

## 10. Field Strength Meter

### Specification :

#### Frequency

Frequency range : 9 kHz to 30MHz  
Frequency settings : Step dial: 1kHz, 10kHz, 100kHz, 1MHz, selectable  
Fine dial: +1kHz, continuously variable  
Memory : 50 frequencies

#### Level

Voltage (E.N.F.) : Accuracy : 1.5dB (at minimum value + 20dB)  
Field strength : Accuracy : +2dB (at minimum value + 20dB)  
Type of antenna : Loop Antenna  
Calibration oscillator : Sine wave, automatically set to the receiving frequency  
Digital display : Display : 4 digits LCD, lowest 0.1dB  
Unit : dBuV, dBuV/m, dB (for conversion coefficient of antenna)

#### Selectivity

Signal to image ratio : 70dB  
Pulse response : Conforms to CISPR specifications  
Output : 1F output (Frequency: 455kHz)  
(Level : 74dBuV (75 load with indicator at 0dB)  
Monitor output : A1A, A2B, A3E wave can be monitored with internal speaker or earphone.  
BFO is provided  
Remote control : Compatible with IEEE 488 (GP-IB)  
Power : AC 100V or 200V, 50/60Hz, 40VA

#### C. Standard Accessories :

AC power cord (2.5) 1 ea  
DC power cord RM12BPG-5s, 2CC& arrow tip, 1.5m 1 ea  
Coaxial cord: 3CW-P, 3C-2WS, #CS-P, 1m 1 ea  
Connecting cord for recorder: BNC-P, Alligator clip, 1.5m 1 ea  
Earphone 1 ea

#### D. Option:

Loop antenna 1 set  
Rod antenna 1 set  
Tripod 1 set  
DC power supply 1 set  
Artificial power line for (CISPR) 1 set  
Artificial power line for (FCC) 1 set  
Artificial power line for (FTZ) 1 set  
GP-IB cable (2m) 1 ea

## Measuring Receiver

### Specifications:

- . Frequency
  - Range : 25MHz to 300MHz
  - Resolution : 120kHz BW; 12.5kHz
  - Setting : Keyboard and FINE dial
  - Reference frequency stability :  $\pm 1 \times 10^{-6}$
- . Voltage measurement (E.M.F) : 25 to 300MHz ; 14dBuV
- . Field strength measurement : 25 to 300MHz ; 4 to 28dBuV/m
- . Type of antenna : Half-wave dipole
  
- . Measured level indication display : Liquid crystal display 4 digits, Min. digit 0.1dB(on digital display), up to 80dB (on analog meter)
  
- . Monitor output : AM and FM can be hear from a speaker,
- . Power : DC 12V :  $< 700\text{mA}$   
AC 100V or 250V, 50/60Hz  $\leq 20\text{VA}$

### Standard Accessories :

- . Carrying case 1 ea
- . Battery pack 1 ea
- . Connecting cord for recorder 1 ea
- . DC power cord 1 ea
- . Earphone 1 ea

### Option :

- . GP-IB interface
- . Dipole Antenna 25 - 520MHz 1 set

## Field Strength Measuring Receiver

### Specification :

|                                |   |
|--------------------------------|---|
| . Frequency Range              | : 300.000 to 999.999MHz                     |
| Resolution                     | : 120kHz BW ; 12.5kHz<br>15kHz BW ; 1kHz    |
| Reference frequency stability  | : $+1 \times 10^{-6}$                       |
| . Voltage measurement (e.m.f.) | : 300 to 999.999MHz ; 5dBuV                 |
| . Comparison oscillator        | : Pulse generator                           |
| . Field strength measurement   |   |
| . Type of Antenna              | : Half-wave dipole                          |
| . Monitor output               | : AM and FM can be heard from a speaker,    |
| . Power                        | : DC 12V : 700mA<br>AC 100V or 250V 50/60Hz |

### Standard Accessories :

|                   |      |
|-------------------|------|
| . Carrying case   | 1 ea |
| . Battery pack    | 1 ea |
| . Connecting cord | 1 ea |
| . DC power cord   | 1 ea |
| . Earphone        | 1 ea |

### Option :

|                     |       |
|---------------------|-------|
| . GP-IB interface   | 1 ea  |
| . Battery pack      | 1 ea  |
| . AC power pack     | 1 ea  |
| . Dipole ant. set   | 1 set |
| . Log-periodic ant. | 1 set |
| . Loop ant. set     | 1 set |
| . Termination       | 1 ea  |

17. Digital Plotter

Specifications:

|                       |                                       |
|-----------------------|---------------------------------------|
| Writing speed         | : Max. 400mm/sec                      |
| Penup down time       | : 40 time/sec                         |
| Pen                   | : 8 pen                               |
| Max. plotting area    | : 400 x 275mm                         |
| Interface             | : RS-232C, GP-IB, centronix available |
| Step width            | : 25 micron                           |
| Accuracy              | : $\pm 0.1 + \frac{30N}{1000}$ mm     |
| Power                 | : AC 100V $\pm 10\%$ , 50/60Hz        |
| Operating temperature | : 5°C - 40°C                          |
| Dimension             | : 525W x 160H x 490L mm (16kg)        |

Large size plotting A3

Standard Accessories :

|                       |        |
|-----------------------|--------|
| 1. Plotting paper     | 1 box  |
| 2. Water ball pen     | 1 set  |
| 3. Fuse (2A)          | 1 ea   |
| 4. Power cord         | 1 ea   |
| 5. Dust cover         | 1 ea   |
| 6. 3P-2P connector    | 1 ea   |
| 7. Acc. Bag           | 1 ea   |
| 8. Paper loading pipe | 1 ea   |
| 9. Manual             | 1 book |

## 12. Function Generator

### Specifications:

Frequency Range : 0.1 Hz - 10 MHz continuously variable  
Attenuator : 0 dB/20dB/40dB, continuously variable for more than 20dB  
Sine-wave Distortion : 0.5% or less (range: 10 Hz - 1 kHz)  
Frequency Modulation : VCF possible  
Amplitude Modulation : +5V, carrier level variable  
Synchronized Output :  
Waveform : Square wave  
Trigger Gate Modes : CONT(continuous oscillation), GATE(oscillating for gate duration), TRIG(single oscillation).  
GATE and TRIG manual operation is possible.  
Sweep Modes : CONT SWEEP, TRIG SWEEP (single sweep, manual operation possible)  
Power Supply : 100/117/217/234V AC, 50 - 400Hz, 50W

### Standard Accessories :

. Instruction manual 1 ea  
. Spare fuse 2 ea  
. Accessory bag 1 ea

### Optional Accessories :

. Coaxial cable  
. Termination

### 13. Function Generator

#### Specifications :

|                      |   |
|----------------------|---|
| Frequency Range      | : 0.01 Hz - 1 MHz continuously variable   |
| Output               |   |
| Waveforms            | : Sine wave, triangle wave, square wave (symmetric)<br>square wave (15:85 max. variable duty), DC   |
| Attenuator           | : 0 dB/20dB/40 dB, continuously variable for more<br>than 34 dB   |
| Frequency Modulation | : VCF possible  |
| Amplitude Modulation |   |
| Synchronized Output  |   |
| Waveform             | : Square wave   |
| Trigger Gate         |   |
| Modes                | : CONT (continuous oscillation), GATE (oscillating<br>for gate duration), TRIG (single oscillation).<br>GATE and TRIG manual operation is possible. |
| Power Supply         | : 100/117/217/234V AC, 50/60Hz, 18W (approx.)   |

#### Standard Accessories :

|                      |      |
|----------------------|------|
| . Instruction manual | 1 ea |
| . Spare fuse         | 2 ea |
| . Accessory bag      | 1 ea |

1A. 3-Tube Color TV Camera

A. Features :

- . Automatic balancing (white balance)
- . Automatic centering
- . Automatic warning system
- . Status display
- . Built-in sync generator
- . Built-in color bar generator
- . Auto lens close mechanism to protect the pick-up tubes during preheat.

B. Specification :

- . Camera Head
  - Pick-up tube : 2/3 saticon (magnetic focus, static deflection)
  - System : RGB 3-tube system
  - Signal system : EIA standard, NTSC COLOR
  - Scanning system : 525 lines, 2:1 interlace, 30frames.sec
  - Horizontal resolution : 750 lines(G channel, at the center)  
650 lines(Y channel, at the center)
  - Minimum illumination : 40 Lux (4 tootcandles) with F 1.6, +18dB
  - Sensitivity : 2,000 lux (200 tootcandles) with F4, at 3200<sup>o</sup>K
  - Signal-to-noise ratio : 57dB up
- . Zoom Lens
  - Focal length : 9.5mm to 143mm  
Manual and motorized  
Selectable zooming ratio : 15X
  - Maximum aperture Ratio : 1.8
- . Viewfinder
  - Picture tube : 5 " monochrome
  - Indicators : REC/TALLY indicator, BATT indicator
  - Resoluition : 400 lines
- . Battery adaptor
  - Usable battery : Two NP-1 battery packs
  - Output voltage : 11V to 14.5V DC
- . Tripod attachment : approx. 100(W) x 40(H) x 311(D)mm  
(4 x-5/8 x 12½")
- . Carrying case

15. U-Matic Video Cassette

Specifications :

- . Video recording system : Rotary 2-head helical scan system  
Luminance; FM recording  
Chrominance; Converted subcarrier direct recording
- . Video signal system : EIA monochrome, NTSC color
- . Power requirements : AC 100 - 120V  $\pm 10\%$ , 45 - 66Hz
- . Video signals
  - Input : 1.0Vp-p, 75 ohms, unbalanced sync negative
  - Outputs : 1.0Vp-p +0.2Vp-p, 75 ohms, unbalanced, sync negative (VIDEO-1, VIDEO-2)
  - Signal-to-noise ratio : Color; Better than 46dB  
Monochrome; Better than 49dB
- . Audio signals
  - Signal-to-noise ratio : Better than 48dB
- . Tape transport
  - Tape speed : 9.53cm/s (3 $\frac{1}{2}$  ips)
  - Wow and flutter : 0.2% RMS
  - Tape : Sony KCA type, or KCS type videocassette tape or equivalent
- . Special functions
  - Pause mode
  - Search
  - Preroll
  - Editing
  - Remote control
  - Auto program search
  - Vertical-interval switcher
  - Dropout compensator
  - Timer operation



16. 12" High Resolution Color Monitor

Specification :

- . CRT Type: Trinitron
- . 4 colors system
- . NTSC, NTSC 4.43, PAL, SECAM
- . Horizontal resolution of 600 lines (RGB inputs)
- . RGB and computer connector
- . 2000 characters can be displayed when used as a character display
- . Built-in interface for IBM-PC
- . Accepts an external sync
- . Selectable normal or under scanning
- . Selectable horizontal AFC time-constant(FAST/SLOW)

17. Transistor Universal Checker

Specifications

|                      |  |
|----------------------|--|
| Transistor           |  |
| AC Beta ( $h_{fe}$ ) |  |
| Measuring Frequency  | : 270 Hz $\pm 10\%$  |
| Measuring Range      | : 0 - 500 3 ranges $\pm 2.5\%$ of full scale   |
| DC Beta ( $h_{FE}$ ) |  |
| Measuring Range      | : 10 - 500 2 ranges, $\pm 2.5\%$ of scale length   |
| ICBO                 |  |
| Measuring Range      | : 0 - 10 mA 4 ranges $\pm 2.5\%$   |
| Diode & Zener Diode  |  |
| Measuring Items      | : Forward and backward voltage and current characteristics   |
| Measuring Voltage    | : 0 - 100V 3 ranges $\pm 2.5\%$  |
| Measuring Current    | : 0 - 10 mA 4 ranges $\pm 2.5\%$   |
| SCR                  |  |
| Measuring Items      | : GO/NO-GO judgement, $V_F$ and $I_H$ measurement  |
| Phototransistor      |  |
| Measuring Items      | : Measurement of voltage-current characteristics (photo and thermal control are external), Others same as forward direction of diode |

## 18. Color Pattern Generator

### Specification :

#### PATTERN

Crosshatch

Center cross

Dot

Raster

Color

: Red, blue, green, white

: 75% luminance NTSC, PAL color bars

#### VIDEO OUTPUT

Output Voltage

: Fixed: 1Vp-p (into 75-ohm load)

Variable: 0 to 1.5Vp-p (into 75-ohm load)

#### RF OUTPUT

Modulation system

: Negative modulation

#### SUB-CARRIER OUTPUT

Frequency

: Center frequency  $\pm$  100Hz, adjustable within 5Hz

#### SYNC SIGNAL

|                               | NTSC(Hz) | PAL-B(Hz) |
|-------------------------------|----------|-----------|
| Horizontal scanning frequency | 15.734k  | 15.625k   |
| vertical scanning frequency   | 59.94    | 50.00     |
| Interface scanning            | 59.94    | 50.00     |
| Progressive scanning          | 60.05    | 50.08     |

## 19. AC Level Meter

### Specification :

Input Frequency

: DC to 1MHz

Level Measurement

Range

: 1mV (-60dB)

1000V (60dB), 7 ranges

Resolution

: 1uV/1mV range, 0.01dB/ -60dB range

Input impedande

: 1M ohm  $\pm$ 5% paralleled by 20pF or less

Response time

: SLOW mode 500ms, FAST mode 50 rms

Range selection

: Manual and automatic

CMRR

: 90dB or more (DC to 60Hz)

Power Requirements

: 100, 115, 200, 230Vac, 50/60Hz, approx. 40VA

Option

: Filter CBEF 400Hz, BEF 1kHz, BPF.2kHz)

: Q-RMS (DIN AUDIO, DIN-NOISE, 1HF-A)

: Q-PEAK(WIDE BAND, DIN-AUDIO, DIN-NOISE)

: Q-PEAK(BEF 1kHz, DIN-AUDIO, DIN-NOISE)

o GP-IB Interface, Analoge and Digital Outputs.

