

Protek B2000

2GHz Universal Counter

2GHz Universal Counter



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NOTE : The design of this instrument is subject to continuous development and improvement. Consequently, this instrument may incorporate minor changes in detail from the information contained in this manual.

SECTION I

Introduction & Specification

1. Introduction

- 1-1. This instrument is a 1GHz/2GHz Universal Counter.
- 1-2. It features a eight digit, high bright seven segment LED display, six Function performance, low power consumption circuit design, small size, light weight, high-stabilized OVEN Oscillator for measurement of accuracy and full input signal conditioning.
- 1-3. The six functions are Frequency, Period, Ratio, Totalize, Time Interval and Self Check.
- 1-4. Simple logic key can be operated many Functions and the Input signal can be conditioned by attenuator.
- 1-5. The location of controls, indicators, connectors and all of information for this Model are provided in this manual. It is recommended that whole information and details should be read and understood before attempting to operate the instrument for correct operation and best results.

2. Specification

2-1. CH A (FREQ A Low/FREQ A Hi)

2-1-1, Range : Low Mode	Hi Mode
0.1Hz~10MHZ	10MHz~100MHz (DC Coupling)
10Hz~10MHz	10MHz~100MHz (AC Coupling)

2-1-2, Input sensitivity

Attenuator 1/1 : 25 mVrms~1 Vrms (0.1 Hz~100MHz)
($V_{p-p} = 2\sqrt{2} V_{rms}$)

Attenuator 1/10 : 250 mVrms~10 Vrms (0.1 Hz~100 MHz)

2-1-3, Slope : +, - (Pull)

2-1-4, LP Filter : Approx. 100 kHz, -3db.

2-1-5, Max Input Voltage : 250 V (DC+AC Peak)

2-1-6, Input Impedance : 1 M Ω (Approx), less than 30pF.

2-1-7, Attenuator : 1/1, 1/10

2-1-8, Input Coupling : AC, DC

2-1-9, Trigger Level : Approx. -350mV to Approx. +350mV
continuously variable, Preset at approx. 0 V.

2-1-10, Gate Time : 0, 01s, 0, 1s, 1s, 10s (4 Mode)

2-1-11, Resolution

LOW MODE	HI MODE
100Hz/ 0, 01s	10kHz/ 0, 01s
10Hz/ 0, 1s	1kHz/ 0, 1s
1Hz/ 1s	100Hz/ 1s
0, 1Hz/ 10s	10Hz/ 10s

2-1-12, Accuracy : ± 1 count \pm Time Base Error

2-1-13, Unit : Low Mode.....kHz

Hi Mode.....MHz

2-2, CH C (FREQ. C)

2-2-1, Range : 100 MHz~1000 MHz (1 GHz Universal Counter)

90 MHz~2000 MHz (2 GHz Universal Counter)

2-2-2, Input sensitivity

25 mVrms~1 Vrms : 100 MHz~1000 MHz(1 GHz Universal Counter)

50 mVrms~1 Vrms : 90 MHz~2000 MHz (2 GHz Universal Counter)

2-2-3, Max Input Voltage : 3 Vrms

2-2-4, Input Impedance : Approx. 50 Ω

2-2-5, Input coupling : AC

2-2-6, Gate time : 0, 0256s, 0, 256s, 2, 56s, 25, 6s (4 Mode)

2-2-7, Resolution

10kHz/ 0, 0256s/ 0, 01s	MODE
1kHz/ 0, 256s/ 0, 1s	MODE
100Hz/ 2, 56s/ 1s	MODE
10Hz/ 25, 6s/ 10s	MODE

2-2-8, Accuracy : ± 1 count \pm Time base error

2-2-9, Unit : MHz

2-3, RATIO A/B

2-3-1, Range : CH A Input (10 MHz~100 MHz)

CH B Input (0.1Hz~10 MHz)

2-3-2, Multiplier : 1, 10, 100, 1000 (4 Mode)

2-3-3, Resolution : $\pm \text{Freq. B}/(\text{Freq. A} \times \text{Magnification})$

2-3-4, Accuracy : CH B Trigger error / (CH B Freq. \times Gate time) ± 1
count

2-3-5, CH B Input

- Input Impedance : 1 M Ω (Approx), less than 30pF
- Slope : +, - (Pull)
- LP Filter : Approx, 100 kHz, -3dB
- Max. Input Voltage : 250V (DC+AC peak)
- Attenuator : 1/1, 1/10
- Input coupling : AC, DC
- Trigger Level : Approx, -350mV to approx, +350mV
continuously variable Preset at approx, 0V
- Input Voltage

Attenuator 1/1 : 25mVrms~1Vrms ($V_{p-p} = 2\sqrt{2}$ Vrms)

Attenuator 1/10 : 250mVrms~10Vrms

2-4, PERIOD (PERI, A) CH A

2-4-1, Range : 0.5 μ s~200,000 μ s (5 Hz~2 MHz)

2-4-2, Min. Pulse width : 250ns

2-4-3, Accuracy : ± 1 count \pm Time base error \pm CH A Trigger
error

2-4-4, Gate time : 0.01s, 0.1s, 1s, 10s (4 Mode)

2-4-5, Resolution

100ns/	0.01s	MODE
10ns/	0.1s	MODE
1ns/	1s	MODE
100ps/	10s	MODE

2-4-6, Unit : μ s

2-5, TIME INTERVAL (T, I A→B) CH A to CH B

2-5-1, Range : 0.5 μ s \sim 200,000 μ s (5 Hz \sim 2 MHz)

2-5-2, Accuracy : ± 1 count \pm Time base error \pm CH A Trigger error \pm Magnification

2-5-3, Multiplier : 1, 10, 100, 1000 (4 Mode)

2-5-4, Minimum pulse width : 250ns

2-5-5, Resolution

100ns/	$\times 1$	MODE
10ns/	$\times 10$	MODE
1ns/	$\times 100$	MODE
100ps/	$\times 1000$	MODE

2-5-6, Unit : μ s

2-6, TOTALIZE (TOTAL, A)

2-6-1, Range : DC \sim 10 MHz

2-6-2, Count capacity : 0 \sim 99999999 (over flow)

2-6-3, Count control : Start/Stop (Reset/Hold switch)

2-7, Self Check

2-7-1, Display : 10 MHz

2-7-2, Gate time : 0.01s, 0.1s, 1s, 10s (over flow) 4 Mode

2-7-3, Unit : kHz

2-8, Basic Oscillator Characteristics,

2-8-1, Basic Frequency : 10 MHz, 3,90625MHz (OVEN)

2-8-2, Rate : $\pm 3 \times 10^{-7}$ /Month

2-8-3, Temperature : $\pm 5 \times 10^{-6}$ (0 \sim 40 $^{\circ}$ C), $\pm 5 \times 10^{-7}$ (0 \sim 30 $^{\circ}$ C)

2-8-4, Power characteristic : $\pm 1 \times 10^{-7}$ ($\pm 10\%$)

2-8-5, Warm up Time : 20 Minutes (25 $^{\circ}$ C)

2-9, Basic Oscillator output

2-9-1, Open output Voltage : over 1 Vp-p (on 1M Ω)

2-9-2, 50 Ω output Voltage : over 500 m Vp-p

2-10, General Specifications

2-10-1, Display : 8 Digits, 14mm 7segment LED, kHz, MHz, μ s, over, Gate (LED)

Function, Gate Time, Hold (LED)

2-10-2, Environment

- Operation temperature : 0°C ~ +40°C
Humidity : less than 85%RH (40°C)
- Storage temperature : -10°C ~ +60°C
Humidity : less than 90%RH (60°C)

2-10-3, Power requirement : AC 100/120/220V \pm 10%, 240V +5%, -10% 50/
60Hz

2-10-4, Power consumption : less than 15VA,

2-10-5, Dimension : Width : 262mm

Height : 84mm

Depth : 230mm

2-10-6, Weight : 2, 35kg

2-10-7, Self Chck : Counting operation check using the internal
reference signal,

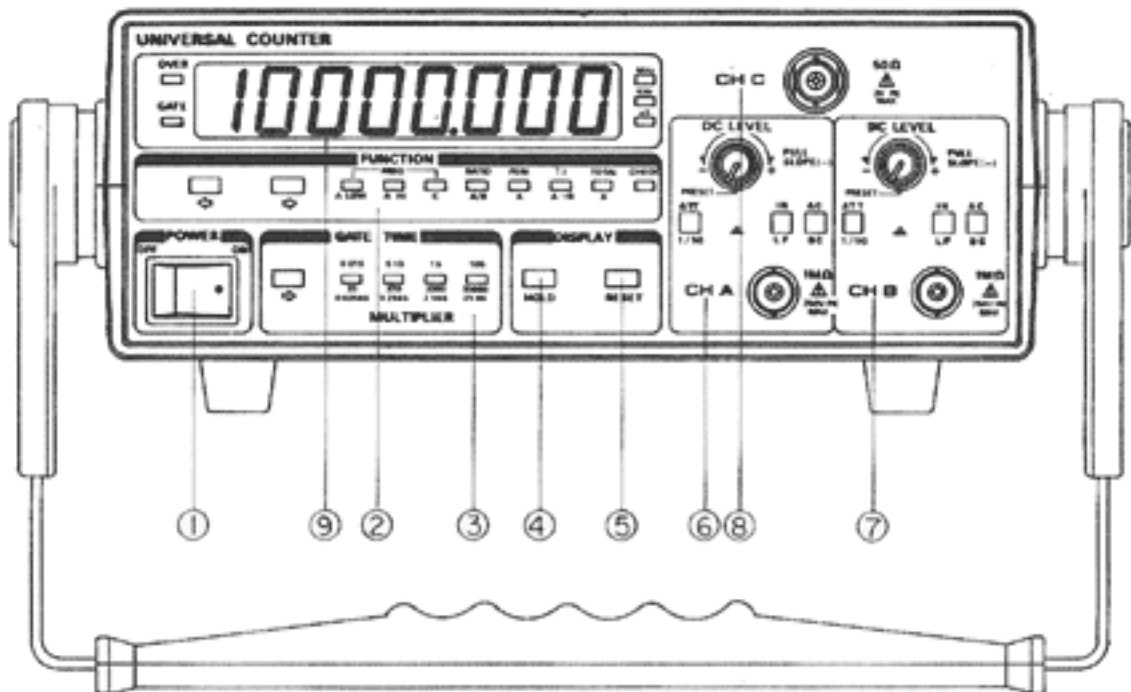
SECTION II

Operation

1. Introduction

This section provides complete operation information needed for this universal counter, this section introduce a description of all front panel, controls, connectors and indicators, operating instructions, operator's maintenance.

2. Front panel



2-1. Power Switch

2-1-1. This Switch is used to close or open the secondary circuit of the power transformer.

2-1-2. When this switch is set to ON, all internal circuitry of the counter is energized.

2-2. Function Block

2-2-1. The selected function is indicated by the corresponding indicator lamp which is on.

2-2-2. Pressing Key \rightarrow shifts the function indicator lamp one position to the right to select another function. Similarly, operation of Key \rightarrow shifts the active indicator lamp one position to the

left to select another function.

2-2-3. The function can be selected from : Freq. A Low, Freq. A Hi, Freq. C, Ratio A/B, PERI A, T, I A→B, Total A, SELF CHECK.

