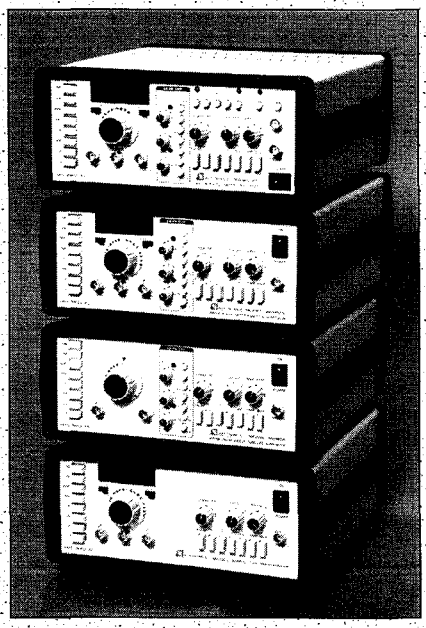
NOY-TRONICS **SERIES 300 FUNCTION GENERATORS**



7,13,20 MHz Generators

FUNCTION / PULSE / SWEEP / MODULATION

INSTRUCTION MANUAL

CONTENTS PAGE NO

JULY 1995

MODEL : 300MSTPC - 2011

SER.NO: 16210

JAN 2 0 1996

WARRANTY

All Newtronics Generators are warranteed against defects in material and workmanship for a one year period after date of manufacture. Newtronics will repair or replace any assembly or component found to be defective under normal use, during this period. Newtronics' obligation under this warranty is limited only to repairing any such instrument which in Newtronics opinion is found to be defective within the scope of the warranty when returned to the factory or to a Newtronics authorized service center. Transportation to the factory or service center will be paid by purchaser. Shipment will not be made without prior authorization by Newtronics.

This warranty will not apply to any instruments repaired or modified by persons not authorized by Newtronics, or not in accordance with instructions furnished by Newtronics. If the instrument is found defective as a result of improper repair, abnormal operating conditions, or misuse, repairs will be billed at cost.

Newtronics assumes no responsibility for its instruments being used in a hazardous or dangerous manner either alone or in conjunction with other equipment. High voltage used in some instruments may be dangerous if misused. Special disclaimers apply to these instruments. Newtronics assumes no liability for secondary charges or consequential damages and, in any event, Newtronics liability for breach of warranty under any contract or otherwise, shall not exceed the purchase price of the specific instrument shipped and against which a claim is made.

Any recommendations made by Newtronics for use of its products are based upon tests believed to be reliable, but Newtronics does not warranty the results to be obtained. This warranty is in lieu of all other warranties, expressed or implied, and no representative or person is authorized to represent or assume for Newtronics any liability in connection with the sale of our products other than set forth herein.

SAFETY

This instrument is wired for earth grounding via the facility power wiring. Do not bypass earth grounding with two wire extension cords, plug adapters, etc.

BEFORE PLUGGING IN the instrument check and comply with installation instructions.

MAINTENANCE may require power on with the instrument covers removed. This should be done only by qualified personnel aware of the electrical hazards.

WARNING notes call attention to possible injury or death hazards in subsequent operations.

CAUTION notes call attention to possible equipment damage in subsequent operations.

SPECIFICATIONS

VERSATILITY

Waveforms: Sine , square  , triangle , DC, pulse  , Sawtooth  and distrorted sine achieved by symmetry variations.

Frequency Range: 0.002Hz-7MHz.
Option: 0.1 13 MHz Sine Wave
Option: 0.2 20 MHz Sine Wave

Main Output: variable to 20Vpp. Impedance 50Ω(600ΩSpecial request).
ATTENUATOR - (90 dB) 0-60 dB in 20 dB steps, plus 30 dB vernier (amplitude).
TTL PULSE OUTPUT function as SYNC. out also. TTL pulse at generator's frequency, rise and fall time typical 40nsec (counters' "INT/EXT" slide swich in "EXT".), duty cycle variable by "WIDTH" control.

DC Offset and DC Output: DC output appears at main (50Ω) output by depressing "DC" pushbutton and releasing all other function pushbuttons. DC offset is achieved by adding "DC" function to any of the main output waveforms sine, square, triangle, sawtooth and pulse). Waveform offset and DC output continuously variable to ±10V, signal peak plus DC offset limited to ±10V and are proportionally attenuated by the attenuator.

Sweep Input (VCG): Up to 1000:1 frequency change with external (AC or DC) 0 to +5V signal. To achieve maximum width, dial setting should be at the minimum and a 0 (or 50mV negative) to +5V sawtooth must be applied. Same can be done with 0 to +5V sawtooth when the dial is set to maximum.

Input impedance: 5kΩ
Linearity: 0.5%
Slewrate: 2% of range per μ sec.

Width (Symmetry) Control: Width of square-wave and symmetry of all waveform outputs is continously adjustable from 10% to 90% (approx.) Varying width provides variable duty cycle pulses, sawtooth ramps and non-symmetrical sinewaves.

Pulse Generator Performance: TTL pulse, dual pulse (positive + negative), high level (20V) pulse, one-shot pulses, self-defined logic (amplitude + DC), all repetition rate and duty cycle controlled.

FREQUENCY AND AMPLITUDE PRECISION

Dial Accuracy:
Models with counter: ±1 least significant digit (virtually 100% accuracy).
Time Symmetry: 1% to 200 KHz.
Sine Flatness: 0.5dB to 5MHz, 3.0dB up to 13MHz.

WAVEFORM CHARACTERISTICS
Sine Distortion: ≤ 1.0% for 20Hz to 100KHz.

Triangle Linearity: Better than 99% up to 200 KHz.
Square Wave Rise and Fall Time: Typical 40nsec terminated with a 50Ω load.
Stability: Amplitude, frequency and DC offset 0.25% for short term, 0.5% for 24 hours.

FREQUENCY COUNTER
Measures generator's frequency in the "INT" mode or external signals in the "EXT" mode.
Range: 100MHz

Accuracy: ± (1 digit + time base accuracy).
Resolution: 1Hz (100Hz on 1-100MHz rahge).
Sensitivity: 70mVRMS 50Hz to 50MHz.
Impedance: 1MΩ/25pF.
Time Base: 10MHz -30PPM crystal.
Overload: Maximum 250Vrms to 1kHz.
Display: 5-digit led shows frequency in kHz.

***Models with AM/FM Sweep (MSP, MSPC, MSTPC)**
AM-Internal/External: Auxillary 400Hz (approx.) interal sinewave will modulate generator's sinewave at the main output. Modulation depth is adjustable from 0 to 100%, External waveforms will perform tone bursts.

FM-Internal/External: Auxillary 400Hz (approx.) interal sinewave will modulate any frequency selected at the generator's output. Deviation is adjustable by "MOD LEVEL" control. 8Vpp (400Hz approx.) modulating source is then available at the "AF OUT" connector. Impedance 600Ω. FSK and lin/log sweep are available at the external FM mode.

Sweep: Sweep start and stop frequencies are held for precise sweep limit adjustment.
Sweep width: Max. width 1000:1 achieved by positive (internal) OV-4V sawtooth.
Sweep rate: Continuously variable 30msec to 10sec.

***Operational Modes (MSTPC):**
CONTINUOUS: Generator runs continuously at selected frequency.

TRIGGERED (EXTERNAL): Generator is quiescent until triggered by external signal or manual trigger, then generates one complete waveform cycle at selected frequency.

GATED (EXTERNAL): As triggered mode, except output continues for dufation of gate signal. Last waveform started is completed.

INTERNAL-TRIGGERED/GATED (BURST): Same as external except triggering/gating is done by the sweep sawtooth signal, which is internally applied to perform bursts (in the gate mode) and single cycles at selected frequencies. Sweep "rate" control determines the burst repetition rate, "width" determines the number of cycles in each burst. ("rate" may slightly influence as well).

MANUAL ("MAN"): Pressing "MAN" will perform one cycle in the external "TRIG" mode. In the external "GATE" mode the output will continuously oscillate as long as "MAN" is pressed.

FREQUENCY LOCKING/SYNCHRONIZING: Generators' output frequency can be stabilized by locking it to external references applied to "lock" input connector.

Trigger Gate: Impedance 10KΩ.
Pulse Width: 200 nsec minimum.
Repetition Rate: 1MHz maximum.
"MAN": Allows manual gating or triggering or creating fully adjustable :one-Shot" pulses when in the pulse generator mode.

GENERAL.

OUTPUT PROTECTION: The generator main output is protected against short circuit or voltage between ± 14V DC 1A S.T.

Environmental: Specifications apply at (25±5)°C. Instrument will operate from 0°C to 50°C.

Dimensions: 270mm Wx125mm Hx245mm D

Weight: 4 Kg

Power: 230VAC (115V option) ±10%, 50-60Hz. consumption, 20 watts max.

Note: Specifications apply for dial at 0.2-2.0 with DC offset removed, with 50Ω resistive load and after 20min. warm-up. All specifications are subject to change without notice.

AGENT:

NOY-TRONICS

SECTION 2: OPERATION

SIMPLE SELECTION OF THE DESIRED WAVEFORM WILL BRING SINE, SQUARE OR TRINAGLE TO THE MAIN OUTPUT.

PROPER USE OF THE BUILT IN - 4 STEP ATTENUATOR PLUS 30DB VERNIER (AMPLITUDE) WILL BRING THE OUTPUT TO THE DESIRED LEVEL.

IT IS IMPORTANT TO UNDERSTAND THAT IN ORDER TO ACHIEVE CLEAN, NOISE FREE WAVWFORMS YOU SHOULD AVOID USING THE AMPLITUDE CONTROL IN ITS VERY LOW END BUT TO REACH LOW LEVEL AMPLITUDE BY PROPER ATTENUATION KEEPING AMPLITUDE CONTROL FAR FOR ITS VERY LOW END.

NOTE: SINE DISTORTION IS AFFECTED BY THE AMBIENT TEMPERATURE WHO STRONGLY AFFECTS WAVEFORM SYMMETRY. WAVEFORM SYMMETRY DETERMINES DISTORTION. A 1.0% DISTORTION IS GURRANTEED IN THE NORMAL OPERATING CONDITIONS. HOWEVER A FAR BETTER DISTORTION (0.4 - 0.5%) MAY BE REACHED ADJUSTING P4 ON PC 300P BOARD.

DC OUTPUT AND DC OFFSET

DC OUTPUT APPEARS AT THE MAIN OUTPUT BY DEPRESSING "DC" PUSHBUTTON AND RELEASING ALL OTHER PUSHBUTTONS. TURNING THE "OFFSET" KNOB CLOCKWISE WILL BRING POSITIVE DC LEVEL TO THE MAIN OUTPUT. THIS LEVEL IS ALSO CONTROLLED BY THE ATTENUATOR. (SAME CAN BE DONE WITH NEGATIVE DC LEVEL).

DC OFFSTE IS ACHIEVED BY ADDING THE ABOVE DC OUTPUT TO ANY OF THE MAIN OUTPUT WAVEFORMS. (CLIPPING DISTORTION MAY APPEAR IF DC OFFSET PLUS SIGNAL PEAK REACHES THE OUTPUT AMPLIFIRES LEVEL LIMITATIONS - +/-10V INTO OPEN CIRCUIT).

DCF - COUNTER DISPLAYED FREQUENCY (MODELS WITH COUNTER)

A BUILT-IN 100 MHZ/70MV FREQUENCY COUNTER, BASED ON NEW LSI TECHNOLOGY, IS A UNIQUE NEWTRONICS FEATURE.

THESE FUNCTION GENERATORS, GIVE A FREQUENCY SETTING ACCURACY OF +-1 LEAST SIGNIFICANT DIGIT AND OVERCOMING THE 2,3 OR 5% ERRORS FOUND ON NORMAL FUNCTION GENERATORS BY A FEW DECADES.

CDF ALSO OVERCOMES THE INFLUENCE OF CHANGING ENVIRONMENTAL CONDITIONS, AND HENCE STABILITY, AS ANY CHANGE IN THE OUTPUT FREQUENCY IS AUTOMATICALLY INDICATED ON THE DIGITAL READOUT AND CAN BE RESET BY THE HIGH RESOLUTION COARSE-FINE TUNING CONTROL. THIS 1:6 REDUCTION DRIVE ENABLES THE FREQUENCY TO BE ADJUSTED IN SMALL ACCURATE STEPS, SIMILAR TO THAT ACHIEVED BY A SYNTHESISER.

ANOTHER BENEFIT OF THE INTERNAL COUNTER IS THE ABILITY TO FEED AN EXTERNAL SIGNAL OF UP TO 100 MHZ INTO THE EXT. FREQ. BNC AS A 100 MHZ, 5 DIGIT FREQUENCY METER.

FREQUENCY SETTING

* A SUGGESTED WAY TO ADJUST CDF GENERATORS FREQUENCY COMBINES A USE OF THE MAIN DIAL TO BRING THE GENERATOR NEAR THE REQUIRED FREQUENCY AND THE FINE ADJUSTMENT TO THE EXACT REQUIRED VALUE OBSREVED ON THE COUNTER'S DISPLAY.

* TO ACHIEVE HIGH SETTING ACCURACY ON LOW FREQUENCY SIGNALS (THE BUILT IN COUNTER WILL READ DOWN TO 5 HZ ONLY), USE EITHER OF THE FOLLOWING METHODS:

A. ADJUST A FREQUENCY 10000 TIMES HIGHER THAN THE REQUIRED FREQUENCY AND THEN DEVIDE BY 10000 - ACCURACY IS 2%, E.G., 0.2 HZ IS REQUIRED - ADJUST THE GENERATOR TO 2000 HZ USING THE "X10K" MULTIPLIER, THEN DEVIDE BY 10000 DEPRESSING THE "X1" MULTIPLIER. THE FREQUENCY ACHEIVED IS 0.2 HZ WITH 2% ACCURACY OF THE MULTIPLIER CAPACITORS.

B. IGNORE THE COUNTER'S DISPLAY AND RELATE YOUR READING TO THE DIAL MARKS ONLY - ACCURACY IS THEN OF COURSE THE DIAL ACCURACY ONLY.

C. **13 MHZ AND 20 MHZ FREQUENCY SETTING**

FREUENCY ADJUSTMENTS UP TO 7 MHZ ARE SIMPLY ACHIEVED BY THE MULTIPLIER PUSHBUTTON AND THE CONTINUES COARSE/FINE DIAL.

FOR SINEWAVES HIGHER IN FREQUENCY - UP TO 13 MHZ OR 20 MHZ (MODEL MSP, MSPC AND MSTPC) FREQUENCY SETTING IS ACHIEVED USING "HF" MODE WITH THE BUILT IN FREQUENCY COUNTER AND IGNORING THE MARKS ON THE DIAL. SPECIFICATIONS WILL CONSIDERABLY BE DEGRAGATED IN THIS RANGE.

NOTE: NORMAL OPERATION OF THE GENERATOR SHOULD USE THE DIAL BETWEEEN 0.2 TO 0.2 ONLY. SPECIFICATIONS LIKE DISTORTION, STABILITY, LINEARITY ETC. APPLY ONLY TO THIS RANGE, AND MAY SERIOUSLY BE AFFECTED WHEN THE 0.002 TO 0.2 DIAL RANGE IS USED. THE MAIN AIM FOR THIS DIAL RANGE IS TO ENABLE WIDE FREQUENCY SPAN FOR SWEEP PURPOSE IN ORDER TO ENABLE WIDE BAND SWEEPING WHEN UPPER SWEEP LIMIT IS SET TO 2.0 THE LOWER LIMIT SHOULD BE SET TO 0.002 (1 : 1000 RANGE) OR LOWER.

HOWEVER FOR SWEEP PURPOSES OUTPUT LEVEL FLATNESS IS OF MAJOR IMPORTANCE AND OTHER SPECIFICATIONS LIKE DISTORTION AND STABILITY ARE OF SECONDARY IMPORTANCE ONLY.

SWATOOTH AND DISTORTED SINE

A SYMMETRICAL TRIANGLE IS CHOSEN; DEPRESSS THE "SYM". PUSHBUTTON! TURNING THE "SYMMETRY" POTENTIOMETER IN BOTH DIRECTIONS WILL CONTINUOUSLY VARY THE TRIANGLE WAVEFORM FROM A QUICK RISE TIME, SLOW FALL TIME SWATOOTH TO A SLOW RISE TIME AND QUICK FALL TIME SWATOOTH. THE ABOVE NODIFICATION IS SMOOTH AND CONTINUOUS AND CAN BE DONE ALSO WITH THE SINEWAVE OUTPUT.

PULSE GENERATOR PERFORMANCE

SIMPLE OPERATION OF THE 300 SERIES AS A PULSE GENERATOR IS ACHIEVED BY DEPRESSING TWO FUNCTION PUSHBUTTONS.

THE SQUARE WAVE PUSHBUTTON
AND THE "PULSE" PUSHBUTTON.

TTL LOGIC: +3V SQUAREWAVE IS AVAILABLE AT THE "PULSE OUTPUT" THIS SIGNAL IS CONTROLLED BY THE "SYMMETRY" POT.