10. Power Meter

Specifications :

- |                            |   |
|----------------------------|---|
| 1. Frequency range         | : 10 Mhz to 140 Ghz   |
| 2. Display                 | : W/dBm/dB (REL) selectable<br>digital in 4 digits<br>with a small analog meter (without<br>numerical readout capacity) |
| 3. Calibrating oscillator  | : Frequency : 50 Mhz output power: 0dBm (1mW)<br>Accuracy : $\pm 1.2\%$ output connector: N(J)                          |
| 4. Averaging               | : Sampling rate time can be set in 3 steps  |
| 5. Holding indicated value | : The indicated value can be held   |
| . Remote control           | : GP-IB interface incorporated  |
| . Power                    | : AC : 100V $\pm 10\%$ ,  |

Standard Accessories :

- |                       |        |
|-----------------------|--------|
| 1. Power cord         | 1 ea   |
| 2. Instruction manual | 1 book |

Option :

- |                            |      |
|----------------------------|------|
| 1. Battery pack            | 1 ea |
| 2. Battery charger         | 1 ea |
| 3. Carrying case           | 1 ea |
| 4. GP-IB interface         | 1 ea |
| 5. Attenuator              | 1 ea |
| 6. Sensor, 10 Mhz - 14 Ghz | 1 ea |
| 7. Sensor, 17GHz - 22 Ghz  | 1 ea |
| 8. Sensor, 40 Ghz - 60 Ghz | 1 ea |

21. Electronic Voltmeter

Specifications :

- |                               |                                      |
|-------------------------------|--------------------------------------|
| 1. Frequency                  | : 10KHz to 1000MHz                   |
| 2. Voltage measuring range    | : 300uV to 3V, 8 ranges (full scale) |
| 3. Voltage measuring accuracy | : 3% (10KHz ~ 1000MHz)               |
| 4. Stability                  | : $\pm 10\%$                         |
| 5. Input impedance            | : Shunted by $\leq 1pF$              |
| 6. DC output for recorder     | : 100mV $\pm 10\%$                   |
| 7. Power                      | : 100V, 50/60Hz, $\leq 12VA$         |

Standard accessories :

- |               |      |
|---------------|------|
| 1. Probe      | 1 ea |
| 2. Probe tips | 2 ea |

Optional Accessories :

- |                            |       |
|----------------------------|-------|
| 1. Voltage divider         | 1 ea  |
| 2. Coaxial connector       | 1 ea  |
| 3. Termination Z-147 A/B/C | 1 set |

## Oscilloscope

### Specifications

1. CRT : 6-inch rectangular  
Display area : 8 x 10 div (1 div = 10mm) parallax free internal graticule
2. Vertical Deflection System  
Modes : CH1, CH2, ALT, CHOP, ADD, QUAD (4CH, 8 Traces)  
Frequency response : DC-200MHz, -3dB  
Rise time : 1.75ns (CH1/2)
3. Max. input voltage : Direct : 250V (DC + AC peak)  
W/probe : 600V (DC + AC peak)
4. Horizontal Deflection System  
Display modes : A, A INTEN, ALT, B (DLY'D), X-Y  
Sweep Modes : A : AUTO, NORM, SINGLE  
B : RUNS AFTER DELAY, TRIG'D DELAY  
Sweep Rates : A : 10ns/div - 0.5s/div  $\pm 2\%$   
B : 10ns/div - 50ms/div  $\pm 2\%$   
Fastest Sweep rate : 1ns/div
5. Signal outputs : A gate out, B gate out, CH1 signal out
6. Powersupply : 100/115/220/230/240V AC  $\pm 10\%$ .

### Standard Accessories:

- |                      |   |
|----------------------|---|
| 1. Power cord        | 1 |
| 2. Probe             | 2 |
| 3. Fuse              | 2 |
| 4. Panel cover       | 1 |
| 5. Dust cover        | 1 |
| 6. Accessory bag     | 1 |
| 7. Inspection manual | 1 |

### Option :

1. Combination trigger probe

### 23. Analog and Digital Storage Oscilloscope

#### B. Specifications :

|                       |                                     |
|-----------------------|-------------------------------------|
| CRT                   | : 7-inch rectangular                |
| Display area          | : 8 x 10 divisions (1 div = 12mm)   |
| Analog recording      |                                     |
| Max. writing speed    | : 2500 div/us                       |
| Read time             | : 30 seconds or more                |
| Digital recording     |                                     |
| Max. writing speed    | : 1000 div/us                       |
| Vertical Deflection   |                                     |
| Modes                 | : CH1, CH2, ALT, CHOP, ADD          |
| Rise time             | : Approximately 3.5 ns              |
| Horizontal Deflection |                                     |
| Mode                  | : A, A INTEN, ALT, B(DLY'D)         |
| A-Sweep               |                                     |
| Sweep mode            | : AUTO, NORM, SINGLE                |
| Sweep rate            | : 20ns/div to 0.5 s/div             |
| B-Sweep               |                                     |
| Delayed sweep         | : Runs after delay, triggered delay |
| Sweep rate            | : 20 ns/div. to 50 ms/div.          |
| Sweep magnification   | : 10 times (main frame operation)   |
| Calibrator            |                                     |
| Output waveform       | : Square-wave 1 KHz, $\pm 1\%$      |
| Power supply          |                                     |
| Voltage range         | : AC 100/117/217/234 V, $\pm 10\%$  |

#### C. Standard Accessories

|                              |      |
|------------------------------|------|
| 1. power cord                | 4 ea |
| 2. Fuse                      | 2 ea |
| 3. Adjusting screw driver    | 1 ea |
| 4. Accessory bag             | 1 ea |
| 5. Instruction manual        | 1 ea |
| 6. Probes (1.5M) with driver | 2 ea |

## 24. Personal Technical Computer

### A. Features :

- . Multitask parallel processing of up to 8 programs.
- . High-speed A/D and D/A converters, GP-IB interface, 4-channel serial I/O interface and other modules, all with full software support.
- . Power-ful graphics and matrix operation capabilities standard.

### B. Spceification :

|                         |                |   |
|-------------------------|----------------|---|
|                         | CPU            | 68000(8MHz clock)   |
| memory                  | ROM            | 16kB  |
|                         | RAM            | 512kB(8MB max)  |
| Display                 | Type           | Separate 12" amber CRT  |
|                         | Characters     | 6x8 dot matrix, 29 lines of 64 characters (three-screen scroll buffer)              |
|                         | Graphics       | 512 X 348 dots, independent 4-screen buffer   |
| Clock/timer/<br>counter | Realtime clock | Year, month, date, day, hour, minute, second, 1s resolution (with battery backup)   |
|                         | Counter        | One counter, 1ms resolution(count:0 to 65535)                                       |
|                         | Keyboard       | Full ASCII Character set, ten-key pad, 12 function keys, editing keys, command keys |
|                         | DMA capability | Standard  |

### C. Option :

- . Printer 1 ea
- . Numeric data processing unit 1 ea
- . Rubble memory 1 ea
- . GP-IB interface 1 ea
- . 8" FDD interface 1 ea
- . Data communication Interface 1 ea
- . EXT interrupt interface 1 ea
- . 4 channel serial I/O interface 1 ea
- . A/D converter 1 ea
- . D/A " 1 ea
- . 8" FDD (2ea) 1 set
- . Multifunction selector 1 ea
- . BCD converter 1 ea
- . GP-IB extender 1 ea
- . Serial I/O interface 1 ea
- . GP-IB serial converter 1 ea
- . Cable 1 ea
- . GP-IB connecting calbe (2m) 1 ea
- . FDD connecting cable(1m) 2 ea
- . A/D converter cable (3m) 4 ea
- . D/A converter cable (3m) 4 ea
- . Utility software 1 system
- o Assembler system
- o UCSD pascal
- o UCSD fortran
- o Basic Compiler
- o Cross assembler

25. Communication Receiver

Specification :

Frequency Range: 150 kHz - 30 MHz  
Mode: AM, FM, SSB (USB/LSB), CW

Frequency Accuracy:  $\pm 10 \times 10^{-6}$

IF Rejection: Better than 70dB

Image Ratio: " " "

Power Requirements: 100/120/220/240V AC. 50/60Hz  
138VDC1

Option : VHF converter unit (118 - 174MHz)

: 500Hz CW Filter

:: Lightning & Static Protector



## 26. DC CALIBRATION SETS

- 1) General Purpose. Interface Bus : This function is included in above mainbody.
- 2) Output Unit Marks : mV, V, mA or  $\mu$ C
- 3) Power Requirements : AC 100V+10% 60Hz
- 4) Voltage Range : 100V, 500V, 1,000V/10 $\mu$ A, 50 $\mu$ A, 100 $\mu$ A
- 5) Accuracy(Voltage) : +0.15% to +0.3%
- 6) Resolution : 0.01 to 10nA(Voltage)
- 7) Current Range : 1A, 10A, 30A/100mV
- 8) Accuracy (Current) : +0.2%
- 9) Resolution : 0.1mA to 0.01mV(Current)

Option : GP-IB Interface Bus

## 27. AC VOLTAGE/CURRENT STANDARD

- 1) General Purpose

Interface Bus Function : This function is included in above mainbody.

- 2) Measuring Range : 100mV, 1V, 10V, 100V, 300V, 1,000V  
: 100mA, 1A, 10A, 50A
- 3) Output Source : 1mV to 1,200V  
: 1mA to 60A
- 4) Accuracy : +0.08% of setting + 0.015% of Range
- 5) Resolution : 10 $\mu$ V to 100mV  
: 10 $\mu$ A to 10mA
- 6) Distortion : 0.07%(Voltage)  
: 0.18%(Current)
- 7) Output Frequency: 50, 60 to 400Hz Generated by Internal Oscillator
- 8) Power Supply : AC 100V+10% 60Hz
- 9) Stability : +0.003% of Range/hr

Option : GP-IB Interface Bus

2.8. Synthesizer Function Generator

Specifications

Frequency : 0.001Hz-20MHz/1000S-0.05uS

VCG  
Generations Variable Frequency : 0.001Hz-20MHz

Trigger Gate. Based  
Control : Internal signal or external signal

Output  
Waveform : Sinusoidal wave, Trigonal wave,  
Square wave, Pulse wave, Complement,  
Pulse wave

Voltage : 30Vp-p

VCA  
Control variable Frequency Range : 1mHz-20MHz

TTL OUT  
Waveform : Square wave (10ms)

GP-IB  
Function possible

Power Supply AC 100V +10%

Internal Remember Memory 100 step. Programmable.  
Store / Call / by variable of EXECUTE

## 29. Scope Calibrator

### Specifications

#### Voltage Calibrator

output

Square wave, 0.12mV - 100V  $\pm 0.5\%$

Rise Time

5  $\mu$ s or less

Flatness

$\pm 0.5\%$  or less

Fast

Sine wave (10ns), square wave(20ns)

#### Sine Wave Generator

Sine wave, 1 kHz  $\pm 20\%$ , 50/60Hz line frequency

#### Waveform Calibrator

Output

Square wave from 0.5Hz - 1MHz

1.3 V max. or more (into 50 $\Omega$ )

Rise Time

5 ns or less

Power supply

100/117/217/234 V AC, 50/60, Hz

### Standard Accessories :

|                      |      |
|----------------------|------|
| o Coaxial cord       | 1 ea |
| o Termination        | 1 ea |
| o Spare fuse         | 2 ea |
| o Accessories bag    | 1 ea |
| o Instruction manual | 1 ea |