* When the check function of last lamp is on, operation of ➡ does select Freq. A Low of first function.

2-3. Gate Time/Multiplier Block

2-3-1. The selected gate time or multiplier is indicated by the lighted lamp.

2-3-2. Gate time is selected when the CHECK, Freq. or PERIOD is selected in the Function block : MULTIPLIER is selected when the T, I A→B, RATIO A/B function is selected in the function block. If the TOTAL function is selected in the function block, the operation in the Gate Time/Multiplier block is not required.

2-3-3. Operation of ➡ shifts the active indicator lamp one position to the right to select a gate time or multiplier 10 times as large.

* When the 10s/×1000 LAMP is ON, operation of ➡ does select 0.01s/×1 of first LAMP goes ON.

2-4. HOLD LAMP Switch

In HOLD LAMP switch one time operation, the measurement (except for Totalize) in progress is paused. Pressing key the HOLD LAMP goes OFF and the operation is continued.

2-5. RESET Switch

2-5-1. When this switch is selected in the Display block, this switch is operated the RESET switch (Initial state : 0)

2-5-2. When the one time pulse is measured at the T-I A→B, measurement is started press the RESET switch surely.

2-6. CH A Block

2-6-1. Frequency Range : DC~100 MHz.

* But, band width can change from MULTIPLIER mode selected.

2-6-2. Adjust the input signal level, then the GATE LAMP starts

blinking and the readout display shows the input signal frequency.

2-6-3. DC LEVEL

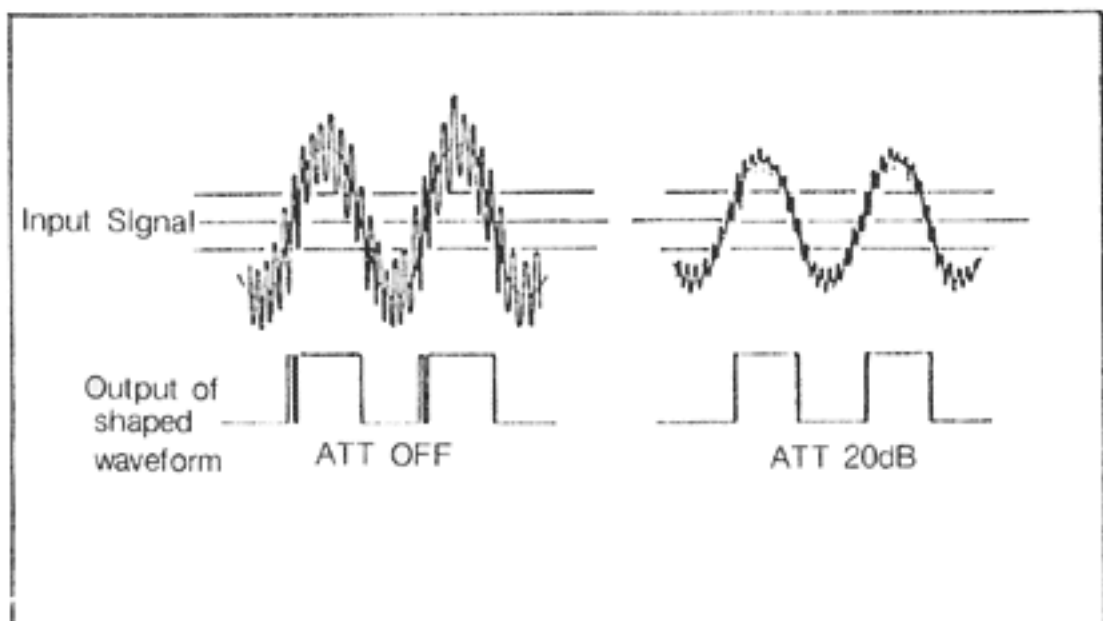
The level control is used to continuously control the trigger level for the signal applied to input. The controllable range is between, Approx,

-0.5V and +0.5V. With the use of the attenuator (ATT, 1/10), it is between approx. -5V and +5V. If an appropriate trigger level is set for an input signal exceeding the input sensitivity, the internal waveform shaper is activated to start count operation. The readout shows display when this waveform shaper circuit is activated.

Turning the LEVEL control fully counter clockwise to the detent selects the PRESET state in which the trigger level is fixed to approx. 0V.

2-6-4. AC/DC Switch

The AC/DC switch is used to select the input coupling mode. When the AC switch is ON, the signal applied to input A is AC coupled to the input circuit. When the AC switch is OFF (PUSH), the signal at the same input is DC coupled to the input circuit. In the AC coupled mode, the lower cut-off frequency is 10 Hz.



2-6-5, ATT, Switch and 1/10 (20dB)

The ATT, switch is used to switch an internal input attenuator ON or OFF. When the 1/10 (20dB) is ON (PUSH), a resistance attenuator of 20dB is inserted into the input A circuit. If the input signal level is sufficiently large, the attenuator may be used to prevent measurement errors due to introduced noise as illustrated below :

2-6-6, LP Filter switch

The L, F (Low-Pass Filter) Switch is used to switch on internal LP F ON or OFF when the switch is ON (PUSH), the range of input A or B is limited to approx. 100 kHz, which will be effective to reject superimposed noise. In this case, the input signal is directly measured, without frequency division.

2-6-7, Slope switch

When the slope switch pull by DC level handle, which will be inversion input wave from slope trig.

2-7, CH B Block

2-7-1, Frequency Range : DC~20 MHz

*But, bandwidth can change from MULTIPLIER mode selected .

2-7-2, CH B is used to T, I A→B and RATIO A/B mode.

2-7-3, DC LEVEL control, AC/DC SW, ATT SW, LP F SW, SLOPE SW are same function as CH A Block,

2-8, CH C Block

2-8-1, Ferquency Range :100 MHz~1000 MHz (1 GHz Universal Counter) 90MHz~2000MHz(2 GHz Universal Counter)

2-8-2, Maximum input voltage without damage : 3 Vrms

Though this CH C circuit protected overload input voltage, don't input voltage more than 3Vp-p.

2-8-3, This range be used FREQ. C Mode,

2-9, Display Block

2-9-1, 8-Digit, 7-Segment LED display used to show measurement data,

2-9-2 OVER LAMP

This LAMP goes ON if the measurement data exceeds the number of display digits. The eight least significant digits of the measurement data will be displayed as they are, even if this LAMP goes ON.

2-9-3. GATE LAMP

This LAMP is ON during count operation busy. When the Freq. A, Freq. C, PERI. A, T, I A→B, or CHECK function is selected, the GATE LAMP does not go on unless the input level exceeds the minimum counting threshold.

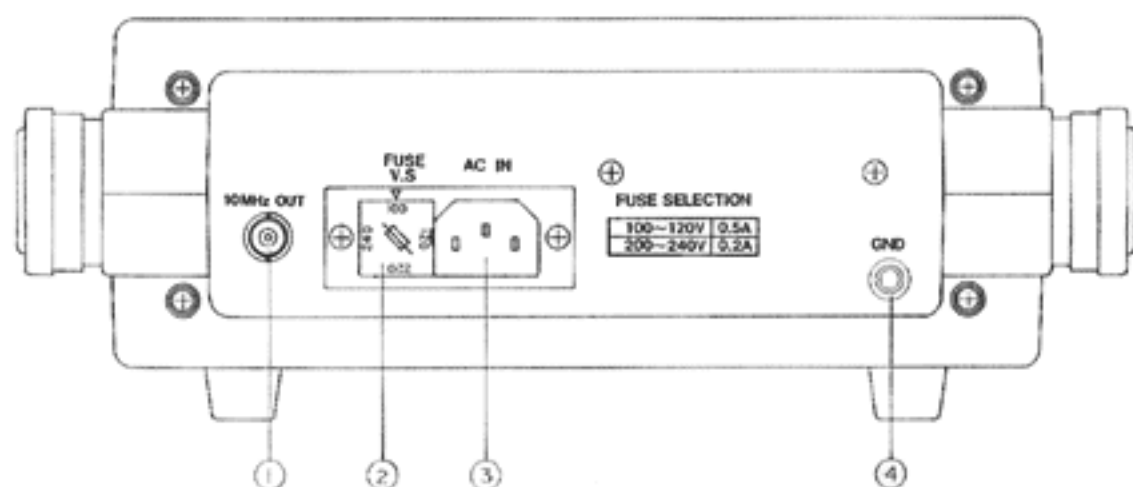
2-9-4. UNIT indicator LAMP

Indicates the UNIT for measurement data shown in the data display (MHz, kHz, μ s)

3. Rear Panel

3-1. 10 MHz output : This connector uses counters internal time base signal as the time reference and output a 10 MHz time base signal.

3-2. Voltage selector



3-2-1 Voltage selector : Selects the nominal instrument operating voltage range (AC 100/120/220V \pm 10%, 240V +5%, -10% 50/ 60Hz)

3-2-2 Fuse holder : Contains a fuse for the AC power circuit.

3-3. AC Inlet

Accepts AC power supply to the counter.

Use the supplied AC power cable for AC power connection.

3-4. Ground terminal : Frame ground for the counter if a 2-prong plug adaptor is used for AC power connection, be sure to ground either the adaptor's ground lead or this ground terminal to the earth.

4. Preparation and General Precautions.

4-1. Inspection

Upon receipt of this instrument, check it carefully for any damage sustained in transit, should any damage be found or if the unit does not operate properly, contact your nearest Hung Chang representative.

4-2. Storage

If the instrument is to be left unused for a long period of time, keep it in a cardboard box placed in a dry place out of direct sunlight.

4-3. Power Supply

The operating voltage is factory set and is indicated beside the rear power receptacle. Be sure to operate the counter within the specified operating voltage range.

4-4. Operating environment.

Do not operate the counter in places where it will be exposed to excessive dust, direct sunlight, or corrosive gas.

Use it in an ambient temperature range between 0°C and +40°C and a relative humidity range less than 85% (40°C).

4-5. Physical impact

Do not expose the unit to excessive physical impact or shock as it uses a precision CRYSTAL OSCILLATOR !

4-6. Do not remove covers or panels and replacement.

It is unable guarantee that function and specification when do remove the product covers or panels and replacement because this counter is using a precision crystal oscillator and high Frequency circuit.

4-7. Input Voltage

To protect the input circuit from overload damage, an high-frequency fuse is provided in the CH A, CH B circuit.

The fuse assures safety unless an excessive input level is applied to the input, though, don't input more than the maximum voltage.

5. Basic operating

5-1. Power source

5-1-1. Set the power switch to OFF.

5-1-2. Connect the supplied AC power cable to the rear AC power connector.

5-1-3. Set the power switch to ON.

5-1-4. Wait about 20 minutes for correct measurement until this counter gets stable in aging.

5-2. Self check

5-2-1. Set Function to CHECK mode.

5-2-2. Set HOLD switch to OFF (LAMP OFF).

5-2-3. The readout display will show the following data according to GATE TIME setting.