NEGATIVE LOGIC: SET ANY REQUIRED NEGATIVE SQURE WAVE USING "LEVEL" + "OFFSET" CONTROLS. THE REPETOTION RATE AND DUTY CYCLE CAN THEN BE CONTROLLED.

DAUL PULSE GENERATOE: IS AVAILABLE WHEN USING THE "PULSE OUTPUT" AS ITS NEGATIVE LOGIC MODE.

C MOS LOGIC: IS AVAILABLE DUE TO THE HIGH OUTPUT LEVELS AT THE MAIN OUTPUT.

SELF DEFINED LOGIC: THE "0" AND "1" LOGIC LEVELS CAN BE SET AS REQUIRED E.G.

FOR "0"= -2V AND "1"= +4V USE 6 VOLT OUTPUT LEVEL SHIFTED + 1V POSITIVELY BY THE "DC OFFSET" CONTROL. FOR "0" = -5V AND "1" = +3V USE 8V OUTPUT LEVEL SHIFTED -1V NEGATIVELY BY THE "DC OFFSET" CONTROL.

AFTER SETTING THE ABOVE - DUTY CYCLE AND REPETITION RATE CAN BE MODIFIED BY "SYM" CONTROL AND BY THE FREQUENCY DIAL RESPECTIVELY.

NOTES

1. THE ACTUAL RISE/FALL TIME OF THE TTL OUTPUT DEPENS ON COUNTER "INT/EXT" SWITCH POSITION (AS TTL OUTPUT IS SLIGHTLY LOADED WHEN USED FOR FREQUENCY MONITORING).

2. AS THE REPETITION RATE IS INCREASED, A CONFLICT DEVELOPS BETWEEN THE MINIMUM PULSE WIDTH DICATED BY RISE AND FALL TIME CONSIDERATION AND THE COMMAND TO ADJUST DOWN TO 10 PERCENT DUTY CYCLE. THE RISE TIME LIMITATION PREVAIL AND THE MINIMUM PULSE WIDTH ON THE X2M RANGE IS APPROXIMATELY 100 MANOSECONDS.

3. IT IS IMPORTANT TO REMEMBER THAT MEDIFING DUTY CYCLE ("SYM" CONTROL) WILL SLIGHTLY AFFECT FREQUENCY WHICH CAN OF COURSE BE READJUSTED USING THE CDF ARRANGEMENT. THE REASON FOR THAT IS SIMPLE - THE TWO CURRENT SOURCES THAT PRUDUCE THE MAIN TRIANGLE/SQUARE WAVEFORMS ARE CONTROLLED BY TWO POTENTIOMETER WAFERS ROTATED BY THE SAME SHAFT THESE TWO WAFERS ARE NOT 100% MATCHES AND THEREFORE CAUSE THE FREQUENCY CHANGE.

S W E E P (MODELS WITH SWEEP)

FREQQUENCY SWEEP OF UP TO 1:1000 MAY BE OBTAINED ON ANY FREQUENCY RANGE. CHOOSING THE PROPER FREQUENCY MULTIPLIER SHOULD BE DONE BY STOP FREQUENCY CONSIDERATION, BOTH START AND STOP FREQUENCIES SHOULD BE WITHIN THE CHOSEN RANGE.

THE LOW STARTING FREQUENCY IS SET BY THE DIAL IN THE NORMAL CINTINUOUS MODE, THE HIGH SWEEP LIMIT MAY BE SET BY PRESSING "STP" PUSHBUTTON AND ADJUSTING THE "WIDTH" CONTROL.
BOTH START & STOP FREQUENCY CAN STATICALLY BE READ ON THE CDF/COUNTER FOR PRECISE SETTING. DEPRESSING "RUN" WILL SWEEP THE OUTPUT FREQUENCY LINEARLY.
THE SWEEPING SPEED IS SET BY VARIABLE "RATE" CONTROL.

THE SAWTOOTH OUTPUT WAVEFORM MAY BE USED FOR DRIVING THE X AXIS OF AN XY RECORDER.

AM-FM MODULATION (MODELS MSP, MSPC, MSTPC)

THE "M" DESIGNED MODELS ARE EQUIPPED WITH A BUILT IN AUXILIARY AUDIO OSCILLATOR.

THE "AM-FM" PUSHBUTTON WILL SELECT THE DESIRED TYPE OF MODULATION "MOD LEVEL" KNOB WILL VERY THE AM DEPTH IN THE AM MODE (TO 100%) AND WILL ALSO CHANGE FM DEVIATION IN THE FM MODULATION MODE. THE AUXILIARY AUDIO SOURCE (WICH IS THE MODULATION SOURCE) APPEARS SIMULTANEOUSLY AT THE "AF OUT" BNC CONNECTOR.

IN THE EXTERNAL "EXT". MODE ANY WAVEFORM APPLIED TO THE "AM-FM INPUT" CONNECTOR-WILL MODULATE THE GENERATOR. MODULATION LEVEL WILL BE CONTROLLED BY THE SAME "MOD. LEVEL" KNOB.

IN THE "EXT". MODE OF OPERATION COMPLEX WAVEFORM LIKE, TRIANGLE / SAWTOOTH AM MODULATION, PWM (PULSE WIDTH MODULATION) CAN BE ACHIEVED BY APPLYING A VARIABLE DUTY CYCLE PULSE, ADJUSTABLE "RE-BURST" - USING 100% AM MODULATION PULSE, FSK (FREQUENCY SHIFT KEYING) USING PULSE IN THE EXT. FM MODE, AND ALSO ADJUSTABLE SWEEP BY APPLYING A SAWTOOTH WAVEFORM.

NOTES (AM-FM)

1. AM MODULATION IS LIMITTED TO SINEWAVE OUTPUT AND WILL REACH FULL SPECIFICATION ON FREQUENCY OF 20 KHZ TO 7 MHZ.
2. AM/FM MODULATION MAY OCCASIONALY START AT 10% ("MOD-LEVEL" CONTROL AT ZERO-FULL ANTI-CLOCK WISE) INSTEAD OF A COMPLETE "ZERO". TO REACH A COMPLETE ZERO SIMPLY SET MODULATION TO "OFF".
3. SLIGHT DISTORTION OF THE OUTPUT WAVEFORM MAY APPEAR ON AM MODULATION REACHING BEYOND 70% DEPTH.
4. IN THE "HF" MODE AM DEPTH IS LIMITED TO 30% AND FM DEVIATION TO A FEW KHZ DEVIATION FROM CENTER FREQUENCY.

TRIGGER GATE (MODEL MSTPC)

PROVIDES SELECTION OF THE MODES IN WHICH THE MAIN GENERATOR MAY BE OPERATED:

A. CONTINIOUS: AN UNITERRUPTED TRAIN OF SELECTED WAVE FORM AT THE OUTPUT.

B. TRIGERED: GENERATOR STARTS AT D-C BASELINE AND PRODUCES ONE COMPLETE WAVEFORM CYCLE WHEN ENABLE BY AN EXTERNAL TRIGGER SIGNAL OR THE MANUAL TRIGGER. WAVEFORM ENDS AT THE ORIGINAL D-C BASELINE.

C. GATE: SAME AS TRIGGERED EXCEPT THAT WAVEFORM CYCLES CONTINUE FOR AS LONG AS THE EXTERNAL OR MANUAL TRIGGER IS APPLIED. THE LAST CYCLE IS ALWAYS COMPLETED AND ENDS AT THE ORIGINAL DC BASELINE.

D. INTERNAL - TRIGGER -GATE -BURST

IN THIS MODE THE SWEEP SAWTOOTH IS INTERNALLY APPLIED TO THE TRIG/GATE CIRCUITARY AND PRODUCES BURSTS OR TRIGGERS SINGLE-CYCLES WHEN "INT" "TRIG" PUSHBUTTON IS DEPRESSED.
SWEEP "RATE" CONTROL IN THE "FAST" OR "SLOW" MODES DETERMINES THE BURST (OR TRIGGER) REPETITION RATE, SWEEP "WIDTH" CONTROL PRESENTS THE NUMBER OR CYCLES IN EACH BURST.

E. MANUAL ("MAN")

DEPRESSING "MAN" WILL PERFORM ONE CYCLE IN THE "EXT" "TRIG" MODE. IN THE "EXT" "GATE" MODE THE OUTPUT WILL CONTINIOUSLY OSCILLATE AS LONG AS "MAN" PUSHBUTTON IS DEPRESSED.

F. "FREQ. LOCK"

THE GENERATOR'S OUTPUT FREQUENCY CAN BE STABILIZED BY LOOKING IT TO ANY EXTERNAL REFERENCE. THE REFERENCE SHOULD BE APPLIED TO THE "LOCK" INPUT BNC CONNECTOR, THE GENERATOR'S FREQUENNCY "FREQ. LOCK" PUSHBUTTON SHOULD BE DEPRESSED - LED LAMP LIGHTS, THEN FINE FREQUENCY TUNE WILL BRING THE GENERATOR TO A COMPLETE LOCK.

NOTE: IT IS RECOMMENDED TO CONFIRM THAT BY OBSERVING BOTH SIGNALS ON A DAUL TRACE OSCILLOSCOPE.

SECTION 3: BLOCK DIAGRAM/CIRCUITS DESCRIPTION

THE FOLLOWING INCLUDE DESCRIPTION FOR:

A. THE BASIC OSCILLATOR - (PC BOARDS 300P, 300T)
B. FREQUENCY COUNTER - (PC BOARDS 300C, 300DP)
C. AM/FM/SWEEP - OSCILLATORS - (PC BOARD 300 MSP)
D. TRIG/GATE/BURST - (PC BOARD 200 T.G.)

A. THE BASIC OSCILATORS (REFER TO BLOCK DIAGRAM AND TO PAGE 26).

THE BASIC OSCILLATOR CONTAINS: REGULATED SUPPLIES + -15V AND + -6V, POWER AMPLIFIED FOR 20VPP OUTPUT LEVEL SUPPLY, OUTPUT PROTECTION CIRCUITARY, - 60 DB ATTENUATORS, SINE SHAPER, RANGE SELECTION BOARD, BUT THE BASIC SYSTEM'S CORE CONSISTS OF TWO CURRENT SOURCES TO CHARGE AND DISCHARGE THE TIMING CAPACITORS AND A FEW BUFFERS USED ALSO TO ADAPT VOLTAGE LEVELS.

1. THE REGULATED SUPPLIES - THE TRANSFORMER TI SUPPLIES AN AC VOLTAGE TO THE SYSTEM. THIS AC VOLTAGE IS RECTIFIED BY TWO DIODA BRIDGES. THE REVTIFIED VOLTAGE IS APPLIED TO ICS'7815 (VOLTAGE REGULATOR). REG. I WILL SUPPLY +15V, REG. 2 IS WIRED SO AS TO SUPPLY -15V. THESE TWO REGULATED VOLTAGES ARE USED TO FEED THE OSCILLATOR BUT ARE SIMULTANEOUSLY APPLIED ON REG. 3 AND REG. 4 WHOSE PURPOSE IS TO SUPPLY +6V AND -6V REGULATED VOLTAGE.

2. THE POWER AMPLIFIER - THE POWER AMPLIFIER IS BASED ON A DIFFERENT CIRCUITARY AT THE INPUT AND ON POWER TRANSISTORS AT THE OUTPUT. THE AMPLIFIER HAS A STRONG NEGATIVE FEEDBAK AND A CONSTANT AQMPLIFICATION FACTOR.

   THE DIFFRENTIAL AMPLIFIER CONSISTS OF TWO TRANSISTORS - Q12, Q13. THE PURPOSE OF Q11 IS TO TRANSFER HIGH FREQUENCY WAVEFORMS WITH HIGH RELIABILITY AND WITHOUT AFFECTING THEIR RISE/ FALL TIME. Q14 SERVES AS A CONSTANT CURRENT SOURCE VIA Q16/QQ17. Q15 SERVES AS AN AMPLIFIER FOR Q11'S OUTPUT. THE DIODES D18, D19, D20, MAINTAIN A CONSTANT JUNCTION VOLTAGE TO Q16 AND Q17 TO FORCE THEM ALWAYS INTO THEIR "ON" (COMDUCTING) MODE. P1 IS USED TO ADJUST THE DIFFERNTIAL AMOLIFIER TO ACHIEVE A "O" VDC. PROPER ADJUSTMENT AT TPA WILL MAINTAIN THE SYMMETRY OF THE OUTPUT-WAVEFORM AROUND ZERO, AND PROPER ADJUSTMENT OF P2 WILL MAINTAIN AN AVERAGE DC OF "O"V AT THE OUTPUT (WHEN DC OFFSET PUSHBUTTON IS NOT IN USE).

THE OUTPUT AMPLIFIER HAS A CONSTANT AMPLIFICATION OF 10.
THE WAVEFORM INPUT IS FED VIA POT 4 - THE AMPLITUDE POT.
P12 IS USED TO ACCURATELY ADJUST A 20VP-P UOTPUT.
THE DESIRED WAVEFORM IS FED INTO P12 DIRECTLY FROM THE WAVEFORM PUSHBUTTON.

THE OUTPUT DC LEVEL CAN BE VARIED BY DEPRESSING THE "OFFSET" PUSHBUTTON, THE VOLTAGE DIVIDER (P3, R84, R85) SIMPLY ENFORCES THEN A DC VOLTAGE AT TPA.

3. OUTPUT PROTECTION CIRCUITRY - THE OUTPUT PROTECTION CIRCUITS ARE BASED ON TWO SCR'S WHOSE PURPOSE IS TO PROTECT THE OUTPUT AMPLIFIER FROM HIGH DC VOLTAGE ACCIDENTALLY APPLIED TO THE OUT-PUT BNC CONNECTOR. OUTPUT AMPLIFIER WHO DO NOT UTILIZE PROTECTION CIRCUITS ARE EXTERMELY SENSITIVE TO HIGH DC VOLTAGE OR CURRENT WHICH OFTEN BURN THE OUTPUT AMPLIFIER AS WELL AS MANY OTHER COMPONENTS.

NOY-TRONICS INSTRUMENTS ARE ALL WELL PROTECTED AGAINST HUMAN MISTAKES OF THAT KIND BUT ARE STILL LIMITED TO 100 VOLTS AND 1 AMPERE.
A DC VOLTAGE ACCIDENTALLY APPLIED TO THE OUTPUT CREATES A CURRENT ON RESISTOR R87, WHEN THIS CURRENT REACHES 0.25 AMP, A 0.7 VOLT LIES ON R87 AND Q18 IS TURNED ON, IT ACTIVATES THEN SCR-2 WHICH SHORTS THE EXTERNAL APPLIED VOLTAGE.
A NEGATIVE VOLTAGE APPLIED ON THE OUTPUT CREATES A MINUS 0.7 VOLTS ON R87 AND SCR-1 THEN ACTIVATED.

WHEN THE -40DB AND -60DB ATTENUATORS ARE USED,NO OUTPUT PROTECTION EXISTS.IT IS SO DESIGNED FOR THE FOLLOWING TWO REASONS:

A.THE INPUT RESISTANCE IN SERIAL TO THE OUTPUT AMPLIFIER VIA THE ATTENUATORS IS SO HIGH THAT NO PROTECTION IS REALY NECESSARY.

B.AT HIGH FREQUENCY AND LOW LEVEL THE PROTECTION CIRCUITARY CAN SERIOUSLY DISTORT THE OUTPUT WAVEFORM.

4. ATTENUATORS. THE ATTENUATORS SYSTEM IS DESIGNED TO ENABLE ATTENUATIONS OF ODB, -20DB, -40DB, -60DB. THE ATTENUATORS FOR 50 OHM IMPEDENCE, R82A-R828 BOTH CREATE THE 50HM OUTPUT IMPEDENCE.

   AT -20DB THE ATTENUATORS ARE R94, R98.
   AT -40DB " " " R95, R96, R97.
   AT -60DB " " " R94, R95, R96, R97, R98.

   THE ATTENUATORS ARE CONECTRD TO THE OUTPUT PROTECTION CIRCUITARY IN THE 0 DB AND -20DB MODES ONLY (SEE PARA.3)

5. SINE SHAPER. A MOTOROLA AMPLIFIER 1445 IS USED FOR SHAPING. THIS AMPLIFIER WORKS IN ITS NON-LINEAR MODE AND CONVERTS A TRIANGLE AT ITS INPUT I TO A SINEWAVE THAT CAN BE ADJUSTED FOR DISTORTION BETTER THAN 0.5 PERCENTS (0.3 IN SOME CASES). Q9 AND Q10 CREATE A BUFFER TO TRANSFER THE SINEWAVE TO THE FUNCTION SELECTOR PUSHBUTTONS.

   THE Q1/Q2 BUFFER IS USED TO BRING THE TRIANGLE WAVEFORM VIA R45 TO THE SINE-SHAPER. P8/P9 ARE USED TO ACHEIVE MINIMUM DISTORTION, P10 IS USED TO ADJUST THE OUTPUT SINEWAVE DC LEVEL AND P11 IS USED TO ADJUST THE MAGNITUDE TRANSFERED TO THE FUNCTIONS SELECTOR.