6. 機械設計実習室

| No. | Nomenclature                 | Q'ty | Remarks |
|-----|------------------------------|------|---------|
| 1   | Drafting M/C for Black Board | 1    |         |
| 2   | Blue Printing M/C            | 1    |         |
| 3   | Episcope for daylight        | 1    |         |



| NO. | Nomenclature  | Q'TY | Remarks |
|-----|---|------|---------|
| 1   | <u>Drafting M/C for black board</u><br>Board size: Approx. 900x3600<br>Rail size: approx. 900x3600<br>Scale size  | 1    |         |
| 2   | <u>Blue printing M/C</u><br>A1 size   | 1    |         |
| 3   | Episcopes for daylight<br>1) Lenses : Approx. 4.0/400mm<br>2) Aperture : A4 size<br>3) Light Source<br>.Halogen lamp of long life: Approx. 1000W<br>.Power supply: 110V<br>4) Focusing: 1.5-3.5m.<br>(distance between main body and screen)<br>5) Projection angle adjustment<br>.Projection lens angle:<br>Approx. 15° to horizontal angle<br>.Main unit angle: Approx. ±8°<br>6) Luminous flux : Approx. 200 lumens<br>7) Magnification : Approx. 8x.<br>8) Power supply : 110V, 60HZ<br>9) Replacement lamp: 20EA | 1    |         |





7. 金型加工実習室裝備（2次分）

| No. | Nomenclature            | Qty | Remarks |
|-----|-------------------------|-----|---------|
| 1   | Profile Projector       | 1   |         |
| 2   | Hydraulic Molding Press | 1   |         |
| 3   | NC Wire Cutting M/C     | 1   |         |
| 4   | CNC Milling M/C         | 1   |         |
| 5   | Injection Molding M/C   | 1   |         |

金

型



1, Profile Projector

1 set

Specification

- 1) Horizontal type
- 2) Protractor screen dia : Approx. 350mm
- 3) Magnification : 5x, 10x, 20x, 50x,
- 4) Magnification accuracy : 0.1% (contour)
- 5) Contour Illuminator : Bulb 12V, 150W
- 6) Surface Illuminator : Bulb 12V, 150W  
: Condenser lens 10x, 20x, 50x  
: included
- 7) Power supply : AC100V, 60HZ

Furnished Accessories

- 1) Contour Illuminator : 1Set
- 2) Power supply cord : 1Set
- 3) Bulb : 2pcs

Standard Set

- 1) Surface Illuminator : 1Set
- 2) Microstage (400x150mm) : 1Set
- 3) Protractor screen : 1Set
- 4) Vertical workpiece holder : 1Set

Optional Accessories

- 1) Projection lens set with condenser lens (5x, 10x, 20x, 50x) : 1Set
- 2) Half reflecting Mirror (5x, 10x, 20x, 50x,) : 1Set
- 3) glass scale 300mm : 1Set
- 4) Center stage : 1Set
- 5) Rotary vise : 1Set
- 6) V block with clamp : 1Set

## 2. Hydraulic Molding Press

1Set

### Specification

- 1) Clamping capacity : 30Ton
- 2) Transfer capacity : 3Ton
- 3) Working Height : Appronx. 800mm
- 4) Ejector space : Approx. 450mm
- 5) Clamp stroke : Approx. 250mm
- 6) Transfer stroke : Approx. 220mm
- 7) Max. clamping pressure : Approx. 150Kg/cm<sup>2</sup>
- 8) Clamping speed (High-Low) : 120mm/sec-30mm/sec
- 9) Motor : AC220V, 60HZ, 3Ph
- 10) Heater : Approx. 8KW
- 11) Cooler water flow : 30 ℓ /min

## 3. NC Wire Cutting Machine

1Set

### Specification

- (1) Machine
  - 1) Maximum Workpiece dimension : Approx. 400x500x100mm
  - 2) Travel. Longitudinal : Approx. 250mm
  - Cross : Approx. 350mm
  - Vertical : Approx. 120mm
- (2) Dielectric Supply Unit
  - 1) Dielectric fluid : Deionized water
- (3) NC Unit
  - 1) Input method : Cossette tape  
MDI, Paper tape
  - 2) Control Axis : X, Y, U, V 4 axes
  - 3) Table Position display : X, Y simultaneous  
7digit. U, V Simultaneous  
Minimum Unit 0.001mm
  - 4) Mirror image : X, Y independent
  - 5) X, Y axial Change : Standard
  - 6) Memory Call : Standard
  - 7) Wire Compensation : MDI
- (4) Power Supply Unit
  - 1) Maximum Machining Current : 20A
  - 2) Pick Current Selection : 14Step
  - 3) Pulse On time Selection : 10Step
  - 4) Pulse off Selection : 10Step

### Optional Accessories

- 1) Ion Exchange resin : 10bag
- 2) filter element : 10Set
- 3) Anticorrosive solution : 10bottles
- 4) Dielectric Conductivity control : 10bottles  
Soulution
- 5) Wire guide : 1Set

### 4. CNC Milling Machine

1Set

#### Specification

- 1) Working surface Size : Approx. 1400x 400mm
- 2) Max. Travel : Approx. 850 (table) x 500 (Ram) x 400  
(Knee)mm
- 3) Spindle Speed : Approx. 40x2000
- 4) Spindle Swivel Angle : 45°
- 5) Distance from Spindle Nose to table top : Approx. 600mm
- 6) Distance from Spindle Center to front of Column : Approx. 600mm
- 7) Motor : AC 220V, 60HZ

#### NC UNIT

- 1) FANUC 10MA or equivalent : 1set

#### Optional Accessories.

- 1) Helical Interpolation : 1Set
- 2) Linear Acceleration/Deceleration : 1Set  
before cutting
- 3) 2nd reference point return: Auto : 1Set
- 4) optional block skip addition : 1Set
- 5) Canned Cycle : 1Set
- 6) Optional Angle chamfering : 1Set
- 7) Programmable Mirror Image : 1Set

- 3) Tool offset amount Memory B :1Set
- 4) Tool offset amount Memory C :1Set
- 0) Additional Tool offset :1Set  
pains:Total199Sets
- 11) Skip function :1Set
- 12) Tool length measurement :1Set
- 13) Custom macro :1Set
- 14) Sequence No. Comparison :1Set
- 15) Program restart :1Set
- 16) Restart of block :1Set
- 17) Manual Numerical Command :1Set
- 18) Additional Programs 100/200 :1Set
- 19) Part Program Storage:Length:80m :1Set
- 20) Expanded Part Program editing :1Set
- 21) Input Output Interface :1Set
- 22) FANUC Cassette B1:80m :1Set
- 23) FANUC Cassette B2:160m :1Set
- 24) Stored Stroke Check 2 :1Set
- 25) Stroke Check before move :1Set
- 26) F1 digit feed :1Set
- 27) External manual absolute ON/OFF :1Set
- 28) 4th Axis Control :1Set
- 29) Input/Output terminal :1Set
- 30) Machine Vise : 200mm :1Set
  
- 31) Indicator and Molder :1Set
- 32) Quill digital Counter :1Set
- 33) Block for securing spindle :1Set  
head
- 34) Cutter Automatic Clamp Unit :1Set
- 35) Automatic power cutoff unit :1Set
- 36) Work off light :1Set
- 37) Milling Chuck Set :1Set
- 38) Work light :1Set
- 39) Work off buzzer :1Set

## 5. Injection Molding Machine

1Set

### Specification

- 1) Screw dia : Approx. 40mm
- 2) Injection capacity : Approx. 250Cm<sup>2</sup>
- 3) Injection Volume(Phenol) : Approx. 200g
- 4) Injection Pressure : Approx. 1600kg/Cm<sup>2</sup>
- 5) Injection rate : Approx. 180Cm<sup>3</sup>/Sec
- 6) Hopper Capacity : Approx. 50 ℓ
- 7) Screw Speed : Approx. 400rpm
- 8) Clamping force : Approx. 120Ton
- 9) Clamp open force : Approx. 8Ton
- 10) Distance between tie rod (HXV) : Approx. 650x550mm
- 11) Clamp Stroke : Approx. 500mm
- 12) Ejector Knockout Stroke : Approx. 100mm
- 13) Pump Motor : AC220V, 60HZ
- 14) Heater included
- 15) Close loop system

### Optional Accessories

- 1) T Slot Plate : 1Set
- 2) Clamprol : 1Set
- 3) Injectvisor : 1Set
- 4) Heaterfailure indicator : 1Set
- 5) Solenoid travel detector : 1Set
- 6) Monitoring : 1Set
- 7) Injectrol-III : 1Set
- 8) Eye Set : 1Set





8. 熱管理實習室

| No. | Nomenclature                     | Q'ty |
|-----|----------------------------------|------|
| 1   | Electric pipe threading machine  | 2    |
| 2   | Hydraulic pipe bender            | 1    |
| 3   | Copper pipe cutter               | 5    |
| 4   | Universal test set               | 1    |
| 5   | Air conditioning laboratory unit | 1    |
| 6   | Refrigeration test bench         | 1    |
| 7   | Air conditioning simulator unit  | 1    |



| No. | Nomenclature   | Q'ty |
|-----|--|------|
| 1   | Electric pipe threading machine<br>1)threading range : 1/2" - 2"   | 2    |
| 2   | Hydraulic pipe bender<br>1)max. dia x t : 60mm x 4mm<br>2)bending angle : 0 - 90 <sup>0</sup>  | 1    |
| 3   | Copper pipe cutter<br>1)max. dia : 6 - 66mm  | 5    |
| 4   | Universal test set<br>1)Wind velocity measuring range : 0-50m/s<br>2)Wind temperature measuring range : 0-100 <sup>0</sup> c<br>3)Static pressure measuring range : 0-500mmAg  | 1    |
| 5   | Air conditioning laboratory unit<br>1)Air supply unit<br>(1)Variable flow rate fan<br>max. flow rate : 1000kg/h<br>(2)Drive motor<br>Out put : 1.5KW<br>(3)Flow rate measuring device<br>Orifice and pressure gage<br>Static pressure tap<br>2)Primary heating unit<br>(1)Electric heater : 1KW<br>(2)Electric heater : 1KW<br>3)Humidifier unit<br>4)Observation chamber (1st)<br>(1)Wet and dry themometer<br>(2)Condensite water measuring device | 1    |

| No. | Nomenclature                               | Q'ty |
|-----|--|------|
|     | 5)Cooling unit                             |      |
|     | (1)Refrigerator device                     |      |
|     | Compressor and drive moter : 0.4KW         |      |
|     | Refrigerant : Freon- 12                    |      |
|     | .Suction and delivery pressure gage        |      |
|     | -76cmHg - 10kg/cm <sup>2</sup> G           |      |
|     | 0 - 20kg/cm <sup>2</sup> G                 |      |
|     | .Suction and delivery themometer           |      |
|     | -30°C - 70°C                               |      |
|     | Condensor water cooled, Inlet and delivery |      |
|     | thermometer                                |      |
|     | .Flow meter                                |      |
|     | (Refrigerant, cooling water)               |      |
|     | .Expansion valve, evaporator               |      |
|     | 6)Re-heating unit                          |      |
|     | 1)Electric heater : 0.5KW                  |      |
|     | 2)Electric heater : 0.5KW                  |      |
|     | 7)Observation chamber (2nd)                |      |
|     | 1)Wet and dry thermometer                  |      |
|     | 8)Standard accessories                     |      |
|     | 1)Leak detector                            |      |
|     | 2)Wet and dry themometer                   |      |
|     | 9)Power AC 220, 60HZ, 3Ø                   |      |
| 6.  | Refrigeration test bench                   |      |
|     | 1)Refrigerating capacity : 3000Kcal/H      |      |
|     | 2)Refrigerant : Freon - 12                 |      |
|     | 3)Compressor : Air-cooled,                 |      |
|     | Reciprocating unit                         |      |

| No. | Nomenclature   | Q'ty   |
|-----|--|--|
|     | 4) Drive motor   | : 1.5KW  |
|     | 5) Condenser   | : Water-cooled   |
|     | 6) Liquid drier  | : Desiccant drier  |
|     | 7) Expansion valve   | : Thermostatic type  |
|     | 8) Heat exchanger  | : High efficiency gas/liquid<br>heat exchange  |
|     | 9) Brine pump  | : 0.2KW  |
|     | 10) Brine tank & ice vessel  |  |
|     | 11) Pressure gage  | : -76chHg - 10kg/cm <sup>2</sup> G<br>0 - 20kg/cm <sup>2</sup> G                                     |
|     | 12) Thermometer  | : -30 <sup>o</sup> c 70 <sup>o</sup> c, 0-100 <sup>o</sup> c<br>-20 <sup>o</sup> c 50 <sup>o</sup> c |
|     | 13) Safety controls  |  |
|     | Pressure cut off switch  |  |
|     | Thermal cut off switch   |  |
|     | 14) Power  | : 220V, 60HZ, 3Ø   |
| 7   | Air conditioning simulator unit<br>a simulator for learner to develop a systematic<br>approach troubleshooting technics about a typical air<br>conditioner mechanical and electrical system. | 1  |
|     | Malfunction  | : 24   |
|     | Power supply   | : AC 110-120V, 60HZ, 1Ø  |



