Service Manual

BMD®

Hitachi 717

1. STRUCTURE AND SPECIFICATIONS

1. STRUCTURE AND SPECIFICATIONS

1-1 Main Block Diagram

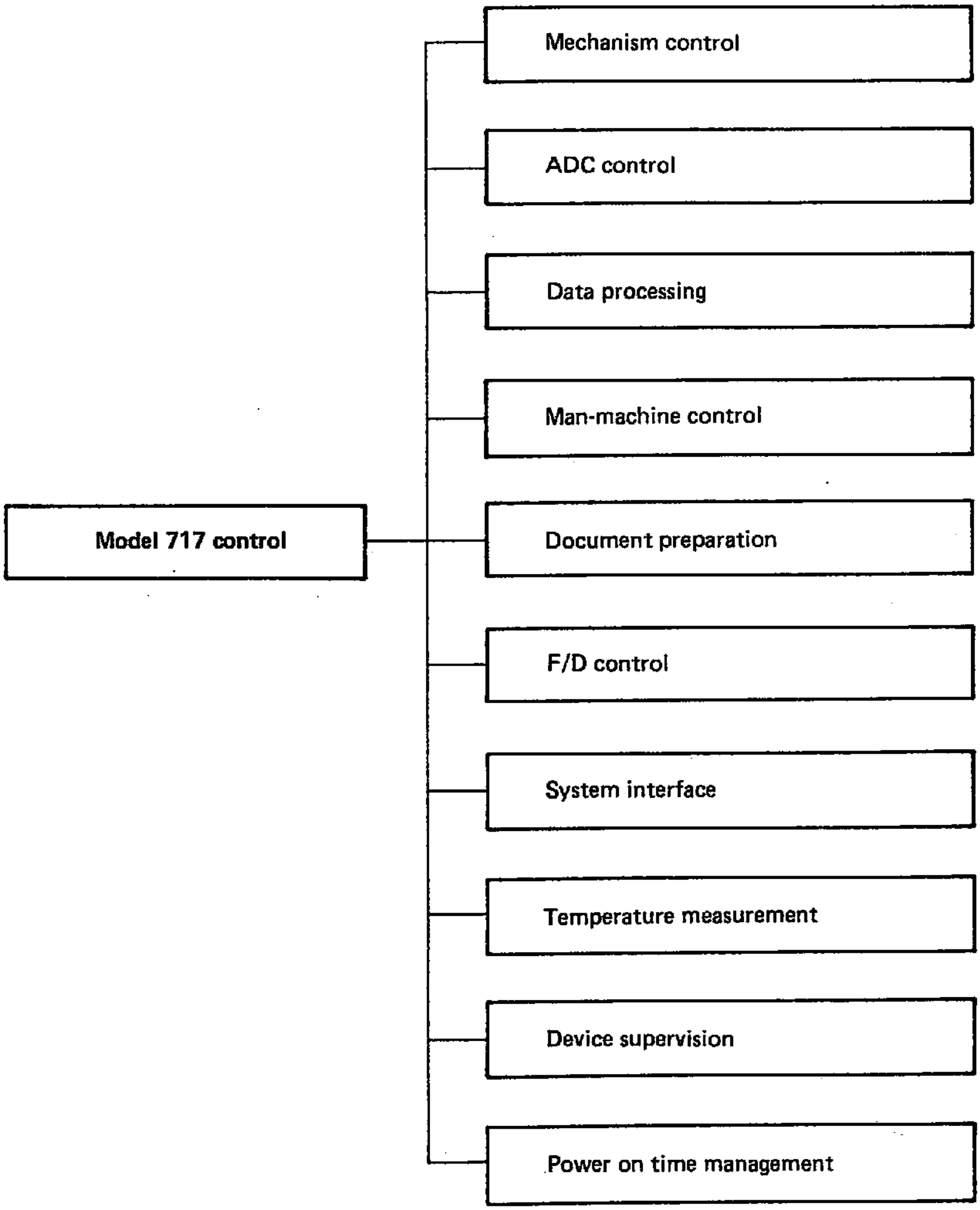


Fig. 1-1-1 Program Structure Block Diagram

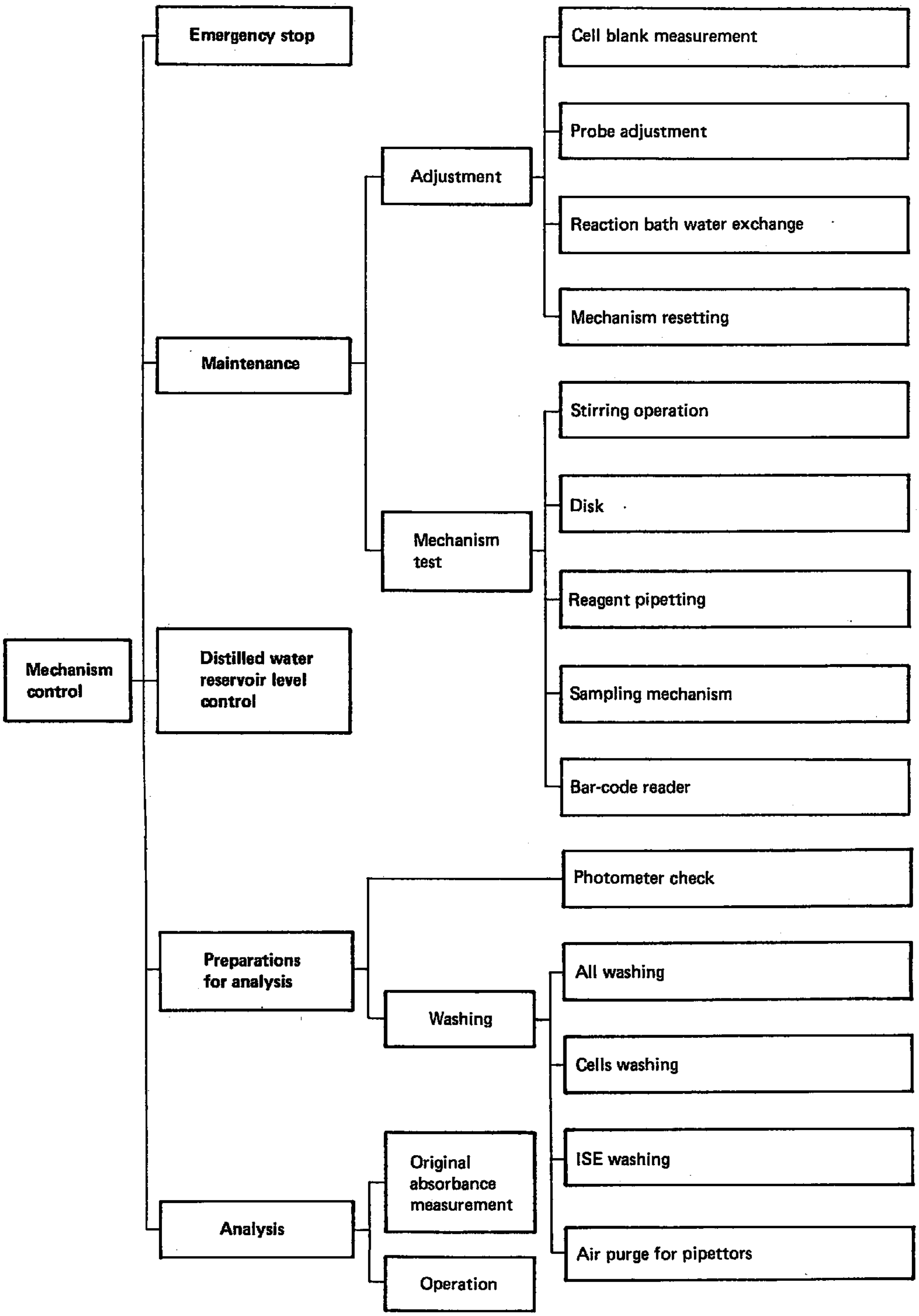


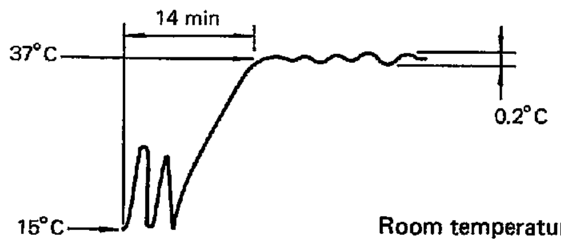
Fig. 1-1-2 Functional Block Diagram for Mechanism Control