6. 300T - RANGE SELECTING PC BARD. THIS CARD CONTAINS A SET OF 8 CAPACITORS; THEY ARE FACTORY ADJUSTED TO BE EXACTLY 1:10 IN RATIO FROM ONE ANOTHER. THE LOADING AND UNLOADING CURRENT IS CONSTANT.
   THE CURRENT IS FED INTO THE TIMING CAPACITORS THEREFORE WHEN A TIMING CAPACITOR IS CHANGED THE FREQUENCY IS ALSO CHANGED (BY A 10 FACTOR APPROX). 200T CARD ALSO CONTAINS TWO TRANSISTORS AND TWO DIODES THAT CONTROL THE CURRENTS APPLIED BY THE BASIC 200P CARD. A CURRENT IS DRIVEN VIA PIN 9 OF PM1 CONNECTOR TO LOAD THE CHOSEN CAPACITOR WILL CONTINUE LOADING AS LONG AS TRANSISTOR Q2 IS IN ITS CUT-OFF STATUS, WHEN THE CAMPATOR U.2 (529) COMMANDS THE CAPACITOR TO UNLOAD, HE DRIVES Q2 INTO "ON" VIA PIN 4 ON PM1 CONNECTOR BY CONNECTING A NEGATIVE VOLTAGE AND FORCING Q1 INTO "CUT-OFF". THE RELEVANT CAPACITOR UNLOADS VIA DIODE D1 UNTILL A POSITIVE VOLTAGE (FROM THE COMPARATOR) AT PIN 4 ON PM1 WILL FORCE Q1 INTO "ON" AND Q2 INTO "CUT-OFF" AND THE LOADING PROCESS INTO THE TIMING CAPACITOR WILL BE RENEWED.

THIS PROCESS IS REPETATIVE AND CREATES A TRIANGLE VOLTAGE WAVEFORM, THE VOLTAGE LEVEL OF THIS TRIANGLE IS DETERMINE BY THE COMPARATOR, THE CURRENT SOURCES DETERMINE ITS FREQUENCY. THE DIAL POTENTIOMETER DETERMINES THE CURRENT SOURCES SIZE AND HENCE THE FREQUENCY (SEE DETAILED EXPLANATION IN THE NEXT PARAGRAPH).

7. THE HEART OF THE GENERATOR. (THE CURRENT SOURCES TO CHARGE THE DISCHARGE THE TIMING CAPACITORS AND THE COMPARATOR).

THE GENERATOR'S HEART IS BASED ON THE EQUAL CURRENT SOURCES THAT LOAD AND UNLOAD THE TIMING CAPACITORS. THE COMPARATOR DETERMINES THE WAVEFORM'S AMPLITUDE. THIS IS AN INTEGRATOR CONTROLLED BU THE COMPARATOR PRODUCING SQUARE AND TRIANGLE WAVEFORMS. THE TRIANGLE IS TRANSFERED TO THE FUNCTION SELECTOR VIA BUFFER Q1/Q2, THE SQUAREWAVE IS TRANSFERED TO THE "PULSE OUT" CONNECTOR VIA BUFFER Q19/Q20.

OPERATION. A DC VOLTAGE APPLIED TO U3 VIA THE DIAL POTENTIOMETER POT 1 DETERMINES THE CURRENT SIZE RUNNING INTO THE TIMING CAPACITORS THROUGHT THE CURRENT SOURCES. P5 DETERMINES THE MAXIMUM VOLTAGE APPLIED TO THE AMPLIFIER (WHEN THE DIAL POTENTIOMETER POTI AT MAX). THE FREQUENCY WILL NOW BE THE MAXIMUM IN ANY RANGE SINCE THE CURRENTS ARE MAXIMAL. WHEN POT 1 IS IN MINIMUM P6 WILL DETERMINE THE CURRENT AND HENCE THE MINIMUM FREQUENCY IN EACH RANGE.

IC - U3 CONTAINS TWO UNITY GAIN AMPLIFIERS. THEIR FEEDBACK RESISTORS ARE R26, R33. THE FIRST AMPLIFIER IS CONNECTED TO POT 1 AND PRODUCES A POSITIVE VOLTAGE, THE SECOND AMPLIFIER IS CONNECTED TO THE FIRST AMPLIFIER'S OUTPUT AND PRODUCES A NEGATIVE VOLTAGE. THE RESULT IS TWO VOLTAGES EQUAL IN SIZE BUT REVERSED IN POLARITY, ONE IS NEGATIVE FOR THE NEGATIVE CURRENT SOURCE, AND THE OTHER IS POSITIVE FOR THE POSITIVE CURRENT SOURCE.
THE OUTPUT SIGNAL FROM BOTH AMPLIFIERS IS TRANSFERED VIA Q5/Q6 AS CURRENT SOURCES TO THE "SYM" SELECTOR THAT CONTROLS THE RATIO BETWEEN THE POSITIVE AND NEGATIVE CURRENTS.

IN NORMAL OPERATION ("SYM"-OFF) THE OUTPUTS OF THE POSITIVE/NEGATIVE AMPLIFIERS ARE TRANSFERED TO THE TWO CURRENT SUPPLIES CONTAINING: TWO BUFFERS (INSIDE U4) A POSITIVE CURRENT SOURCE Q7 AND A NEGATIVE CURRENT SOURCE - Q8, WHOSE PURPOSE IS TO LOAD THE CAPACITORS, P3/P4 ARE USED TO ACCURATELY ADJUST THE TWO CURRENT SOURCES TO BE EQUAL AND MAINTAIN A 50% DUTY CYCLE. THE SYMMETRICAL INPUTTO U4 (PINS 3 AND 5) IS USED TO SET AN ACCURATE 50% DUTY CYCLE AT THE LOW END OF THE DIAL BY P7.

Q7 POSITIVE OUTPUT CURRENT,LOADS THE TIMING CAPACITORS VIA PIN 9 ON JM-1.
Q8 NEGATIVE OUTPUT CURRENT UNLOAD THE TIMING CAPACITORS VIA PIN 7.

THE CAPACITORS ARE CHARGED VIA PIN 9 AND THROUGHT DIODE D2 ON 300T CARD, AND DISCHARGED VIA PIN 7 AND THROUGHT DIODE D1 ON THE SAME 300T CARD.
SWITCHING POINT FROM CHARGING TO DISCHARGING AND VICE VERSA IS DETERMINED BY THE COMPARATOR U2 (529).

WHEN A POSITIVE VOLTAGE EXISTS AT THE COMPATATOR'S OUTPUT A CURRENT FLOWS THROUGH DIODES D1/D1A AND A + 1.4 VOLT EXISTS AT PIN 4 OF JM1/PM1. Q1 (ON 300T BOARD) STATUS IS NOW "ON" AND DIODE D1 IS NOW BLOCKED, HOWEVER D2 TO THE TIMING CAPACITORS. THE CHOSEN CAPACITOR VIA PIN 1 ON PM1/JM1 THROUGHT BUFFER U2 TO THE COMPARATOR'S INPUT.
WHEN THE VOLTAGE DEVELOPED ACROSS THE CAPACITOR REACHES 1.4 VOLTS (SAME AS THE VOLTAGE ACROSS D1 AND D1A) THE COMPARATOR'S OUTPUT WILL SWITCH TO NEGATIVE VOLTAGE - THIS VOLTAGE STARTS DISCHARGING THE TIMING CAPACITOR VIA PIN 4 ON JM1PM1. THE NEGATIVE VOLTAGE EXISTING ON THE COMPARATOR'S OUTPUT WILL CAUSE A CURRENT FLOWING VIA D2D2A AND A -1.4 VOLT AT PIN "+" OF THE COMPARATOR.

WHEN THE TIMING CAPACITOR'S VOLTAGE REACHES -1.4 VOLT, THIS VOLTAGE IS TRANSFERED VIA U1 TO PIN "-" OF THE COMPARATOR. THE COMPARATOR WILL NOW SWITCH TO HIS PREVIOUS TRIANGLE WAVEFORMS OF EQUAL AMPLITUDES.

8. <u>BUFFERS.</u> THE THREE BASIC WAVEFORMS TRIANGLE, SQUARE AND SINE ARE TRANSFERED TO THE FUNCTION SELECTOR IN EQUAL AMPLITUDES AND SYMMETRICALLY AROUND ZERO ("0" -DC OFFSET). THE SQUARE AND THE TRIANGLE ARE ORGINALLY CREATED IN EQUAL AMPLITUDES (SEE PARA. 7), P11 IS USED TO DETERMINE THE SINEWAVW AMPLITUDE TO BE EQUAL TO THE SQUARE AND THE TRIANGLE AMPLITUDES. DC LEVEL ADJUSTMENTS ARE MADE USING P10 FOR THE SINEWAVE, USING P13 FOR THE TRIANGLE AND USING P14 FOR THE SQUARE.

B. AM - FM - SWEEP OSCILLATORS. (SEE PAGE 45 300MSP PC BOARD)

300 MSP CARD IS CONNECTED TO PC 200P VIA JM2, -+ 15V SUPPLY IS FED TO 200MSP VIA PINS 7/8 ON JM2.

300 MSP CONTAINS 3 MAIN CIRCUITS, A 400HZ AUDIO OSCILLATOR, A VARIABLE FREQUENCY/AMPLITUDE SWATOOTH GENERATOR AND AN AMPLITUDE MODULATION CIRCUIT.

1. 400HZ AUDIO OSCILLATOR. THIS IS A WEIN-BRIDGE OSCILLATOR BASED ON C7/R30 AND C6/R27, A FET TRANSISTOR Q2 IS USED TO STABILIZE THE AMPLITUDE, P5 IS USED TO SET THE EXCITATION POINT AND P6 IS USED TO SET THE LEVEL AT THE 741 - (AMPLIFIER) OUTPUT.

   THE AMPLIFIER'S OUTPUT IS USED IN THE INTERNAL MODULATION MODE ONLY' THEN THE 400HZ SINE IS FED VIA PIN 5 ON PM2/JM2 (PC BOARD 300P) INTO A POTENTIOMETER THAT DETERMINES THE MODULATION DEPTH. THEN THE SIGNAL IS FED VIA PIN 4 ON PM2 (ON AM MODULATION MODE) THROUGHT C10 TO PIN 1 OF THE BALANCED MODULATOR U3 (1496).

2. AM MODULATION CIRCUIT. U3 IS A BALANCED MODULATION TYPE 1496 WHICH IS FACTORY PREPARED FOR AM MODULATION. THE MODULATING AUDIO IS FED INTO PIN 1, AND THE MODULATED RF IS FED VIA CP INTO PIN 10. THE RF SIGNAL IN THIS CASE IS PROVIDED BY THE MAIN PC BOARD PC200P AND IS FED VIA PIN 10 IN JM1/PM1 TP 200 MSP CARD. THE MODULATED SIGNAL (PIN 6 ON U3) IS TRANSFERED VIA BUFFER Q1 AND CAPACITOR C11 TO PIN 9 ON PM2/JM2 AND TO THE FUNCTION SELECTOR. P4 IS USED TO ADJUST THE RF LEVEL TO ACHIEVE 20VP-P SIGNAL AT THE OUTPUT.

3. SAWTOOTH OSCILLATOR: THIS CLASIC SAWTOOTH OSCILLATOR IS BASED ON AN INTEGRATOR/COMPARATOR CIRCUITARY. THE INTEGRATOR (BSED ON U1B AND CHARGING CAPACITOR C3)CIRCUITARY) IS FED BY A CHARGING CURRENT VIA POT 1: POT 1 IS USED TO VARY THE CHARGING CURRENT, ANF THUS THE SAWTOOTH OUTPUT FREQUENCY VIA "RATE" CONTROL WHICH IS CONNECTED TO POT 1. THE CAPACITOR'S DISCHARGE IS DONE QUICKLY AND CONSTANTLY VIA R21.

   THE INTEGRATOR'S (U1B) OUTPUT IS FED INTO COMPARATOR U1A WHICH INVERTS ITS OUTPUT ACCORDING TO THE SIGNAL'S MAGNITUDE AT ITS INPUT. THE RESULT IS A SQUARE WAVE AT U1A'S OUTPUT.

   WHEN THE COMPARATORS OUTPUT IS NEGATIVE CAPACITOR C3 (IN THE INTEGRATOR) IS CHARGED, AND U1B'S OUTPUT VOLTAGE RISES, THE VOLTAGE WILL KEEP INCREASING AS LONG AS THE COMPARATORS (U1A) INPUT V1A P2 EQUALS TO THE VOLTAGE AT THE COMPARATORS PIN WHICH IS CONNECTED TO P1. THEN A POSITIVE VOLTAGE APPEARS AT THE COMPARATORS OUTPUT WHICH CAUSES QUICK DISCHARGE OF C3 VIA DIODES D6, D3 AND R21 WHICH IS A SPECIAL LOW OHM RESISTOR,51 OHM.

THE DIRECTIVITY OF D6 AND D3 IS THE SAME TO TRANSFER THE COMPARATORS OUTPUT TO THE INTEGRATOR.

P1 IS USED TO DETERMINE THE SAWTOOTH DC BASELINE AND P2 IS USED TO DETERMINE THE SAWTOOTH AMPLITUDE.

4. ADDITIONALS: THE INDICATING LED LEMPS ARE USED TO INDICATE THE FOLLOWING:

LED 1 LIGHT TO INDICATE SWEEP OPERATION. LED 2 LIGHTS TO INDICATE AM/FM MODULATION.

IN THE FM MODE THE 400HZ SIGNAL IS FED VIA "MOD LEVEL" POT. (ON FRONT PANEL) AND VIA "AM/FM" PUSHBUTTON TO PIN 12 (ON THE CONNECTOR), AND THEN TO SWEEP INPUT ON THE MAIN OSCILLATOR. FM DEVIATION IS DETERMINED VIA "MOD LEVEL" CONTROL ON THE FRONT PANEL.

ANOTHR CIRCUIT IS AROUND "HF" PUSHBUTTON WHICH INSERT TWO LOW-OHM RESISTORS INTO THE TWO MAIN CURRENT SOURCES IN ORDER TO CONSIDERABLY INCREASE THEIR CURRENT AND THUS CREATE HIGH 20MHZ OR 13MHZ FREQUENCY RANGE.

FUNCTIONAL OPERATION

* THE UPPER PUSHBUTTON DEPRESSED "OFF" CW OUTPUT WITHOUT ANY SWEEP, AM OR FM.

* MODULATION: DEPRESS "ON" (THE SECOND) PUSHBUTTON ("OFF" WILL OUTOMATICALLY BE RELEASED). THEN AM/FM SELECTOR IS USED TO CHOOSE THE DESIRED TYPE OF MODULATION.

  AM - IS AVAILABLE ON SINEWAVE AND ON 20KHZ AND UPPER RANGES ONLY.

  FM - IS AVAILABLE ON ALL WAVEFORMS AND ON ALL RANGES.

* DEPRESSING START/STOP PUSHBUTTONS THE SWEEP CIRCUITARY INTO OPERATION (THE LED LAMP LIGHTS ACCORDINGLY). START SWEEP FREQUENCY IS DETERMINED BY THE MAIN DIAL, SWEEP STOP FREQUENCY IS DETERMINED BY "WIDTH" POTENTIOMETER WHILE "STOP" PUSHBUTTON IS DEPRESSING. DEPRESS "RUN" TO START SWEEP RUNNING.

C. **FREQUENCY COUNTER**. (REFER TO BLOCK DIAGRAM AND TO DRAWING IN PAGE.18,37,42 PC BOARD 300CN & 300DPN)

THE FREQUENCY COUNTER CIRCUITARY CONTAINS TWO DIFFERENT BOARDS.

THE DISPLAY BOARD 300 DPN
THE COUNTING BOARD 300 CN

THE DISPLAY BOARD 300 DPN

THIS BOARD IS MOUNTED IN THE FRONT PART OF THE INSTRUMENT AND CONTAINS 5 "SEVEN SEGMENT" DISPLAYS, AN "INT/EXT" SELECTOE, A "FAST/SLOW" SELECTOR, AND AN INTERNAL AND EXTERNAL FREQUENCY MEASUREMENTS ARE AVAILABLE. THE DISPLAY IS ACTIVATED BY THE COUNTER PC BOARD VIA CONNECTOR J1.

THE COUNTING BOARD 300 CN.

THE INPUT SIGNAL IS TRANSFERED FROM 200 DPN VIA AN INPUT STAGE SAND VIA A FET TRANSISTOR Q1, TO A BUFFER Q2 AND THEN ON TO AMPLIFIER U1. P1 IS USED TO ADJUST THE INPUT CIRCUITS SENSITIVITY, THE AMPLIFIED SIGNAL IS CONVERTED TO A TTL LEVEL SQUARE WAVE VIA A DIFFRENTIAL STAGE Q3-Q4 AND A BUFFER Q5. THE SIGNAL IS TRANSFERED FROM Q5 TO THE LOGIC CIRCUITARY DIVIDED INTO 4 BY U2 AND INTO 25 BY U3 & U4. U5 CHOOSES THE SIGNAL TO BE MEASURED BY U7, WHETHER IT IS A SIGNAL DIVIDED BY 100 OR THE INPUT FREQUENCY SIGNAL ITSELF.