*GATE TIME vs DISPLAY digits in period measurement

GATE TIME	D I S P L A Y	
0.01s	10000.0	± 0.1kHz
0.1s	10000.00	± 0.01kHz
1s	10000.000	± 0.001kHz
10s	OVER 0000.0000	± 0.0001kHz

5-3. CH A Low/Hi Frequency measurement (DC~100 MHz)

5-3-1. Set Function to Freq. A Low mode

→ Less than 10 MHz

Set Function to Freq. A Hi mode

→ More than 10 MHz

5-3-2, Set HOLD switch to OFF (LAMP OFF)

5-3-3, Apply the signal to be measured to the input A connector,

5-3-4, In case of need, set Function to ATT SW, AC/DC SW, LP F SW, SLOPE SW, GATE Time,

5-3-5, The DC level control is used to continuously control the trigger level for the signal applied to input A,

5-3-6, In case of need, set Hold SW to ON, when display data is fixed,

5-4, CH C Frequency measurement

*100 MHz~1000 MHz (1 GHz Universal Counter)

*90 MHz~2000 MHz (2 GHz Universal Counter)

5-4-1, Set Function to Freq. C mode,

5-4-2, Set HOLD switch to OFF (LAMP OFF)

5-4-3, Apply the signal to be measured to the input C connector,

5-4-4, In case of need, set Function to GATE time,

5-4-5, When Input signal is over than $1V_{p-p}$, measure with external attenuator,

5-4-6, In case of need, set Hold SW to ON (LAMP ON) when display data is fixed,

*CH A and CH C input GATE Time vs Readout Resolution

GATE TIME		0.01s	0.1s	1s	10s
Resolution	CH A LOW	100 Hz	10 Hz	1 Hz	0.1 Hz
	CH A HI	10 kHz	1 kHz	100 Hz	10 Hz
	CH C	10 kHz	1 kHz	100 Hz	10 Hz

*CH C GATE Time is 2.56 Times,

5-5, PERI A, measurement ($0.5\mu s \sim 200,000\mu s$)

5-5-1, Set Function to PERI A mode

5-5-2, Set HOLD switch to OFF (LAMP OFF)

5-5-3, Apply the signal to be measured to the CH A connector,

5-5-4. In case of need, set Function to ATT SW, DC/AC SW, LP F SW, SLOPE SW, GATE Time,

*Relation of GATE Time vs readout Resolution,

GATE TIME	0.01s	0.1s	1s	10s
Resolution	100ns	10ns	1ns	100ps

5-5-5. The DC Level control is used to continuously control the trigger level for the signal applied to input A when this waveform shaper circuit is activated,

5-5-6. In case of need, set Hold SW to ON (LAMP ON) when display data is fixed,

5-6. Time Interval measurement (T, I A→B) (0.5 μ s~200,000 μ s)

5-6-1. Set function to T, I A→B mode,

5-6-2. Set Hold switch to OFF (LAMP OFF)

5-6-3. Apply the signal to be measured to the CH A, CH B connector,

5-6-4. In case of need, set Function to ATT SW, AC/DC SW, LP F SW, SLOPE SW with CH A, CH B and set Function to multiplier (GATE Time)

5-6-5. CH A, CH B for DC level control is used to continuously control the trigger level for the input signal,

5-6-6. In case input signal is one time pulse, press the RESET SW,

5-6-7. If the signal level and the DC LEVEL control setting are adequate, the GATE lamp starts blinking, and the readout display shows the positive pulse width measured, (the same with SLOPE)

5-6-8. In case of need, set Hold SW to ON (LAMP ON)

*Relation of MULTIPLIER vs readout Resolution

MULTIPLIER	1	10	100	1000
Resolution	100ns	10ns	1ns	100ps

5-7. RATIO A/B

CH A (10 MHz~100 MHz)

CH B (DC~10 MHz)

- 5-7-1. Set Function to RATIO A/B.
- 5-7-2. Set HOLD SW to OFF (LAMP OFF)
- 5-7-3. Apply the signal to be measured to the CH A, CH B connector
- 5-7-4. In case of need, set function to ATT SW, AC/DC SW, SLOPE SW, LP F SW, with GATE time.
- 5-7-5. The DC level control is used to continuously control the trigger level for the signal applied to CH A with CH B.
If the signal level and the DC LEVEL control setting are adequate, the readout display shows the RATIO.
- 5-7-6. In case of need, set Hold SW to ON (LAMP ON)
* Resolution : $\pm \text{FREQ. B} / (\text{FREQ. A} \times \text{Magnification})$
* Magnification : 1, 10, 100, 1000 (Multiplier)
- 5-8. TOTAL A (DC~10 MHz)
- 5-8-1. Set Function to TOTAL A mode.
- 5-8-2. Set Hold SW to OFF (LAMP OFF)
- 5-8-3. Apply the signal to be measured to the CH A connector.
- 5-8-4. In case of need, set Function to ATT SW, LP F SW, SLOPE SW, DC LEVEL preset or an appropriate position.
If the input signal level and the DC LEVEL control setting are both adequate, the readout display shows the Totalize.
- 5-8-5. Press the RESET SW, then set counter to "0".
- 5-8-6. State count
- 5-8-7. In case of need, Hold SW ON then stop count, set Hold SW to OFF (LAMP OFF) when continue count from before Hold ON value.

SECTION III

ADJUSTMENT&CALIBRATION

1. Introduction

In general, the most significant factor affecting measurement accuracy of an electronic counter is the frequency accuracy of its internal crystal oscillator.

This frequency accuracy must always be controlled to a constant value, or its deviation, if any, should be very small.

To insure measurement data reliability of an electronic counter, it must be calibrated periodically or its operation environment should be carefully conditioned.

This counter calibration period is just on a year.

This universal counter of adjustment or calibration set limits to time base frequency and trigger level.

To exact calibration, it is in need of aging time more than 30 minutes.

2. Test equipment required

2-1. Quartz Oscillator : 10 MHz (Accuracy : Less than 1×10^{-9})

2-2. Synthesized signal generator : 0.1 Hz~2 GHz

3. Adjustment

3-1. Adjustment for crystal oscillator

3-1-1. More than 30 minutes of aging time.

3-1-2. Set Function to Freq. A low

Input standard signal 10 MHz to CH A

3-1-3. Counter set as follows :

- LP F SW : OFF
- AC/DC SW : AC
- ATT SW : 1/1
- Gate Time : 1s
- DC LEVEL : Maximum turn to left (preset)

3-1-4. Adjust the TCI (20P) until the frequency readout is 10000.000 ± 1 (KHz) digit at the Display.

3-2. Adjustment for CH A low mode time base Frequency

3-2-1, Set Function to Freq, A Low,

10 MHz 20 mVrms (Approx, 56mVp-P) of sine wave input to CH A connector,

3-2-2, Counter set as follows :

- LP F SW : OFF
- AC/DC SW : AC
- ATT SW : 1/1
- GATE Time : 0.01s
- DC LEVEL : Maximum turn to left (preset)

3-2-3, Adjust the VR 5 until the frequency readout is 10000.0 ± 1 (kHz) digit at the Display.

3-3, Adjustment for CH A Hi mode time base Frequency.

3-3-1, Set Functin to Freq A Hi 100 MHz 30 mVrms

(Approx, 84 mVp-p) of sine wave input to CH A connector.

3-3-2, Counter set as follows :

- LP F SW : OFF
- AC/DC SW : AC
- ATT SW : 1/1
- GATE Time : 0.01s
- DC LEVEL : Maximum turn to left (preset)

3-3-3, Adjust the VR1 until the frequency readout is 100.00 ± 1 (MHz) digit at the Display.

3-4, Adjustment for CH B time base Frequency.

3-4-1, Set Function to RATIO A/B.

3-4-2, 100 MHz 20 mVrms (56mVp-p) input to CH A connector.

3-4-3, 10 MHz 20 mVrms (56mVp-p) input to CH B connector.

3-4-4, Counter set as follows :

- LP F SW : OFF
- AC/DC SW : AC
- ATT SW : 1/1
- GATE Time : 1s
- DC LEVEL : Maximum turn to left (preset)

3-4-5, Adjust the VR2 until the frequency readout is 10.00 ± 2 digit

at the Display.

3-5. Adjustment for CH C time base Frequency.

5-5-1. Set function to Freq. C

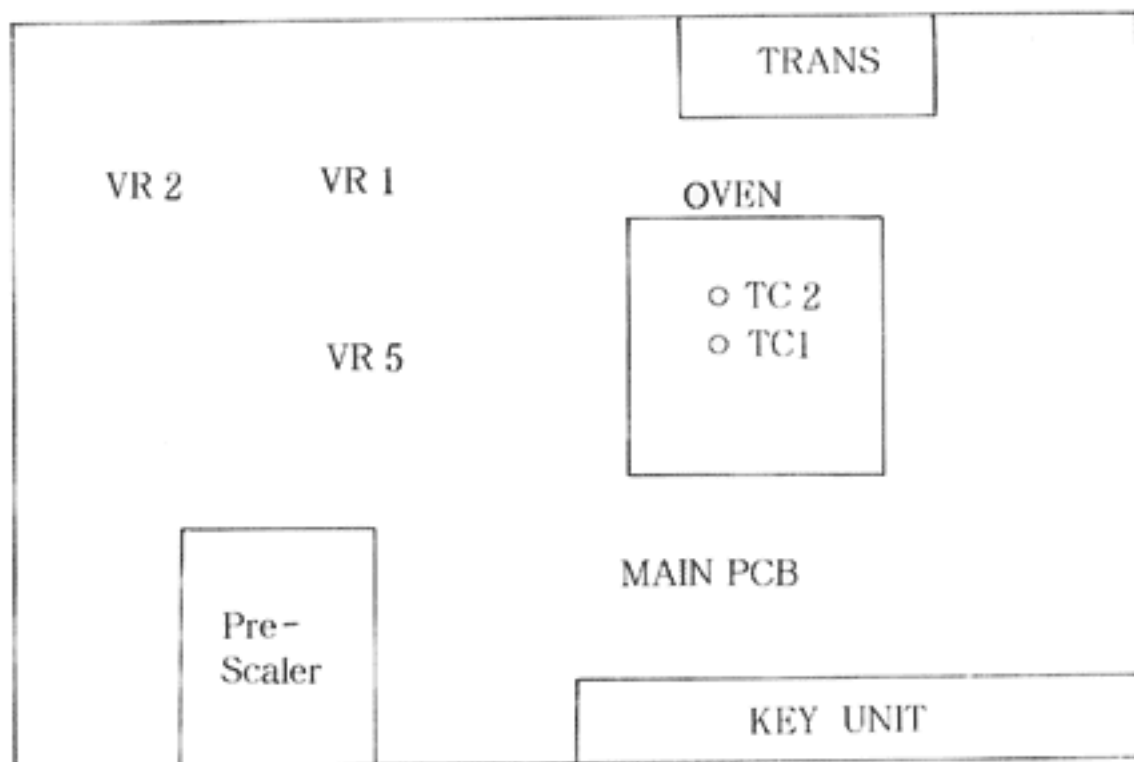
Input standard signal 1000 MHz (1GHz Universal Counter),
2000MHz (2GHz Universal Counter)

3-5-2. Counter set

- LP F SW : OFF
- AC/DC SW : AC
- ATT SW : 1/1
- GATE Time : 1s

3-5-3. Adjust the TC2 (20P) until the frequency readout 1000.0000 ± 1 (1GHz Universal Counter) / 2000.0000 ± 1 (2GHz Universal Counter)