1-2 Specifications

Table 1-2-1

<table>
<tr><th>No.</th><th>Test Item</th><th>Example of Actually Measured Value</th></tr>
<tr><td>1</td><td>Insulation resistance</td><td>Primary side .... 75 MΩ
Secondary side .... 60 MΩ</td></tr>
<tr><td>2</td><td>Withstand voltage</td><td>Primary side .... 1500 V/min
Secondary side .... 650 V/min</td></tr>
<tr><td>3</td><td>Leakage current</td><td>100 V AC .... 0.05 mA
220 V AC .... 0.04 mA</td></tr>
<tr><td>4</td><td>Current consumption of AC power source</td><td>100 V AC .... 13.2 A
220 V AC .... 6.2 A</td></tr>
<tr><td>5</td><td>Current consumption of DC power source</td><td><table><tr><td rowspan="2">DC Power</td><td>5 V</td><td>24 V</td><td>15 V</td><td>−15 V</td><td>12 V</td><td>12 V</td></tr><tr><td>11.1 A</td><td>6.9 A</td><td>0.14 A</td><td>0.20 A</td><td>1.7 A</td><td>1.7 A</td></tr></table></td></tr>
<tr><td>6</td><td>Current consumption of AC fuse</td><td>10 A (F100, PL4100) .... 3.4 A
3 A (F101, P430) .... 1.0 A
3 A (F102, P430) .... 1.0 A
7.5 A (F103, P475) .... 3.0 A
5 A (F104, P450) .... 1.8 A</td></tr>
<tr><td>7</td><td>Current consumption of fuse for DC power source</td><td>10 A (F107) .... 5.7 A
5 A (F108) .... 3.0 A (with ISE)
5 A (F109) .... 4.5 A
10 A (F110) .... 6.0 A</td></tr>
<tr><td>8</td><td>AC line noise resistance</td><td>2000 Vp-p for 800 nsec</td></tr>
<tr><td>9</td><td>Momentary power failure</td><td>20 msec (100 % dip), Power fail 85 ± 2 V</td></tr>
<tr><td>10</td><td>Static electricity</td><td>8 kV</td></tr>
<tr><td>11</td><td>Rush current</td><td>289 A max.</td></tr>
<tr><td>12</td><td>Distilled water consumption</td><td>(1) Consumption at power switch ON .... 2.07 ℓ
(2) Rinse water consumption (per hour) .... 17.6 ℓ/hr
(3) Consumption at INC. WATER EXCHANGE .... 2.0 ℓ
o Adjusting method
After fully CW, return it 3/4 turn CCW at power freq. of 50 Hz or 2-1/2 turns CCW at 60 Hz.</td></tr>
</table>

(cont'd)

No.	Test Item	Example of Actually Measured Value
13	Temp. control of reaction bath	 Room temperature ..... 15°C
14	British thermal unit	1720 kcal/h

2. SOFTWARE STRUCTURE AND TIMING CHART

2. SOFTWARE STRUCTURE AND TIMING CHART

2-1 Data Processing

(1) Fundamental Measurement

The fundamental measurement with this analyzer is as shown in Fig. 2-1-1.
After measurement of the water blank and addition of the 1st reagent, the absorbance is measured for 50 points at intervals of about 12 seconds over a 10-minute period, and data processing is made using the value from which the water blank value has been subtracted. The actual timing to be used for the absorbance differs with the analytical method.

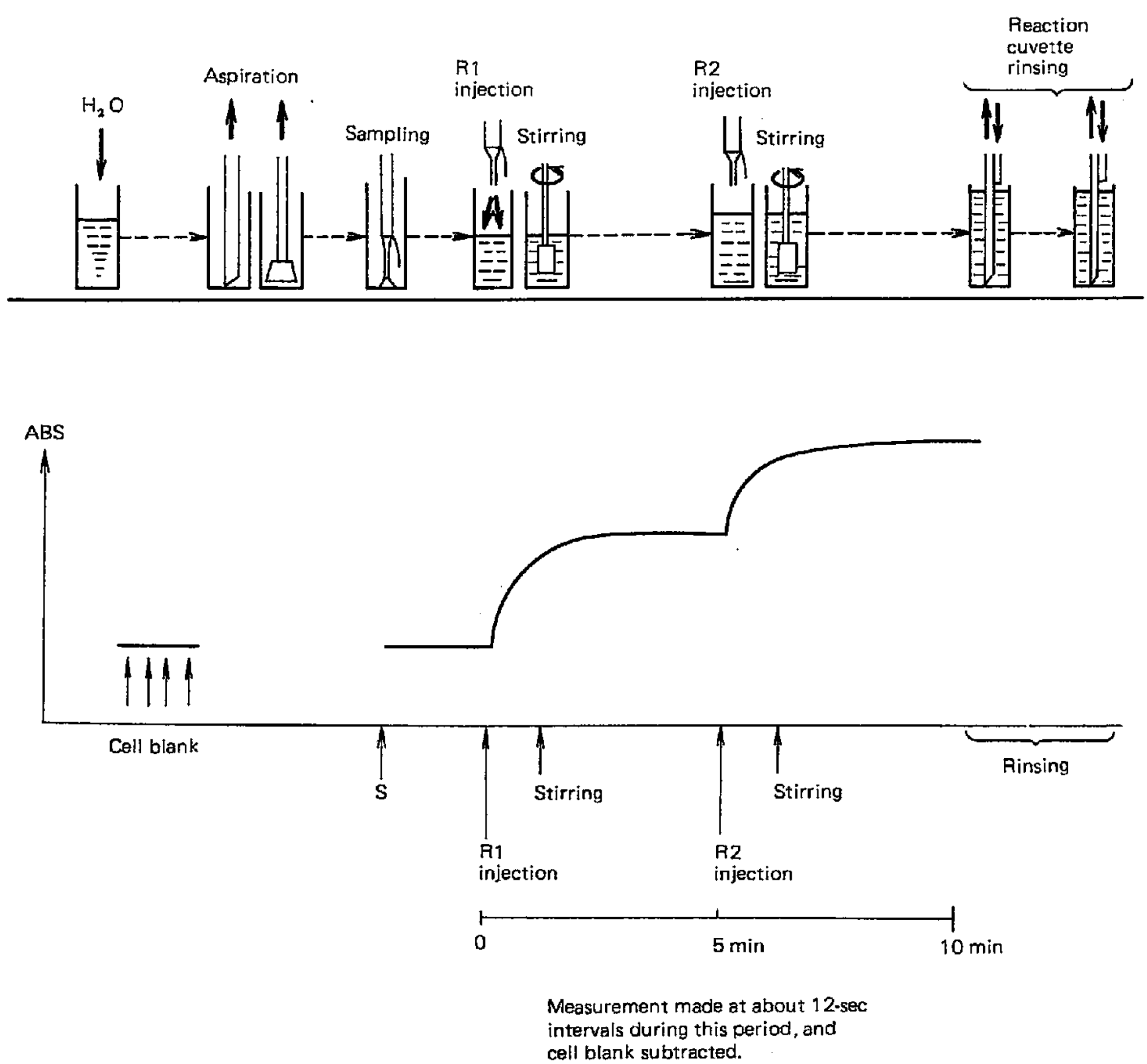


Fig. 2-1-1 Fundamental Measurement

(2) Whole Reaction Process Photometry

Figure 2-1-2 shows the photometric monitoring sequence of the whole reaction process in the Model 717 analyzer. After measurement of water blank, the first reagent (R1) is added to each sample. Then, for ten minutes, absorbance of reaction solution is measured repetitively every 12 seconds. That is, photometric measurement is repeated 50 times for ten minutes as indicated below. The user can select arbitrary photometric (absorbance) points from these 50 points to meet the particular purpose of test.