U7 CONTAINS THE TIME BASE CIRCUITARY AND THE MEASURING CIRCUITARY U8 AND THE SLIDE SWITCHES ON THE DISPLAY PC BOARD ARE USED TO DEFINE THE WAY TO OPERATE U7 VIA CONNECTOR J1. (1 SEC/0.1 SEC VIA FAST/SLOW SELECTOR AND DECIMAL OPINT). THE 10MHZ TIME BASE CIRCUIT IS BASED ON A 10MHZ CRYSTAL. ITS FREQUENCY CAN BE ADJUSTED BY TRIMMER CT1.

THE VOLTAGE/POWER TO THE COUNTER CIRCUITARY IS SUPPLIED BY REGULATOR U6.IN RANGES 7MHZ,2MHZ AND 200KHZ IN "INT" MODE THE TIMING PC BOARD 300T (OR 200TG) IS ALSO A FACTOR IN DETERMINING THE DECIMAL POINT.

** SLIDE SWICH POSITION FOR EXT. FREQ. MODE.(IN 5 DIGITS COUNTER)

RANGE	POSITION
UP TO 99999HZ	5HZ - 1MHZ
100KHZ - 999.99KHZ	MIDDLE POSITION OF THE SWICH
1MHZ - 99.999MHZ	1 - 100MHZ

D. TRIGGER, GATE, BURST, (MODEL MSTPC).

300T PC BOARD IS REPLACED WITH PC 200TG IN INSTRUMENTS CONTAINING TRIGGER, GATE AND BURST. LOGIC CIRCUITS ON THIS PC BOARD WILL DETERMINE THE TIMING AND THE DURATION OF OPERATING THE MAIN OSCILLATOR (SEE THE DESCRIPTION OF THE HEART OF THE INSTRUMENTS).

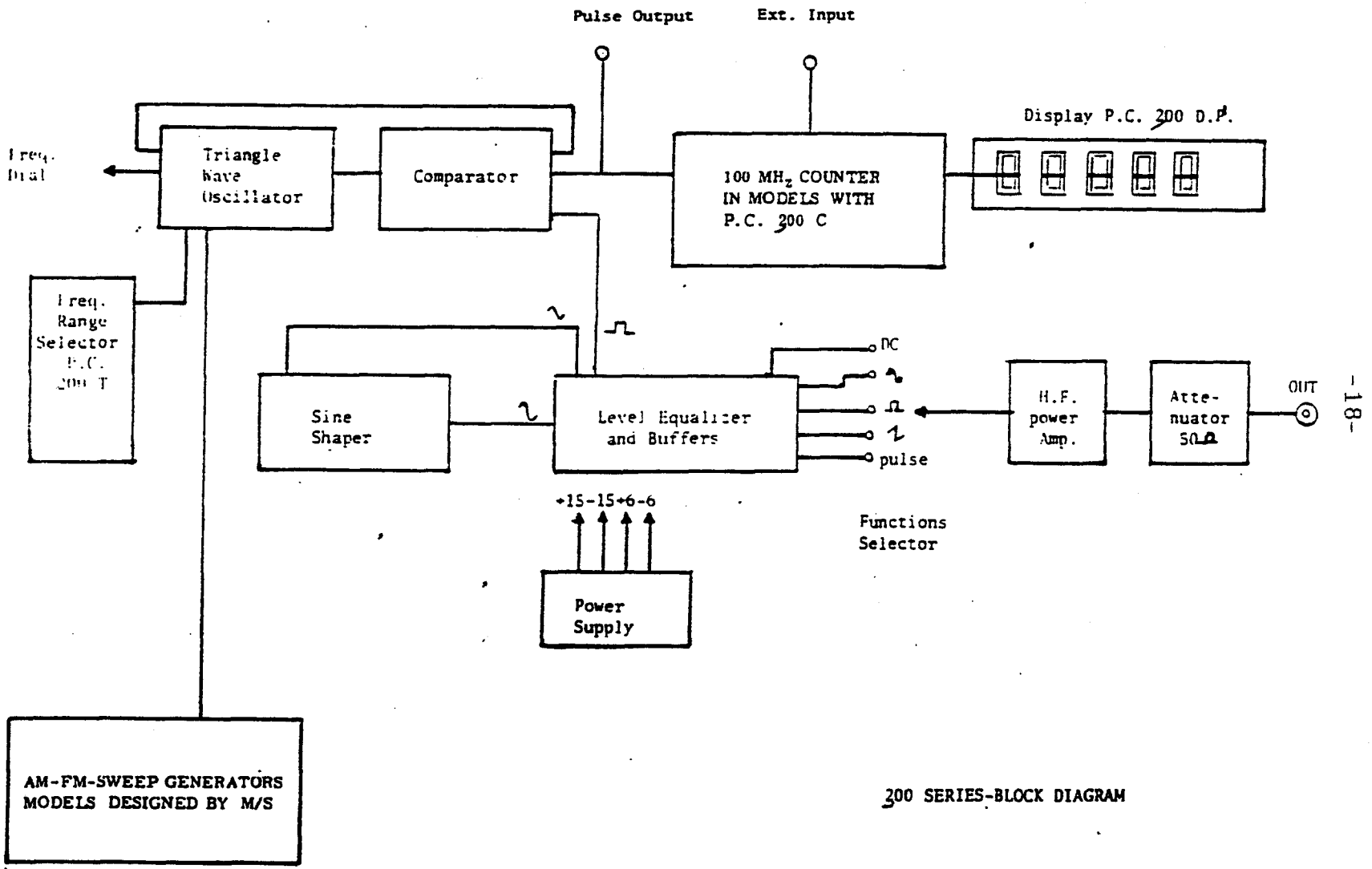
MODEL 300MSTPC HAS 200SW PC BOARD. THIS PC BOARD DIRECTLY CONTROLS 200TG PC BOARD. U3 ACTS AS A COMPARATOR AND CONVERTS THE RTIGGER GATE INPUT VIA PIN 3 ON CONNECTOR J1 TO A SQUARE-WAVE. THE SQUARE-WAVE WIDTH VARIES DEPENDING ON THE FREQUENCY AND THE DC LEVEL OF THE INPUT SIGNAL, WE CAN THEREFORE DETERMINE THE OUTPUT NUMBER OF CYCLES (PULSES) IN THE GATE MODE.

IN THE BURST MODE THE INTERNAL SAWTOOTH (USED FOR SWEEP PURPOSES) IS APPLIED ON PIN 3 OF J1, SWEEP "WIDTH" AND SWEEP "RATE" CONTROLS WILL THEREFORE CONTROL THE BURST PARAMETERS (REPETITION RATE AND DUTY CYCLE).

IN THE GATE MODE PIN 8 OG J1 IS GROUNDED, U1B IS OPERATED VIA U3 TO PIN 4 OF U2B, IT THEN CHANGES ITS OUTPUT FOR THE DURATION OF THE PULSE WIDTH APPLIED BU U3. U1B OPERATES THE TIMING CIRCUITARY OF THE MAIN OSCILLATOR VIA TRANSISTORS Q3 ,Q4, Q5, Q6.

IN THE TRIGGER MODE PIN 1 OF J1 IS GROUNDED, THE OUTPUT SIGNAL OF U3 IS APPLIED ON PIN 12 OF U2D AND ACTIVATES U1B VIA U1A TO ACHIEVE ONE AND ONLY ONE COMPLETE CYCLE. THIS IS MADE POSSIBLE AS THE SIGNAL FROM U2A APPLIED ON PIN 4 OF U1A AND TO PIN 11 OF U1B VANISHES AFTER ONE COMPLETE OPERATING CUCLE.

P1 IS USED TO ADJUST A "O"-V D.C. (D-PHASE ADJUSTMENT). THE COUNTER IS SHUT DOWN AT THE TRIGGER/GATE AND BURST MODES VIA ONE LEAD WIRE CONNECTED TO THE "COUNTER SHUT DOWN" PIN.



200 SERIES-BLOCK DIAGRAM

CALIBRATION AND FINAL ADJUSTMENTS

1. CONTROLS POSITION SHOULD BE AS FOLLOWS:

   AMPLITUDE POT. AT MINIMUM (COUNTER CLOCKWISE), ALL FUNCTION PUSHBUTTON RELEASED, "X10K" RANGE PUSHBUTTON DEPRESSED. ATTENUATOR - ODB.

   USE TRIM POT. P1 TO ADJUST POINT "A" (ON MAIN BOARD) - OBSERVE A READING OF O$\pm$ 0.02 VOLT DC USING A 1:10 PROBE.

2. USE TRIM POT. P2 TO ADJUST THE MAIN 50 OHM OUTPUT - OBSERVE A READING OF 0 0.02 VOLT DC, (NOISES OF ABOUT 10-20 MV MAY APEAR- THEY SHOULD BE IGNORED).

3. REPEAT STEPS 1 AND 2 AFTER A 5 MINUTE WARM UP.

4. DEPRESS SQUAREWAVE AND "PULSE" PUSHBUTTON. "AMPLITUDE" POT. AT MAXIMUM CLOCKWISE, 20 KHZ FREQUENCY,"SYMMETRY" & "DC OFFSET" POT. AT MIDRANGE.

   CHECK FOR 50% DUTY CYCLE (CHANGED BY "SYMMETRY" CONTROL) DEPRESS AND RELEASE DC OFFSET PUSHBUTTON AND CHECK FOR UNCHANGED OUTPUT (DC OFFSET WILL CHANGE USING "OFFSET" POT).

   "OFFSET" AND "SYMMETRY" KNOBS SHOULD BE MECHANICALLY CENTERED WHEN 0 OFFSET AND 50% DUTY CYCLE ARE ADJUSTED.

   AFTER PROCEDURE IS COMPLETED RELEASE DC OFFSET KNOB.

5. ADJUST P12 FOR 20V P-P SQUAREWAVE, AND P14 FOR ZERO DC OFFSET.

6. USE TRIMMER CTI TO ADJUST BEST SQUAREWAVE SHAPE (IF EXIST)

7. DEPRESS TRIANGLEWAVE PUSHBUTTON AND USE P13 TO ADJUST TRIANGLE SYMMETRY AROUND ZERO. (IT SHOULD BE A 20V P-P TRIANGLE WAVE).

8. RELEASE "PULSE" PUSHBUTTON. USE P3 AND P4 TO ACHIEVE A 50% DUTY CYCLE AND TO ADAPT FREQUENCY RELATIONSHIP BETWEEN "PULSE" POSITION AND ORDINARY SQUAREWAVE POSITION.

   CONNECT A SCOPE TO THE MAIN 50 OHM OUTPUT (AND COUNTER TO MODELS WITHOUT BUILT-IN COUNTER)

9. DEPRESS SQUAREWAVE, "X10K" PUSHBUTTON AND ROTATE THE DIAL MAXIMUM CLOCKWISE. ADJUST P6 FOR 15 HZ AND P7 FOR A 50% DUTY CYCLE SQUAREWAVE.

   NOTE: P6 AND P7 HAVE AN INFLUENCE ON EACH OTHER.

10. LOOSEN ONE OF THE SCREWS ON THE DIAL AXE. DEPRESS "20K" RANGE PUSHBUTTON AND ROTATE THE DIAL COUNTER CLOCKWISE UNTILL THE COUNTER READS 5 KHZ ±100HZ. RELEASE THE SCREW AND FIX THE DIAL MECHANICALLY ON ".5" WITH ONE SCREW ON THE AXE.

11. ROTATE THE DIAL FOR "2.0" AND ADJUST P5 FOR 20 KHZ ± 100HZ.

12. POTATE THE DIAL TO ".5" AND CHECK FOR 5 KHZ ±400HZ. IF NOT GOOD LOOSEN THE SCREW AND REPEAT STEPS 10-12 UNTIL YOU SUCCEED TO ACHIEVE BOTH STEPS.

13. CHECK FOR 15 KHZ, 10 KHZ, 2 KHZ READING ON THE COUNTER.

14. DEPRESS SQUAREWAVE ("⌇⌇") PUSHBUTTON AND PUT THE DIAL AT "2.0" CHECK THE FREQUENCY AT ALL RANGES FROM 2 HZ UNTIL 200 KHZ. THE FREQUENCY SHOULD BE WITHIN ± 2% OF FULL SCALE.

15. DEPRESS THE 7MHZ RANGE AND ADJUST CT2 FOR 7MHZ. FOR MODELS WITH 13MHZ OR 20MHZ OPTIONS DEPRESS "H.F" PUSHBUTTON AND OBSERVE 13MHZ OR 20MHZ ON THE COUNTER.

16. DEPRESS "20KNZ" RANGE AND TRIANGLE PUSHBUTTONS AND CHEK FOR A SYMMETRICAL TRIANGLEWAVE AROUND ZERO.ADJUST IF NECESSARY WITH P13.

17. DEPRESS SINE " " PUSHBUTTON AND SET FREQUENCY TO 20 KHZ. ADJUST WITH P11 (FOR 20 V-PP), P10 (SYMMETRY AROUND ZERO LINE) P8 AND P9 TO ACHIEVE A SINEWAVE WITH MINIMUM DISTORTION.

18. CHECK TO SEE THAT "TTL PULSE" AND EXTERNAL SWEEP EXIST.

29. CHECK THE ATTENUATORS -20 DB, -40 DB, -60 DB.

    NOTE: FOR -60 DB BOTH "-20 DB" AND "-40 DB" PUSHBUTTON SHOULD BE DEPRESSED. ACCURACY ABOUT 5%.

21. CHECK THE OPERATION OF THE OUTPUT PROTECTION CIRCUITS. PUT "AMPLITUDE" POT. AT ITS MINIMUM POSITION. ± 12 V DC APPLIED TO THE MAIN OUTPUT SHOULD OPERATE THE PROTECTION CIRCUITS, IN ODB AND -20 DB. IN OTHER ATTENUATOR POSITIONS THE RESISTORS ARE BIG ENOUGH TO PROTECT THE OUTPUT AMPLIFIERS.

TIMING PC BOARD 300 T
(ALL MODELS WITHOUT TRIG. GATE)

NOTE: THIS BOARD IS FACTORY CALIBRATED IN ALL RANGES, AND NO CALIBRATION SHOULD BE MADE EXCLUDING TRIMMERS ON 2MHZ RANGE.

BEFORE CHANGING ANY OF THE CAPACITORS IN THE 300T BOAD, GO OVER THE CALIBRATION PROCEDURE. ONLY IF YOU COULD NOT ACHIEVE A ± 2% ON "2.0" DIAL SETTING FROM 2HZ TO 200 KHZ AND ± 5% ON 2MHZ, THEN MAKE THE CALIBRATION.

ROTATE THE DIAL TO "2.0". CHECK FOR ALL THE RANGES (EXEPT 2MHZ RANGE) AND LOOK FOR THE MINIMUM READING. BRING ALL THE RANGES TO THOSE THAT AFFECT THE RANGE (SEE DRAWING). YOU SHOULD BRING ALL THE RANGES WITHIN 2% OF FULL SCALE.

IN THE 2MHZ RANGE, THE CAPACITOR CHOSEN SHOULD ALLOW A FREQUENCY CHANGE (USING PC BOARD TRIM CAPACITORS) OF 1.9MHZ TO 2.0MHZ.

FREQUENCY COUNTER PC BOARD 300C, DISPLAY PC BOARD 300 DP.

1. CONNECT THE MAIN OUTPUT TO THE "EXT FREQUENCY" BNC INPUT. PUT A 10 KHZ SIGNAL. MOVE COUNTER'S FUNCTION SELECTOR SLIDE SWITCH TO "EXT". POSITION.

   MOVE THE COUNTER'S RANGE SELECTOR SLIDE SWITCH A FEW TIMES FROM "5 HZ - 1 MHZ" TO "1-100 MHZ" POSITION. CHECK IF THE DECIMAL POINT MOVES. LEAVE THE SWITCH IN THE "5 HZ - 1 MHZ" POSITION.

2. APPLY A 150 MV P-P ADJUST WITH P1 (ON PC 300C) FOR A CORRECT READING IN THE COUNTER. (10KHZ)

3. MOVE THE FAST/SLOW SWICH TO ITS MIDDLE POSITION (IN MODELS WITH 5 DIGITS COUNTER),IN THIS POSITION THE COUNTER COUNTS THE RANGE OF 100KHZ TO 1MHZ.

4. APPLY A 0.5MHZ SIGNAL (DEPRESS 2MHZ RANGE) AND CHECK FOR A CORRECT COUNTER READING. ADJUST P1 IF NECESSARY.

5. APPLY AN EXTERNAL 80 MHZ SIGNAL TO THE "EXT. FREQUENCY" BNC. CHECK FOR COUNTER READING IN "1-100 MHZ" POSITION. (SENSITIVITY DECREASES IN HIGHER FREQUENCY).

6. ADJUST THE CRYSTAL'S CIRCUIT. CONNECT AN EXTERNAL CALIBRATED COUNTER WITH A 1:10 PROBE TO "TP1" POINT (NEAR THE CRYSTAL), ADJUST WITH CT1 TO ACHIEVE A 10 MHZ ± 2 HZ. WAIT FOR 5 MINUTES AND READJUST IF NECESSARY.