9. 機電應用實習室

| No. | Nomenclature                        | Q'ty | Remarks |
|-----|-------------------------------------|------|---------|
| 1   | Microprocessor Development Systems  | 6    |         |
| 2   | Microcomputer Systems               | 2    |         |
| 3   | 68000-based one-board microcomputer | 10   |         |
| 4   | Electro-mechanical training systems | 10   |         |
| 5   | Sequential control system trainer   | 10   |         |
| 6   | Programmable controller             | 10   |         |
| 7   | Digital LCR meter                   | 4    |         |
| 8   | X-Y recorder                        | 2    |         |
| 9   | Digital X-Y plotter                 | 2    |         |
| 10  | Pocket tachometer                   | 4    |         |
| 11  | Digital thermometer                 | 3    |         |
| 12  | Portable luxmeter                   | 3    |         |
| 13  | Insulation tester                   | 1    |         |
| 14  | Transister checker                  | 1    |         |
| 15  | Wow flutter meter                   | 1    |         |
| 16  | DC voltage / current standard       | 1    |         |
| 17  | General use instruments             | 64   |         |
| 18  | Intelligent robot system            | 1    |         |
| 19  | ROM eraser                          | 1    |         |
| 20  | Digital memoryscope                 | 1    |         |
| 21  | Electronic circuit trainer          | 1    |         |
| 22  | Motor limit control system          | 1    |         |

機  
電  
應  
用





1. Microprocessor Development Systems

I. MDS SYSTEM TO BE NEEDED FOR TRAINING

1. STAND ALONE MDS FOR Z80A & Z80B SYSTEM : 3set
2. INTEGRAL MDS SYSTEM FOR 8BIT CPU : 1set  
INCLUDE ;
  - + 80C85 INCIRCUIT EMULATOR PROBE : 1ea
  - + 8048/49/50 INCIRCUIT EMULATOR PROBE : 1ea
  - + 8051 INCIRCUIT EMULATOR PROBE : 1ea
  - + 6809 INCIRCUIT EMULATOR PROBE : 1ea
3. MDS SYSTEM FOR MC68000. : 1set
4. MDS SYSTEM FOR 8086/87/88 : 1set

II. GENERAL SPEC

1. BUILT IN KEYBOARD
2. " MONITOR
3. " FLOPPY DISK DRIVE
4. S/W DEVELOPMENT FUNCTION;
  - + EDIT
  - + ASSEMBLE
  - + LINK
  - + DEBUGGING
5. H/W DEVELOPMENT FUNCTION ;
  - + EMULATION OF CPU
  - + BREAK POINTS
  - + TRACE TRIGGERING
6. RS232C COMMUNICATION WITH HOST COMPUTER
  - + IBM PERSONAL COMPUTER
  - + NEC 98XA PERSONAL COMPUTER

III. KIMM'S RECOMMENDATION

1. ABOVE MDS SYSTEMS SHOULD BE MADE BY SINGLE MANUFACTURER FOR S/W COMPATIBILITIES.
2. ABOVE MDS SYSTEMS SHOULD BE MADE BY THE MANUFACTURERS WHO HAVE MORE MARKET SHARE THAN 20% IN JAPANESE MDS MARKET.

## 2. Microcomputer Systems

1) Microcomputer : 2 set

CPU : 80286  
8MHz clock  
Co-processor 80287

### Memory

ROM : 48K bytes  
RAM : User's memory 512k bytes

### Display

text : 80 characters x 25lines  
graphic : 1120 x 750 dots  
16 colors

FDD 1M bytes

HDD 20M bytes

### Interface

printer interface

serial interface : RS-232C

Extension slot

2) Monitor 2set

14" color display  
non-glare  
16colors  
dissolution : 1120 dots x 750lines

3) Printer

1set

24 pin 15" printer

4) Software

FORTRAN Compiler

PL/1 "

PASCAL "

C "

Assembler

Disassembler

Utility program

Etc.

|    |                                     |        |
|----|-------------------------------------|--------|
| 3. | 68000-based one-board Microcomputer | 10 set |
|    | 1) CPU/Memory Board                 | 10 EA  |
|    | .68000 CPU board                    |        |
|    | .RAM 128K bytes                     |        |
|    | .ROM 64K bytes(2764x8)              |        |
|    | .Interrupt 7 level                  |        |
|    | .RS-232 C       1 channel           |        |
|    | .16M bytes direct access            |        |
|    | 2) Extender                         | 10 EA  |
|    | 3) Universal board                  | 30 EA  |
|    | 4) 7-slot card cage                 | 10 EA  |

#### 4. Electro-Mechanical Training System

##### A. Feature

1. The system should be provided with electric machines and industrial motors control system for educational purpose.
2. The system shall be flexible in design and be able to accommodate potential add-ons and extensions.
3. Each windings of all electric machine should be open type and terminated on the front panel.
4. This system should consists of the following items:
  - 1) 1 - Mobile Console
  - 2) 1- Storage Cabinet
  - 3) 1- Direct Current Machine
  - 4) 1- Squirrel Cage Induction Motor
  - 5) 1- Wound Rotor Machine
  - 6) 1- Synchronous Machine
  - 7) 1- Capacitor Start Motor
  - 8) 1- Capacitor Run Motor
  - 9) 1- Universal Motor.
  - 10) 1- Repulsion-Induction Motor
  - 11) 2- Variable Resistance
  - 12) 2- Variable Inductance
  - 13) 2- Variable Capacitance
  - 14) 3- Transformer
  - 15) 1- DC Volt Ammeter
  - 16) 1- AC Ammeter
  - 17) 1-AC Voltmeter
  - 18) 1-Single Phase Wattmeter
  - 19) 1-Three Phase/Single Phase Wattmeter
  - 20) 1- Three Phase Wattmeter/Varmeter

- 21) 1- Synchronizing Module
- 22) 1- Three-Phase Rheostat
- 23) 1- Three-Phase Variable Voltage Power Supply
- 24) 1- Electrodynamometer
- 25) 1- Hand Tachometer
- 26) 3- Connection Lead Set
- 27) 3- Timing Belt
- 28) 1- SCR Speed Control
- 29) 1- Control system of Industrial Motors

## B. Specifications

### 1. Mobile Console

The Mobile Console shall accommodate twelve half size or six full size equipment modules that are specifically designed for educational purpose and mounted on four heavy duty rubber tire swivelling casters so that can be moved to any location in the laboratory where power has been made available. The lower portion of the console serves as a storage cabinet and above the cabinet is a pull out work surface to examine equipment or rest books.

### 2. Storage Cabinet

This cabinet is constructed with a 16 gauge steel and finished with a gray scuff resistant baked enamel paint for storage of full equipment modules.

- 1) Stairs: 5 or more
- 2) Dimensions: 1950 (H) x 1220(W) x 530(D) approx.

### 3. Direct Current Machine

- 1) Motor :  $\frac{1}{4}$ HP or more, 120Vdc, 1800RPM approx.
- 2) Generator : 120W or more 120Vdc, 1800RPM approx.
- 3) Have shunt and Series Winding that can operate as a shunt M/C, series M/C, compound cumulative and differential
- 4) Field Rheostat protected with a circuit breaker.

4. Squirrel-Cage Induction Motor

- 1)  $\frac{1}{4}$  HP or more, 120/208Vac, 3-Phase, 60Hz, 1670rpm or more
- 2) Have one winding per phase at the stator
- 3) Run as a standard squirrel-cage motor and as an asynchronous induction generator.

5. Wound Rotor Machine

- 1)  $\frac{1}{4}$  HP or more, 120/208Vac, 3-Phase, 60Hz 1800 rpm approx.
- 2) 60Hz, 1500 rpm or more
- 3) Have one winding per phase at the stator
- 4) The rotor shall be wound in star

6. Synchronous Machine

- 1) Motor:  $\frac{1}{4}$  HP or more, 120/208Vac, 3-Phase 60Hz, 1800 rpm approx.
- 2) Generator: 102W or more, 120/208Vac, 3-Phase 60Hz, 1800 rpm approx.
- 3) Have one winding per phase at the stator

7. Capacitor Start Motor

- 1)  $\frac{1}{4}$  HP or more, 120Vac, 60Hz single Phase, 1715rpm approx
- 2) Have main winding and starter winding
- 3) The starting winding is circuit breaker protected against overload.

8. Capacitor-Run Motor

- 1)  $\frac{1}{4}$  HP or more, 120Vac single phase, 60Hz, 1715 rpm approx.
- 2) Designed to be used as well as a two-phase machine

9. Universal Motor

- 1)  $\frac{1}{4}$  HP or more, 120Vac 60Hz, single phase, 1800rpm approx.  
120Vdc 1800 rpm approx.
- 2) The motor have three terminated independent winding as series winding, amature and compensating winding.

10) Repulsion-Induction Motor:

- 1)  $\frac{1}{4}$  HP or more, 120Vac single phase, 60Hz  
1650 rpm approx.
- 2) It performs zero speed, forward, reverse and  
speed control experiment.

11) Variable Resistance

- 1) 0-252W, 120Vac/dc
- 2) Resistors: 9 or more
- 3) Loading ampere: 0-0.7A/each phase,  
0-2.1A/single phase
- 4) 3-Phase loading: delta or Wye

12) Variable Inductance

- 1) 252Vars, 120Vac, 60Hz
- 2) Inductors: 9 or more
- 3) Loading ampers: 0-0.7/each phase approx.  
0-2.1A/single phase approx.
- 4) 3-Phase loading: delta or wye

13) Variable Capacitance

- 1) 252 Vars, 120VAC, 60Hz
- 2) Capacitors: 9 or more
- 3) Loading ampere: 0-0.7A/each  
0-2.1A/parallel

14) Transformer

- 1) Single phase transformer which has two discrete  
windings or more
- 2) Coil 1: 120Vac, 0.5Aac or more  
Coil 2: 208VAC, 0.3Aac or more



15. DC Volt Ammeter
  - 1) Three meters or more
  - 2) DC Voltmeter : 0-20, 0-200 Vdc or more
  - 3) DC Milliammeter : 0-500 mAdc or more
  - 4) DC Ammeter 0-2.5 5Adc or more
  - 5) Accuracy : 2% or better
16. AC Ammeter
  - 1) Three ammeters or more
  - 2) AC Ammeter : 0-0.5, 0-2.5, 0-8 Aac or more
  - 3) AC Ammeter : 0-0.5, 0-2.5, 0-8 Aac or more
  - 4) AC Ammeter : 0-0.5, 0-2.5, 0-8, 0-25 Aac or more
  - 5) Accuracy : 2% or better
17. AC Voltmeter
  - 1) Three Voltmeters or more
  - 2) AC Voltmeter 0-100, 0-250 Vac or more
  - 3) AC Voltmeter 0-100, 0-250 Vac or more
  - 4) AC Voltmeter 0-100, 0-250 Vac or more
  - 5) Accuracy : 2% or better
18. Single Phase Wattmeter
  - 1) Max power : 150 Vac or dc, 10Aac or dc or more
  - 2) Range : 0-750W or more
  - 3) Accuracy : 2% or better
19. Three-phase/single-phase wattmeter
  - 1) Range : 0-300W
  - 2) Max power : 300Vac or dc, 2Aac or dc
  - 3) Accuracy : 2% or better
20. Three-Phase Wattmeter/Varmeter
  - 1) Wattmeter
    - a. Max Power : 240Vac 1.5A or more
    - b. Range : 0-300 W or more
    - c. Accuracy : 2% or better

- 2) Varmeter
  - a. Max Power: 240Vac, 1.5Aac
  - b. Range 0-300Var or more
  - c. Accuracy : 2% or better
  
21. Synchronizing Module
 

This module is used to indicate synchronism between two alternators and to electrically interconnect the alternators by closing the three phase switch and also determine phase sequence of phase circuit and relative power dissipation in ac and dc circuits

  - 1) Three indicator lamps: 6W 220V
  - 2) Three thermal magnetic breakers
  - 3) Triple-pole single throw switch 5A, 220V
  
22. Three-Phase Rheostat
  - 1) The rheostat is used to allowing simultaneous and equal variations in resistance in all three phase legs by single control knob.
  - 2) Each of the three phase legs are protected from over-current by thermal magnetic breaker
  - 3) Rheostat ratings: 0-16 ohms line to neutral, 150W 2A
  
23. Three-Phase Variable Voltage Power Supply.
  - 1) Input Voltage : 120/208Vac, 3-Phase (4 wires plus ground)
  - 2) Output(fixed) : 120/208Vac 15A or more,  
3-phase 120Vac, 15A or more  
1-phase 120Vdc, 2A or more
  - 3) Output (variable) : 0-120, 0-208Vac, 5A or more  
3-phase 0-120, 5A or more  
1-phase 0-120Vdc, 8A or more
  - 4) Voltmeter range : 0-500V or more
  
24. Electrodynamometer Module
  - 1) Torque : 0-27 pound inch
  - 2) Accuracy : +2% or better
  - 3) Speed : 0-3000 rpm or more
  
25. Hand Tachometer
  - 1) Speed range: 0-10000 rpm or more
  - 2) Direction of rotation: cw/ccw,
  - 3) Interchangeable shaft attachment

- a. 1-Concave rubber tip
  - b. 1-Convex rubber tip
  - c. 1-rubber disc
- 4) Accuracy: 1% or better

26. Connection Lead Set

- 1) Stacking banana-banana connection lead:
- 2) Capacity' : 15A or more
- 3) Insulation voltage : 2000 volts or more
- 4) Quantity/set: 25ea. or more

27. Timing Belt

- 1) Material: Synchro Cog rubber
- 2) Prevent Slip by teeth in timing belt

28. SCR Speed Control Module

The module is designed for student experiment with open loop and closed loop speed control of DC machine.