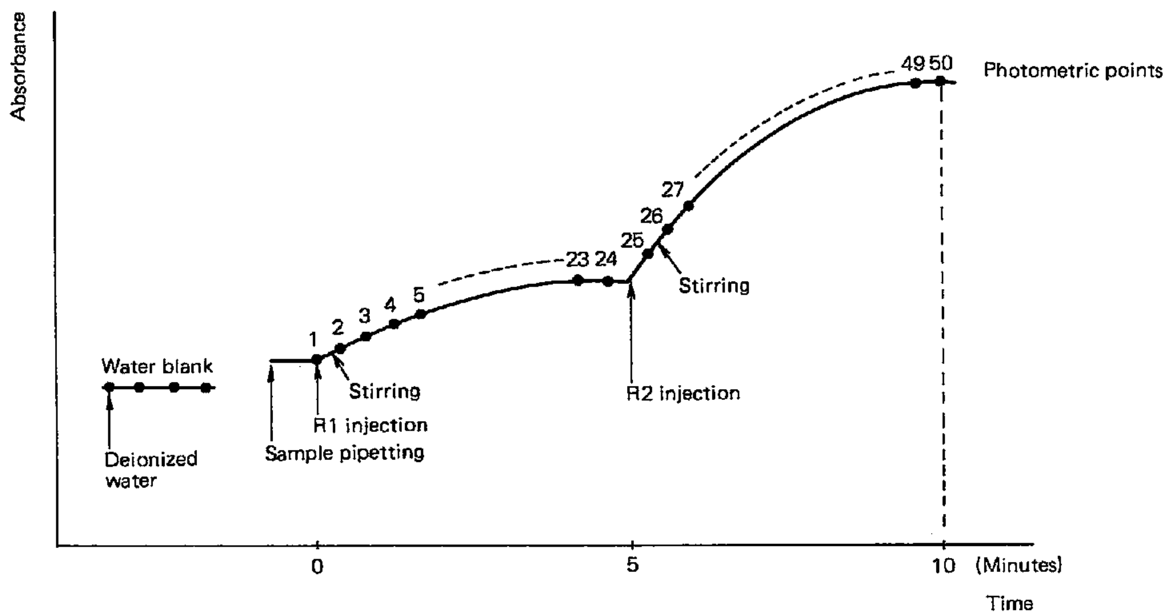


Fig. 2-1-2 Reaction Time Course

Table 2-1-1 Photometric Points and Elapsed Time

Photometric Point	Elapsed Time (sec)	Time Interval (sec)	Photometric Point	Elapsed Time (sec)	Time Interval (sec)	Photometric Point	Elapsed Time (sec)	Time Interval (sec)
1	0.00	Approx. 11.87	18	201.76	11.87	35	401.54	11.87
2	11.87		19	213.63		36	413.41	
3	23.74		20	225.50		37	425.28	
4	35.60		21	237.37		38	437.14	
5	47.47		22	249.23		39	449.01	
6	59.34		23	261.10	11.87	40	460.88	
7	71.21		24	272.97	9.89	41	472.75	
8	83.08		25	282.86	11.87	42	484.62	
9	94.95		26	294.72		43	496.49	
10	106.81		27	306.59		44	508.35	
11	118.68		28	318.46		45	520.22	
12	130.55		29	330.33		46	532.09	
13	142.42		30	342.20		47	543.96	
14	154.29		31	354.07		48	555.83	
15	166.16		32	365.93		49	567.70	11.87
16	178.02	11.87	33	377.80	11.87	50	579.56	
17	189.89		34	389.67				

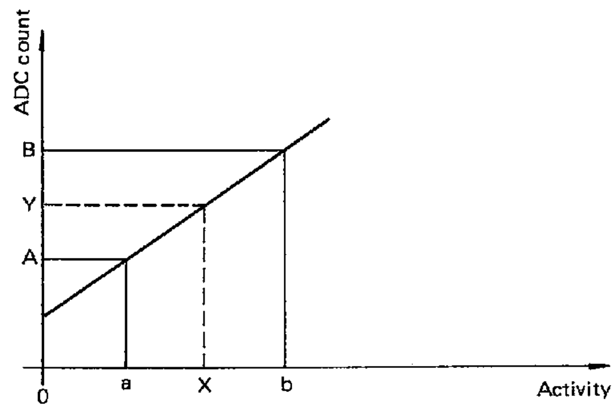
2-1-1 Absorbance Measurement

ADC-error data alarm is added when ADC value was not acquired at even one point among all photometric points.

- ADC Control

(a) ADC Calibration

1) Calibration Formula



a . . . . Corresponds to calibration voltage 2 V
b . . . . Corresponds to calibration voltage 6 V
A . . . ADC count for 2 V input
B . . . . ADC count for 6 V input

Fig. 2-1-3 ADC Calibration

Activity X can be calculated by the formula below according to measured ADC count Y with reference to the above figure.

$$X = \frac{b-a}{B-A}\left(Y - \frac{Ab - Ba}{b - a}\right)$$

a and b values become as listed below in photometric assay and ISE measurement.

	Activity	a (2 V)	b (6 V)	10 V	0 V
Photometric assay	10 mm-converted absorbance $\times 10^{-4}$ Abs	8333	25,000	41,667	0
ISE measurement	Electromotive force mV	+150	**b (8 V)** −150	+250	−250

Fig. 2-1-4 Abs vs. ADC Value Comparison

2) Integral Time and Allowable Error of Calibration Voltage ADC Count

- Photometric assay: 16 bits, full, 7.2 msec
  ISE assay: 16 bits, full, 3.6 msec
- ADC count for each calibration voltage lies within the following range.
  Photometric assay:
  2 V . . . . 6189 to 10,315
  6 V . . . . 13,946 to 23,244
  ISE assay:
  2 V . . . . 12,377 to 20,629
  8 V . . . . 35,650 to 59,416
  ADC CALIB alarm is issued when each output ADC value exceeds the above range upon ADC calibration.

(b) ADC Error Check

ADC error alarm occurs if the number of ADC starts does not match that of acquired ADC values.

2-1-2 Temperature Measurement

(a) Temperature ADC

1) Integral Time
Set at 1.8 msec.

2) Calibration Formula

$$\text{Temperature} \times 100 = \frac{1600Y}{B-A} + \frac{800B - 2400A}{B-A}$$

A . . . ADC count for calibration voltage 2 V
B . . . ADC count for calibration voltage 6 V
Y . . . Measured ADC count

3) Calibration Error

Temperature ADC calibration error alarm is generated when the output ADC count for each calibration voltage is not within the following range.

2 V . . . . 6189 to 10,315
6 V . . . . 13,946 to 23,244

4) Temperature ADC Error
Alarm is issued when temperature ADC cannot terminate.

(b) Temperature Measurement

- Incubation Bath in End Point Assay
  1) Temperature is measured every 1.5 seconds, and an average of 4 measured temperatures is indicated on OPERATION MONITOR screen.
  2) Overheat alarm occurs when temperature rises beyond 39°C.
  3) Temperature alarm is issued if the current temperature is out of a range of 25/30/37°C ± 0.5°C.

2-1-3 Original Absorbance Measurement

(1) Functions

- Absorbances at all measuring points are output. Concentrations and serum indexes are also output.
- Routine or stat samples are subjected.
- New channels can be added only for serum indexes. No channel is added to test-to-test correction or isozyme P.

(2) Key-in Procedure

Enter "YES" for the ORIGINAL ABS of the START CONDITIONS screen, and then depress the START key.

(3) Operation

Same as routine operation.

2-1-4 Photometer Check

(1) Function

Water blank absorbance is measured with the photometer.

(2) Key-in Procedure

Enter "START" for the PHOTOMETER CHECK shown in the START CONDITIONS screen.

(3) Operation

1) The cells having numbers 119 and 1 are rinsed, and then water for blank is added to them.
2) The absorbances of water blanks contained in cells 119 and 1 are measured at 12 wavelengths.
   Upon completion of the measurements, the absorbances measured at the respective wavelengths are averaged. The average value is then separated into ADC's for main wavelength measurement and sub wavelength measurement, which are then printed out together with the data acquired through the preceding measurement.
3) The data acquired through the current measurement are written into a floppy disk.

Note: If the STOP key is depressed, or STOP alarm is issued during the above operation, the system stops the rest of the operation.
In this case, the measurement results will not be written into a floppy disk.

2-2 Status Transition Matrix

< Operation >

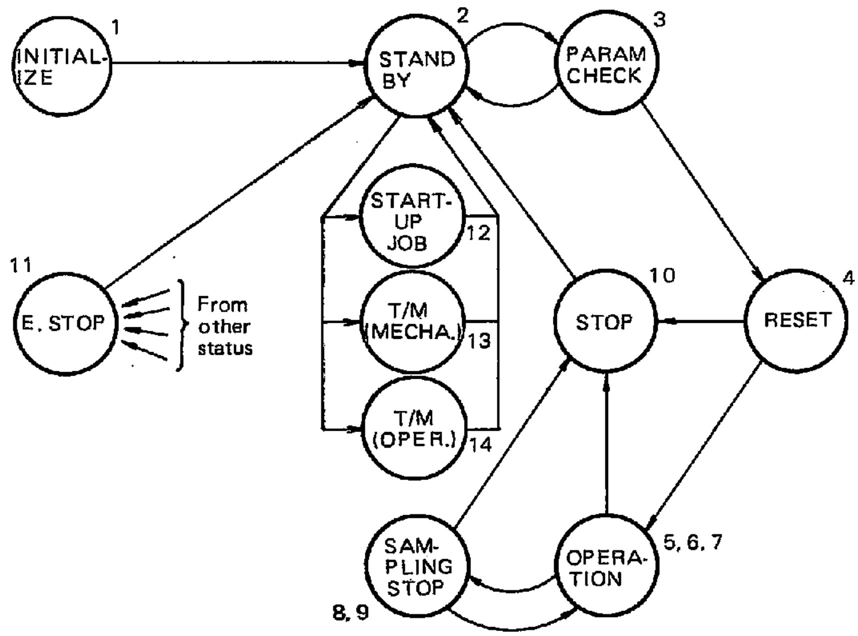


Fig. 2-2-1 Status Transition Diagram

Table 2-2-1 Status Transition

No.	Status Name		No →	1	2	3	4	5	6	7	8	9	10	11	Remarks
			Event	Alarm				Keys						Auto STOP	
						S. STOP									
				E. STOP	STOP	Mechanism	Liquid Level Sensor	START	S.STOP	STOP	START-UP JOB	T/M (MECHA.)	T/M (OPER.)		
1	Initialize			11	–	–	–	–	–	–	–	–	–	2	
2	Standby			11	–	–	–	3	–	–	12	13	14	–	
3	Parameter check			11	2	–	–	–	–	–	–	–	–	4	
4	Reset			11	10	–	–	–	–	–	–	–	–	5	
5	Operation	Sampling		11	10	9	7	–	7	10	–	–	–	6	
6	Operation	Auto stop		11	10	9	7	–	–	10	–	–	–	8	Rinsing of sampling probe
7	Operation	Key stop		11	10	9	–	–	–	10	–	–	–	8	Rinsing of sampling probe
8	Sampling stop	Restart enabled		11	10	–	–	5	–	10	–	–	–	10	
9	Sampling stop	Restart disabled		11	10	9	–	5	–	10	–	–	–	10	
10	Stop			11	–	–	–	–	–	2	–	–	–	2	
11	Emergency stop			–	–	–	–	–	–	2	–	–	–	2	
12	Start-up job			11	2	–	–	–	–	2	–	–	–	2	The STOP key is ineffective during air purge.
13	T/M (mechanism)			11	2	–	–	–	–	2	–	–	–	2	The STOP key is ineffective under mechanism reset or water exchange condition.
14	T/M (operation)			11	–	–	–	–	–	2	–	.	–	2	