3-6. Adjustment point position and USE



FRONT PANEL

POINT	U S E
TC-1	CH A (CH A, LOW)
TC-2	CH C
VR-1	CH A HI
VR-2	CH B
VR-5	CH A LOW

SECTION IV PARTS LIST

CODE-NO	PARTS NAME	SPEC (DESCRIPTION)	UNIT	Q'TY	REF-NO
2-A10-046	MAIN PCB ASS'Y	U1000 (HC)	KIT	1.0000	
2-C28-107	CERAMIC CAPACITOR	0.01UF 50V (DD106F 103Z)	EA	3.0000	C60, 61, 63
2-C28-028	CERAMIC CAPACITOR	0.1UF 25V (DD 600BC 104Z)	EA	19.0000	C15, 16, 20, 21, 22, 24-27 30-34, 36, 37, 43, 44, 50, 51
2-C28-024	CERAMIC CAPACITOR	1000PF 50V (DD104B 102K)	EA	5.0000	C46, 48, 49, 54, 55
2-C28-031	CERAMIC CAPACITOR	220PF 50V (DD111CH 221J)	EA	1.0000	C52
2-C28-111	CERAMIC CAPACITOR	220PF 50V (DD12RH 221J)	EA	4.0000	C1, 2, 5, 6
2-C28-116	CERAMIC CAPACITOR	27PF 50V (DD105CH 270J)	EA	1.0000	C19
2-C28-018	CERAMIC CAPACITOR	39PF 50V (DD105CH 390J)	EA	1.0000	C35
2-C28-117	CERAMIC CAPACITOR	5PF 50V (DD105CH 050J)	EA	1.0000	C47
2-C33-006	ELECTROLYTIC CAPACITOR	10UF 16V SM	EA	10.0000	C7, 8, 11-14, 17, 18, 28, 38
2-C33-034	ELECTROLYTIC CAPACITOR	2200UF 16V	EA	1.0000	C42
2-C33-055	ELECTROLYTIC CAPACITOR	470UF 16V	EA	1.0000	C45
2-C33-085	ELECTROLYTIC CAPACITOR	47UF 6.3V (BP)	EA	2.0000	C9, 10
2-C31-044	METALIZED FILM CAPACITOR	0.47UF 250V (MFR-474K)	EA	2.0000	C3, 4
2-C34-039	MICA CAPACITOR	33PF (VFM 05C 5%)	EA	2.0000	C40, 56
2-C34-041	MICA CAPACITOR	47PF (VFM 05C 5%)	EA	3.0000	C23, 39, 41
2-C33-087	SUPER CAPACITOR	FYD-OH-104Z	EA	1.0000	SC1
2-C31-032	TRIMMER CAPACITOR	20P	EA	2.0000	TC1, 2
2-C21-096	FLATE CABLE CONNECTOR	A*L-240911 (40P)	EA	1.0000	CN1
2-C32-040	CRYSTAL	10MIZ (5PPM)	EA	1.0000	X1
2-C32-039	CRYSTAL	3.90625MIZ (5PPM)	EA	1.0000	X2
2-C03-026	DIODE	1S 1588	EA	20.0000	D1-20
2-C46-034	DIODE	2B 4B41	EA	1.0000	DW1
2-C04-065	FET	2SK 241GR	EA	2.0000	Q1, 3
2-C04-057	IC	HD 10551	EA	1.0000	IC3
2-C04-001	IC	ICM 7226 BIPL	EA	1.0000	IC10
2-C04-059	IC	MC 7805CT	EA	1.0000	IC12
2-C04-060	IC	SN 74HC352P	EA	1.0000	IC5
2-C04-044	IC	TC 4051BP	EA	1.0000	IC8
2-C04-043	IC	TC 4052BP	EA	2.0000	IC9, 14
2-C04-042	IC	TC 4584BP	EA	1.0000	IC16
2-C46-031	IC	TC 74HC 390P	EA	1.0000	IC4
2-C04-036	IC	TC 74HC 193AP	EA	1.0000	IC6
2-C04-037	IC	TC 74HC 393AP	EA	1.0000	IC7
2-C04-038	IC	TC 74HC 86AP	EA	1.0000	IC13
2-C46-106	IC	TC 74HC 04AP	EA	1.0000	IC11
2-C04-046	IC	UPC 1663C	EA	2.0000	IC1, 2

CODE-NO	PARTS NAME	SPEC (DESCRIPTION)	UNIT	Q'TY	REF-NO
2-C32-012	INDUCTOR	0.47UH	EA	1.0000	L1
2-C32-003	INDUCTOR	1UH	EA	1.0000	L4
2-C32-015	INDUCTOR	470UH (LF1-471J)	EA	2.0000	L2,3
2-B32-003	MAIN PCB	Q1-065-04	EA	1.0000	
2-C11-004	CARBON FILM RESISTOR	1.5K OHM 1/4W J	EA	1.0000	R57
2-C10-008	CARBON FILM RESISTOR	10 OHM 1/4W J	EA	4.0000	R3,8,24,29
2-C11-044	CARBON FILM RESISTOR	100K OHM 1/4W J	EA	17.0000	R40-49,64,66,70,86
2-C11-023	CARBON FILM RESISTOR	10K OHM 1/4W J	EA	7.0000	R12,34,53-55,59,60
2-C10-013	CARBON FILM RESISTOR	22 OHM 1/4W J	EA	2.0000	R5,27
2-C11-071	CARBON FILM RESISTOR	270K OHM 1/4W J	EA	2.0000	R4,25
2-C11-036	CARBON FILM RESISTOR	47K OHM 1/4W J	EA	1.0000	R65
2-C10-036	CARBON FILM RESISTOR	510 OHM 1/4W J	EA	2.0000	R80,81
2-C20-206	METAL FILM RESISTOR	1.8K OHM 1/8W F	EA	1.0000	R28
2-C12-018	METAL FILM RESISTOR	100 OHM 1/4W F	EA	7.0000	R15,16,36,37,50,52,71
2-C13-056	METAL FILM RESISTOR	100K OHM 1/4W F	EA	2.0000	R2,23
2-C14-006	METAL FILM RESISTOR	150K OHM 1/4W F	EA	1.0000	R19
2-C13-001	METAL FILM RESISTOR	1K OHM 1/4W F	EA	10.0000	R6,9-11,14,26,30-33
2-C14-019	METAL FILM RESISTOR	1H OHM 1/4W F	EA	2.0000	R56,58
2-C12-026	METAL FILM RESISTOR	270 OHM 1/4W F	EA	1.0000	R38
2-C20-177	METAL FILM RESISTOR	2K OHM 1/8W F	EA	1.0000	R7
2-C13-020	METAL FILM RESISTOR	3.9K OHM 1/4W F	EA	1.0000	R51
2-C18-066	METAL FILM RESISTOR	300 OHM 1/4W F	EA	1.0000	R17
2-C13-022	METAL FILM RESISTOR	4.7K OHM 1/4W F	EA	4.0000	R1,13,21,35
2-C12-036	METAL FILM RESISTOR	470 OHM 1/4W F	EA	5.0000	R18,39,61,83,85
2-C13-063	METAL FILM RESISTOR	51K OHM 1/4W F	EA	2.0000	R52,84
2-C14-016	METAL FILM RESISTOR	900K OHM 1/4W F	EA	2.0000	R20,22
2-C03-066	NETWORK RESISTOR	RAS-8S-1048J (100KJ*8)	EA	1.0000	RA1
2-C39-201	PUSH SWITCH	PS-132A	EA	4.0000	SW2,3,7,8
2-C39-200	PUSH SWITCH	PS-132B	EA	2.0000	SW1,6
2-C30-042	NTC THERMISTOR	1K OHM J (TD5-C225D)	EA	1.0000	TH1
2-C06-011	TR	2SA 1015-Y	EA	2.0000	Q6,7
2-C06-020	TR	2SC 1815-Y	EA	2.0000	Q5,9
2-C06-027	TR	2SD 880-Y	EA	1.0000	Q8
2-C37-070	EMPIRE TUBE	1 PI	H	0.0040	
2-C29-007	SEMI FIXED RESISTOR	TM 64K3 (PV2) B10K OHM (NOBLE)	EA	3.0000	VR1,2,5
2-C39-216	VARIABLE RESISTOR	03-04-05	EA	2.0000	VR3,4
2-C21-206	CONNECTOR WAFER	5273-02A	EA	1.0000	CN3
2-C21-082	P/C CONNECTOR WAFER	5045-03A 3P	EA	2.0000	CN4,5
2-T54-202	X-TAL OVEN CASE	U-04-P124 (BSP+0.3)	EA	1.0000	
2-C37-104	X-TAL HEAT SINK	U-04-P158 (BSRM T0.3)	EA	1.0000	
2-T11-026	HEXAGON NUT	M3 NI/PL	EA	1.0000	
2-C42-135	SILICOONE RUBBER	ARH 234	EA	2.0000	
2-C42-136	SILICOONE RUBBER (1)	ARH 230 (T0.3*13*18)	EA	1.0000	

CODE-NO	PARTS NAME	SPEC (DESCRIPTION)	UNIT	Q'TY	REF-NO
2-T48-013	MACHINE SCREW	BH(+) M3.0x8.0 NI/PL	EA	1.0000	
2-T23-166	SHIELD PLATE (B)	U-04-P126 (BSP T0.3)	EA	1.0000	
2-T23-167	SHIELD PLATE (C)	U-04-P127 (BSP T0.3)	EA	1.0000	
2-T52-104	BOND	TSE-384-B	EA	0.0010	
2-A10-047	KEY PCB ASS'Y	U1000 (HC)	KIT	1.0000	
2-C28-028	CERAMIC CAPACITOR	0.1UF 25V (DD 600BC 104Z)	EA	2.0000	C2,3
2-C33-011	ELECTROLYTIC CAPACITOR	100UF 6.3V	EA	1.0000	C1
2-C21-196	FLATE CABLE CONNECTOR	A*B 140001 (40P)	EA	1.0000	CN1
2-C04-040	IC	TC 74HC 138AP	EA	1.0000	IC1
2-C04-041	IC	TC 74HC 139AP	EA	1.0000	IC2
2-C04-072	LED	TLG366	EA	4.0000	LD1-4
2-C04-071	LED	TLY124	EA	17.0000	LD5-21
2-C43-120	KEY PCB	01-066-04	EA	1.0000	PCB
2-C04-068	NETWORK RESISTOR	RAS-8S-2218J	EA	1.0000	RA2
2-C04-069	NETWORK RESISTOR	RAS-8S-3318J	EA	1.0000	RA1
2-C39-203	PUSH SWITCH	PT-0011A	EA	1.0000	SW4
2-C39-204	PUSH SWITCH	PT-001N	EA	4.0000	SW1,2,3,5
2-A10-048	PRESALER PCB ASS'Y	U1000 (HC)	KIT	1.0000	
2-C27-095	CABLE	U2000-01	EA	1.0000	CN1
2-C28-115	CERAMIC CAPACITOR	0.001UF 50V (BD0050YU 102J)	EA	2.0000	C15,16
2-C28-114	CERAMIC CAPACITOR	0.01UF 50V (BD0070YU 103J)	EA	1.0000	C17
2-C33-107	ELECTROLYTIC CAPACITOR	3.3UF 50V (SME 50V B3.3M)	EA	1.0000	C18
2-T41-040	METALIZED FILM CAPACITOR	104PF 63V (WIMA) BOX TYPE	EA	1.0000	C19
2-T06-007	BNC CONNECTOR	UG-1000/U	EA	1.0000	
2-C02-044	DIODE	1N 4152 R	EA	2.0000	D3,4
2-C04-009	IC	U 666 B	EA	1.0000	U3
2-C43-121	PRESALER PCB	F-1000PS	EA	1.0000	
2-C10-022	CARBON FILM RESISTOR	100 OHM 1/4W J	EA	1.0000	R38
2-C11-007	CARBON FILM RESISTOR	2.2K OHM 1/4W J	EA	2.0000	R35,36
2-C18-009	CARBON FILM RESISTOR	51 OHM 1/4W J	EA	1.0000	R33
2-C10-036	CARBON FILM RESISTOR	510 OHM 1/4W J	EA	1.0000	R37
2-C11-041	CARBON FILM RESISTOR	68K OHM 1/4W J	EA	1.0000	R34
2-C01-004	TR	BC 327	EA	2.0000	Q5,6
2-T06-006	PRESALER CASE	LF1000 (SPT0.3)	EA	1.0000	
2-T06-005	PRESALER SHIELD COVER	SPT0.3 (LF1000)	EA	1.0000	
2-A10-051	PRESALER PCB ASS'Y	U2000 (HC)	KIT	1.0000	
2-C27-095	CABLE	U2000-01	EA	1.0000	
2-C28-028	CERAMIC CAPACITOR	0.1UF 25V (DD 600BC 104Z)	EA	2.0000	C6,7
2-C28-103	CHIP CAPACITOR	1000PF (GRM42-6B-102K 50B)	EA	3.0000	C1-3
2-C33-102	ELECTROLYTIC CAPACITOR	10UF 6.3V	EA	1.0000	C5
2-C28-048	SEMI CONDUCTOR CERAMIC CAPACITOR	0.01UF 25V (DD 600BC 103Z)	EA	1.0000	C4
2-T06-007	BNC CONNECTOR	UG-1000/U	EA	1.0000	CN1

