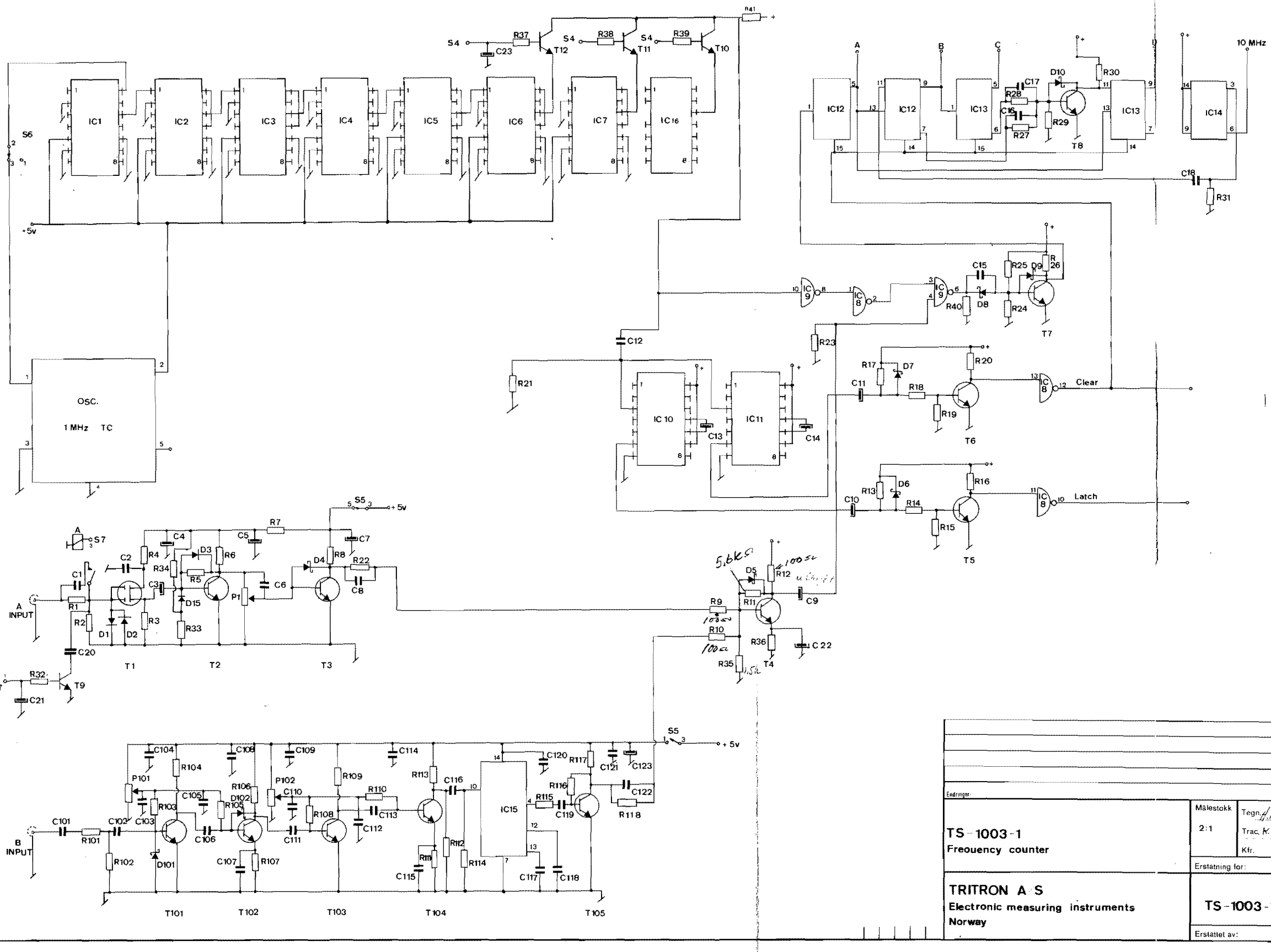
PLUG

T202 (REAR PANEL)

·) indicate that the component is on the leadside of the PC-board.