- 1) Input : 120Vac, 60Hz, 3.5A or more
- 2) Output : 0-150Adc, 2A or more

C. Accessories (fore each set)

- 1. Line Cord
- 2. Instruction and student experiment manual each 5 copies/set
- 3. The other standard accessories even not stated here before should be supplied.

D. Remark

- 1. Warranty: One year warranty is to start at the date of delivery to the using school.

## 5. Sequential Control System Trainer

### Contents of Experiment

- . Basic operating experiment of relay
- . Delay operation, delay recovery
- . Self Conservation circuit
- . One short (single operating circuit)
- . Furica circuit
- . Priority circuit
- . Interlock circuit
- . Time limit circuit
- . Time limit circuit
- . Counter circuit
- . Positive rotation, Negative rotation
- . Y- $\Delta$  moving
- . Thermo control experiment
- . Sequence circuit
- . Choice circuit

6. Programmable Controller 10set
- 1) Control Unit 10EA
    - Program system : stored program
    - Number of I/O points : 5/2 points
    - Number of internal auxiliary relays : 5/2 points
    - Programming capacity : 3.3k addresses
    - Number of timers and counters : 128 points
      - timer : 0.1 - 1999.9sec
      - counter : 1 - 1999 counts
    - Register : 256 bytes (8bits)
  - 2) Base Unit 10EA
  - 3) AC Input Unit 10EA
    - input points : 16points
    - input voltage : AC 100V 60HZ
  - 4) DC Input Unit 10EA
    - input points : 16points
    - input voltage : DC 12V/24V
  - 5) DC Output Unit 10EA
    - output points : 16points
    - output voltage : DC 12/24V
    - output current : DC 2A
  - 6) AC Output Unit 10EA
    - output points : 16 points
    - output voltage : AC 200V
    - output current : AC 2A
  - 7) Programmer 10EA
    - display : 11contacts +1 coil
    - 11 relay lines
    - message : 20 characters 2 lines
  - 8) Computer link module 2EA
    - EIA RS 422
  - 9) RS 232 C/RS 422 interface card 2EA

## 7. digital LCR Meter

Measurement Frequencies: 120 Hz, 1 kHz, 10 kHz  $\pm 3\%$

### Measuring Range:

#### Electrostatic Capacitance (C):

100 Hz, 120 Hz: 1 pF ~ 19.99 nF in 8 ranges  
1 kHz: 0.1 pF ~ 199.9  $\mu$ F in 8 ranges  
10 kHz: 0.01 pF ~ 199.9  $\mu$ F in 8 ranges

#### Inductance (L):

100 Hz, 120 Hz: 1  $\mu$ H ~ 199.9 H in 7 ranges  
1 kHz: 0.1  $\mu$ H ~ 199.9 H in 7 ranges  
10 kHz: 0.01  $\mu$ H ~ 19.99 H in 7 ranges

#### Dissipation Factor (D, Q):

D: 1.999  
Q: 199.9

#### Resistance (R):

1 m $\Omega$  ~ 19.99 M $\Omega$  in 8 ranges

Test Mode Selection: Parallel (PRL), Series (SER), Auto or Manual

Measurement Signal Level: 1V or less than 50 mV

Measurement Time: About 400 ms at range-hold

Indication: L, C, R 3-1/2 digits; D, Q 3-1/2 digits (D: 1.999,

Q: 199.9). Numerical indication is given by LED (red) i.e., units of L/C/R, Q, D, bias, range selection, operation of GP-IB etc.

Measurement Functions: Inductance (L), Electrostatic Capacitance (C), Resistance (R)

Test Terminal: 5 terminals, consisting of 2 signal markers, 2 signal detectors and one guard terminal

Off-Set Adjustment: Zero adjustment for stray capacitance between test terminals is possible. Compensation capacitance: within 5 pF

Bias Power Supply: External terminal Max. 30 V

## Options

### Measurement Adaptor:

Test adaptor (for all measurement range)

Lead adaptor (4 terminal) (for large C, small L, low R)

Lead adaptor (3 terminal) (for small C, high R)

Kelvin clip adaptor (for all measurement range)

External Control: Panel change can be controlled through external terminal. Control by GP-IB is possible

## 8. X-Y Recorder

### A. Feature:

- o Writing speed : 2,000mm/s(Y axis)  
1500m/s (X axis)
- o "Visible Ink-reservoir" Disposable contridge pens
- o Standard remote control functions
- o -400% zero offset
- o Built in time base

### B. Specification:

|                  |  |
|------------------|--|
| Input            |  |
| Measuring system | : Null balance potentiometric<br>DC servo system   |
| Input            | : Floating and guarded 0.05,<br>0.1, 0.2, 0.5, 1, 2, 5, 10, 20mV/<br>cm & V/cm 18 ranges |
| AVR control      | : Continuously variable between<br>ranges.   |
| Input impedance  | : 1M ohm $\pm 10\%$  |
| Source impedance | : 10k $\Omega$ or less   |
| Accuracy         | : $\pm 0.25\%$ of full scale deflection<br>(standard ranges)                             |
| Linearity        | : $\pm 0.1\%$ of full scale  |
| Dead band        | : $\pm 0.1\%$ of full scale  |
| Zero adjustment  | : Continuous zero adjustment,<br>0 to 100% full scale                                    |
| Zero offset      | : from 0% to -400%   |
| Time base        |  |
| Range            | : 0.5, 1, 2, 5, 10s/cm 4 ranges  |
| Accuracy         | : $\pm 2\%$ of full scale  |
| Linearity        | : $\pm 1\%$ of full scale  |
| Pen & Chart      |  |
| Writing system   | : Visible felt-tip pen   |
| Writing area     | : DIN A3 format (380x250mm)  |

|   |   |
|---|---|
| Writing speed                               | : 1500mm/s<br>1000mm/s  |
| Pen lift                                    | : Electric local and remote<br>(response 5Hz maximum)   |
| Chart hold                                  | : Electrostatic   |
| Remote control                              |   |
| Penlift                                     | : TTL or contact closure<br>(down when low or on)   |
| Time base start                             | : TTL or contact closure<br>(starts when low or on)   |
| Time base reset                             | : TTL or contact closure<br>(reset when low or on)  |
| Rear input                                  | : X and Y axes  |
| Power requirements                          | : AC 100, 115, 220V 60Hz<br><br>approx. 40VA (bal.)<br>approx. 140VA (unbal.)                 |
| Accessories supplied with<br>the instrument | : Chart paper (1 book), feltpen<br>(5 pcs), fuse (1 pc) external<br>control connector (1 pc). |



## 9. Digital X-Y Plotter

### A. Features :

1. 1 step 25 micron high resolution
2. Fastest plotting speed max. 400mm/sec
3. 8 color pen
4. Large size plotting (A3)

### B. Specification :

|                       |  |
|-----------------------|--|
| Writing speed         | : Max. 400mm/sec                           |
| Penup down time       | : 40 time/sec                              |
| Pen                   | : 8 pen                                    |
| Max. plotting area    | : 400 x 275mm                              |
| Interface             | : RS-232C, GP-IB, centronix available      |
| Step width            | : 25 micron                                |
| Accuracy              | : $\pm 0.1 + \frac{30N}{1000}$ mm          |
| Power                 | : AC 100V $\pm 10\%$ , 50/60Hz             |
| Operating temperature | : $5^{\circ}\text{C} - 40^{\circ}\text{C}$ |
| Dimension             | : 525W x 160H x 490L mm (16kg)             |

### C. Standard Accessories :

|                       |        |
|-----------------------|--------|
| 1. Plotting paper     | 1 box  |
| 2. Water ball pen     | 1 set  |
| 3. Fuse (2A)          | 1 ea   |
| 4. Power cord         | 1 ea   |
| 5. Dust cover         | 1 ea   |
| 6. 3P-2P connector    | 1 ea   |
| 7. Acc. Bag           | 1 ea   |
| 8. Paper loading pipe | 1 ea   |
| 9. Manual             | 1 book |

## 10. Pocket Tachometer

### 1) Touch Type

- . Measurement system  
touch, using a contact rubber tip  
and surface speed wheel
- . Measuring ranges  
2,000 rpm range  
20,000 rpm range
- . Resolution  
0.1 rpm on 2,000 rpm range  
1 rpm on 20,000 rpm range
- . Accuracy  
± 0.3 rpm on 2,000 rpm range  
± 2 rpm on 20,000 rpm range

### 2) Touchless Type

- . Measurement system  
touchless, using a photo probe and reflective tape
- . Measuring ranges  
2,000 rpm range  
20,000 rpm range
- . Resolution  
0.1 rpm on 2,000 rpm range  
1 rpm on 20,000 rpm range
- . Accuracy  
± 0.3 rpm on 2,000 rpm range  
± 3 rpm on 20,000 rpm range
- . Effective measurement distance  
between photo probe and reflective tape  
30 to 300mm
- . Type of display: 5-digit LCD
- . Maximum reading: 19999

## 11. Digital Thermometer

- . Resolution

  - Temperature range :  $0.1^{\circ}\text{C}$

  - 20mV range :  $1\mu\text{V}$

  - 200mV range :  $10\mu\text{V}$

- . Temperature range :  $-200^{\circ}\text{C} \text{ -- } 1700^{\circ}\text{C}$

- . Internal Compensation Accuracy of Thermocouple

  - :  $\pm 0.3^{\circ}\text{C}$

- . Input Current : Less than  $500\text{ pA}$

- . Common Mode Rejection : More than  $140\text{dB}$

- . Normal Mode Rejection : More than  $80\text{ dB}$

- . Power :  $100\text{VAC } 60\text{HZ}$

  - Rechargeable Ni-Cd battery  $12\text{V DC}$

- . Maximum Indication :  $19999$

- . Response Time to rated accuracy :  $1.5\text{sec}$

- . Sample rate : Approx. 2 times / Sec. and Hold

  - (remote control possible by external contact or  
TTL-Level)

- . Input Impedance : more than  $10\text{M } \Omega$

## 12. PORTABLE LUXMETER

- 1) Measuring Range : 0-300/0-1,000/0-3,000 Lux(3 range)
- 2) Accuracy :  $\pm 5\%$  of full scale value(calibrated with a standard tungsten lamp of color temperature 2854°k)
- 3) Obliquity error compensation : By means of an obliquity error compensating globe with diffuse transmitting characteristics.
- 4) Compensation : By means of a compensating filter provided for luminosity factor correction operational in both measuring range.
- 5) Recorder Output : 0-10mV(output resistance : approx 4Kohm)
- 6) Photovoltaic cell : Selenium cell
- 7) Indicator : Taut-band suspension type indicator provided with a mirror scale to eliminate parallax error.