CODE-NO	PARTS NAME	SPEC (DESCRIPTION)	UNIT	Q'TY	REF-NO
2-C04-064	DIODE	ISS 226	EA	1.0000	D1
2-C04-058	IC	MB 506	EA	1.0000	IC1
2-C46-106	IC	TC 74HC04AP	EA	1.0000	IC2
2-C43-127	PRESALER PCB	01-067-05	EA	1.0000	
2-C20-087	CARBON FILM RESISTOR	10K OHM 1/8W J	EA	2.0000	R3,4
2-C20-099	CARBON FILM RESISTOR	1M OHM 1/8W J	EA	1.0000	R5
2-C20-107	CARBON FILM RESISTOR	2.2K OHM 1/8W J	EA	1.0000	R2
2-T46-048	CARBON FILM RESISTOR	2M OHM 1/4W J RD 25	EA	1.0000	R7
2-C25-102	CHIP RESISTOR	224 OHM RC 315-226K	EA	1.0000	R6
2-C25-101	CHIP RESISTOR	50 OHM TRM 55K J	EA	1.0000	R1
2-T06-006	PRESALER CASE	LF1000 (SPTT T0.3)	EA	1.0000	CN1
2-T06-005	PRESALER SHIELD COVER	SPTT T0.3 (LF1000)	EA	1.0000	CN2
2-B10-076	FRONT PANEL ASS'Y	U1000 (HC)	KIT	1.0000	
2-T01-001	BNC CONNECTOR	UG-625/U	EA	2.0000	
2-C39-205	POWER SWITCH	PS-300G	EA	1.0000	
2-C37-106	SUMI TUBE	4.5PI	M	0.0010	
2-T26-100	LEAD WIRE	U2000-05	EA	2.0000	
2-T26-101	LEAD WIRE	U2000-06	EA	2.0000	
2-T07-159	FRONT PANEL	U-03-P120 (SPEC T1.2)	EA	1.0000	
2-T07-160	TOP PLATE	U1000 U-03-P122 (POLY CAB T0.5 SILK)	EA	1.0000	
2-T22-147	SHIELD PLATE (D)	U-04-P128 (BSP T0.3)	EA	1.0000	
2-B10-077	REAR PANEL ASS'Y	U1000 (HC)	KIT	1.0000	
2-C21-208	CABLE	U2000-02	EA	1.0000	
2-C21-207	CABLE	U2000-04	EA	1.0000	
2-T01-001	BNC CONNECTOR	UG-625/U	EA	1.0000	
2-T02-007	FUSE	0.5A 250V 5*20MM	EA	1.0000	
2-C40-054	AC INLET	42R 341121	EA	1.0000	
2-C39-217	POWER TRANSFORMER	U2000	EA	1.0000	
2-C37-106	SUMI TUBE	4.5PI	M	0.0014	
2-T26-102	LEAD WIRE	U2000-03	EA	1.0000	
2-T11-026	HEXAGON NUT	M3 NI/PL.	EA	2.0000	
2-T11-029	HEXAGON NUT	M6 NI/PL.	EA	1.0000	
2-T08-001	REAR PANEL	8100A (L-SHEET T1 SB-142L) GREY	EA	1.0000	
2-T48-013	MACHINE SCREW	BH(+) M3.0*8.0 NI/PL	EA	2.0000	
2-T53-106	MACHINE SCREW	FH(+) M3.0*8.0 NI/PL	EA	2.0000	
2-T08-016	GROUND TERMINAL	ESBM NI/PL	EA	1.0000	
2-T11-006	PLAIN WASHER	3PI NI/PL.	EA	2.0000	
2-T11-009	SPRING WASHER	3PI NI/PL	EA	2.0000	
2-T11-018	TOOTHED LOCK WASHER	6PI ZN/PL (INSIDE)	EA	1.0000	
2-Z10-025	LINE ASS'Y	U1000 (HC)	KIT	1.0000	
2-T07-055	BOTTOM CASE	8010A (HANNAM ABS 750, GREY)	EA	1.0000	
2-T06-030	TOP CASE	8010A (HANNAM ABS 750, GREY)	EA	1.0000	
2-T58-014	HOUSING COVER (A)	Z216 (HANNAM ABS 750, GREY)	EA	2.0000	
2-T58-015	HOUSING COVER (B)	Z216 (HANNAM ABS 750, GREY)	EA	2.0000	

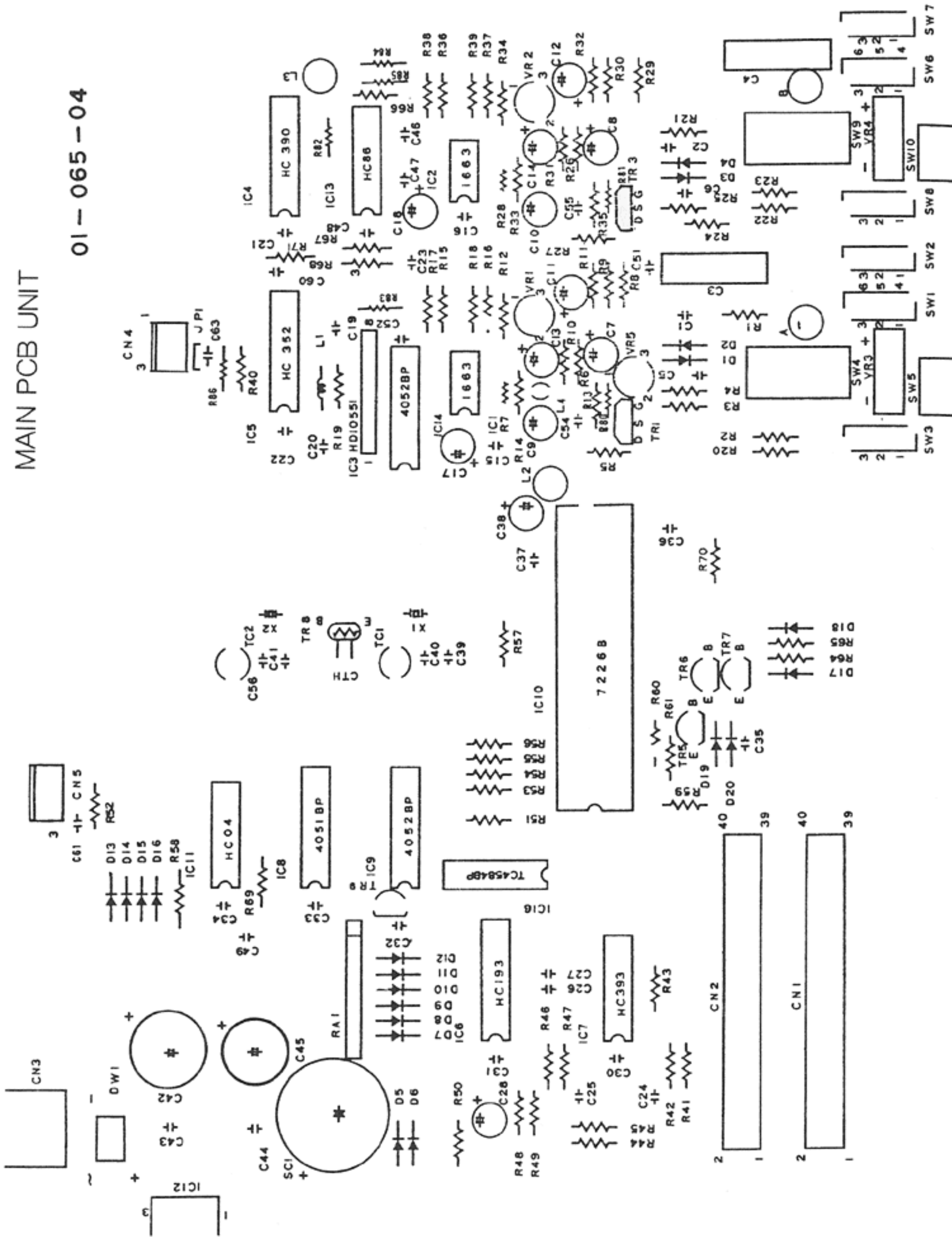
CODE-NO	PARTS NAME	SPEC (DESCRIPTION)	UNIT	Q'TY	REF-NO
2-T02-002	RUBBER FOOT	HC5502 (RUBBER BLACK)	EA	4.0000	
2-T12-114	FRAME	U-03-P121 (SBOC T1.2)	EA	2.0000	
2-T08-021	HANDLE	8010A (T2.8 CR/PL)	EA	1.0000	
2-T58-012	ROTATOR HOUSING	Z-216 A-(HANNAM ABS 750,GREY)	EA	2.0000	
2-T58-013	ROTATOR HOUSING	Z-216 B-(HANNAM ABS 750,GREY)	EA	2.0000	
2-T23-035	HANDLE KNOB	08615 (HANNAM ABS 750,GREY)	EA	1.0000	
2-T23-044	KEY TOP KNOB	5802 (ACRYL LUCKY 850)	EA	5.0000	
2-T23-168	KEY TOP KNOB	AP-37-GL (PS-1S2 TYPE)	EA	6.0000	
2-T21-003	KNOB (1)	5502 (HANNAM ABS 750,GREY)	EA	2.0000	
2-T11-026	HEXAGON NUT	M3 NI/PL	EA	5.0000	
2-T58-023	NUT	Z216 (SPC T2.0 ZN/PL)	EA	2.0000	
2-T58-025	SPRING PLATE	Z216 (PISR T0.5 NI/PL)	EA	2.0000	
2-T08-047	SHIELD POLE	U-04-R130 (RSEBH 5*275)	EA	4.0000	
2-T58-016	ROTATOR	Z216 (HANNAM ABS 750,GREY)	EA	2.0000	
2-C42-136	SILICONE RUBBER (1)	ARI 230 (T0.3*13*18)	EA	1.0000	
2-T58-040	MACHINE SCREW	PH(+) M3.0*6.0 NI/PL	EA	17.0000	
2-T10-039	MACHINE SCREW	PH(+) M2.6*6.0 ZN/PL	EA	4.0000	
2-T54-214	MACHINE SCREW	PH(+) M2.6*6 NI/PL	EA	8.0000	
2-T58-050	MACHINE SCREW	PH(+) M4.0*17.0 ZN/PL	EA	2.0000	
2-T54-203	TAPPING SCREW	PH(+) P12.5*6 ZN/PL, 1PART	EA	4.0000	
2-T58-042	WASHER WITH MACHINE SCREW	PH(+) M3.0*10.0 NI/PL	EA	4.0000	
2-T54-201	WASHER WITH MACHINE SCREW	PH(+) M3.0*6.0 NI/PL	EA	4.0000	
2-T07-161	SHIELD PLATE (A)	U-04-P125 (ESP T0.3)	EA	1.0000	
2-T42-093	RUG TERMINAL	P13 NI/PL	EA	1.0000	
2-T02-031	CABLE TIE	100MM (SMALL AN-1)	EA	2.0000	
2-T50-010	PACKING ASS'Y	U1000 (HC)	KIT	1.0000	
2-T14-018	COAXIAL CABLE	BNC-TO-BNC 100CM (RG58)	EA	1.0000	
2-T27-068	POWER CORD	VM1182-12762M	EA	1.0000	
2-T58-006	FUSE	0.2A 250V 5*20MM	EA	1.0000	
2-T02-007	FUSE	0.5A 250V 5*20MM	EA	1.0000	
2-T08-043	HANDLE PLATE	HUNG CHANG (PC T0.3)	EA	1.0000	
2-T07-090	INNER BOX	395*300*164 (BENCH NEW DW-1PART)	EA	1.0000	
2-T07-091	OUT BOX	BENCHI (NEW) (DW-3 628*409*356)	EA	1.0000	
2-T14-042	SNOW BOX	8010A (FRONT/REAR)	EA	1.0000	
2-T13-121	MANUAL	U1000	EA	1.0000	
2-T14-012	POLY BAG	0.1*500*350	EA	1.0000	
2-T14-008	POLY BAG	14*22	EA	1.0000	
2-T14-013	POLY BAG	5.5*8 (ZIPPER)	EA	1.0000	
2-T52-003	SILICA-GEL	5/G	EA	2.0000	