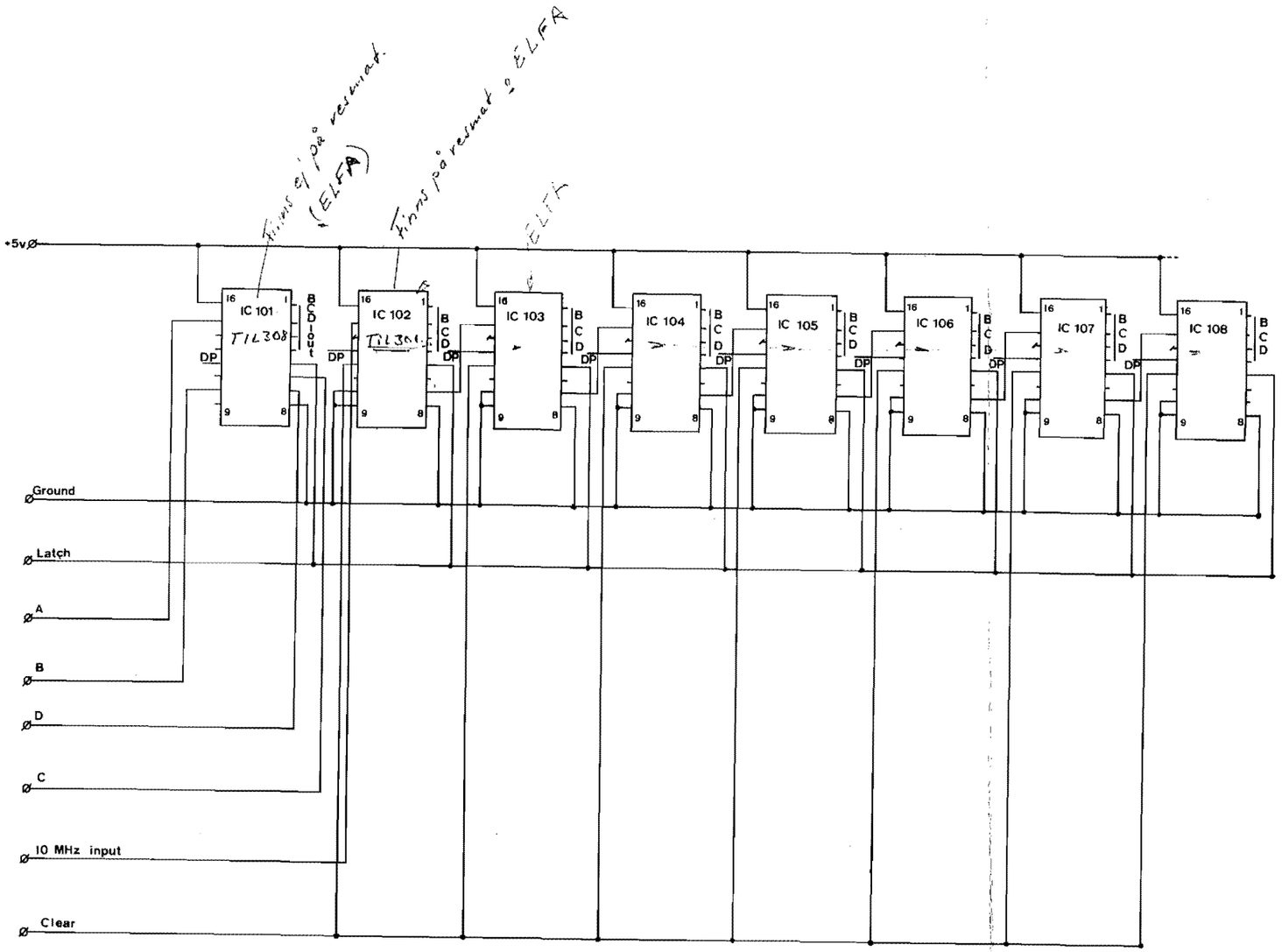
A/S Tertnæs A 2

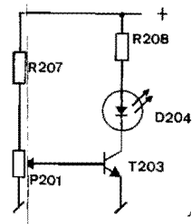
Endringer:		Målestokk 2:1	Tegn. Bulle
TS-1003-2 Component layout			Trac. K. Graue 9.10.75
			Kfr.
		Erstatning for:	
TRITRON A/S Electronic measuring instruments Norway	EML-100-2	Blad 5	Neste blad 6
		Erstattet av:	



Endringer:

TS-1003-1 Freouency counter	Målestokk 2:1	Tegn. H. Brun Trac. K. Grøv 4.10.85 Kfr.
	Erstatning for:	
TRITRON A/S Electronic measuring instruments Norway	TS-1003-1	Blad 6 Neste blad 7
	Erstattet av:	





Lampe indicator on the counter and display board.