Notes: 1. Start-up job : Air purge, WASH, photometer check, ISE priming

2. T/M (mechanism) : Sampling mechanism, disk mechanism, reagent pipetting, stirrer mechanism, reset, water exchange, cell blank, probe adjustment, bar-code reader

3. T/M (operation) : Parameter read/write, precision check, memory check, log-out, floppy disk utility, printer check

MODEL 717
AUTOMATIC ANALYZER

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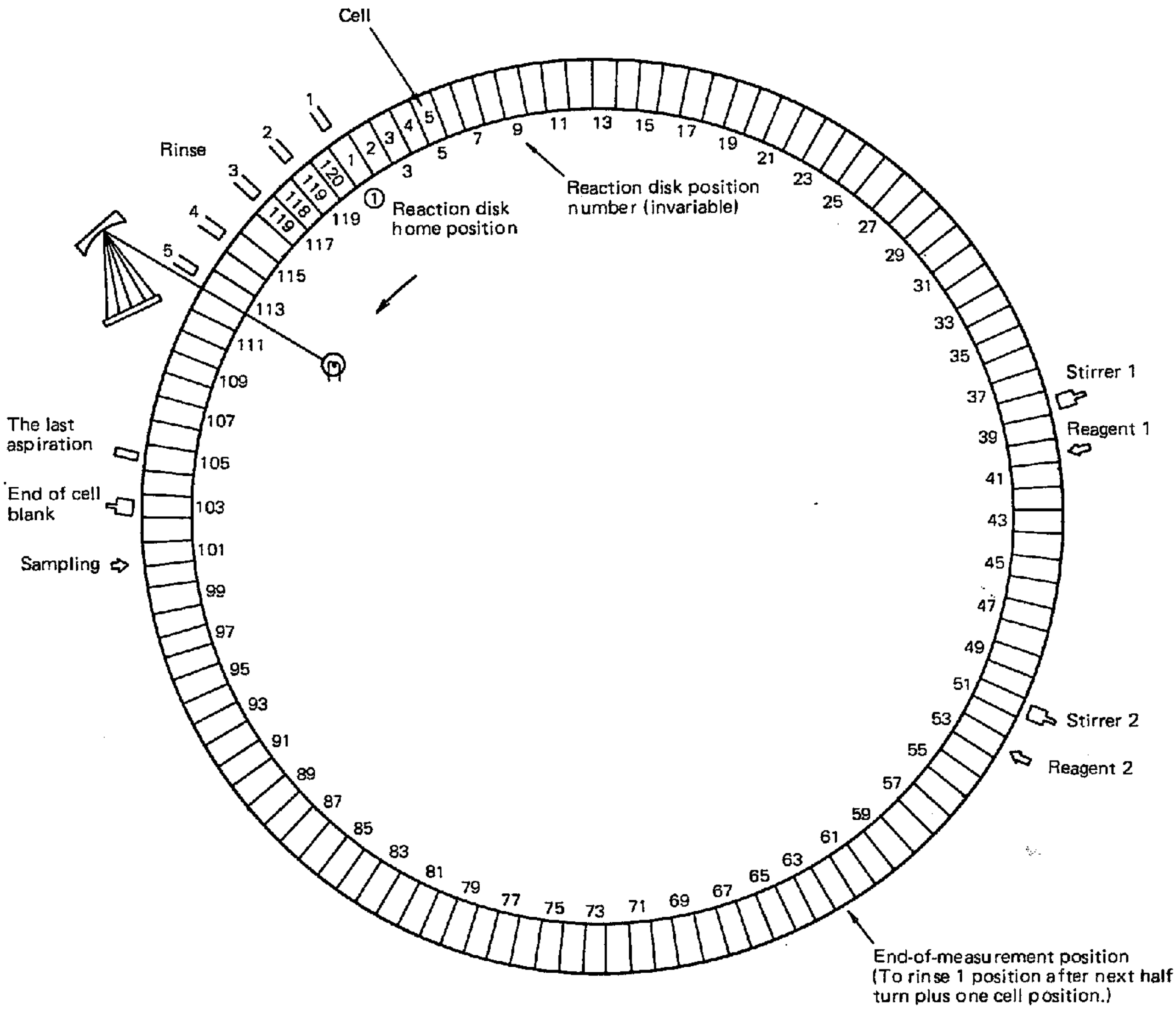
2-3 Major Functions

2-3-1 Reaction disk

The reaction disk is capable of accommodating 120 cells.



- Reaction disk rotation: Half turn plus one cell per six seconds

Under condition that the cell #N is at the position #P on reaction disk:

(1) For reaction disk position #P, the following equations can be established.
Next cell number = (N + 61) mod 120
Preceding cell number = (N + 59) mod 120

(2) For cell #N, the following equations can be established.
Next position number = (P + 59) mod 120
Preceding position number = (P + 61) mod 120

Fig. 2-3-1 Reaction Disk Operation Sequence

2-3-2 Serum Sampling

(1) Sample Pipetting

The kind, sequence no., position no., ID no. and channel no. of a sample under sampling are indicated on OPERATION MONITOR screen.

< Sample Pipetting Sequence >

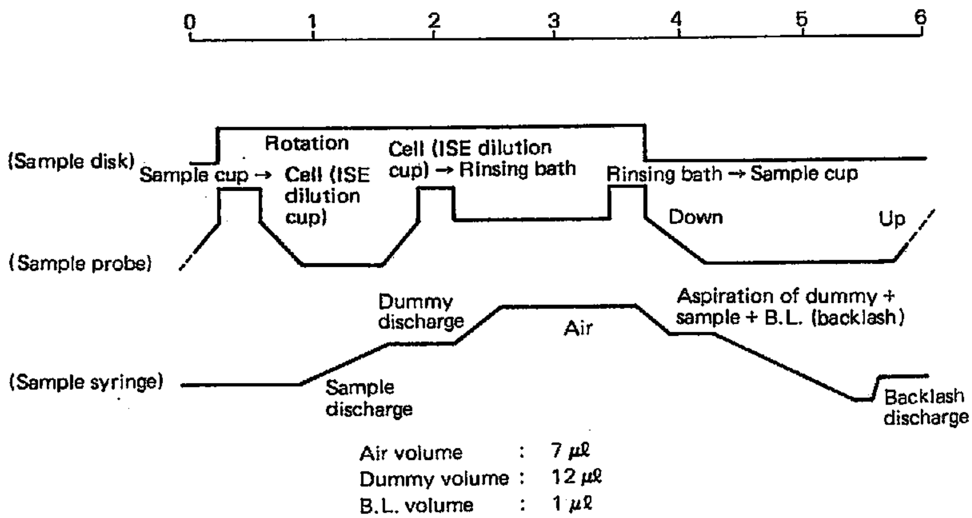


Fig. 2-3-2 Sample Pipetting Diagram

(a) Operation of Sample Disk
- Operates only when a sample is switched over to the next one.
- Rotates to nearest intermediate point and then to a new sample position when sample position is changed from the outer to inner row.
- Rotates up to a required position in the directioon in which rotational distance is shorter.

(b) Operation of Sample Probe and Syringe
- Preliminary washing
  The inside and outside of sample probe are washed only when sampling was not performed in the previous cycle.
- Aspiration
  Air is sucked and dummy is aspirated only at the first sampling of a sample.
- Discharge
  Determined by SAMPLE VOLUME entry via CHEMISTRY PARAMETER screen.
- Washing
  Only at the final sampling of a sample, dummy and air are discharged, and inside and outside of sample probe are washed.