SECTION V

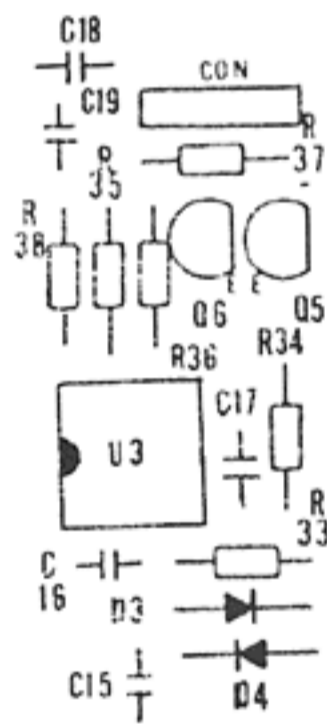
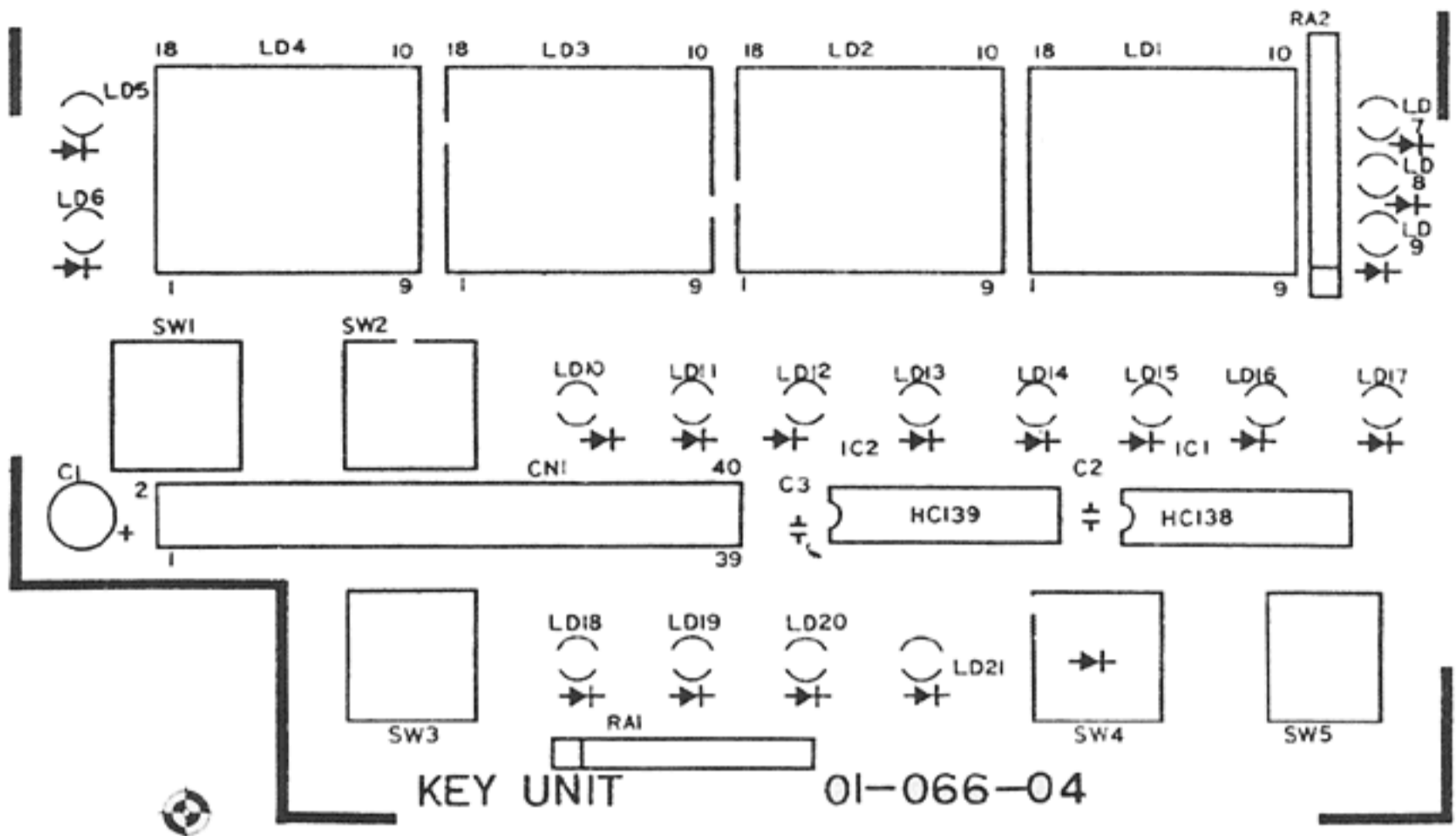
1. MARKING DIAGRAM

MAIN PCB UNIT

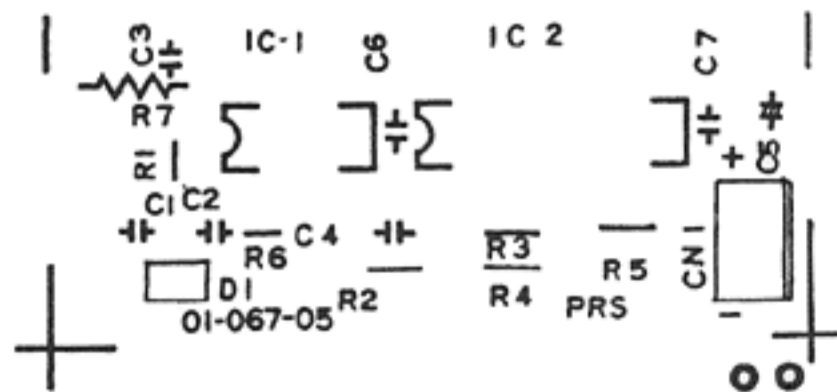
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KEY UNIT