Endringer:

TS-1003-1 Circuit diagram of counter and display	Målestokk 2:1	Tegn.	
		Trac. K Grav	4.10.75
		Kfr.	
	Erstatning for:		
TRITRON A.S Electronic measuring instruments Norway	TS-1003-1	Blad 8	
		Neste blad 9	
	Erstattet av:		

SECTION SEVEN
REPLACEMENT PARTS

7– 1. INTRODUCTION

This section contains information for ordering replacement parts. Table 7–1 lists parts in alpha-numeric order, TRITRON part number, description of the component, and manufacturer of the component.

7– 2. ORDERING INFORMATION

To obtain replacement parts, address order or inquiery to the nearest TRITRON A/S representative, or direct to:

TRITRON A/S,
Service Department,
P.O.Box 2114,
N-7001 Trondheim
Norway.

7– 3. To obtain parts that is not listed, the following information are necessary.

a) Instrument type number.

b) Instrument serial number.

c) Function and location of the part.

d) Description of the part.

Reference	TRITRON part no:	Description	VALUE type	MANUF.:
B1	EGA-1001	Rectifing bridge, 2,5A	6PP40	Signetics
C-1	ECF-3007	capasitor, ceramic 10%	1nF	Philips
C-2	ECF-3001	capasitor, ceramic 10%	10pF	Philips
C-3	ECT-3111	capasitor, tantal, 6,3V	47uF	Bosch
C-4	ECT-3111	capasitor, tantal, 6,3V	47uF	Bosch
C-5	ECT-3111	capasitor, tantal, 6,3V	47uF	Bosch
C-6	ECM-3001	C.variable, ceramic	6-30pF	Stettner
C-7	ECT-3111	capasitor, tantal, 6,3V	47uF	Bosch
C-8	ECF-3001	capasitor, ceramic 10%	10pF	Philips
C-9	ECT-3111	capasitor, tantal, 6,3V	47uF	Bosch
C-10	ECT-3100	capasitor, tantal 6,3V	1uF	Bosch
C-11	ECT-3100	capasitor, tantal 6,3V	1uF	Bosch
C-12	ECF-3010	capasitor, ceramic 10%	100nF	Philips
C-13	ECT-3112	capasitor, tantal, 6,3V	10uF	Bosch
C-14	ECT-3112	capasitor, tantal, 6,3V	47uF	Bosch
C-15	ECF-3000	capasitor, ceramic, 10%	3,9pF	Philips
C-16	ECF-3001	capasitor, ceramic, 10%	10pF	Philips
C-17	ECF-3001	capasitor, ceramic, 10%	10pF	Philips
C-18	ECF-3002	capasitor, ceramic, 10%	22pF	Philips
C-19	ECT-3111	Capasitor, tantal 6,3V	47uF	Philips
C-20	ECT-3001	Capasitor, ceramic 10%	10pf	Philips
C-21	ECT-3111	Capasitor, tantal 6,3V	47uF	Philips
	ECT-3112	Capasitor, tantal 6,3V	10uF	Philips
C-101	ECF-3007	capasitor, ceramic, 10%	1nF	Philips