** SLIDE SWICH POSITION FOR EXT. FREQ. COUNTER.(IN 5 DIGITS COUNTER)

5HZ - 1MHZ	POSITION ---	RANGE UP TO 99999HZ
MIDDLE	POSITION ---	RANGE 100KHZ - 999.99KHZ
1 - 100MHZ	POSITION ---	RANGE 1MHZ - 99.999MHZ

AM-FM-SWEEP ADJUSTMENTS (MODELS 300MSP,300MSPC,300MSTPC)

1. SET GENERATOR'S FREQUENCY TO 150KHZ AMPLITUDE MAXIMUM CLOCKWISE AND "MOD LEVEL" CONTROL TO MINIMUM.

2. DEPRESS SINE PUSHBUTTON AND MODULATION PUSHBUTTON, MODULATION LED LAMP SHOULD LIGHT. SET AM MODULATION.

3. USE P4 TO ADJUST 20VPP AT THE MAIN OUTPUT.

4. SET "AMPLITUDE" CONTROL TO 10VPP AND "MOD LEVEL" TO MAXIMUM CLOCKWISE.

5. SET OSCILLOSCOPE TIME BASE TO 1MSEC/CM.

6. USE P6 TO BRING THE MODULATION AUDIO CIRCUIT TO ITS EXITATION POINT, THEM ADD 10 DEGREE MORE (NOT TO REMAIN IN A CRITICAL AREA).

7. USE P5 TO ADJUST 100% AM MODULATION DEPTH.

8. USE P7 TO ACHIEVE MINIMUM MODULATION DISTORTION.

9. DEPRESS FM PUSHBUTTON, USE "MOD LEVEL" CONTROL TO VARY FM DEVIATION AND CONFIRM FM MODULATION EXISTANCE.(TIME BASE 2US/CM)

10. RELEASE THE FM PUSHBUTTON AND CONNECT "AF-OUT" BNC TO AN OSCILLOSCOPE, A 400 HZ AUDIO SHOULD APPEAR ON THE SCREEN.

11. DEPRESS SWEEP "STOP" PUSHBUTTON, TURN WIDTH & RATE SWEEP CONTROLS FULLY CLOCKWISE, SWEEP LED LAMP SHOULD LIGHT.

12. CONNECT THE OSCILLOSCOPE TO THE SWEEP OUTPUT (" ¦" OUT) BNC AND USE P3 TO ADJUST A 3.5 VOLT DC.

13. DEPRESS "RUN" AND USE P1/P2 TO ACHIEVE A SAWTOOTH WAVEFORM OF "0" TO 3.5 VOLTS.

14. CONNECT THE MAIN OUTPUT BACK TO THE OSCILLOSCOPE AND ADJUST RATE AND WIDTH CONTROL SO AS TO BE ABLE TO VARIETY THE PRESENCE OF A VARIABLE SWEEP AT THE MAIN OUTPUT.

15. DEPRESS "EXT". SWEEP SHOULD STOP RUNNING

16. DEPRESS "HF". THE OUTPUT FREQUENCY SHOULD BE ABOUT TWICE THE FREQUENCY INDICATED BY THE DIAL WITH A 10% ACCURACY.

17. RELEASE "EXT" PUSHBUTTON (RELEASE "HF" PUSHBUTTON AND DEPRESS "OFF".

P.C BOARD 200 TG - TIMING PLUS TRIG/GATE

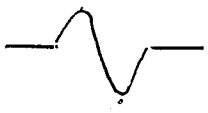
(MODEL 300 MSTPC)

NOTE: * THIS PC BOARD EXISTS IN MODEL 300 MSTPC BUT NO ADJUSTMENTS ARE NRCRSSARY THERE.

* ORDINARY TIMING ADJUSTMENT ARE DONE SIMILIARLY TO ALL OTHER MODELS.

1. SET THE GENERATOR TO 10 KHZ/20VPP SINE AND CONNECT TO AN OSCILLOSCOPE SET TO 50 MS/DIV.
2. APPLY A 1 KHZ/5VPP AUXILIARY SINE TO THE GENERATORS TRIG/GATE INPUT.
3. USE P1 ON 200 TG PC BOARD TO ADJUST PHASE TO 0^{0}.

GOOD



NOT GOOD

SERIES 300 OPTIONS:

NO OPTION -- : 7MHZ

OPTION-01 : 13MHZ SINE WAVE.
PUSH BUTTON 20MHZ-OP.02 IN USED.
WILL BRING THE FREQUENCY TO 13MHZ.

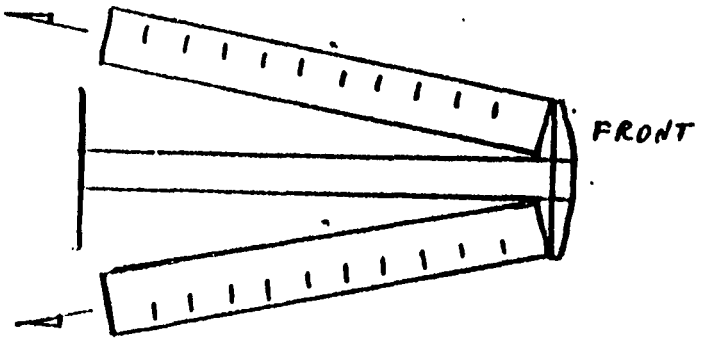
OPTION-02 : 20MHZ SINE WAVE.
PUSH BUTTON 20MHZ-OP.02 IN USED.
WILL BRING THE FREQUENCY TO 20MHZ.

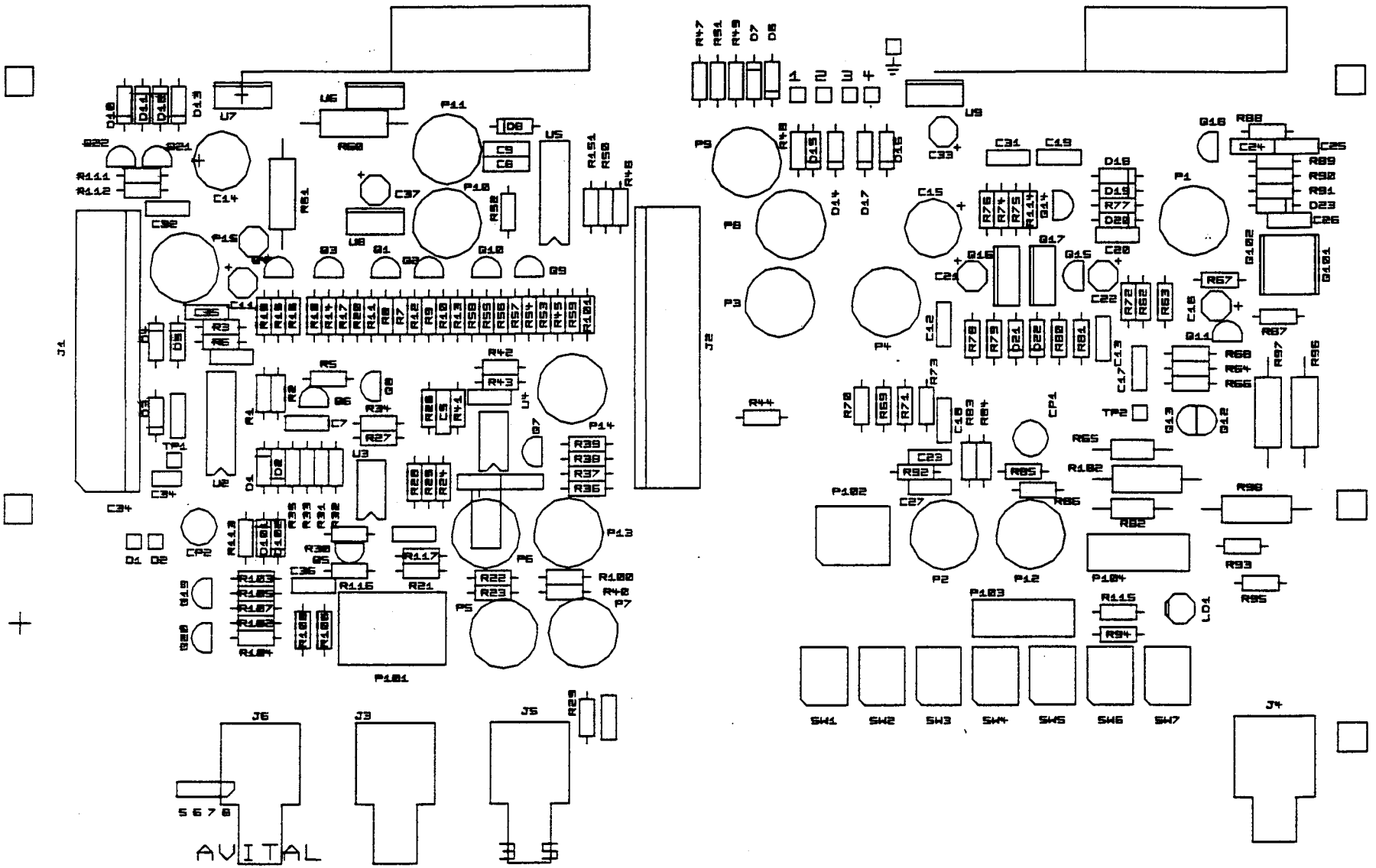
NOTE: THE HIGH FREQUENCY SINEWAVE IS AN AUXILIARY OUTPUT AND IT IS RECOMMENDED TO OPERATE THE AM MODE TO ACHIEVE WAVE AROUND THE ZERO. THE AM POT. MUST BE AT MINIMUM TO AVOIDE MODULATION IF NOT NECESSARY.

BOX DISASSEMBLING FOR MAINTENANCE PURPOSES

A) REMOVE THE REAR BEZEL BY PUSHING ONE SIDE WITH YOUR THUMB TO THE OUT OF THE BOX WHILE THE OTHER HAND REMOVES THE BEZEL FROM THE REAR PANEL.
B) REMOVE THE EARTHING SCREWS OF THE COVERS.
C) LIFT THE REAR PART OF THE TOP AND BOTTOM COVERS.
D) PULL COVERS REARWARDS.

Pull covers rearwards




AVITAL
SILK SCREEN

PARTS LIST: PC 200P - MAIN PC BOARD

REF. DESIGN	VALUE	DESCRIPTION	NEWTRONICS PART No.
R1	220 OHM	R: ¼W, 5%	200-01221
R2	510 OHM	R: ¼W, 5%	200-01511
R3	510 OHM	R: ¼W, 5%	200-01511
R4	36 OHM	R: ¼W, 5%	200-01360
R5	390OHM	R: ¼W, 5%	200-01391
R6	1 KOHM	R: ¼W, 5%	200-01102
R7	5.1KOHM	R: ¼W, 5%	200-01512
R8,R9	680OHM	R: ¼W, 5%	200-01681
R10	5.1KOHM	R: ¼W, 5%	200-01512
R11,R12	10 OHM	R: ¼W, 5%	200-01100
R13	100OHM	R: ¼W, 5%	200-01101
R14,R15	680OHM	R: ¼W, 5%	200-01681
R16,R17	5.1KOHM	R: ¼W, 5%	200-01512
R18,R19	10 OHM	R: ¼W, 5%	200-01100
R20	100OHM	R: ¼W, 5%	200-01101
R21	3.9OHM	R: ¼W, 5%	200-01390
R22	47 KOHM	R: ¼W, 5%	200-01473
R23	12 KOHM	R: ¼W, 5%	200-01123
R24,R26	130KOHM	R: ¼W, 5%	200-01134
R25	200KOHM	R: ¼W, 5%	200-01204
R27	10 KOHM	R: ¼W, 5%	200-01103
R28	5.1KOHM	R: ¼W, 5%	200-01512
R29	1 KOHM	R: ¼W, 5%	200-01102
R30	39 KOHM	R: ¼W, 5%	200-01393
R31	10 KOHM	R: ¼W, 5%	200-01103
R110	820 OHM	R: ¼W, 5%	200-01821

REF. DESIGN	VALUE	DESCRIPTION	NEWTRONICS PART No.
R32	5.1KOHM	R: ¼W, 5%	200-01512
R33	10 KOHM	R: ¼W, 5%	200-01103
R34	39 KOHM	R: ¼W, 5%	200-01393
R35	10 KOHM	R: ¼W, 5%	200-01103
R36	22 KOHM	R: ¼W, 5%	200-01223
R37	5.1KOHM	R: ¼W, 5%	200-01512
R38	270 OHM	R: ¼W, 5%	200-01271
R39	1 KOHM	R: ¼W, 5%	200-01102
R40	470 OHM	R: ¼W, 5%	200-01471
R41	5.1KOHM	R: ¼W, 5%	200-01512
R42	22 KOHM	R: ¼W, 5%	200-01223
R43	270 OHM	R: ¼W, 5%	200-01270
R44	1 KOHM	R: ¼W, 5%	200-01102
R45	3.9KOHM	R: ¼W, 5%	200-01392
R47, R46	1 KOHM	R: ¼W, 5%	200-01102
R48	1 KOHM	R: ¼W, 5%	200-01102
R49	10 KOHM	R: ¼W, 5%	200-01103
R50	220 OHM	R: ¼W, 5%	200-01221
R51	33 KOHM	R: ¼W, 5%	200-01333
R51a	24 KOHM	R: ¼W, 5%	200-01243
R52	1 KOHM	R: ¼W, 5%	200-01102
R53	5.1 KOHM	R: ¼W, 5%	200-01512
R54, R55, R104, R105	680 OHM	R: ¼W, 5%	200-01681
R56	5.1 KOHM	R: ¼W, 5%	200-01512
R57, R58	10 OHM	R: ¼W, 5%	200-01100
R59	100 OHM	R: ¼W, 5%	200-01101
R60	39 OHM	R: 2W, 5%	200-03068
R61	68 OHM	R: 1 W, 5%	200-03082
R62	2.2KOHM	R: ¼W, 5%	200-01222
R63	47 KOHM	R: ¼W, 5%	200-01473

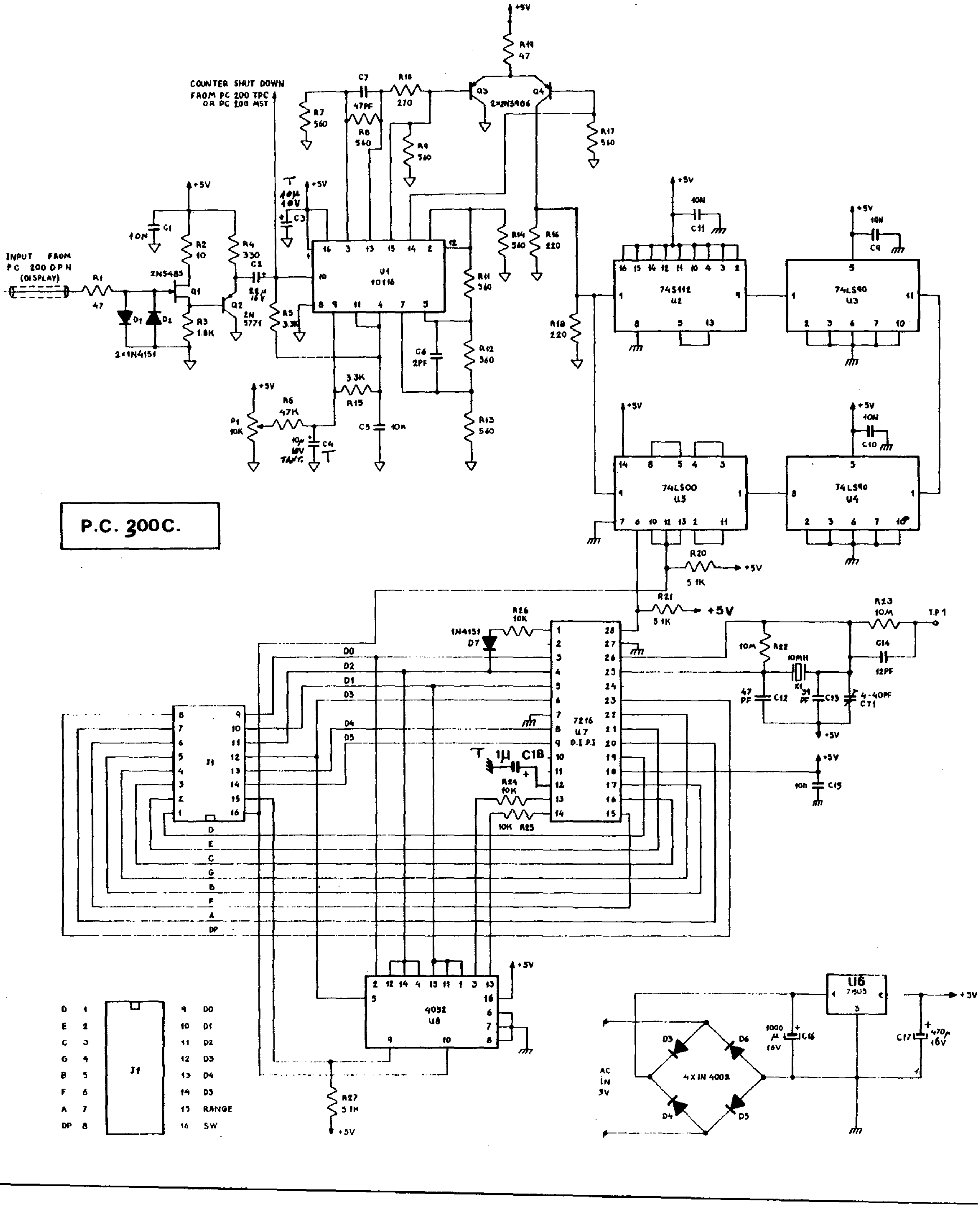
REF. DESIGN	VALUE	DESCRIPTION	NEWTRONICS PART No.
R64	220 OHM	R: ¼W, 5%	200-01221
R65	560 OHM	R: ½W, 5%	200-02561
R66	470 OHM	R: ¼W, 5%	200-01471
R67	6.2 KOHM	R: ¼W, 5%	200-01622
R68	470 OHM	R: ¼W, 5%	200-01471
R69	1 MOHM	R: ¼W, 5%	200-01105
R70	2000KOHM	R: ¼W, 5%	200-01204
R71	33 KOHM	R: ¼W, 5%	200-01333
R72	100 OHM	R: ¼W, 5%	200-01101
R73	3.3 KOHM	R: ¼W, 5%	200-01332
R74	5.1 KOHM	R: ¼W, 5%	200-01512
R75	24 KOHM	R: ¼W, 5%	200-01243
R76	390 OHM	R: ¼W, 5%	200-01391
R77	36 OHM	R: ¼W, 5%	200-01360
R78, R81	1.5 OHM	R:¼W, 5%	200-01015
R79, R80	10 OHM	R:¼W, 5%	200-01100
R82A	270 OHM	R:½W, 5%	200-02271
R82B	56 OHM	R:2W, 5%	200-03560
R83 , R109	2.2 KOHM	R:¼W, 5%	200-01222
R84	3 3 KOHM	R:¼W, 5%	200-01333
R85	3.3 KOHM	R:¼W, 5%	200-01332
R86	100 OHM	R:¼W, 5%	200-01101
R87	3.6 OHM	R:¼W, 5%	200-01360
R88...R91	470 OHM	R:¼W, 5%	200-01471
R92	36 OHM	R:¼W, 5%	200-01360
R93,R106,R107	10 OHM	R:¼W, 5%	200-01100
R94	470 OHM	R:¼W, 5%	200-01471
R95,R100,R101 R102,R103	5.1KOHM	R:¼W, 5%	200-01512
R 108	100 OHM	R:¼W, 5%	200-01101