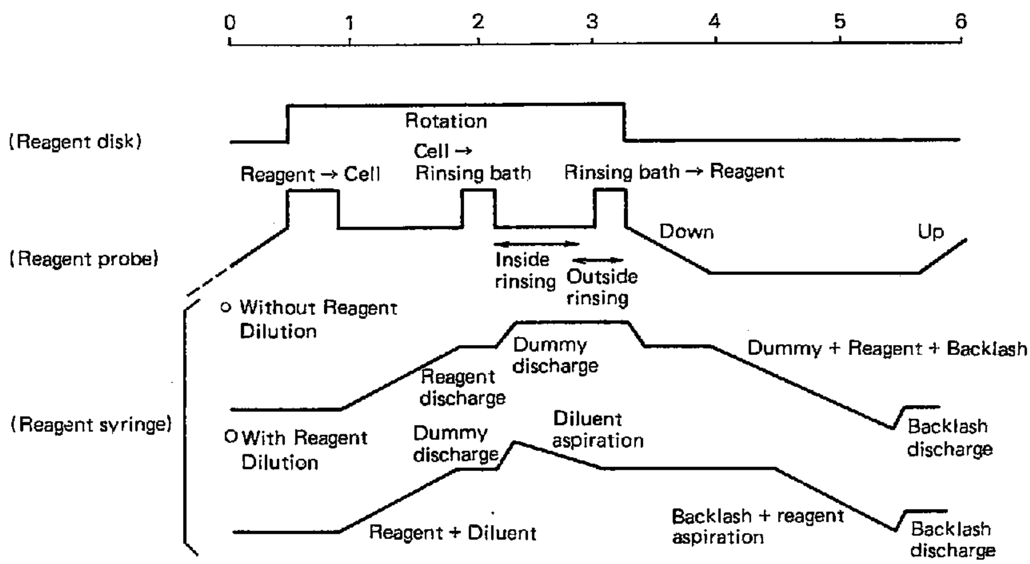
(c) Processing upon Completion of Sampling
- Calibration
  "NO" appears for START UP CALIB. on START CONDITIONS screen.
- Recalibration
  "NO" apears for CALIB. (RERUN) on START CONDITIONS screen.
- Stat sample
  Sample data are erased from STAT screen.
- Routine sample
  The next sample no. appears for START SAMPLE NO. on START CONDITIONS screen.
- Rerun sample
  Same as for routine sample only in RERUN ONLY mode.

(d) Measure against Abnormality
- Although the sample probe goes down in order to aspirate a sample, it will not go down and SAMPLING PROBE (4-8) alarm will occur if water drops have adhered between the liquid level sensor and the tip of sample probe.
- If no sample is placed where the sample probe goes down for aspirating a sample, a warning for indicating the absence of sample is added to data.

2-3-3 Reagent Sampling

(1) Reagent Pipetting

< Reagent Pipetting Sequence >



Air volume : 22 μℓ
Dummy volume : Pipetted reagent volume/16 + 10 μℓ
B.L. volume (aspiration) : 17 μℓ
B.L. volume (discharge) : 25 μℓ

Fig. 2-3-3 Reagent Pipetting Diagram

(a) Operation of Reagent Disk

- Operates when channel is switched.
- Rotates up to a required position in the direction in which rotational distance is shorter.

(b) Operation of Reagent Probe and Syringe

- The volume of pipetted reagent is determined by REAGENT VOLUME entry on CHEMISTRY PARAMETER screen.
- When "diluent volume" is entered for DILUTION on CHEMISTRY PARAMETER screen, over the rinsing bath, the plunger in the syringe lowers in response to each dilution volume below, and flushing is performed so that the reagent probe is filled with water up to its leading end. Then reagents are aspirated in each specified volume, and water (of the dilution volume) and sample are discharged into the cell.

  R1 dilution volume .... 0 to 350 $\mu\ell$

  R2 dilution volume .... 0 to 350 $\mu\ell$

(c) Display of Remaining Reagent

After a reagent is aspirated, its remaining volume is calculated and indicated on REAGENT VOLUME CHECK screen.

This indication is given in volumetric steps for the number of samples, and the first digit (1 to 9 samples) is truncated.

The following formulas are employed for calculating the remaining volume.

1) In case water drops have not adhered between the liquid level sensor and the tip of the reagent probe when the probe lowers to aspirate a reagent:
   - Without Reagent Dilution:
     Remaining reagent volume = (Remaining pulses upon lowering of reagent probe) × (Lowering distance per pulse) × (Bottom area of reagent bottle)/(Pipetted reagent volume + Dummy reagent volume)
   - With Reagent Dilution
     Remaining reagent volume = (Remaining pulses upon lowering of reagent probe) × (Lowering distance per pulse) × (Bottom area of reagent bottle)/(Pipetted reagent volume)
2) In case water drops have adhered to the liquid level sensor on the same occasion as above:

   Remaining reagent volume = (Remaining volume just after previous aspiration) — 1

(d) Measure against Abnormality

- STOP alarm occurs for 3 consecutive detections of water drops adhering to the liquid level sensor upon lowering of the reagent probe for aspirating a reagent. For up to 2 detections, the reagent is aspirated with reference to the previous pulse rate. On this occasion the alarm is not recorded. Instead, it is entered as a retry in the alarm log. Note, however, that analysis stops when an abnormality is detected at the first aspiration.
- An alarm for indicating the absence of a reagent is added to data when no reagent is accessed by the reagent probe which has lowered in order to aspirate the reagent.
- When reagent becomes inadequate for 10 samples, REAGENT SHORT alarm occurs.

2-3-4 Rinsing of Cell

(1) Cell Rinsing Sequence

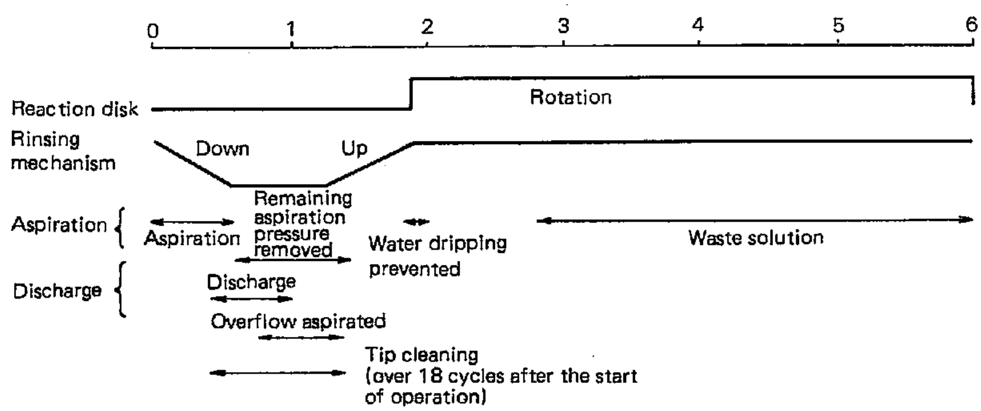


Fig. 2-3-4 Cell Rinsing Operation

2-3-5 Stirrer and Photometric Measurement

(1) Stirrer Sequence

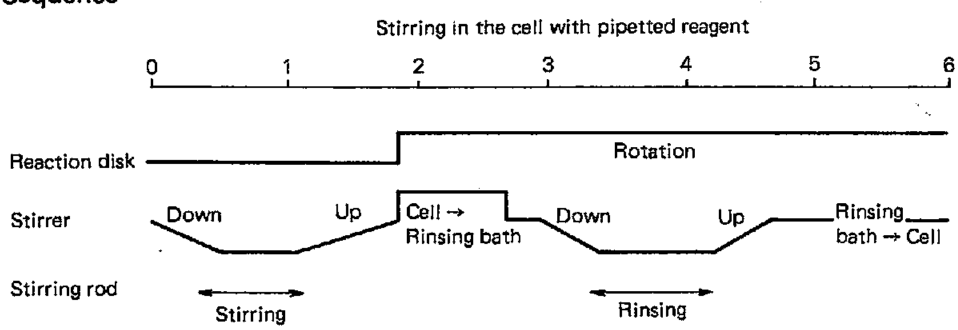


Fig. 2-3-5 Stirring Operation

(2) Photometric Sequence

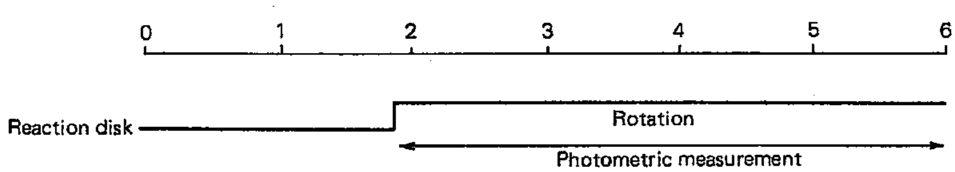


Fig. 2-3-6 Photometric Operation

1) A total of 61 cells are measured for 4.1 seconds while the reaction disk rotates.

2) One cell is measured 54 times repetitively.
If an ADC attempt is unsuccessful during measurements repeated 54 times, the unsuccessful data is cleared to zero and the ADC alarm is indicated.

(3) Others

The R1 and R2 stirring operations are not independent of each other. Therefore, when either R1 or R2 is discharged, both R1 and R2 are stirred.