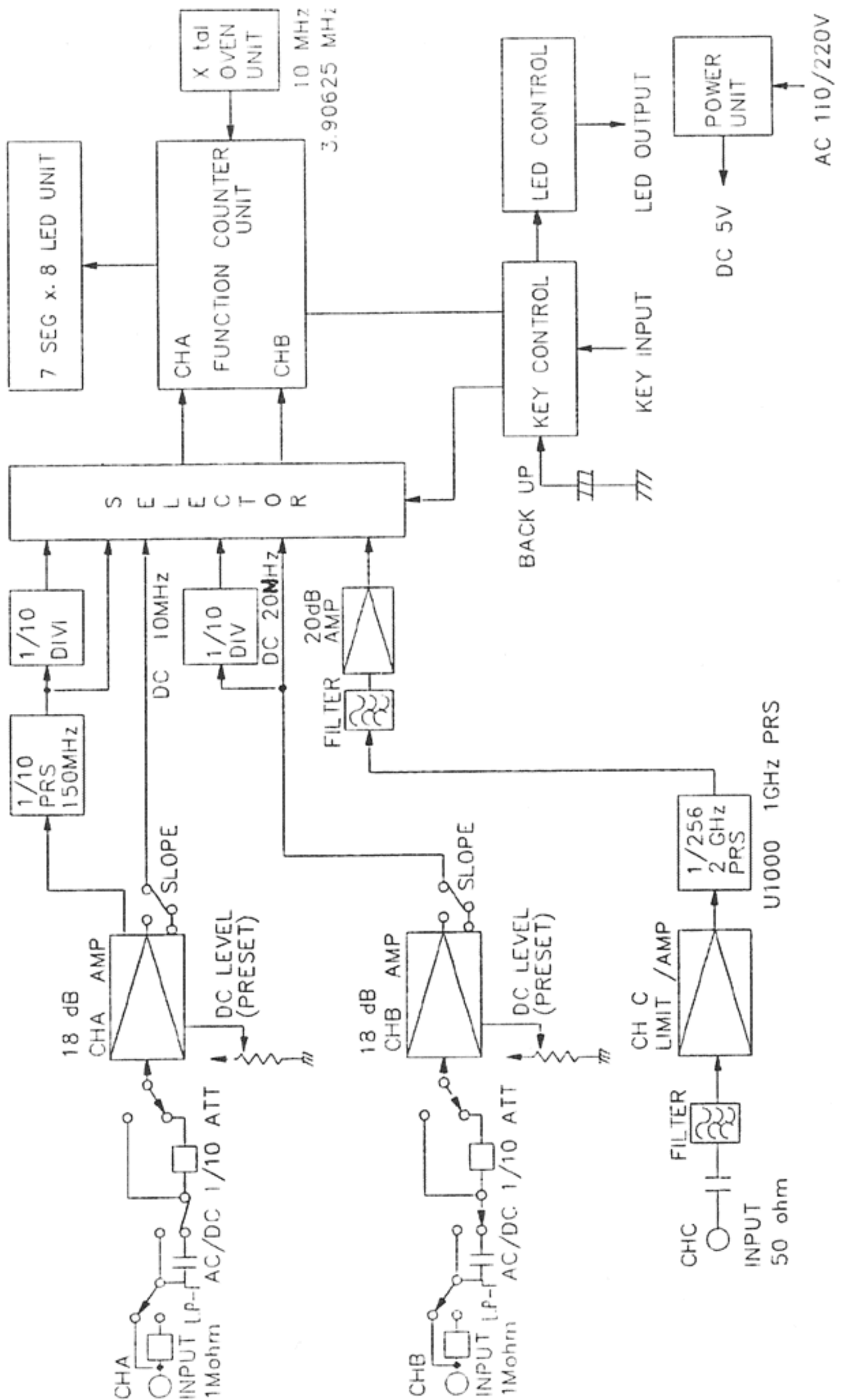


1GHz PRESCALER UNIT

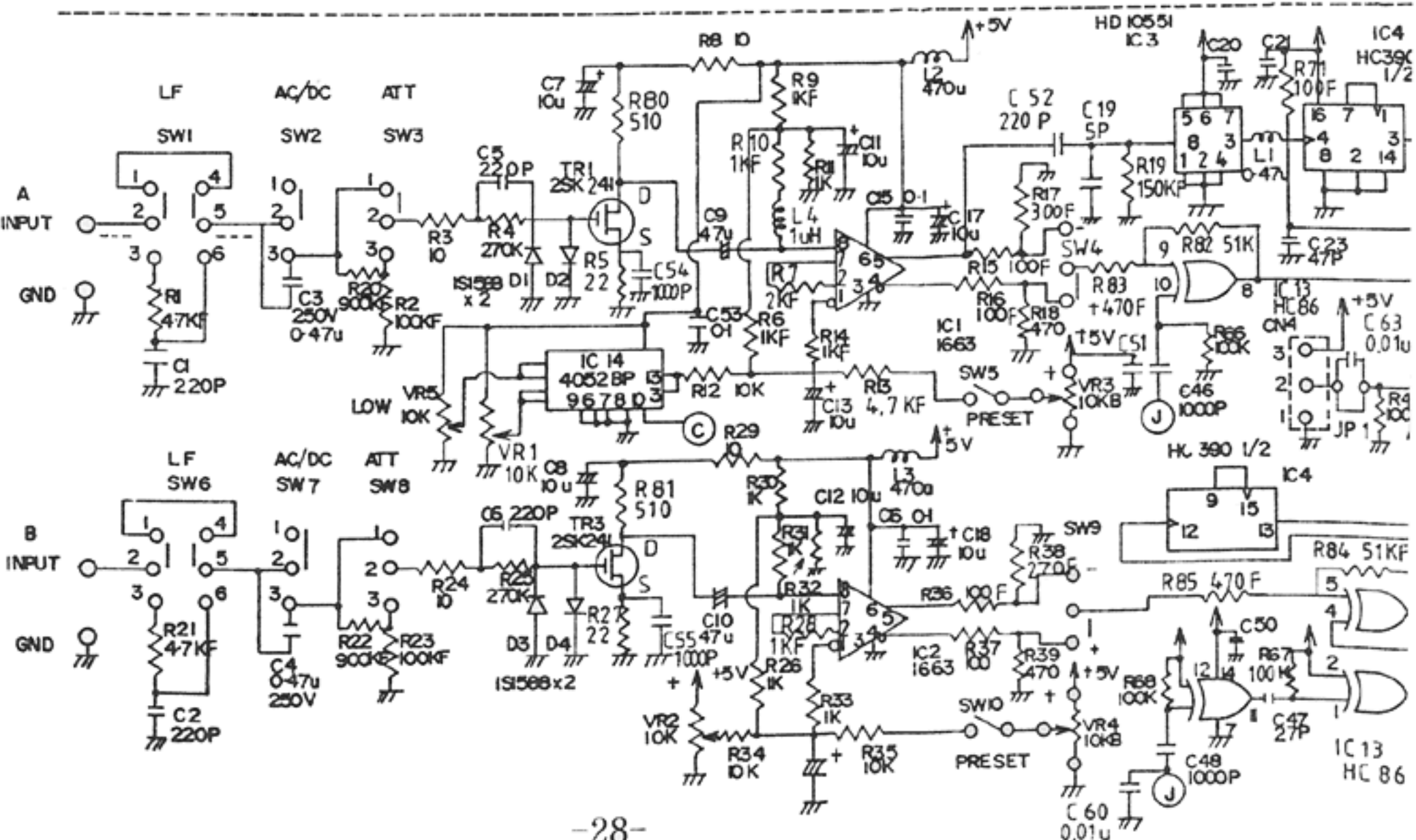
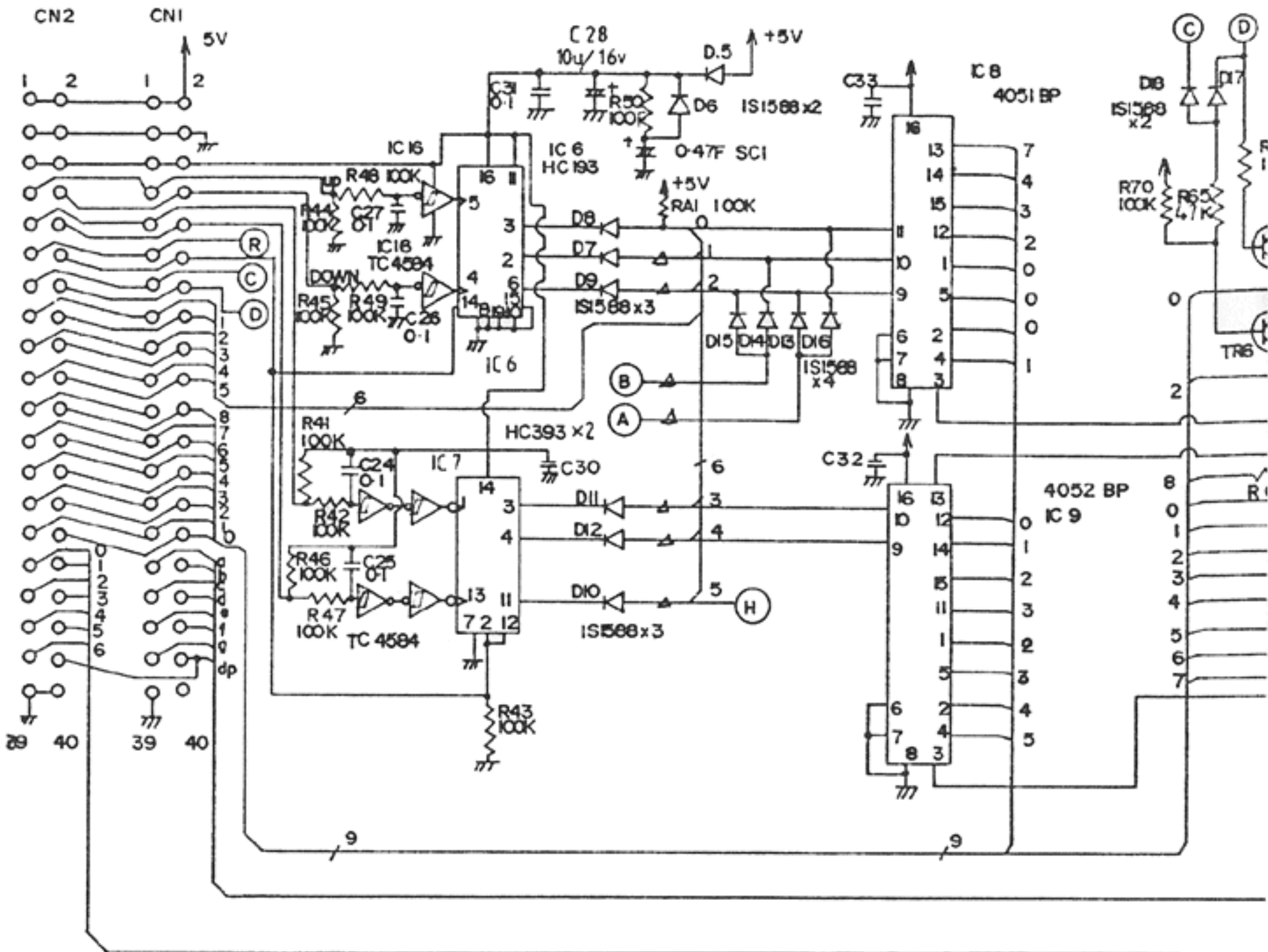