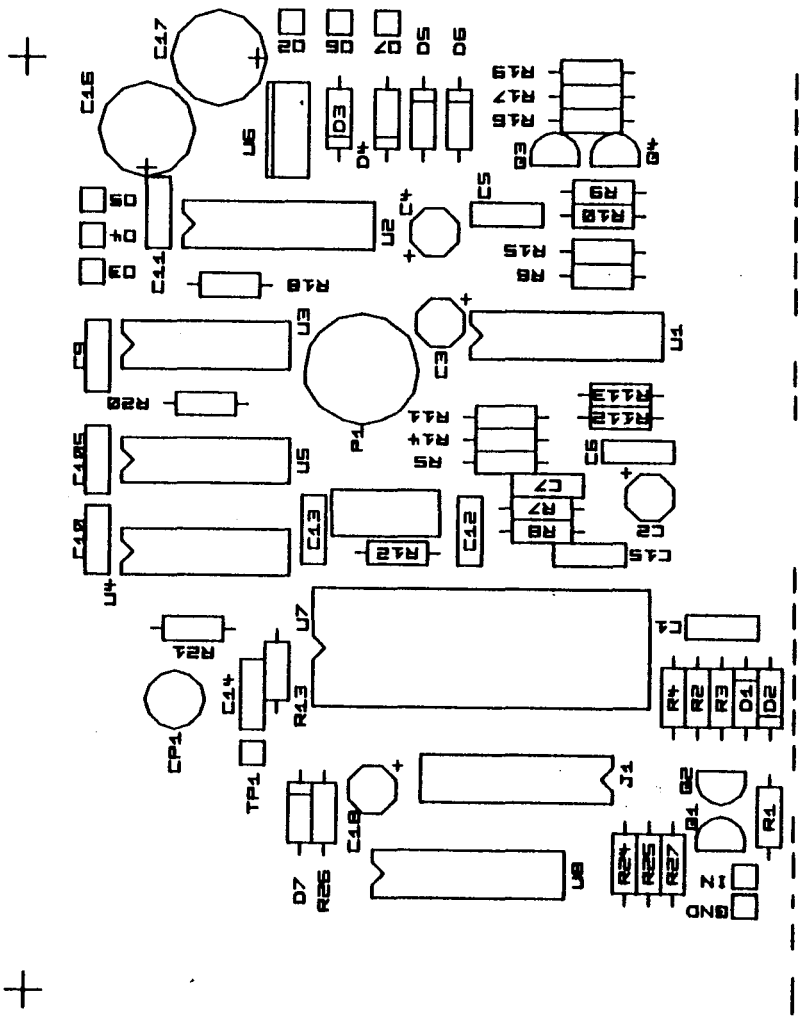
REF. DESIGN	VALUE	DESCRIPTION	NEWTRONICS Part N
R97, R96	100 OHM	R: 2W 5%	200-03101
R98	56 OHM	R: 2W, 5%	200-03560
R99	24 KOHM	R: ¼W, 5%	200-03243
C1	8.2pF	C:CERAMIC 100V	200-06082
C33	39 pF	C:CERAMIC 100V	200-06390
C5	10 pF	C:DISC	200-06100
C2, C3, C4	0.01 μF	C:POLYESTER, 100V	200-06103
C6, C7	22 pF	C:DISC	200-06220
C8, C9, C12	0.01μF	C:POLYESTER, 110V	200-06103
C10, C11	100μF	C:ELECT, 16V	200-05107
CT1, CT2	4-40 pF	TRIMER	200-41040
C14,C15	1000μF	C:ELECT, 25 V	200-05108
C16	1 μF	C : ELECT, 25 V	200-05105
C17	0.01μF	C: POLYESTER, 100V	200-06103
C18	22 pF	C:DISC	200-06220
C19, C20	0.01μF	C:POLYESTER, 100V	200-06103
C21, C22, C32	10 μF	C:ELECT., 25V	200-05106
C23	0.01μF	C:POLYESTER, 100V	200-06103
C24, C25	100 pF	C:DISC	200-06101
C26	0.01μF	C : POLYESTER, 100V	200-06103
C27	2200pF	C : POLYESTER, 100V	200-06222
C28, C29, C31	0.01μF	C : POLYESTER, 100V	200-06103
C 30	270pF	C: CERAMIC, 100 V	200-06271
C 34	12 pF	C: CERAMICS, 100V	200-06120
D1, D1A		DIODE: 1N4151	200-18151
D2, D2A		DIODE: 1N4151	200-18151
D3, D4, D5, D6, D7, D8		DIODE: 1N4151	200-18151

IN4151=IN4148

REF. DESIGN	VALUE	DESCRIPTION	NEWTRONICS Part No.
LED 1		LED DL-11 LAR	200-46102
D10...D17		DIODE:REC, 1N4002	200-18002
D18...D23		DIODE:SI, 1N4151	200-18151
Q1, Q3, Q5		TSTR: BC 237	200- 25237
Q8, Q9, Q15, Q20		TSTR:BC 237	200- 25237
Q2, Q4, Q6		TSTR: BC 307	200- 25307
Q7, Q10, Q11 , Q18, Q19		TSTR: BC 307	200- 25307
Q12, Q13,		TSTR: 2N 3906	200- 25906
Q14		TSTR: 2N2905	200- 25905
Q16		TSTR: MPSUO5	200-25005
Q21		TSTR: 2N5459	200-25459
Q17		TSTR: MPSU55	200-25055
U2		IC: MA760 HC	200- 35760
U3, U4		IC: MA1458	200- 35458
U5		IC: MC1445L	200- 35445
P1, P2	200KOHM	TRIM:	200-13204
P3, P4, P9	1 KOHM	TRIM:	200-13102
P5. P8. P11	4.7KOHM	TRIM:	200-13472
P6	2.2KOHM	TRIM:	200-13222
P7, P10, P12	470 OHM	TRIM:	200-13471
P13, P14	100 KOHM	TRIM:	200-13104
POT. 1	10 KOHM	POT:DIAL, TYPE A	200-85101
POT. 2	3x2. 5 KOHM	POT:SYM. MODULATION, TYPE A	200-85102
POT. 3	10 KOHM	POT:DC OFFSET, TYPE A	200-85103
POT. 4	1 KOHM	POT. AMPLITUDE TYPE B	200-85104

REF. DESIGN	VALUE	DESCRIPTION	NEWTRONICS PART No.
SYM,PULSE	4C/O	PUSH-BUTTONS	200-82104
TRIANGLE	2C/O	-"-	200-82102
SQUARE	2C/O	-"-	200-82102
SINE	2C/O	-"-	200-82102
DC	2C/O	-"-	200-82102
-20$_{\mu}$dB	2C/O	-"-	200-82102
-40dB	2C/O	-"-	200-82102
ON-OFF	2C/O	-"-	200-82103
JM1		12PIN MOLEX CONNECTOR	200-51120
JM2		12PIN MOLEX CONNECTOR	200-51120
SCR1		SCR: 106B	200-25106
SCR2		SCR: 106B	200-25106
REG1		REGULATOR MA7815	200-35315
REG2		REGULATOR MA7815	200-35815
REG3		REGULATOR MA7806	200-35806
REG4		REGULATOR MA7906	200-35906


P.C. 200C.
INPUT FROM P.C. 200 DPN (DISPLAY)
COUNTER SHUT DOWN FROM PC 200 TPC OR PC 200 MST
2N5485
2N 5771
2×1N4151
2×2N3906
10116
U1
74S112
U2
74LS90
U3
74LS00
U5
74LS90
U4
7216
U7
D.I.P.I
4052
U8
J1
U6
7805
4×IN 4002
AC IN 5V
TP1
D 1
E 2
C 3
G 4
B 5
F 6
A 7
DP 8
9 D0
10 D1
11 D2
12 D3
13 D4
14 D5
15 RANGE
16 SW


C17
C16
D8
D9
D7
D5
D6
R19
R17
R15
Q3
Q4
U6
D3
D4
C11
D5
D4
D3
U2
C4
C5
R9
R10
R6
R15
R18
U3
C9
R20
P1
C3
U1
R14
R13
R12
R5
R4
R11
C6
C2
C105
C7
R7
R8
C45
U5
C10
U4
C13
R12
C12
R24
U7
C4
R4
R2
R3
D1
D2
C14
R13
CP1
TP1
J1
Q2
Q1
R1
C18
D7
R26
U8
R24
R25
R27
IN
GND

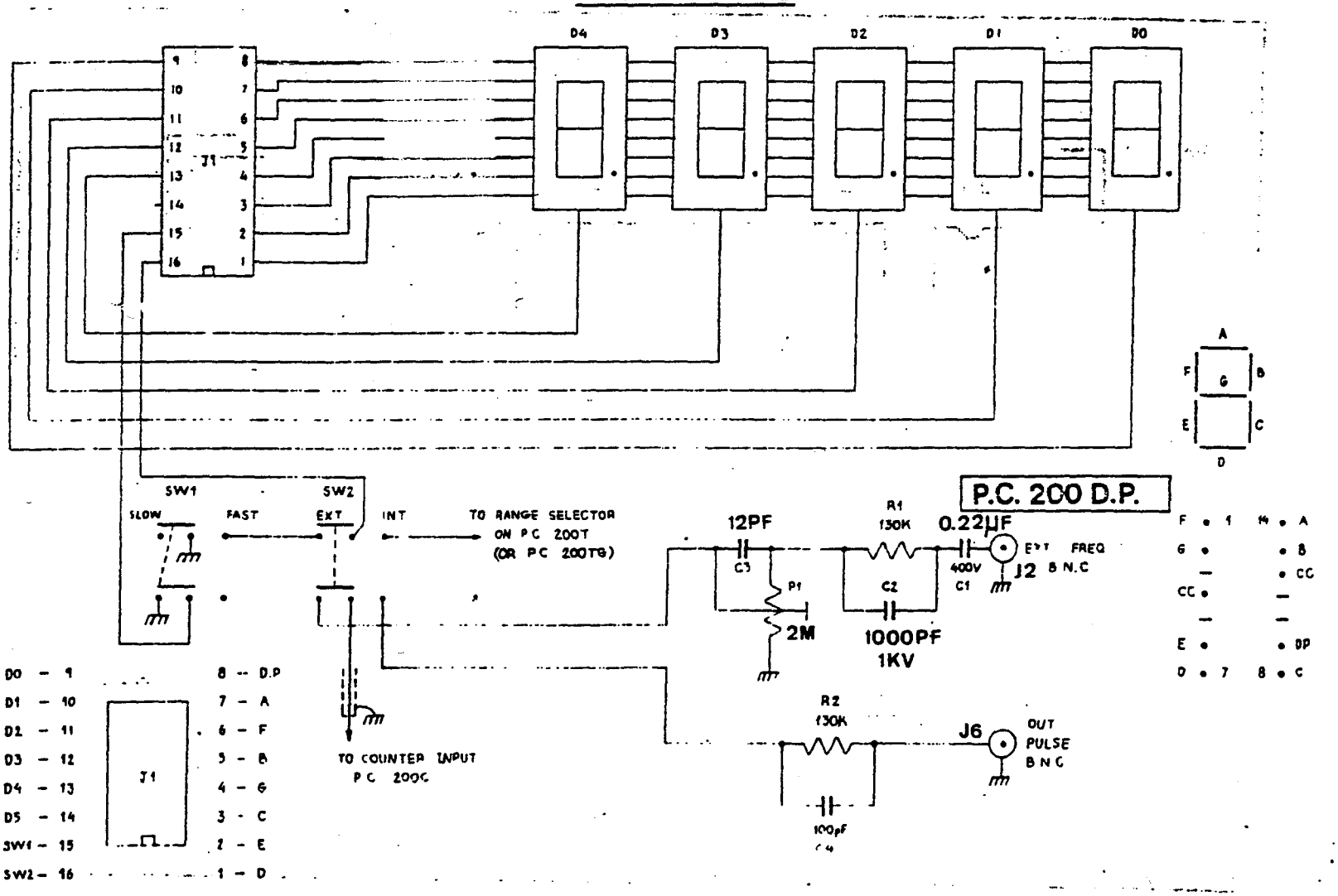
PARTS LIST PC 200CN - FREQ. COUNTER PC BOARD.