2-4 Floppy Disk Functions

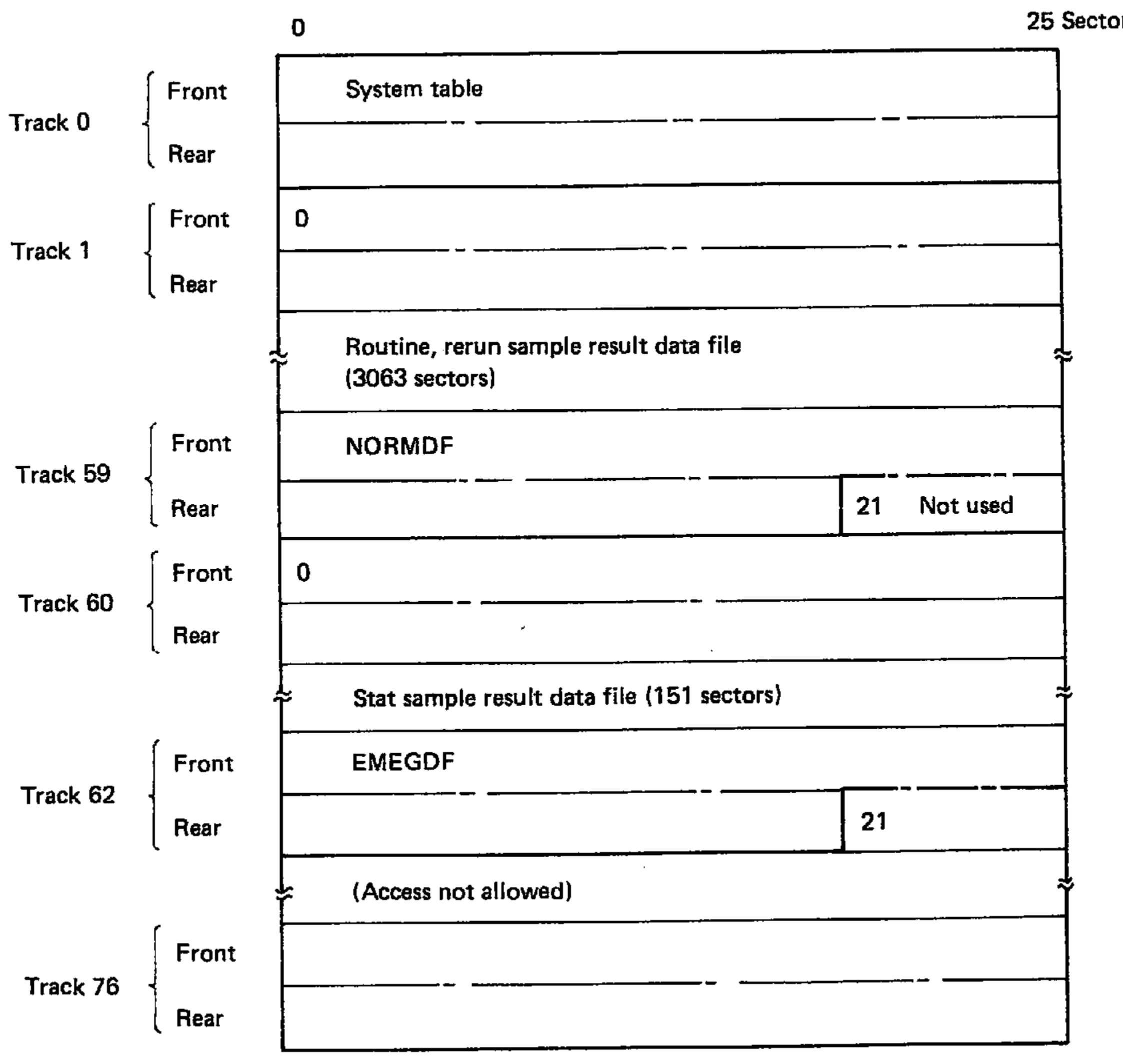
2-4-1 Specifications of Data Disk

(1) General

FD is a double density type (256 bytes/sector) for all tracks of front and rear sides and is formatted.

By copying via FD UTILITY on MAINTENANCE screen, copied FD track 0 is formatted on both sides with 256 bytes × 26 sectors.

(2) Data Disk Configuration



(3) Result Data File

(a) Configuration of Routine and Rerun Sample Result Data File

Sector	
0	Sample measurement code
63	Result of sample 1
66	Result of sample 2
3060	Result of sample 1000

(b) Contents of Routine and Rerun Sample Result Data

Unless otherwise specified, information recorded as data is binary data.

1) Sample Measurement Code

Offset byte	
0	ID no. of sample
11	Routine measurement code of sample 1
12	Rerun code of sample 1
13	(no use)
16	ID no. of sample 2
27	Routine measurement code of sample 2
28	Rerun code of sample 2
29	(no use)
32	
(n-1) x 16 + 0	ID no. of sample n
" + 11	Routine measurement code of sample n
" + 12	Rerun code of sample n
" + 13	(no use)
	(no use)
16127	

$\neq 0$ when sample is measured

$= 0$ when sample is not measured

$n \leqq 1000$: Routine, rerun sample

ID no. is 11-character ASCII code.

Note: Becomes 0 by data clear.

2) Results

Offset byte	
0	Sample information
16	(Do not use)
62	Routine alarm codes
108	Routine sample results
292	Routine result presence codes
338	Comment data
378	(Do not use)
446	Rerun alarm codes
492	Rerun results
676	Rerun result presence codes
722	(no use)
767	

i) Sample Information

Offset	Byte	Description	Remarks
S00	1	Sample type	Routine, rerun: 1 (Stat: 2)
S01	2	Sample number	Routine, rerun: 1 to 1000 (Stat: 1 to 100)
S03	1	Disk number	Routine, rerun: 0 to 9 (Stat: 0)
S04	1	Position number	Routine, rerun: 1 to 60 (Stat: 1 to 7)
S05	11	ID number	ASCII code

ii) Alarm Code

Offset byte		
0	Test 1 alarm	≠ 0 when data alarm is present.
1	Test 2 alarm	= 0 when data alarm is absent.
		For details, see data alarm codes.
45	Test 46 alarm	

iii) Result

0	Test 1 result	Expressed by 4 byte real number.
4	Test 2 result	For details, see real number expression.
180	Test 46 result	

iv) Result Presence Code

Offset byte		
0	Test 1 result presence	≠ 0 when the test is measured.
1	Test 2 result presence	= 0 when the test is not measured.
45	Test 46 result presence	

v) Comment Data

40-byte ASCII code

(c) Data Alarm Codes

b7	b6	b5	b4	b3	b2	b1	b0

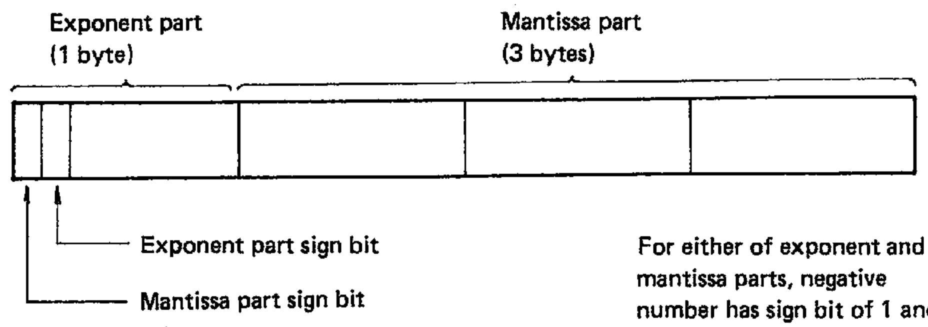
b5 to b0: See table below. (S01 to S3F alarm codes, not 0)

b6: Overflow (alarm yes at 1, no at 0)

b7: Calculation impossible (alarm yes at 1, no at 0)

	0	1	2	3	4	5	6	7
S00	No alarm	ADC abnormal	Cell blank abnormal	Sample insufficient	Reagent insufficient	Absorbance over	Linearity abnormal (8 points or less)	Reaction limit over (all points)
S08	Reaction limit over (only 1 point OK)	Reaction limit over (only 2, 3 points OK)	Linearity abnormal (9 points more)	Prozone error	(no use)			
S10	(no use)							
S18	ISE noise	(no use)	ISE level abnormal	(no use)			Panic value over	Cross-tests correction error
S20	Cross-tests correction impossible error	(no use)						
S28	(no use)							
S30	(no use)							
S38	(no use)							

(d) Real Number Expression



For either of exponent and mantissa parts, negative number has sign bit of 1 and is expressed by complement of 2.

< Example >

Value	Real Number Expression (in bit data)			
1.0	00 00 00 01	10 00 00 00	00 00 00 00	00 00 00 00
4.0	00 00 00 11	10 00 00 00	00 00 00 00	00 00 00 00
–1.0	10 00 00 01	10 00 00 00	00 00 00 00	00 00 00 00
3.0	00 00 00 10	11 00 00 00	00 00 00 00	00 00 00 00
–3.0	10 00 00 10	11 00 00 00	00 00 00 00	00 00 00 00
0.5	00 00 00 00	10 00 00 00	00 00 00 00	00 00 00 00
0.25	01 11 11 11	10 00 00 00	00 00 00 00	00 00 00 00
0	00 00 00 00	00 00 00 00	00 00 00 00	00 00 00 00

(e) Configuration of Stat Sample Result Data File

Sector	
0	Sample measurement code
1	Result of sample 1
2-1/2	Result of sample 2
149-1/2	Result of sample 100

(f) Contents of Stat Sample Result Data

Unless otherwise specified, information recorded as data is binary data.