C-102	ECF-3007	capasitor, ceramic, 10%	1nF	Philips
C-103	ECF-3005	capasitor, ceramic, 10%	330pF	Philips
C-104	ECF-3009	capasitor, ceramic, 10%	EnF	Philips
C-105	ECF-3005	capasitor, ceramic, 10%	330pF	Philips
C-105	ECF-3005	capasitor, ceramic, 10%	330pF	Philips
C-106	ECF-3003	capasitor, ceramic, 10%	68pF	Philips
C-107	ECF-3002	capasitor, ceramic, 10%	22pF	Philips
C-108	ECF-3009	capasitor, ceramic, 10%	10nF	Philips
C-109	ECF-3009	capasitor, ceramic, 10%	10nF	Philips
C-110	ECF-3005	capasitor, ceramic, 10%	330pF	Philips
C-111	ECF-3004	capasitor, ceramic, 10%	82pF	Philips
C-112	ECF-3005	capasitor, ceramic, 10%	330F	Philips
C-113	ECF-3003	capasitor, ceramic, 10%	68pF	Philips
C-114	ECF-3009	capasitor, ceramic, 10%	10nF	Philips
C-115	ECF-3002	capasitor, ceramic, 10%	22pF	Philips
C-116	ECF-3004	capasitor, ceramic, 10%	82pF	Philips
C-117	ECF-3006	capasitor, ceramic, 10%	470pF	Philips
C-118	ECF-3006	capasitor, ceramic, 10%	470pF	Philips
C-119	ECF-3008	capasitor, ceramic, 10%	4,7nF	Philips
C-120	ECF-3009	capasitor, ceramic, 10%	10nF	Philips
C-121	ECF-3009	capasitor, ceramic, 10%	10nF	Philips
C-122	ECF-3008	capasitor, ceramic, 10%	4,7nF	Philips
C-123	ECT-3111	capasitor, ceramic, 6,3V	47uF	Bosch
C-201	ECN-3111	C.electrolytic, 16V	4700uF	FRAKO
C-202	ECN-3111	C.electrolytic, 16V	4700uF	FRAKO
C-203	ECN-3100	C.electrolytic, 16V	1000uF	FRAKO
C-204	ECT-3111	Capasitor, tantal/el,6,3V	47uF	Bosch/NEC
D-1	EGE-1001	Schottky diode	MBD-501	Motorola
D-2	EGE-1001	Schottky diode	MBD-501	Motorola
D-3	EGE-1001	Schottky diode	MBD-501	Motorola
D-4	EGE-1001	Schottky diode	MBD-501	Motorola
D-5	EGE-1001	Schottky diode	MBD-501	Motorola
D-6	EGE-1001	Schottky diode	MBD-501	Motorola
D-7	EGE-1001	Schottky diode	MBD-501	Motorola
D-8	EGE-1001	Schottky diode	MBD-501	Motorola
D-9	EGE-1001	Schottky diode	MBD-501	Motorola
D-9	EGE-1001	Schottky diode	MBD-501	Motorola
D-10	EGE-1001	Schottky diode	MBD-501	Motorola
D-15	EGC-1003	diode	1N4148	Texas Instr.
D-61 to D-70	EGC-1003	diode	1N4148	Texas Instr.
D-77 to D-80	EGC-1003	diode	1N4148	Texas Instr.
D-101	EGE-1001	Schottky diode	MBD-501	Motorola
D-102	EGE-1001	Schottky diode	MBD-501	Motorola
D-201	EGC-1001	diode		Siemens
D-202	EGC-1001	diode		Siemens