REF. DESIGN	VALUE	DESCRIPTION	NEWTRONICS PART NO.
R1, R19	47 OHM	R: ¼W, 5%	202 - 01470
R2	10 OHM	R: ¼W, 5%	202 - 01100
R3	1.8 KOHM	R: ¼W, 5%	202 - 01182
R4	330 OHM	R: ¼W, 5%	202 - 01331
R5, R15	3.3 KOHM	R: ¼W, 5%	202 - 01332
R6	47 KOHM	R: ¼W, 5%	202 - 01473
R7,R8,R9,R11,) R12,R13,R14,) R17.)	560 OHM	R: ¼W, 5%	202 - 01561
R10	270 OHM	R: ¼W, 5%	202 - 01271
R16, R18	220 OHM	R: ¼W, 5%	202 - 01221
R20, R21, R27	5.1 KOHM	R: ¼W, 5%	202 - 01512
R22, R23	10 MOHM	R: ¼W, 5%	202 - 01106
R24, R25, R26	10 KOHM	R: ¼W, 5%	202 - 01103

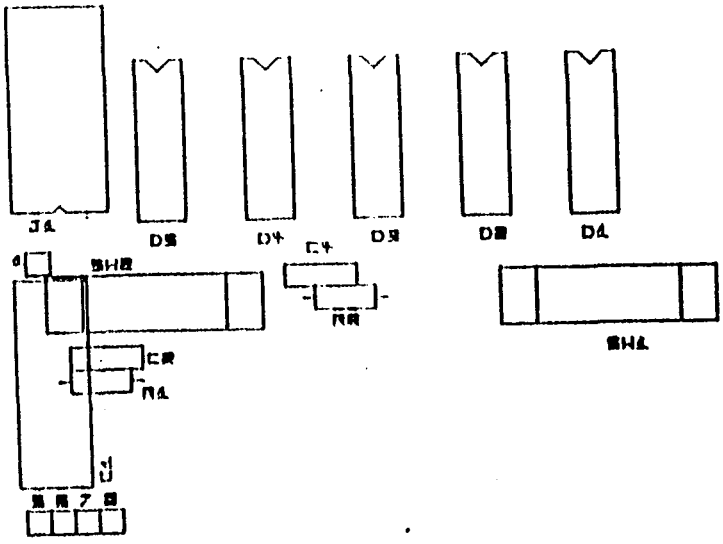
REF. DESIGN	VALUE	DESCRIPTION	NEWTRONICS PART NO.
P1	10 KOHM	TRIMPOT	202 - 13103
CT1	4-40pF	C: TRIMER	202 - 14040
C1,C3,C5,C9,) C10,C11,C15.)	10nF	C: POLYESTER 100V	202 - 06103
C2	22mF	C: ELECT.16V	202 - 05108
C4	10mF	C: TANTALUM 10V	202 - 05109
C6	2pF	C: DISC	202 - 06200
C7, C12	47pF	C: DISC	202 - 06470
C13,	39pF	C: DISC	202 - 06390
C14,	12pF	C: DISC	202 - 06120
C16,	1000mF	C: ELECT.16V	202 - 05108
C17,	470mF	C: ELECT.10V	202 - 05477
D1, D2, D7	IN4151	DIODE	202 - 18151
D3, D4, D5, D6	IN4002	DIODE	202 - 18002
Q1	2N5485	FET	202 - 2585
Q2	2N5771	TSTR	202 - 2571
Q3	2N3906	TSTR	202 - 2506
Q5	2N3904	TSTR	202 - 2504

REF. DESIGN	VALUE	DESCRIPTION	NEWTRONICS PART NO.
U1	10116	I.C.	202 - 35116
U2	74S112	I.C.	202 - 35112
U3, U4.	74LS90	I.C.	202 - 35090
U5	74LS00	I.C.	202 - 35000
U6	7805	REG	202 - 35005
U7	7216DIPI	I.C.	202 - 35216
U8	4052	I.C.	202 - 35052
X1	10MHZ	CRYSTAL	202 - 81106

DISPLAY BOARD



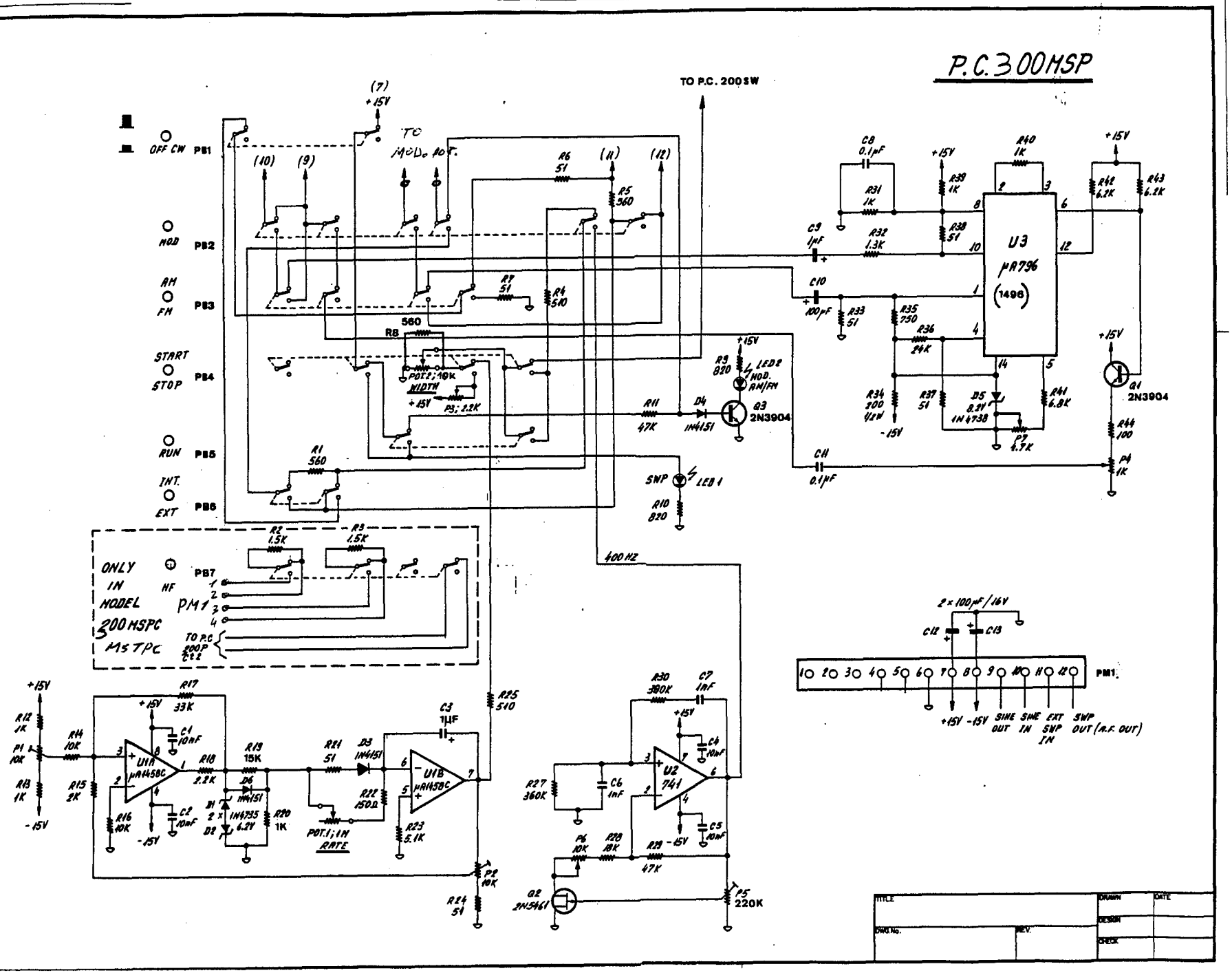
+ SILK SCREEN +



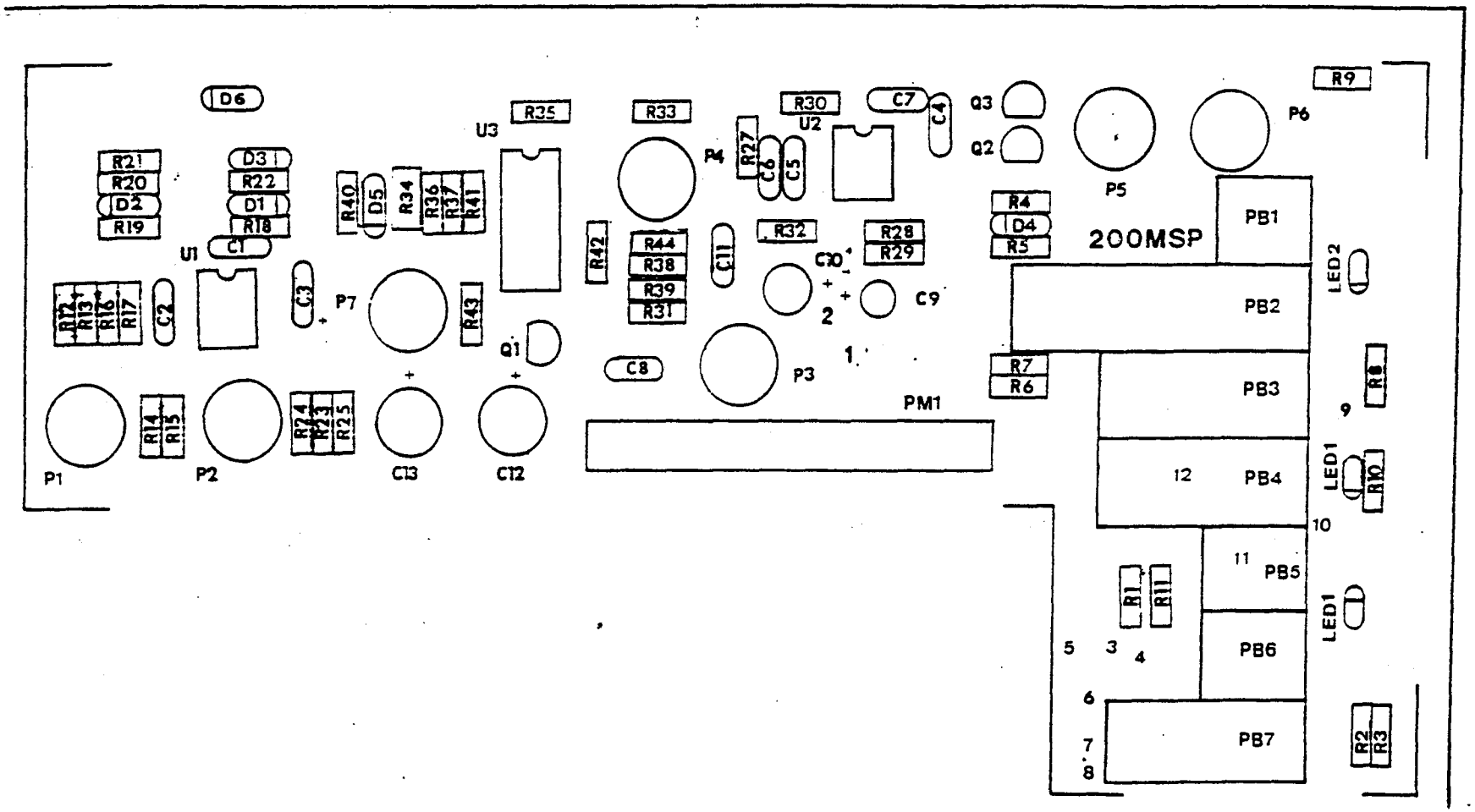
PARTS LIST PC 200DPN

REF. DESIGN	VALUE	DESCRIPTION	NEWTRONICS PART NO.
R1, R2	130 KOHM	R: ½W 5%	203 - 01134
C1	0.01mF	C: POLYESTER 400V	203 - 06101
C2	1nF	C: CERAMIC 1KV	203 - 08102
C3	10 pF	C: CERAMIC 100V	203 - 08100
C4	100pF	C: CERAMIC 100V	203 - 8101
P1	1 MOHM	TRIMPOT	203 - 13105
Do...D5	LED: 7 SIG-MENT	LR1364E	203 - 45100
SW1, SW2	2 c/o	SLIDE SWITCH	203 - 82201

P.C.300MSP



TITLE		DRAWN	DATE
		DESIGN	
DWG No.	REV.	CHECK	

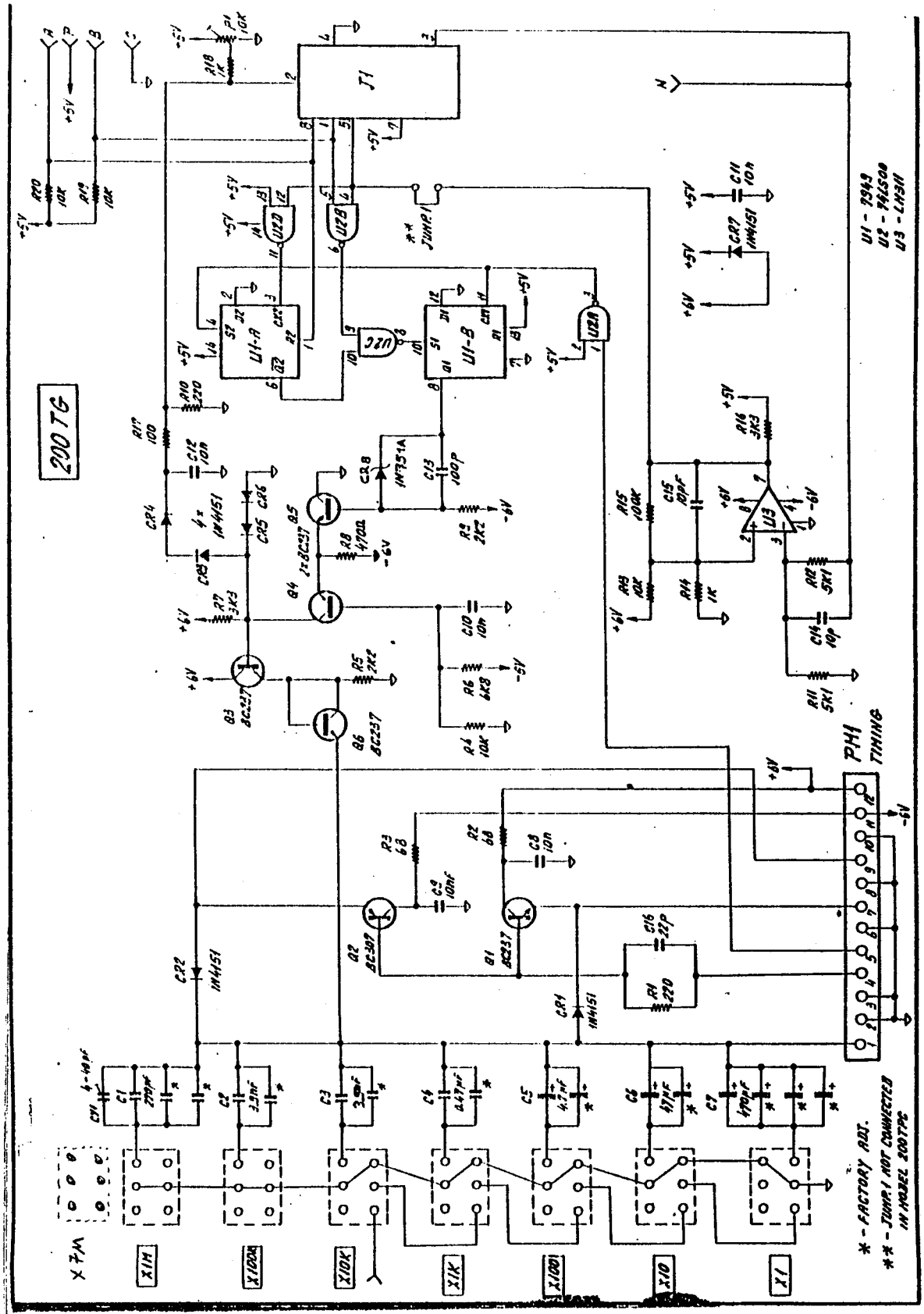

D6
R21
R20
D2
R19
D3
R22
D1
R18
C1
U1
R12
R13
R16
R17
C2
C3
P7
R40
D5
R34
R36
R37
R41
R43
U3
R35
Q1
R42
R33
P4
R44
R38
R39
R31
C11
R27
C6
C5
R30
U2
C7
C4
Q3
Q2
R32
R28
R29
C10
C9
C8
P3
PM1
P5
P6
R9
R4
D4
R5
200MSP
PB1
LED2
PB2
R7
R6
PB3
R8
9
12
PB4
LED1
R10
10
11
PB5
R1
R11
LED1
5
3
4
PB6
6
7
8
PB7
R2
R3
P1
P2
R14
R15
R24
R23
R25
C13
C12

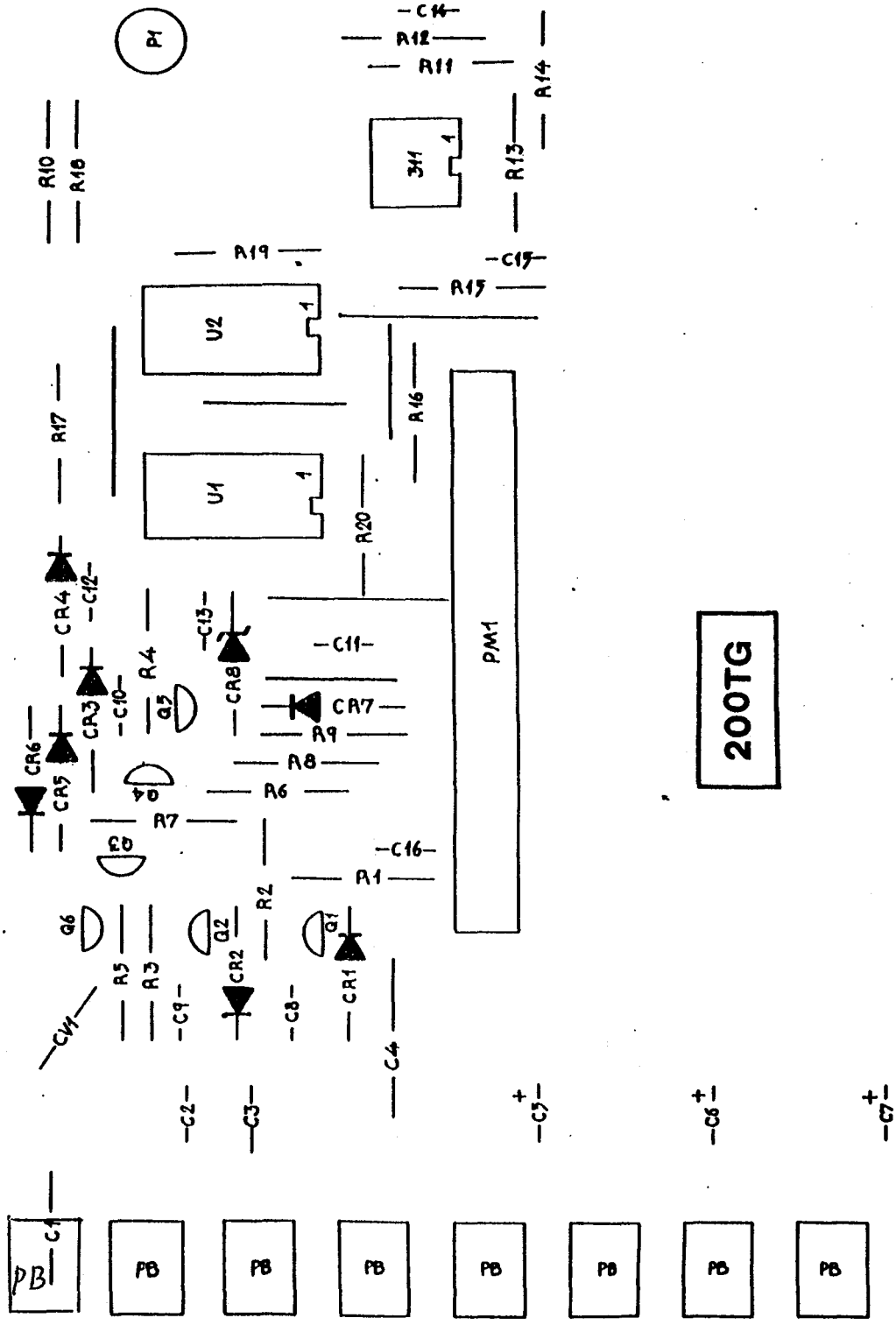
PARTS LIST 200 MSP.