1) Sample Measurement Code

Offset byte	
0	Stat measurement code of sample 1
1	Stat measurement code of sample 2
(n-1) X 1	Stat measurement code of sample n
	(no use)
255	

$\neq 0$ when the sample is measured.

$= 0$ when the sample is not measured

$n = 100$: Stat sample

Note: Becomes 0 by data clear.

2) Results

Offset byte	
0	Sample information
16	(Do not use)
62	Stat alarm code
108	Stat result
292	Stat result presence code
338	Comment data
378	(Do not use)
383	

For details, see "(b) Contents of Routine and Rerun Sample Result Data".

(4) Special Copy

SPECIAL COPY of FD UTILITY on MAINTENANCE screen copies track 1 and subsequent excluding track 0 of FD.

2-4-2 Floppy Disk Structure

- 717 FD CONTENT

Shown below are the disk contents for check SUM in execution of FD CHECK on the MAINTENANCE screen.

(1) DATA DISK

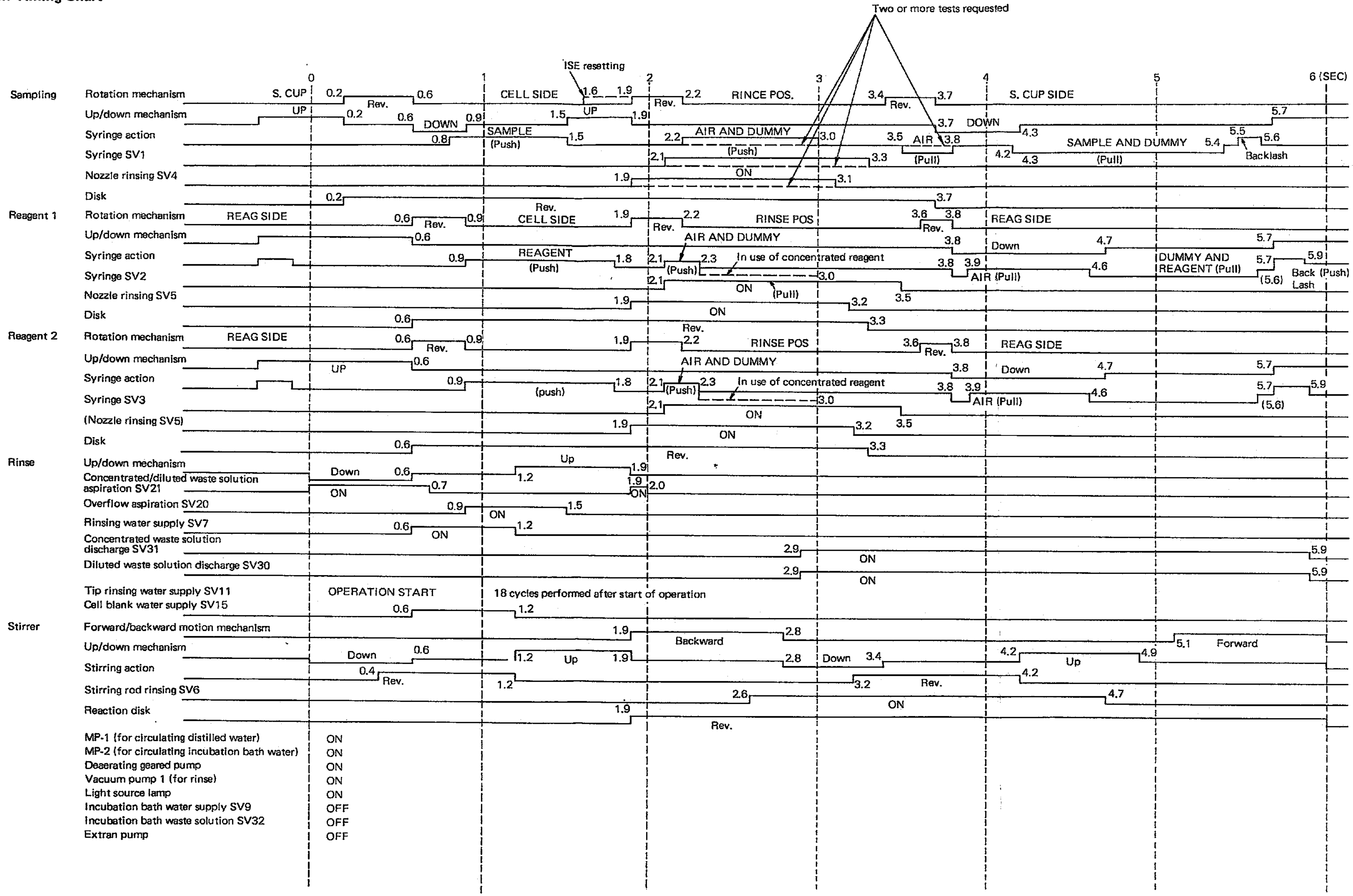
1.	NORMDF	: Measured result of routine sample, 46 tests for each sample, 1000 samples
2.	RERUNDF	: Measured result of rerun sample, 46 tests for each sample, 1000 samples
3.	EMEGDF	: Measured result of stat sample, 46 tests for each sample, 100 samples
4.	CALIBOF	: Measured result of calibration
5.	COMTRCDF	: Communication trace data, test selection information and result, for 160 minutes

(2) SYSTEM DISK

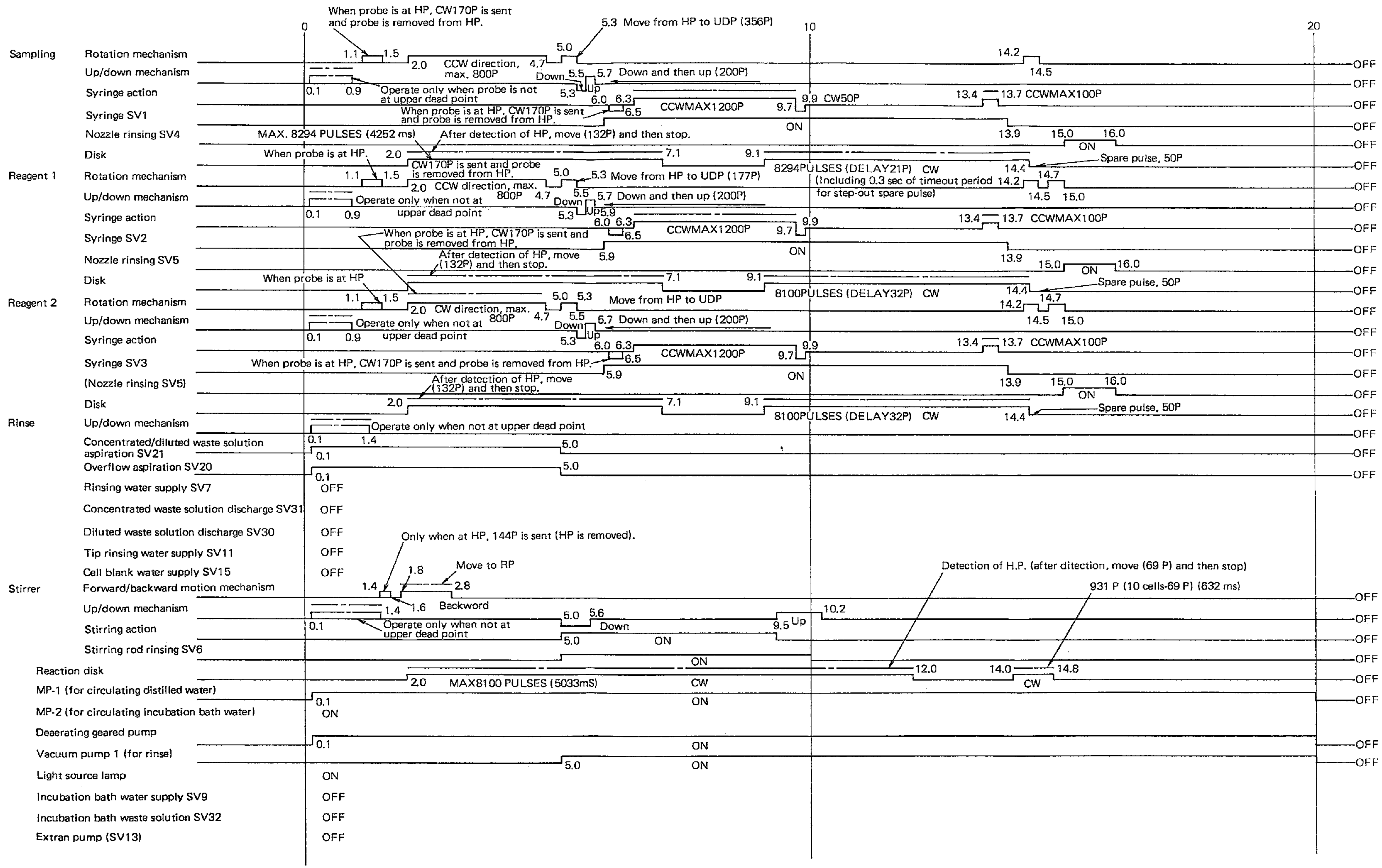
1.	DALMDF	: Daily alarm data, 8 alarms and 8 retries for each cycle, 999 cyles
2.	CALMDF	: Cumulative alarm data, 20 alarms and 20 retries for each day, 256 days
3.	CUMLQCDF	: Cumulative QC data, 31 days × 6 controls × 43 tests
4.	CLBTRCDF	: Calibration trace data
5.	PARAM1	: Analytical parameter
6.	PARAM2	: Analytical parameter
7.	REAGVOL	: Remaining reagent volume
8.	CALIB	: Calibration result for end-point assay
9.	ISECALIB	: Calibration result for ISE assay
10.	INDEXBLK	: Serum index blank value
11.	RBLKLEVL	: Reagent blank level
12.	CELBLANK	: Result of cell blank measurement
13.	TSNORM	: Test selection for routine and rerun samples, 1000 samples
14.	TSCSTD	: Test selection for calibration and control samples (3 types of calibration samples plus 6 control samples)
15.	PHOTDF	: Photometer data
16.	COMMONPF	Programs
	~	
37.	OPTIONPF	
38.	COMMENT	: Comments on samples; 1000 routine sample, 100 stat samples