Reference	TRITRON part no:	Description	VALUE type	MANUF.:
D-203	EGC-1002	diode	AA-113	Sescosem
D-204	EGG-1001	diode (LED)	TIL209	Texas Instr.
D-301	EGC-1003	diode	1N4148	Texas Instr.
D-302	EGC-1003	diode	1N4148	Texas Instr.
D-303	EGC-1003	diode	1N4148	Texas Instr.
D-304	EGC-1003	diode	1N4148	Texas Instr.
F1	EFK-1001	Fuse	0,5A	Philips
IC-1-IC-7/16	EKG-1001	Integrated circuit	SN7490	Texas Instr.
IC-8	EKG-1002	Integrated circuit	SN7414	Texas Instr.
IC-9	EKG-1003	Integrated circuit	SN75S10	Texas Instr.
IC-10	EKG-1004	Integrated circuit	SN74121	Texas Instr.
IC-11	EKG-1004	Integrated circuit	SN74121	Texas Instr.
IC-12	EKG-1005	Integrated circuit	SN74S112	Texas Instr.
IC-13	EKG-1005	Integrated	SN74S112	Texas Instr.
IC-14	EKG-1004	Integrated circuit	SN74121	Texas Instr.
IC-15	EKE-1001	ECL 1:10 divider	SP8630	Plessey
IC-101	EGG-1002	LED display	TIL308	Texas Instr. Hmm ej Resmat.
IC-102 to IC-108	EGG-1003	LED display	TIL306	Texas Instr. MX726-500300
Osc:	EMB-1001	TCXO, 1MHz oscillator	251-2119	Vectron Lab. 2201- +89
R-1	EAD-1021	res.carb.flm. 1/4W 10%	150kohm	Philips
R-2	EAD-1020	res.carb.flm. 1/4W 10%	820kohm	Philips
R-3	EAD-1001	res.carb.flm. 1/4W 10%	100ohm	Philips
R-4	EAD-1011	res.carb.flm. 1/4W 10%	820ohm	Philips
R-5	EAD-1019	res.carb.flm. 1/4W 10%	18kohm	Philips
R-6	EAD-1009	res.carb.flm. 1/4W 10%	470ohm	Philips
R-7	EAD-1001	res.carb.flm. 1/4W 10%	100ohm	Philips
R-8	EAD-1009	res.carb.flm. 1/4W 10%	470ohm	Philips
R-9	EAD-1001	res.carb.flm. 1/4W 10%	100ohm	Philips
R-10	EAD-1001	res.carb.flm. 1/4W 10%	100ohm	Philips
R-11	EAD-1016	res.carb.flm. 1/4W 10%	5,6kohm	Philips
R-12	EAD-1001	res.carb.flm. 1/4W 10%	100Ωohm	Philips
R-13	EAD-1017	res.carb.flm. 1/4W 10%	8,2kohm	Philips
R-14	EAD-1018	res.carb.flm. 1/4W 10%	12kohm	Philips
R-15	EAD-1018	res.carb.flm. 1/4W 10%	12kohm	Philips
R-16	EAD-1011	res.carb.flm. 1/4W 10%	820ohm	Philips
R-17	EAD-1017	res.carb.flm. 1/4W 10%	8,2kohm	Philips
R-18	EAD-1018	res.carb.flm. 1/4W 10%	12kohm	Philips
R-19	EAD-1018	res.carb.flm. 1/4W 10%	12kohm	Philips
R-20	EAD-1011	res.carb.flm. 1/4W 10%	820ohm	Philips
R-21	EAD-1017	res.carb.flm. 1/4W 10%	8,2kohm	Philips
R-22	EAD-1010	res.carb.flm. 1/4W 10%	560ohm	Philips
R-23	EAD-1010	res.carb.flm. 1/4W 10%	560ohm	Philips
R-24	EAD-1012	res.carb.flm. 1/4W 10%	3,3kohm	Philips
R-25	EAD-1012	res.carb.flm. 1/4W 10%	3,3kohm	Philips
R-26	EAD-1007	res.carb.flm. 1/4W 10%	330ohm	Philips
R-27	EAD-1010	res.carb.flm. 1/4W 10%	560ohm	Philips
R-28	EAD-1010	res.carb.flm. 1/4W 10%	560ohm	Philips
R-29	EAD-1010	res.carb.flm. 1/4W 10%	560ohm	Philips
R-30	EAD-1004	res.carb.flm. 1/4W 10%	180ohm	Philips
R-31	EAD-1011	res.carb.flm. 1/4W 10%	820ohm	Philips
R-32	EAD-1016	res.carb.flm. 1/4W 10%	5,6kohm	Philips
R-33	EAD-1007	res.carb.flm. 1/4W 10%	330ohm	Philips
R-34	EAD-1001	res.carb.flm. 1/4W 10%	100ohm	Philips
R-35	EAD-1020	res.carb.flm. 1/4W 10%	1,5kohm	Philips
R-36	EAD-1021	res.carb.flm. 1/4W 10%	220ohm	Philips
R-37	EAD-1016	res.carb.flm. 1/4W 10%	5,6kohm	Philips
R-38	EAD-1016	res.carb.flm. 1/4W 10%	5,6kohm	Philips
R-39	EAD-1016	res.carb.flm. 1/4W 10%	5,6kohm	Philips
R-40	EAD-1009	res.carb.flm. 1/4W 10%	470ohm	Philips
R-41	EAD-1020	res.carb.flm. 1/4W 10%	1,5kohm	Philips
R-61	EAD-1016	res.carb.flm. 1/4W 10%	5,6kohm	Philips
R-62	EAD-1016	res.carb.flm. 1/4W 10%	5,6kohm	Philips
R-63	EAD81022	res.carb.flm. 1/4W 10%	220ohm	Philips
R-64	EAD-1022	res.carb.flm. 1/4W 10%	220ohm	Philips
R-65	EAD-1022	res.carb.flm. 1/4W 10%	220ohm	Philips
R-101	EAD-1002	res.carb.flm. 1/4W 10%	32ohm	Philips
R-102	EAD-1003	res.carb.flm. 1/4W 10%	27ohm	Philips
R-103	EAD-1018	res.carb.flm. 1/4W 10%	12kohm	Philips
R-104	EAD-1001	res.carb.flm. 1/4W 10%	100ohm	Philips