REF. DESIGN	VALUE	DESCRIPTION	NEWTRONICS PART NO.
R21,R24,R6,R7 R33,R38,R37	51 OHM	R:5%, ¼W	209-01510
R44	100 OHM	R:5%, ¼W	209-01101
R22	150 OHM	R:5%, ¼W	209-01151
R25, R4	510 OHM	R:5%, ¼W	209-01511
R8,R5,R1	560 OHM	R:5%, ¼W	209-01561
R35	750 OHM	R:5%, ¼W	209-01751
R9,R10	820 OHM	R:5%, ¼W	209-01821
R40,R31,R39, R12,R13	1 KOHM	R:5%, ½W	209-01102
R32	1.3 KOHM	R:5%, ¼W	209-01132
R2, R3	1.5 KOHM	R:5%, ¼W	209-01152
R15	2 KOHM	R:5%, ¼W	209-01202
R18, R20	2.2 KOHM	R:5%, ¼W	209-01222
R23	5.1 KOHM	R:5%, ¼W	209-01512
R42, R43	6.2 KOHM	R:5%, ¼W	209-01622
R41	6.8 KOHM	R:5%, ¼W	209-01682
R14, R16	10 KOHM	R:5%, ¼W	209-01103
R28	18 KOHM	R:5%, ¼W	209-01183
R36	24 KOHM	R:5%, ¼W	209-01243
R17	33 KOHM	R:5%, ¼W	209-01333
R19	39 KOHM	R:5%, ¼W	209-01393
R11, R29	47 KOHM	R:5%, ¼W	209-01473
R27, R30	360 KOHM	R:5%, ¼W	209-01364
R34	200 OHM	R:5%, ½W	209-02201

REF. DESIGN	VALUE	DESCRIPTION	NEWTRONICS PART NO
P4	1KOHM	TRIMPOT	209-13102
P3	2.2KOHM	TRIMPOT	209-13222
P7	4.7KOHM	TRIMPOT	209-13472
P1, P2, P6	10KOHM	TRIMPOT	209-13103
P5	220KOHM	TRIMPOT	209-13224
POT.1	1MOHM	POT.	209-85105
POT.2	5KOHM	POT.	209-85502
Q1, Q3,		TSTR BN237	209-25237
Q2		TSTR 2N5461	209-25461
U1		INT. CIRCUIT MA1458C	209-35458
U2		INT. CIRCUIT 741	209-35741
U3		INT. CIRCUIT 796	209-35796
C6, C7	1nF	POLYESTER	209-06102
C1,C2,C5,C4	10nF	POLYESTER	209-06103
C8,C11	100nF	POLYESTER	209-06104
C3	470nF	POLYESTER	209-06474
C9	1µF	ELECTROLIT	209-05105
C10,C12,C13	100µF	ELECTROLIT	209-05107

REF. DESIGN	VALUE	DESCRIPTION	NEWTRONICS PART N(
D1, D2	1N4735	ZEN: DIODE	209-16735
D3,D4,D6	1N 4151	SI : DIODE	209-18151
D5	1N 4738	ZEN: DIODE	209-16738
LED 1, LED 2.	DL-11LAR	LED	209-46102
PM1		CONNECTOR 12 PIN MOLEX	209-51112
PB1	2C/O OFF	PUSHBUTTON	209-82102
PB2	6C/O MOD.ON	PUSHBUTTON	209-82106
PB3	4C/O AM/FM	PUSHBUTTON	209-82104
PB4	4C/O STOP	PUSHBUTTON	209-82104
PB5	2C/O RUN	PUSHBUTTON	209-82102
PB6	2C/O INT/EXT	PUSHBUTTON	209-82102
PB7	4C/O HF	PUSHBUTTON	209-82104

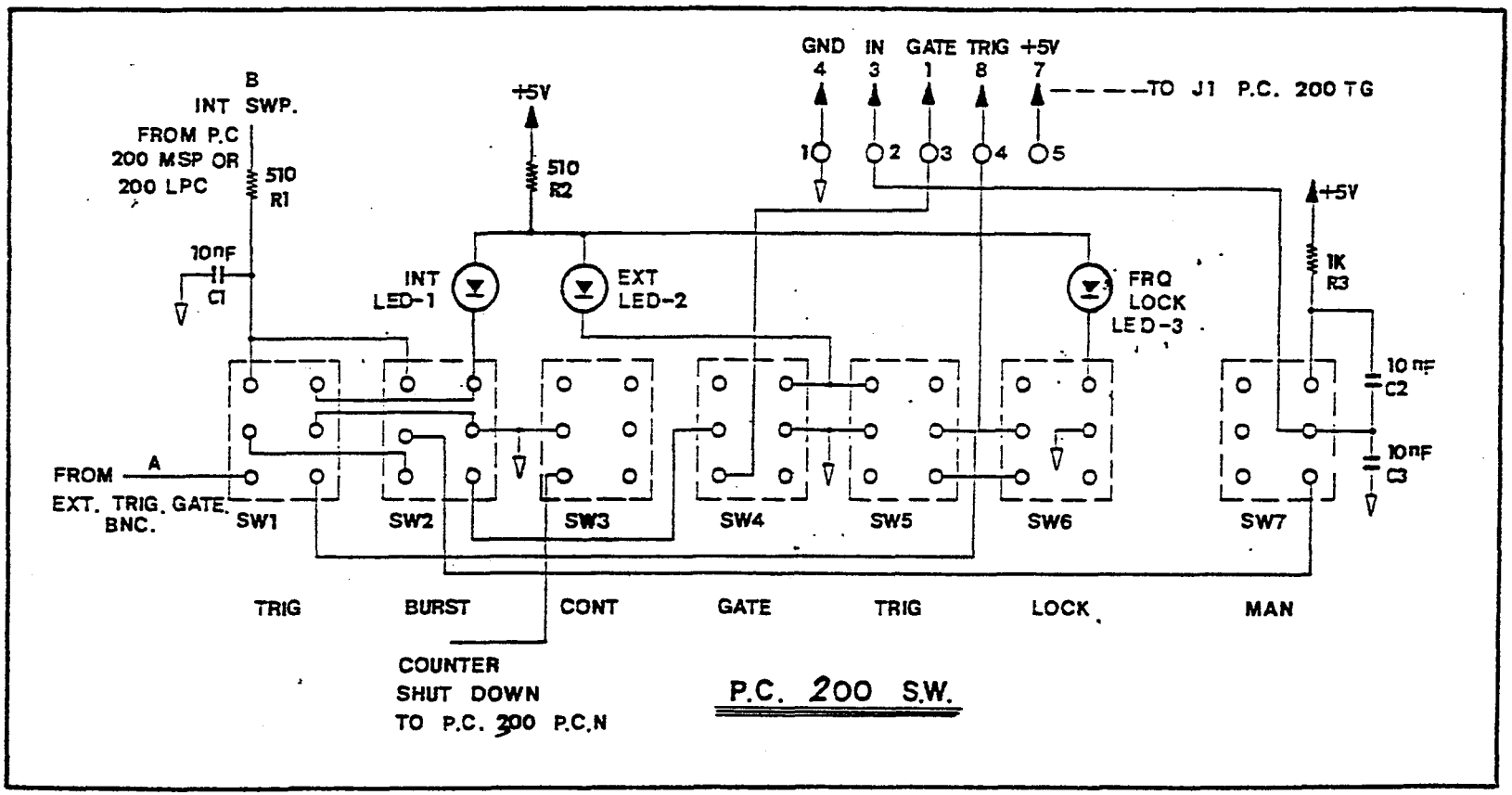

200 TG
U1 - 7548
U2 - 74S00
U3 - LM311
* - FACTORY ADJ.
** - JUMP1 NOT CONNECTED IN HIGHER 200 TG'S.
PH1 TIMING
X1H
X100H
X10K
X1K
X100
X10
X1

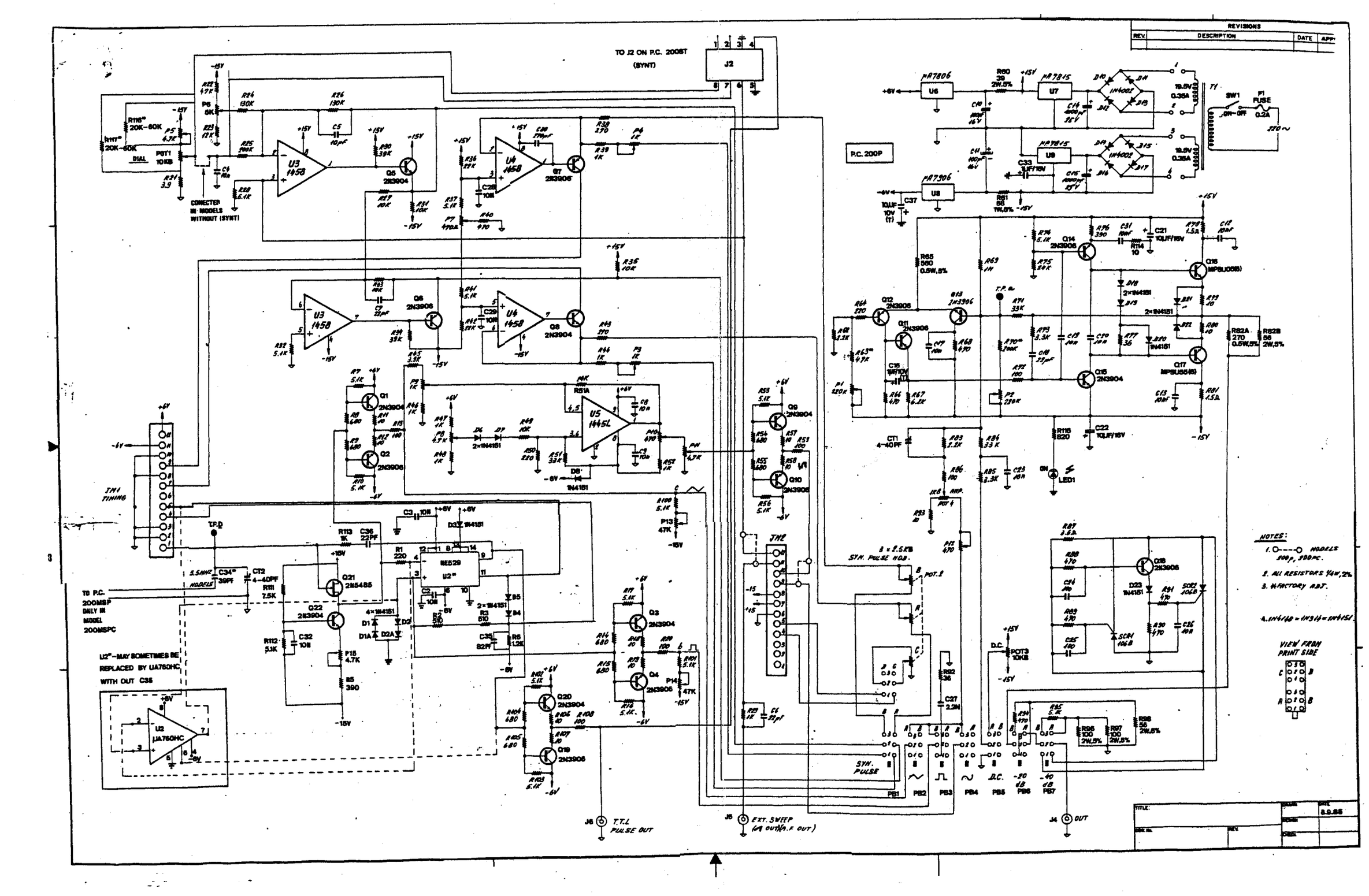

P1
C14
R12
R11
R14
R10
R16
3I1
R13
R19
C15
R15
U2
R17
R16
U1
R20
PM1
CR4
C12
C13
C11
R4
CR8
C10
CR3
Q5
CR7
R9
CR6
R8
CR5
Q4
R6
R7
Q3
C16
R1
Q6
Q2
Q1
R2
R5
R3
CR2
CR1
C9
C8
C4
C1
C2
C3
C5
C6
C7
PB
PB
PB
PB
PB
PB
PB
PB
200TG

PARTS LIST 200TG

REF. DESIGN	VALUE	DESCRIPTION	NEWTRONICS PART NO.
R3, R2	68 OHM	R: 5%, ¼W	207-01680
R17	100 OHM	R: 5%, ¼W	207-01101
R10, R1	220 OHM	R: 5%, ¼W	207-01221
R8	470 OHM	R: 5%, ¼W	207-01471
R18, R14	1 KOHM	R: 5%, ¼W	207-01102
R9, R5	2.2 KOHM	R: 5%, ¼W	207-01222
R16, R7	3.3 KOHM	R: 5%, ¼W	207-01332
R6	6.8 KOHM	R: 5%, ¼W	207-01682
R13,R19,R20, R4	10 KOHM	R: 5%, ¼W	207-01103
R15	100 KOHM	R: 5%, ¼W	207-01104
R11, R12	5.1 KOHM	R: 5%, ¼W	207-01512
C1	270 pF	C:CERAMIC 100V	207-06271
C2	3900 pF	C:POLYESTER 100V	207-06392
C3	39000 pF	C:POLYESTER 100V	207-06393
C4	0.47 µF	C:POLYESTER 100V	207-06474
C5	4.7 µF	C:TANTALUM 10V	207-05475
C6	47 µF	C:TANTALUM 10V	207-05476
C7	470µF	C:TANTALUM 3V	207-05477
C14, C15	10 µF	C: DISC	207-06106
C16	22 pF	C: DISC	207-06220
C13	100 pF	C; DISC	207-06101
C8,C9,C10,C11 C12	0.01	C: DISC	207-06103
CV1	4-40pF	TRIMER	207-41040
P1	10 KOHM	TRIM.	207-13103

REF. DESIGN	VALUE	DESCRIPTION	NEWTRONICS PART NO.
PM1		CONNECTOR 12 PIN MOLEX	207-52120
PB	2C/O	X1-XIM PUSHBUTTON	207-82102
CR1,CR2,CR7, CR3,CR6.CR4, CR5.		1N 4151 DIODE: SI	207-18151
CR8	5.1V	IN 751A ZENER DIODE	207-16751
Q2		TSTR BC307	207-25307
Q1, Q3,Q5,Q4, Q6.		TSTR BC237	207-25237
U1		INT. CIRCUIT 7474	207-35474
U2		INT. CIRCUIT 74LS00	207-35000
U3		INT. CIRCUIT LM311	207-35311


GND 4
IN 3
GATE 1
TRIG 8
+5V 7
TO J1 P.C. 200 TG
1 2 3 4 5
B
INT SWP.
FROM P.C
200 MSP OR
200 LPC
510
R1
10nF
C1
+5V
510
R2
INT
LED-1
EXT
LED-2
FRQ
LOCK
LED-3
+5V
1K
R3
10 nF
C2
10nF
C3
A
FROM
EXT. TRIG. GATE.
BNC.
SW1
SW2
SW3
SW4
SW5
SW6
SW7
TRIG
BURST
CONT
GATE
TRIG
LOCK
MAN
COUNTER
SHUT DOWN
TO P.C. 200 P.C.N
P.C. 200 S.W.


REVISIONS
REV.
DESCRIPTION
DATE
APP.
TO J2 ON P.C. 200ST
(SYNT)
J2
P.C. 200P
NOTES:
1. ○---○ MODELS 200P, 200PC.
2. ALL RESISTORS ¼W, 2%.
3. W-FACTORY ADJ.
4. 1N6140 = 1N914 = 1N4151
VIEW FROM PRINT SIDE
TP1 TIMING
TP2
TO P.C. 200MSP ONLY IN MODEL 200MSPC
U2 = µA760HC MAY SOMETIMES BE REPLACED BY UA760HC WITH OUT C36
SYN. PULSE
D.C.
J6 T.T.L PULSE OUT
J5 EXT. SWEEP (+V OUT/-V.F. OUT)
J4 OUT
TITLE:
8.9.85