### 13. INSULATION TESTER

- 1) Rated Voltage/Resistance : 250V/500 Mohms  
(3-Ranges)
  - : 500V/1,000 Mohms
  - : 2000V/2,000 Mohm
- 2) Accuracy :  $\pm 5\%$  to  $\pm 10\%$
- 3) Scale Length : Approx. 88mm
- 4) Measuring Terminal Voltage : 90% of more of rated Voltage at mid-scale point.
- 5) Power Source : Dry Cell 8 pcs
- 6) With Accessories for above
  - a) Dry Cell Battery : 8 pcs
  - b) Line Probe : 2 pcs
  - c) Probe Case : 1 pc
  - d) Instruction Manual : 1 Copy

#### 14. Transistor Checker

- .  $h_{FE}$  value should be directly read on the meter
- .  $h_{FE}$  Measurement:
  - Measuring Range: 10-100, 30-300, 100-1000, 3 ranges
  - Measurement Error :  $\pm(3\% +1)$  of full scale
  - Collector Voltage setting:
    - 10points : 0.3, 0.5, 1.3, 6.9, 10, 12, 15(V)
    - Voltage Error :  $\pm(5\%+50mV)$
  - Collector Current Setting: 50,100,200,500( $\mu A$ ),1,2,5,10,20  
50,100,200,500(mA)
  - Current Error :  $\pm 3\%$  but 50 $\mu A$  :  $\pm 5\%$
  - Collector Voltage to 500mA : 0.3, 0.5, 1, 3V, 4points
- .  $I_{CBO}$  Measurement :
  - Measuring Range : 0.002 ~ 0.1, 1, 10, 100( $\mu A$ ), 1, 10(mA)
  - 6 ranges
  - Measurement Error :  $\pm 3\%$  of full scale
  - $V_{CB}$  Setting : 2 ranges 0-30, 100(V)
- . Operating Temperature :  $0^{\circ}C - 50^{\circ}C$

15. Wow Flutter Meter,

Specifications

|                             |  |
|-----------------------------|--|
| Input Frequency Range       | : 3kHz + 300Hz, for JIS, NAB CCIR.<br>3.15kHz + 300Hz, for DIN(IEC/ANSI).  |
| Wow Flutter Range           | : 0.0015% to 3% in six ranges(0.003% to 3% for<br>inputs in 0.1 to 30mVrms input):<br>0.01%,0.03%,0.1%,0.3%,1%,and 3% at full scale. |
| Indication                  | : JIS: Effective value.<br>NAB: Average value.<br>DIN(IEC/ANSI),CCIR: Peak value.  |
| Memory Measurements         |  |
| Mode                        | : Peak hold for JIS,NAB, DIN(IEC/ANSI) and CCIR<br>Sigma Memory for DIN and CCIR.  |
| Wow Flutter Digital Display | : Floating zero condition at end of measurement<br>until the next measurement;effective figures,<br>3 digits.                        |
| Frequency Counter           |  |
| Range                       | : 10Hz to 99.99kHz in two ranges.  |
| GP-IB Interface             | : SH1,AH1,T5,TE0,L3,LE0,SR1,RL1,PPO,DC1,DT1,CO<br>(Ref.: IEEE Std.488-1978)  |
| Power Requirements          | : AC 100V, 115V, 215V or 230V, 50/60Hz;approx.   |

## 16. DC Voltage / Current Standard

### Output Voltage/Current Ranges and Accuracy of Output:

| Range  | Output voltage/<br>current | Reso-<br>lution | Accuracy of output<br>(at 23±3°C) |
|--------|----------------------------|-----------------|-----------------------------------|
| 10 V   | 0 to ±12,000 V             | 1 mV            | ±0.02% of range                   |
| 1 V    | 0 to ±1,2000 V             | 100 μV          | ±0.02% of range                   |
| 100 mV | 0 to ±120.00 mV            | 10 μV           | ±0.02% of range                   |
| 10 mV  | 0 to ±12,000 mV            | 1 μV            | ±(0.02% of range<br>+ 4 μV)       |
| 100 mA | 0 to ±120.00 mA            | 10 μA           | ±0.02% of range                   |
| 10 mA  | 0 to ±12,000 mA            | 1 μA            | ±0.02% of range                   |
| 1 mA   | 0 to ±1,2000 mA            | 0.1 μA          | ±0.02% of range                   |

### Maximum Output and Internal Resistance:

| Range  | Maximum output<br>(approx.)             | Internal resistance<br>(approx.) |
|--------|---|----------------------------------|
| 10 V   | 120 mA                                  | Less than 10 mΩ                  |
| 1 V    | 120 mA                                  | Less than 10 mΩ                  |
| 100 mV | *1 kΩ                                   | 1 Ω                              |
| 10 mV  | *1 kΩ                                   | 1 Ω                              |
| 100 mA | 15 V (0 to 50 mA)<br>9 V (50 to 100 mA) | 1 MΩ<br>1 MΩ                     |
| 10 mA  | 15 V                                    | 10 MΩ                            |
| 1 mA   | 15 V                                    | 10 MΩ                            |

### Temperature Setting Range

| TC Type<br>(RANGE) | Setting range<br>(EMF. output) | Accuracy (at 23±3°C)                              |                                      | Resolution<br>(approx.) |
|--------------------|--------------------------------|---|--------------------------------------|-------------------------|
|                    |                                | At 25°C x n<br>setting (n: posi-<br>tive Integer) | At setting<br>other than<br>25°C x n |                         |
| R                  | 0 to 1,768°C                   | ±2.76°C   | ±3.26°C                              | 1°C                     |
| K                  | -200 to 1,200°C                | ±0.40°C<br>*±0.94°C                               | ±0.47°C<br>*±1.17°C                  | 0.1°C                   |
| E                  | 0 to 700°C                     | ±0.25°C   | ±0.31°C                              | 0.1°C                   |
| J                  | -200.0 to 600.0°C              | ±0.37°C<br>*±0.68°C                               | ±0.44°C<br>*±0.90°C                  | 0.1°C                   |
| T                  | -200.0 to 200.0°C              | ±0.20°C<br>*±0.35°C                               | ±0.25°C<br>*±0.50°C                  | 0.1°C                   |

Ripple: Less than ± 0.01% of setting range on 100 mV, 1, 10 V, 10, 100 mA ranges (for DC to 60 Hz components), less than ± 0.05% of setting range on 1 mA range

Common Mode Rejection (DC to 60 Hz): Approx. 120 dB for voltage output, approx. 0.1 μA/V for current output

Effect of Power Supply Voltage Fluctuation: Within ± 0.02% of range against ± 10% fluctuation in rated value

Overcurrent Protection: Automatically limits output current at approx. 120 mA

Overvoltage Protection: Automatically sets output voltage to zero at approx. 15 V

Polarity Selection: + or -

Setting value indication : 5-digit LED display

Output unit marks : mV, V, mA or °C

Option : GP-IB



## 17. General Use Instruments

### 1) Electronic Galvanometer

1 set

#### . Measuring Range

$\pm 5\mu\text{V}$  /  $\pm 50\mu\text{V}$  /  $\pm 500\mu\text{V}$  /  $\pm 5\text{mV}$  /  $\pm 50\text{mV}$   
 $\pm 5\text{nA}$  /  $\pm 50\text{nA}$  /  $\pm 500\text{nA}$  /  $\pm 5\mu\text{A}$  /  $\pm 50\mu\text{A}$

#### . Maximum Sensitivity

$0.2\ \mu\text{V} / \text{div.}$

$0.2\text{nA} / \text{div.}$

#### . Input Resistance

$1\text{K}\Omega$

#### . Accuracy of Indicator

$\pm 10\%$  of full scale value

### 2) Portable Double Bridge

1 set

#### . Measuring range : $0.1\text{m}\Omega$ to $110\ \Omega$

#### . Measuring Dial : 1.00 to 11.00 $\Omega$ at x 1

#### . Multipliers : x 0.0001, x 0.001, x 0.01, x 0.1, x 1, x 10

#### . Min Division : $50\text{m}\Omega$ at x 1

#### . Accuracy : $\pm(0.05\ \Omega \times \text{multiplier} + 0.001\text{m}\Omega)$

#### . Current Rating : 10A at x 0.0001

3A at x 0.001

1A at x 0.01

0.3A at x 0.1

0.1A at x 1

0.01A at x 10

### 3) Portable Wheatstone Bridge

1 set

#### . Measuring Range

$1.000\ \Omega$  to  $10.00\text{M}\ \Omega$  in four digit reading

#### . Minimum Division

$0.001\ \Omega$

#### . Multiplier

x 0.001, x 0.01, x 0.1, x 1,

x 10, x 100, x 1000,

#### . Measuring Arms

$1000\ \Omega$  x 10 +  $100\ \Omega$  x 10 +  $10\ \Omega$  x 10 +  $1\ \Omega$  x 10

#### . Accuracy

$\pm 0.1\%$  of reading on  $100\ \Omega$  to  $100\text{K}\ \Omega$

$\pm 0.3\%$  of reading on  $10\ \Omega$  to  $1\text{M}\ \Omega$

$\pm 0.6\%$  of reading on  $1\ \Omega$  to  $10\text{M}\ \Omega$

#### 4) Digital Wattmeter

1 set

##### . Input Range

Voltage : 250V

Current : 1, 2, 5, 10A

Power : 250, 500, 1250, 2500W

##### . Resolution

Voltage : 100mV / digit

Current : 1mA / digit

Power : 100mW / digit

##### . Frequency Range

40 to 400HZ

##### . Accuracy

$\pm(0.5\%$  of reading  $+0.1\%$  of range)

for 47 to 63HZ

at  $\text{Cos}\phi = 1$

##### . Power factor influence

less than  $\pm 0.5\%$  of reading

at  $\text{Cos}\phi = 0.5$  50 or 60HZ

5) PORTABLE AC AMMETER

10 EA

- (1) Principle : Moving Coil Type(taut band)
- (2) Rated Accuracy :  $\pm 0.5\%$  of full scale
- (3) Scale Length : Approx 135mm
- (4) Measuring Range : 20/50/100/200mA

6) PORTABLE AC VOLT-AMMETER

10 EA

- (1) Principle : Moving Coil Type(Taut band)
- (2) Rated Accuracy :  $\pm 0.5\%$  of full scale
- (3) Scale Length : Approx 135mm
- (4) Voltage Range : 30/75/150/300/750V
- (5) Current Range : 0.15/0.3/0.75/1.5/3/7.5/15/30A

7) PORTABLE DC AMMETER

10 EA

- (1) Principle : Moving Coil Type(taut Band)
- (2) Rated Accuracy :  $\pm 0.5\%$  of full scale
- (3) Scale Length : Approx 135mm
- (4) Measuring Range : 10/30/100/300 mA

8) PORTABLE DC VOLT-AMMETER

10EA

- (1) Principle : Moving Coil Type (taut Band)
- (2) Rated Accuracy :  $\pm 0.5\%$  of full scale
- (3) Scale Length : Approx 135mm
- (4) Voltage Range : 3/10/30/100/300/1,000V
- (5) Current Range : 1/3/10/30/100/300mA  
: 1/3/10/30A, 50mV

9) Decade resistance box

10EA

Resistance Range: 0.100 to 1,111.210  $\Omega$   
(Minimum resistance is 0.100  $\Omega$ )  
Dial Composition: 100  $\Omega \times 0$  to 10, 10  $\Omega \times 0$  to 10, 1  $\Omega \times 0$  to 10,  
0.1  $\Omega \times 1$  to 11, 0.01  $\Omega \times 0$  to 10, 0.001  $\Omega \times 0$   
to 10  
Resolution: 0.001  $\Omega$   
Accuracy:  $\pm (0.01\% + 2 \text{ m}\Omega)$  at temperature  $23 \pm 2^\circ\text{C}$ ,  
humidity 45 to 75%, and 0.1 W power application  
Max. Allowable Input Power: 0.25 W/step  
Within 1 W for overall instrument  
Max. Allowable Input Current: 50 mA (100  $\Omega$  steps), 150 mA (10  $\Omega$   
steps), 500 mA (1  $\Omega$  steps), and 1.5 A (0.1  $\Omega$   
steps)

10) Decade resistance box

10EA

Resistance Range : 0 to 111.1110 M $\Omega$   
Dial Composition : 100  $\Omega \times 10 + 1 \text{ k}\Omega \times 10 + 10 \text{ k}\Omega \times 10 + 100 \text{ k}\Omega$   
 $\times 10 + 1 \text{ M}\Omega \times 10 + 10 \text{ M}\Omega \times 10$   
Accuracy : 100  $\Omega$ , 1 k $\Omega$ , 10 k $\Omega$  and 100 k $\Omega$  steps...  $\pm (0.05\% +$   
0.05  $\Omega)$ ; 1 M $\Omega$  and 10 M $\Omega$  steps ...  $\pm 0.2\%$   
(At temperature  $23 \pm 2^\circ\text{C}$ , humidity below 75%  
including residual resistance of approx. 0.05  $\Omega$ )  
Max. Allowable Input:  
100  $\Omega$  step ..... 100 mA  
1 k $\Omega$  step ..... 30 mA  
10 k $\Omega$  step ..... 10 mA  
100 k $\Omega$  step ..... 3 mA (100 to 600 k $\Omega$ )  
2,000 V (700 k $\Omega$  to 1 M $\Omega$ )  
1 M $\Omega$  step ..... 2,000 V  
10 M $\Omega$  step ..... 2,000 V

## 18. Intelligent Robot System

### .Manipulator

multi-articulated

6 axes

load capacity : 5 kg ((actuator inclusive)

repeatability :  $\pm$  0.1 mm

speed : 2000 mm/sec.

### .Visual system

automatic position determination

pattern recognition

memory : 512 x 512 x 1 bit

area sensor : CCD camera

### .Obstacle probe by supersonic

### .Clean system

## 19.ROM eraser

Ten pieces PROM erase at the same time

## 20. Digital Memoryscope

### A. Features :

1. 12 bit x 4096 word, 2us/word
2. Microprocessor-controlled intelligent waveform recording devices incorporating CRTs
3. Convenient SAVE/RECALL and TRACE ADVANCE functions
4. Monitor display with low writing speed
5. Electronic scale that is free from drift
6. Flexible display format including SET UP STATE and MEMORY LIST
7. Flexible readout modes simplify measurement such as digital readout of data with engineering units using two cursors.
8. Trace shift and expansion of X and Y axis can be freely selected
9. Powerful WRITE AREA SET function.