Reference	TRITRON part no:	Description	VALUE type	MANUF.:
R-105	EAD-1018	res.carb.flm. 1/4W 10%	12kohm	Philips
R-106	EAD-1005	res.carb.flm. 1/4W 10%	68ohm	Philips
R-107	EAD-1006	res.carb.flm. 1/4W 10%	68ohm	Philips
R-108	EAD-1018	res.carb.flm. 1/4W 10%	12kohm	Philips
R-109	EAD-1006	res.carb.flm. 1/4W 10%	68ohm	Philips
R-110	EAD-1018	res.carb.flm. 1/4W 10%	12kohm	Philips
R-111	EAD-1008	res.carb.flm. 1/4W 10%	22ohm	Philips
R-112	EAD-1004	res.carb.flm. 1/4W 10%	180ohm	Philips
R-113	EAD-1001	res.carb.flm. 1/4W 10%	100ohm	Philips
R-114	EAD-1019	res.carb.flm. 1/4W 10%	18kohm	Philips
R-115	EAD-1001	res.carb.flm. 1/4W 10%	100ohm	Philips
R-116	EAD-1019	res.carb.flm. 1/4W 10%	18kohm	Philips
R-117	EAD-1001	res.carb.flm. 1/4W 10%	100ohm	Philips
R-118	EAD-1020	res.carb.flm. 1/4W 10%	1,5kohm	Philips
R-201	EAD-1013	res.carb.flm. 1/2W 10%	32ohm	Philips
R-202	EAD-1014	res.carb.flm. 1/2W 10%	10ohm	Vectron
R-203	EAD-1015	res. 1W wire wound10%	0,32ohm	Philips
R-204	EAD-1009	res. 1/8W carb.flm10%	470ohm	Philips
R-205	EAD-1009	res. 1/8W carb.flm10%	470ohm	Philips
R-206	EAD-1011	res. 1/8W carb.flm10%	820ohm	Philips
R-207	EAD-1012	res. 1/8W carb.flm10%	3,3kohm	Philips
R-208	EAD-1007	res. 1/8W carb.flm10%	330ohm	Philips
R-209	EAA-100	res.2cm wire	0,1ohm	Philips
R-301	EAD-1019	res. 1/8W carb.flm10%	18kohm	Philips
R-302	EAD-1019	res. 1/8W carb.flm10%	820ohm	Philips
R-303	EAD-1019	res. 1/8W carb.flm10%	18kohm	Philips
P-1	EAM-2002	1/2W pot.1 turn 10%	1kohm	Helipot
P-101	EAM-2002	1/2W pot. 1 turn 10%	1kohm	Helipot
P-102	EAM-2002	1/2W pot. 1 turn 10%	1kohm	Helipot
P-201	EAM-2003	1/2W pot. 1 turn 10%	4,7kohm	Helipot
T-1	EEB-1001	FET trans.	40841	RCA
T-2	EEE-1001	UHF trans.	BFR90/91	RCA
T-3	EEE-1001	UHF trans.	BFR90/91	Philips
T-4	EEE-1001	UHF trans.	BFR90/91	Philips
T-5	EEC-1001	AF trans.	BC-107	Philips
T-6	EEC-1001	AF trans.	BC-107	SGS/Ates
T-7	EEE-1001	UHF trans.	2N2369	SGS/Ates
T-8	EEB-1002	Signal trans.	BFR90/91	Philips
T-9	EEC-1001	AF-trans.	BFY-90	Philips
T-10	EEC-1001	AF-trans.	BC-107	Philips
T-11	EEC-1001	AF-trans.	BC-107	Philips
T-12	EEC-1001	AF-trans.	BC-107	Philips
T-101	EEE-1001	UHF-trans.	BFR90/91	Philips
T-102	EEE-1001	UHF-trans.	BFR90/91	Philips
T-103	EEE-1001	UHF-trans.	BFR90/91	Philips
T-104	EEE-1001	UHF-trans.	BFR90/91	Philips
T-105	EEE-1001	UHF-trans.	BFR90/91	Philips
T-201	EEC-1001	AF trans.	BC-107	SGS/Ates
T-202	EEA-1001	reg.trans.	2N3055	Sescosem
T-203	EEC-1001	AF trans.	BC-107	SGS/Ates
T-301	EEC-1001	AF-trans.	BC-107	SGS/Ates
T-302	EEC-1001	AF-trans.	BC-107	SGS/Ates
T-1	EBA-1001	Toroid transformer	N3748B	Norsk Transduktor
VR-1	EVD-1000	Voltage reg.	CU-7805	Philips
A	ERD-1000	Reed relay	1FORMA	Astralux

Trykk: BJÆRUM, Tr.heim