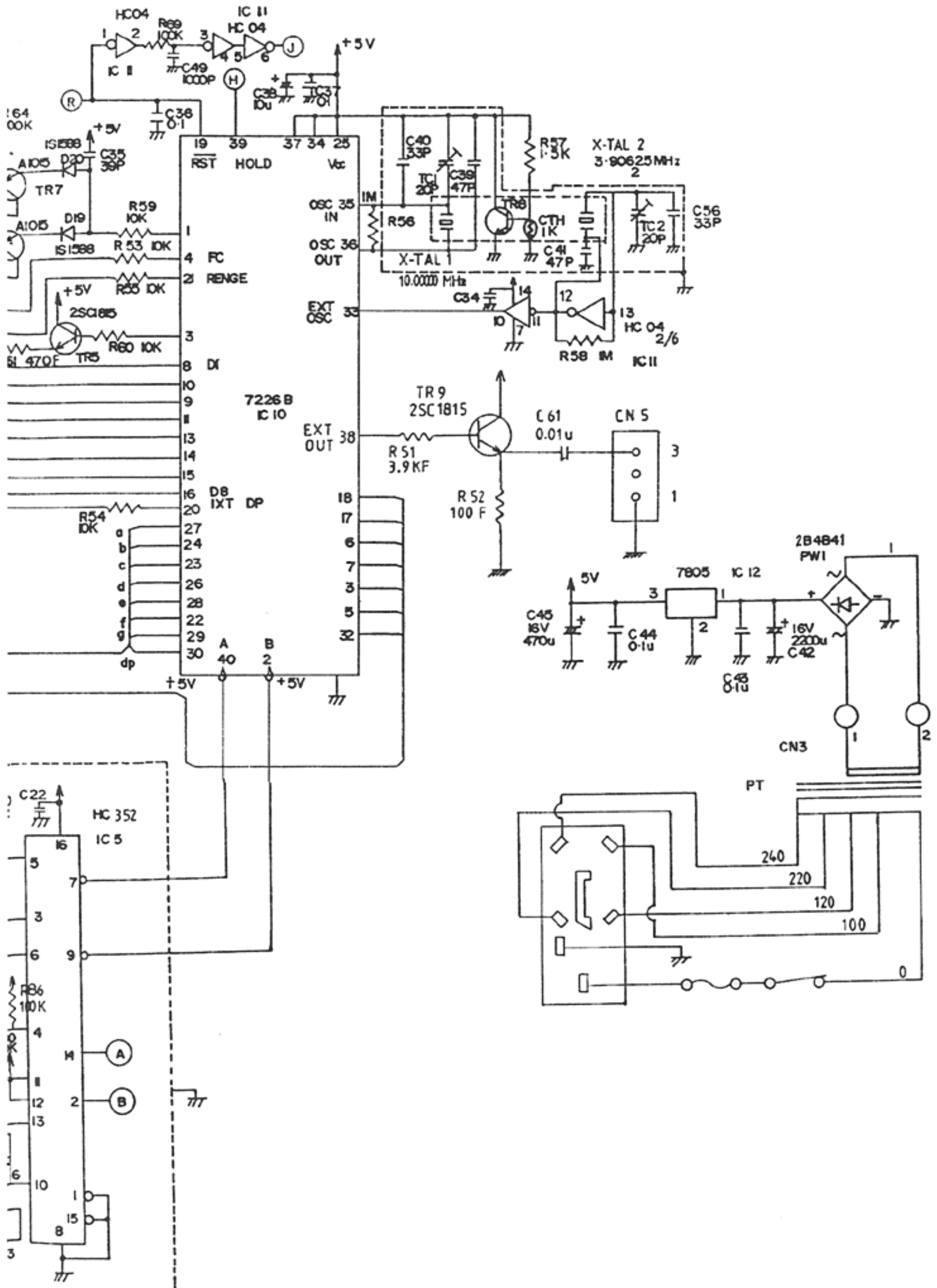
2GHz PRESCALER UNIT

2. BLOCK DIAGRAM

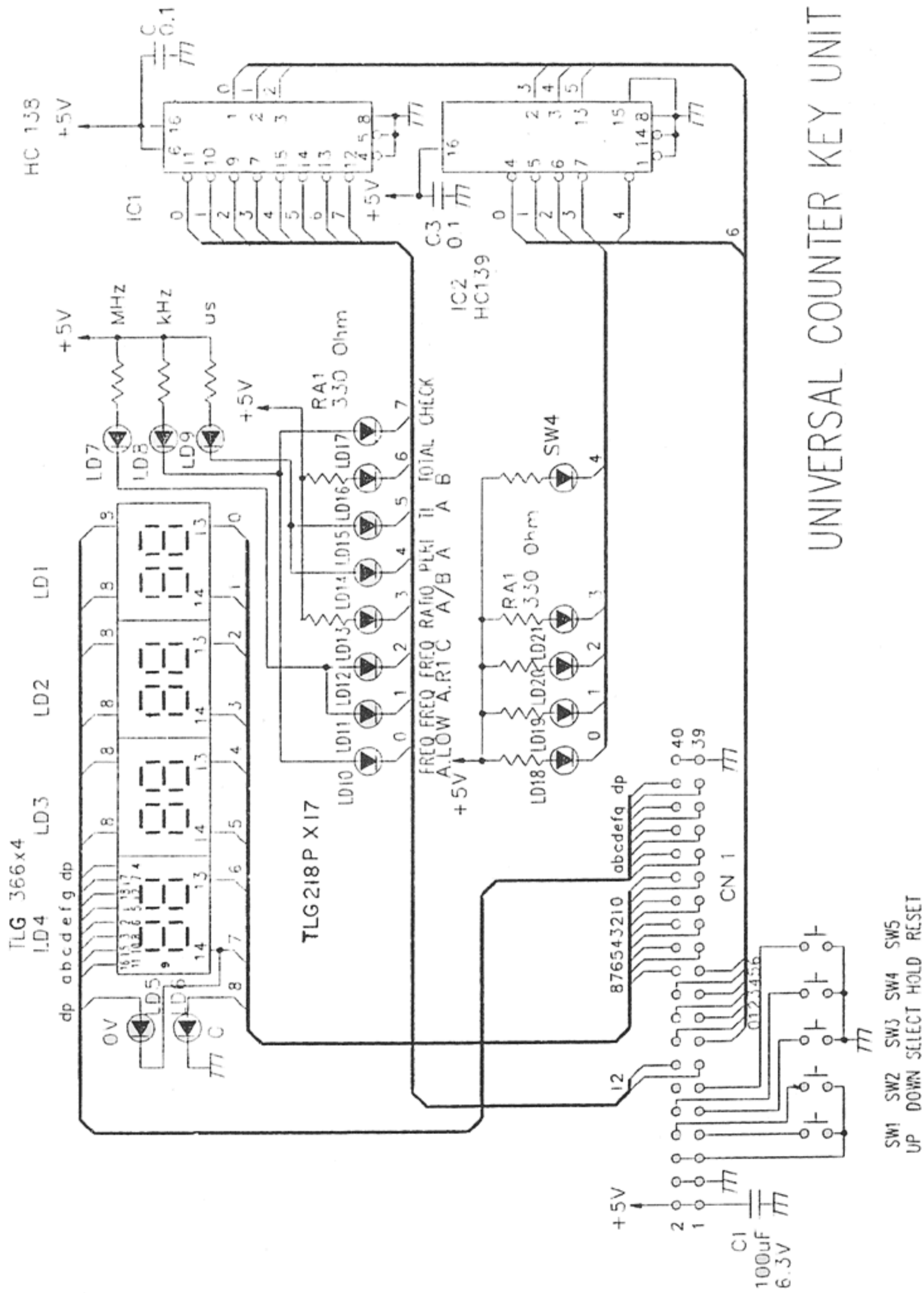


3. CIRCUIT DIAGRAM



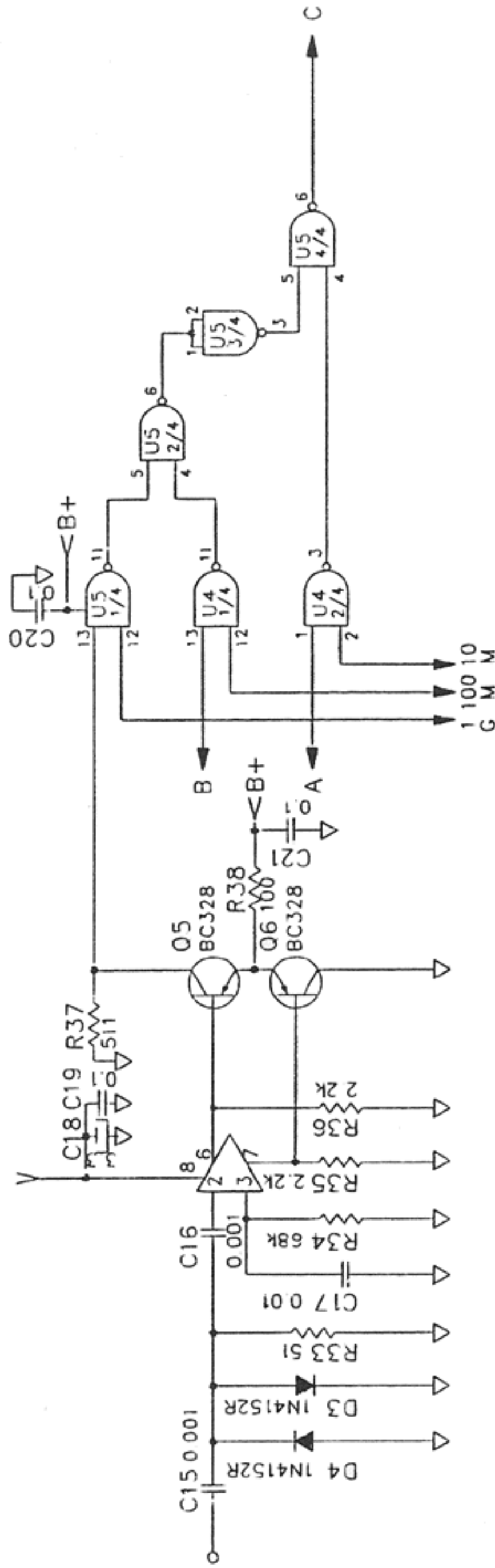


KEY UNIT



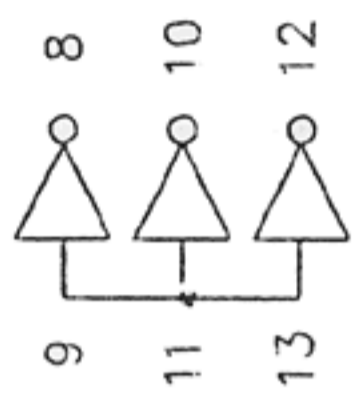
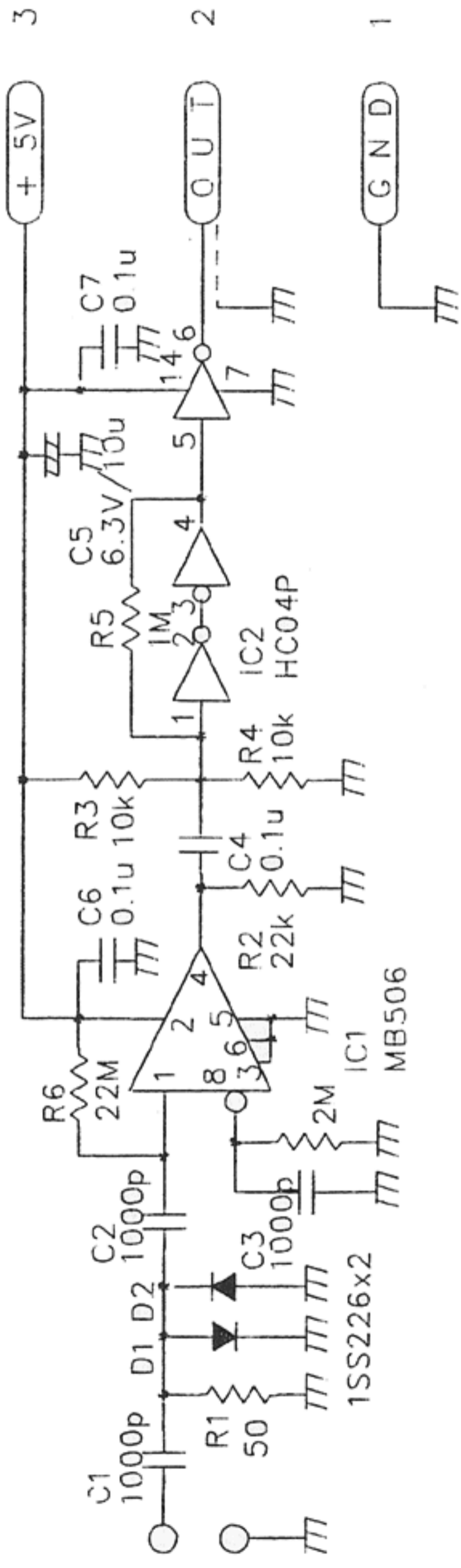
UNIVERSAL COUNTER KEY UNIT

SW1 SW2 SW3 SW4 SW5
UP DOWN SELECT HOLD RESET



1GHZ PRESCALER UNIT

CN 1 (TO CN-4)



2GHZ PRESCALER UNIT