### B. Specifications :

1. Memory
  - Memory length : 12-bit x 4096 word
  - Fastest writing speed : 2us/word
  - Memory element : MOS Static RAM
2. Voltage Axis (Vertical, at both CH1 and CH2)
  - Input amplifier : 2 channels, single-ended type
  - Input channel :  $\pm 0.05V$ - $\pm 100V$  full scale
  - Sensitivity :  $\pm 0.05V$ - $\pm 250V$  (continuously variable)
  - Input offset : 0 -  $\pm 90\%$  of full scale
  - Bandwidth : DC-100kHz, -3dB (DC-coupled)  
14Hz-100kHz, -3dB (AC-coupled)
  - Input coupling : AC-GND-DC
  - Input RC : 1M ohm  $\pm 1\%$ , 37pF approx.
  - Max. input voltage : 200V (DC + AC peak)
- A/D Converter
  - Resolution : 12-bit (0.025% of full scale)
  - Conversion system : Successive approximation type, independent at channels
  - Conversion speed : 2 us approx.
  - Aperture time : 5ns or less
3. Triggering
  - Modes : AUTO, NORMAL
  - Sources : CH1, CH2, EXT
  - Coupling : AC, DC
  - Frequency : DC-100kHz (DC-coupled)  
10Hz-100kHz (AC-coupled)
- Sensitivity
  - Internal : 5% or less of full scale when both DC and AC-coupled
  - External : 200mVp-p or less at when both DC and AC-coupled

|                           |   |
|---------------------------|---|
| Tripping Level Range      |   |
| Internal                  | : 0-+100% of full scale                                     |
| External                  | : 0-+2V or more   |
| OV FIX LEVEL              |   |
| Internal                  | : +5% of full scale   |
| External                  | : +200mV  |
| Tripping level check      | : Available at CHECK terminal                               |
| Ext. Input RC             | : 1M ohm $\pm$ 1% 50pF approx.                              |
| 4. Time Axis (Horizontal) |   |
| Modes                     | : MANUAL, WRITE AREASET                                     |
| Internal clock            |   |
| Writing speed             | : 2us/word - 2 s/word                                       |
| External clock            |   |
| Writing speed             | : 1us/word (max.)   |
| Input R                   | : 50k ohm or more   |
| Delay range               | : +20480 word - -(memory length -1)<br>word                 |
| 5. Writing                |   |
| Modes                     | : SINGLE, REPEAT  |
| Selection                 | : CH1ALL, CH2ALL, DUAL ALL, CH1 HALF,<br>CH2HALF, DUAL HALF |
| 6. Display                |   |
| Display formats           | : TRACE 1, TRACE 1-2, XY, SET UP<br>STATE, MEMORY STATE     |
| 7. Memory Selection       | : SAVE/RECALL, TRACESELECT<br>ADVANCE, TRACE EXCHANGE       |
| 8. Readout                |   |
| Modes                     | : SCALE, CURSOR, DIFF, MAX/MIN                              |
| Cursors                   | : 2 independent cursors                                     |
| 9. Magnification          |   |
| Y Axis                    | : 64 times max.   |
| X Axis                    | : 64 times max. (CH1 ALL or CH2 ALL<br>written)             |
| NORM                      | : Normalizes to the original size<br>and position           |
| 10. CRT                   | : 6-inch rectangular with electronic scale                  |
| 11. Outputs               |   |
| Selection                 | : DATA, PEN   |
| Digital outputs           | : Binary, TTL Level   |
| Analog outputs            |   |
| Y out                     | : +5V full scale  |
| X out                     | : +5V sawtooth  |

C. Standard Accessories :

|                       |        |
|-----------------------|--------|
| 1. Power cord         | 1 ea   |
| 2. Coaxial cable      | 4 ea   |
| 3. Fuse               | 2 ea   |
| 4. Dust cover         | 1 ea   |
| 5. Accessory bag      | 1 ea   |
| 6. Instruction manual | 1 book |

D. Options :

GP-IB interface



## 21. Electronic Circuits Trainer

### 1) Electronic Circuits Trainer

1. Oscillator and modulator circuits training unit  
Training of collector tuning (bias, frequency and oscillation requirements)  
Training of CR type phase transient oscillator  
Training of collector modulating circuit.
2. AM receiver Circuit Training Unit  
Training of IF tuning characteristic  
Training of bias characteristic at AGC and non-AGC  
Training of detection characteristic  
Training of Receiver Circuit and Frequency Converter
3. Audio Amplifier Circuit Training Unit  
Training of bias determination amplitude, frequency characteristic, phase characteristic wide band amplification (training of feed back, peaking and low frequency boost)  
Training of double amplifier circuit  
Training of power amplifier circuit (bias, power, efficiency, distortion)
4. Rectifier and Smoothing Circuit Training Unit  
Training of half wave rectifier circuit and full wave rectifier circuit  
Training of smoothing circuit (C, LC,  $\pi$ )

\* Power source : AC 100V 50HZ

### 2) Logic Circuits Trainer

#### Features :

1. Basic operation training of AND, OR, NOT, NAND, NOR and exclusive OR.
2. Assembly and operation training of half-adder and full-adder
3. Assembly and operations training of encoder and decoder
4. Basic operation training of R-S and J-K flip flops
5. Basic operation training of shift registers, other application training

#### Specifications :

Circuit elements : AND, OR, NOT, NAND, NOR, Exclusive OR, R-SFF, J-KFF, half shift register, LED (1) (0) indicator (10 digits)

Signal sources : 1kHz square wave about 5Vp-p one shot clock pulse about 4Vp-p with 0.3 $\mu$ s

Power source : AC 100V 60HZ

### 3) Pulse Circuit Trainer

#### Features :

1. Training of differentiation circuit and integration circuit
2. Training of clipping circuit and clamping circuit
3. Training of logic circuits (AND, OR, NOT)
4. Training of Miller circuit and bootstrap circuit
5. Training of multi-vibrator (mono-stable, astable, bistable, schmitter trigger)

#### Specification :

|                  |   |
|------------------|---|
| Circuit elements | : 13 kind, (differentiation, integration, clamp, clip, AND, OR, NOT, Miller, bootstrap, mono-stable, multi-vibrator, astable multi-vibrator, bistable multivibrator, Schmitter trigger) |
| Internal signals | : 1kHz square wave, about 10Vp-p<br>1kHz sine wave, about 10Vp-p<br>100Hz square wave, about 10Vp-p   |
| Power source     | : AC 100 V 50HZ   |

### 4) Oscilloscope Circuits Trainer

1. CRT circuit
2. Vertical amplifier circuit
3. Trigger circuit
4. Sweep generator circuit
5. Unblanking circuit
6. Horizontal amplifier circuit

\* Power source Ac 100V 60HZ

### 5) Semiconductor Trainer

#### Features :

1. Training of characteristic (voltage and current) measurement of 2 terminal elements.  
Measurements ; diode, zener diode, selenium rectifier, varistor, thyristor, etc.
2. Training of characteristic (voltage, current, various parameters) measurement of 3 terminal elements.  
Transistor : static characteristic, h parameter (AC overlapping)  
FET : static characteristic, amplitude, impedance  
SCR : static characteristic

#### Specifications :

|                      |  |
|----------------------|--|
| Control power source | : Regulated voltage 5V - -10V, with 50mA max<br>Regulated current, 10uA - 10mA |
| Power Source         | : AC 100V, 60Hz  |

## 6) Electronic Counter Circuits Trainer

### Features :

1. Training of frequency measurement
2. Training of period measurement
3. Training of time interval measurement
4. Training of frequency ratio measurement
5. Training of totalizing measurement

### Specification :

1. Frequency Measurement : 1 MHz max.
2. Period Measurement : 1ms - 10 s
3. Time interval Measurement : 1ms - 1,000 s
4. Frequency ratio Measurement : f1 : 1MHz max. f2:1 MHz Max.  
: Multiple  $\times 1 \times 10 \times 100$
5. Totalizer : capacity 999  
: resolution 10 us
6. Input sensitivity : 0.1V r.m.s. 0.3Vp-p
7. Number of digits to be indicated : decimal 3 digits
8. Power source : AC 100V 50HZ

## 7) Arithmetic Calculator Circuits Trainer

### Features :

1. Training of adding calculator
2. " subtracting calculator
3. " multiplying calculator
4. " dividing calculator

### Specifications :

1. Calculating system : Binary calculating system by manual control
2. Addition : (1) addition of 1 digit  
 $0 + 0 = 0 - 9 + 9 = 18$   
(2) Accumulation, 19 max.
3. Subtraction : (1) Subtraction of 1 digit  
(2) Accumulation - 15 max.
4. Multiplication : Multiplication Of 1 digit  
 $0 \times 0 = 0 - 9 \times 9 = 81$
5. Division : division of 1 digit  
 $0 \div 1 = 0 - 9 \div 1 = 9$
6. Indicate : Quotient and remainder
7. Indicate : quotient and remainder
8. Power source : AC 100V 50HZ

22. Motor Limit Control Equipment

Control points:12

Output points: 8

10. 電子計算實習室

| No. | Nomenclature      | Q'ty | Remarks |
|-----|-------------------|------|---------|
| 1   | Personal Computer | 40   |         |
| 2   | Monitor           | 40   |         |
| 3   | Printer           | 20   |         |
| 4   | Software          | 1    |         |

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## 1. Personal Computer

CPU : 80286  
8MHz clock

### Memory

ROM : 48K bytes  
RAM : User's memory 512k bytes

### Display

text : 80 characters x 25 lines  
graphic : 1120 x 750 dots  
16 colors

FDD 1M bytes

### Interface

printer interface  
serial interface : RS-232C

Extension slot

## 2. Monitor

14" color display  
non-glare  
16 colors  
dissolution : 1120 dots x 750 lines

### 3. Printer

24 pin 15" printer

### 4. Software

FORTRAN      Compiler

PL/1            "

PASCAL         "

COBOL           "

Assembler

Disassembler

Utility program

Etc.



11. 材料試驗實習室

| No. | Nomenclature                 | Q'ty | Remarks |
|-----|------------------------------|------|---------|
| 1   | Dynamic Amplifier & Recorder | 1    |         |
| 2   | Strain Meter                 | 1    |         |
| 3   | Magnetic Particle Tester     | 1    |         |
| 4   | Ultrasonic Tester            | 1    |         |
| 5   | Spark Tester                 | 1    |         |



| No | Nomenclature                 |  | Q'ty   | Remarks |
|----|------------------------------|--|--|---------|
| 1  | Dynamic Amplifier & Recorder | No. of measuring points:<br>1 (multi-channel package possible)<br>with Auto. Balance with Low Pass Filter<br>(Accessories)<br>Oscillograph of Inkless pen  | 1<br><br><br><br>1   |         |
| 2  | Strain Meter                 | Date Logger<br>(Option)<br>Scanner Case<br>Scanner Unit for Strain gage<br>Scanner Unit for Strain Transdu Car<br>Scanner Connecting Cord<br>Digital Casset Tape   | 1<br><br>1<br>1<br>1<br>1<br>1                                       |         |
| 3  | Magnetic Particle Tester     | 200V 30A<br>DC2000A AC1500A<br>830(W)x550(D)x835(H) 140kg<br><br>(Accessories)<br>Blackout Curtain<br>Black Light<br>Magnetic Powder<br>Foot Switch<br>Auxiliary Coil<br>Test Piece<br>Copper Rod<br>Contact Prod<br>Contact Block<br>Magnetizing Cable<br><br>Centrifuge Tube<br>Flux Gauge | 1<br><br><br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>2<br><br>1<br>1 |         |
| 4  | Ultrasonic Tester            | 160(H)x235(L)x355(W)<br>with DAC Circuit, A-Scope Recording Output Circuit and B-Scope Recording Output Circuit<br><br>2Z10x10A45<br>2X10x10A70<br>5Z10x10A45<br>5Z10x10A70  | 1<br><br><br>1<br>1<br>1<br>1  |         |
| 5. | Sparktest                    | With Accessories<br>JIS G 0566-1980  | /  |         |



12. 熱處理實習室

| No. | Nomenclature           | Q'ty | Remarks |
|-----|------------------------|------|---------|
| 1   | Universal Gear Tester  | 1    |         |
| 2   | Rolling Gear Tester    | 1    |         |
| 3   | Toolmaker's Microscope | 1    |         |
| 4   | Air Gage               | 1    |         |

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| No | Nomenclature                     | Q'ty | Remarks |
|----|----------------------------------|------|---------|
| 1  | Carburizing Furnace              | 1    |         |
| 2  | Tempering Furnace                | 1    |         |
| 3  | Salt Bath Furnace                | 1    |         |
| 4  | High Frequency Induction Furnace | 1    |         |

Pit type Drip system  
 Effective size: 2000 x 300 mmH  
 Temperature: 800 - 950°C  
 Electric capacity: 15 KW  
 Working capacity: 50 Kg.  
 Drip capacity: 120 cc/H.

Optional accessories;  
 1. CO2 Gas analyzer (1)  
 Measuring range: 0 - 0.22  
 2. Drip feed base + C3H8 (1)  
 Enrich Co2 controller  
 3. Control panel (1)  
 4. Gas collection equipment (1)  
 5. Tray (2)  
 6. Cooling and Quenching chamber (1)  
 Size: 500Wx800Lx800Hmm  
 Heater: Pipe heater 3 KW

Operating temperature:  
 150 - 600°C  
 Effective dimension: 3000 x 300H mm  
 Electric capacity: 3-phase 4 KW

Direct heating pot type  
 Temperature: 1,050 - 1,300°C  
 Heating control accuracy:  
 1,350°C + 10°C  
 Pot size: 200W x 280L x 230H mm  
 Electric capacity: 3-phase 24 KVA  
 Temperature control by a thermocouple  
 Indicator for temperature deviation

Output: 10 - 20 KVA  
 Frequency: 100 - 200 KHz.  
 Type: Vacuum tube type  
 Construction of :-  
 1. Power  
 2. Rectifier  
 3. Oscillator  
 4. Voltage controller  
 5. Detector  
 6. Actuator  
 7. Heater  
 8. Automatic temperature controller  
 9. Air cooling system  
 10. Water cooling system





13. 表面处理実習室

| No.   | Nomenclature  | Q'ty | Remarks |
|-------|---|------|---------|
| 1     | Trichloroethylene Degreaser                         | 1    |         |
| 2     | Alkaline Degreasing Tank                            | 2    |         |
| 3     | Electro Cleaning Tank                               | 1    |         |
| 4     | Acid Dipping Tank                                   | 3    |         |
| 5     | Neutralization Tank                                 | 1    |         |
| 6     | Copper Strike Plating Tank                          | 1    |         |
| 7     | Copper Plating Tank(CU/SO4)                         | 1    |         |
| 8     | Copper Plating Tank                                 | 1    |         |
| 9     | Nickel Plating Tank                                 | 1    |         |
| 10    | Chromium Plating Tank                               | 1    |         |
| 11    | Hard Chromium Plating Tank                          | 1    |         |
| 12    | Zinc Plating Tank                                   | 1    |         |
| 13    | Nitric Acid Dipping Tank                            | 2    |         |
| 14    | Chromate Coating Tank                               | 3    |         |
| 15    | Etching Tank  | 1    |         |
| 16    | Anodizing Tank                                      | 1    |         |
| 17    | Dyeing Tank   | 2    |         |
| 18    | Sealing Tank  | 1    |         |
| 19    | Water Rinsing Tank                                  | 9    |         |
| 20    | 2-Range Water Rinsing Tank                          | 7    |         |
| 21    | Drug Out & 2-Range Water Rinsing Tank               | 7    |         |
| 22    | Silicon Rectifier                                   | 8    |         |
| 23    | Pre-Treatment Line Control Panel                    | 1    |         |
| 24,25 | Electro Plating Line Control Panel                  | 2    |         |
| 26    | Anodizing Electro Plating Line Control Panel        | 1    |         |
| 27    | Filter  | 7    |         |
| 28    | Blower  | 1    |         |
| 29    | Buffing M/C   | 1    |         |
| 30    | Centrifugal Dryer                                   | 1    |         |
| 31    | Dryer   | 1    |         |
| 32    | Cooling Device System                               | 1    |         |
| 33    | Fume Hood(For each Plating tank with Dumper 22 PCS) | 1    |         |

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| No. | Nomenclature                        | Qty | Remarks |
|-----|-------------------------------------|-----|---------|
| 34  | Barrel M/C                          | 2   |         |
| 35  | Analytical Balance                  | 1   |         |
| 36  | Digital PH Meter                    | 8   |         |
| 37  | Direct Reading Balance              | 1   |         |
| 38  | Water Distilling Apparatus          | 1   |         |
| 39  | Thermostat Oven (Dry Oven)          | 1   |         |
| 40  | Specific Gravity Hydrometer         | 4   |         |
| 41  | DC Voltage/Current Standard         | 1   |         |
| 42  | Vaccum Pump                         | 1   |         |
| 43  | Chemical Analyzer Set               | 1   |         |
| 44  | Sulphameter                         | 1   |         |
| 45  | Atomic Absorption Spectrometer      | 1   |         |
| 46  | Weather Meter (Weather - O - Meter) | 1   |         |

| NO | Nomenclature                |   | Q'ty | Remarks |
|----|-----------------------------|---|------|---------|
| 1  | Trichlorethylene Degreaser  | Size: 1,050 x 350 x 900Hmm<br>Effective size;<br>Warm zone tank: 290 x 280<br>250mmd<br>Cool zone tank: 290 x 280<br>300mmd<br>Vapor zone tank: 290 x<br>280 x 300mmd<br>Material: SUS-304 2mm(t) | 1    |         |
| 2  | Alkaline Degreasing Tank    | Size: 300 x 350 x 400 mmd<br>Material: SUS-304 3mm(t)   | 2    |         |
| 3  | Electro Cleaning Tank       | Size: 300x350x400 mmd<br>Material: SS 3.2mm(t)<br>Inside: 3mm(t) Hard rubber<br>lining  | 1    |         |
| 4  | Acid Dipping Tank           | Size: 300x350x400mmd<br>Material: PVC 5mm(t)  | 3    |         |
| 5  | Neutralization Tank         | Size: 300x350x400mmd<br>Material: PVC 5mm(t)  | 1    |         |
| 6  | Copper Strike Plating Tank  | Size: 300x350x400mmd<br>Material: SS 3.2mm(t)<br>Inside: 3mm(t) Hard rubber<br>lining   | 1    |         |
| 7  | Copper Plating Tank (CuSO4) | Size: 300x350x400mmd<br>Material: SS 3.2mm(t)<br>Inside: 3mm(t) Hard rubber<br>lining   | 1    |         |
| 8  | Copper Plating Tank         | Size: 300x350x400mmd<br>Material: SS 3.2mm(t)   | 1    |         |

| NO. | Nomenclature               |  | Q'ty | Remarks |
|-----|----------------------------|--|------|---------|
| 9   | Nickel Plating Tank        | Size: 300x350x400mmd<br>Material: SS 3.2mm(t)<br>Inside: 3mm(t) Hard rubber lining | 1    |         |
| 10  | Chromium Plating Tank      | Size: 300x350x400mmd<br>Material: SS 3.2mm(t)<br>Inside: 3mm(t) Hard rubber lining | 1    |         |
| 11  | Hard Chromium Plating Tank | Size: 300x350x400mmd<br>Material: SS 3.2mm(t)<br>Inside: 3P-FRP lining             | 1    |         |
| 12  | Zinc Plating Tank          | Size: 300x350x400mmd<br>Material: ss 3.4mm(t)<br>Inside: 3mm(t) Hard rubber lining | 1    |         |
| 13  | Nitric Acid Dipping Tank   | Size: 300x350x400mmd<br>Material: PVC 5mm(t)                                       | 2    |         |
| 14  | Chromate Coating Tank      | Size: 300x350x400mmd<br>Material: PVC 5mm(t)                                       | 3    |         |
| 15  | Etching Tank               | Size: 300x350x400mmd<br>Material: SUS-304 3mm(t)                                   | 1    |         |
| 15  | Anodizing Tank             | Size: 300x350x400mmd<br>Material: SS 3.2mm(t)                                      | 1    |         |
| 17  | Dyeing Tank                | Size: 300x350x400mmd<br>Material: SUS-304 3mm(t)                                   | 2    |         |
| 18  | Sealing Tank               | Size: 300x350x400mmd<br>Material: SUS-304 3mm(t)                                   | 1    |         |
| 19  | Water Rinsing Tank         | Size: 300x350x400mmd<br>Material: PVC 5mm(t)                                       | 9    |         |

| NO. | Nomenclature                          |  | Q'ty             | Remarks |
|-----|---------------------------------------|--|------------------|---------|
| 20  | 2-Range Water Rinsing Tank            | Size: (300 x 2) x 350<br>400mmd<br>Material: PVC 5mm(t)  | 7                |         |
| 21  | Drug Out & 2-Range Water Rinsing Tank | Size: (300 x 3) x 350 x 400<br>Material: PVC 5mm(t)  | 7                |         |
| 22  | Silicon Rectifier                     | Air cooling system<br>Input: 3-phase 220V 60Hz.<br>Operation system: Remote control system<br>Control system: AVR or ACR<br>Output: DC 12V 100 A | 1                |         |
|     | " "                                   | - Ditto -, but<br>Output: DC 10V 100 A   | 5                |         |
|     | " "                                   | - Ditto -, but<br>Output: DC 12V 200 A   | 1                |         |
|     | " "                                   | - Ditto -, but<br>Output: DC 12V 200 A<br>With Pole-Exchanger)   | 1                |         |
|     | " "                                   | - Ditto -, but<br>Output: DC 25V 100 A<br>Without pole-Exchanger   | 1                |         |
| 23  | Pre-Treatment Line Control Panel      | For Rectifier controller x<br>" Temperate controller x<br>" Motor switch x   | 1 1<br>3<br>1    |         |
| 24  | Electro Plating Line Control Panel    | Cu, Ni, Electro Plating<br>For Rectifier controller x<br>" Temperate controller x<br>" Motor switch x  | 1<br>4<br>4<br>4 |         |
| 25  | " "                                   | - Ditto - but<br>For Rectifier controller x<br>" Temperate controller x<br>" Motor switch x  | 1<br>3<br>3<br>1 |         |

| NO. | Nomenclature                                 |   | Q'ty        | Remarks |
|-----|--|---|-------------|---------|
| 26  | Anodizing Electro Plating Line Control Panel | For Rectifier controller x 1<br>" Temperate controller x 6<br>" Motor switch x 1  | 1<br>6<br>1 |         |
| 27  | Filter                                       | Type: Z-INS<br>Motor: 0.15 KW   | 7           |         |
| 28  | Blower                                       | Type: TB-750<br>Motor: 0.75 KW  | 1           |         |
| 29  | Buffing Machine                              | Type: EFC-3.7<br>Speed: 250 rpm.<br>Motor: 3.7 KW   | 1           |         |
| 30  | Centrifugal Dryer                            | Type: HB-30<br>Speed: 1,150 rpm.<br>Motor: 0.75 KW<br>Heater: 2 KW  | 1           |         |
| 31  | Dryer  | Type: NA-201<br>Material: Inside SUS-304.<br>the others is SS   | 1           |         |
| 32  | Cooling Device System                        | For Cu, HCu, Anodize and Solution:<br>Water chiller x 1<br>Cooling tower x 1<br>Circulation pump x 1<br>Cooling water tank x 1<br>Motor drive valve x 3<br>Pipe material x 1<br>Control panel x 1 | 1           |         |
| 33  | Fume Hood                                    | For each plating tank<br>With Dumper 22 pcs.  | 1           |         |
| 34  | Barrel <i>M/C</i>                            | Type: K-10<br>Material: PVC<br>Size : 1150 x 150mm  | 2           |         |

| NO. | Nomenclature                |   | Qty | Remarks |
|-----|-----------------------------|---|-----|---------|
| 35  | Analytical Balance          | Max. capacity: 200 g<br>Min. Reading : 0.1 mg   | 1   |         |
| 36  | Digital PH Meter            | PH 0 -14  | 8   |         |
| 37  | Direct Reading Balance      | Capacity: amx. 200g<br>Min. reading: 0.05 mg.   | 1   |         |
| 38  | Water Distilling Apparatus  | Capacity: 6 liters/h.<br>AC 220V(3Ø) or 200V(1Ø)  | 1   |         |
| 39  | Thermostat Oven (Dry Oven)  | Temperature range: 0 to 200°C<br>Interior: SUS-304 600W x 500L x 910Hmm<br>Heater: 1.8 KW | 1   |         |
| 40  | Specific Gravity Hydrometer | Hydrometer Set<br>Set of 19 pcs.  | 4   |         |
| 41  | AC Voltage/Current Standard | High accuracy: +0.08%<br>Output: 1mV to 1,200V<br>: 1mA to 60A                            | 1   |         |
| 42  | Vacuum Pump                 | Free air displacement: 35 liters/min.<br>Ultimate vacuum: $10^{-3}$<br>Motor: 200W        | 1   |         |
| 43  | Chemical analyzer set       | The set includes a colorimeter model WAL-F  |     |         |

| No. | Nomenclature                        |   | QTY. | Remarks |
|-----|-------------------------------------|---|------|---------|
| 44  | Sulphameter                         | Sulphur meter consist of;-<br>1. Centrifuge equipment<br>2. Graduated centrifuge tubes<br>3. etc. | 1    |         |
| 45  | Atomic Absorption Spectrometer      | Atomic absorption & Flame emission spectrophotometer  | 1    |         |
| 45  | Weather Meter (Weather - 0 - Meter) | Water cooled Xenon Long-Lifer clamp 5.0 KW x 1<br>Carbon arc lamp 135V 16A x 2 pcs.               | 1    |         |









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