2-5 Timing Charts

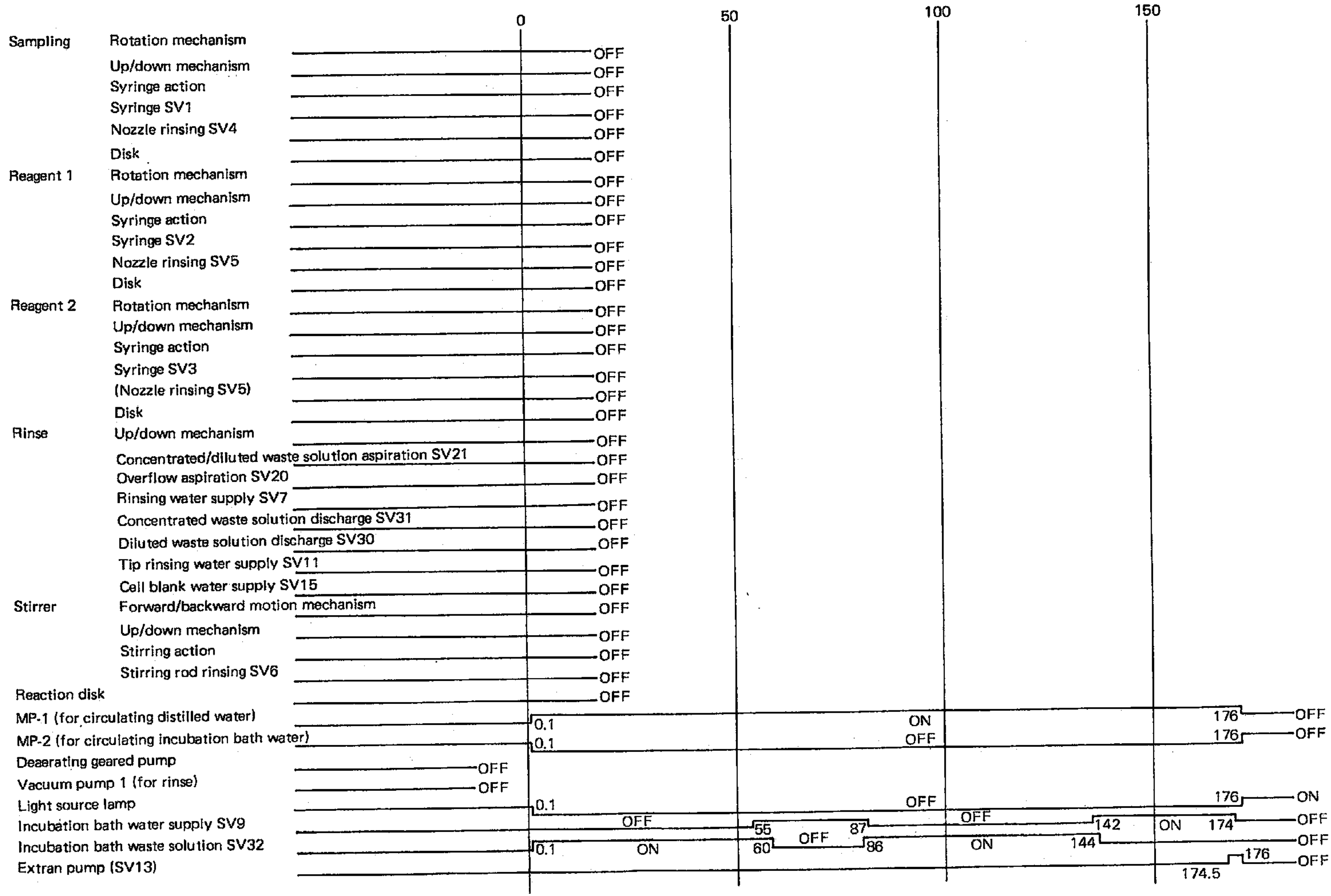
2-5-1 Main Function Timing Chart



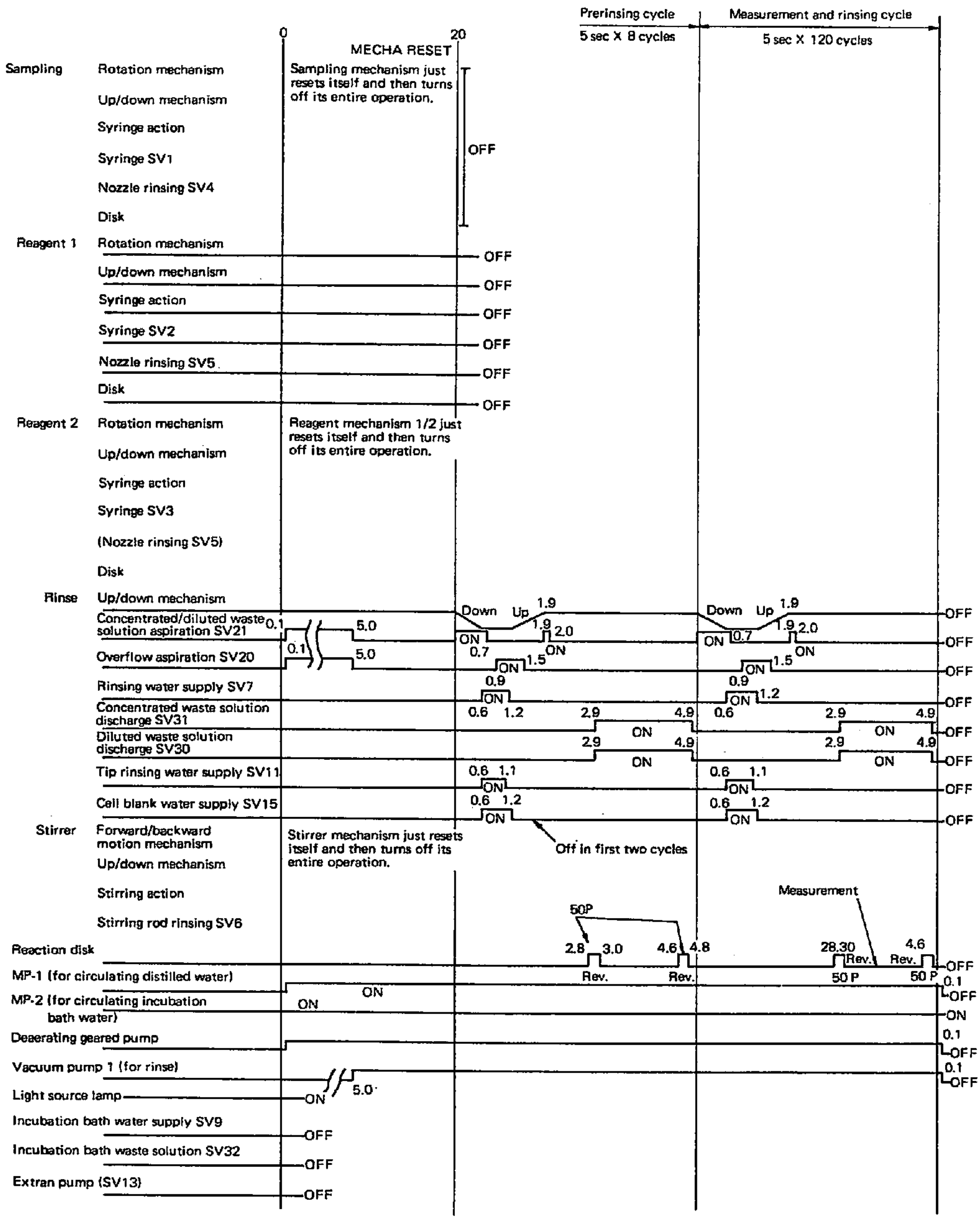
2-5-2 Maintenance Pro. (Reset) Time Chart



2-5-3 Maintenance Pro. (Inc. Water Exchange) Time Chart

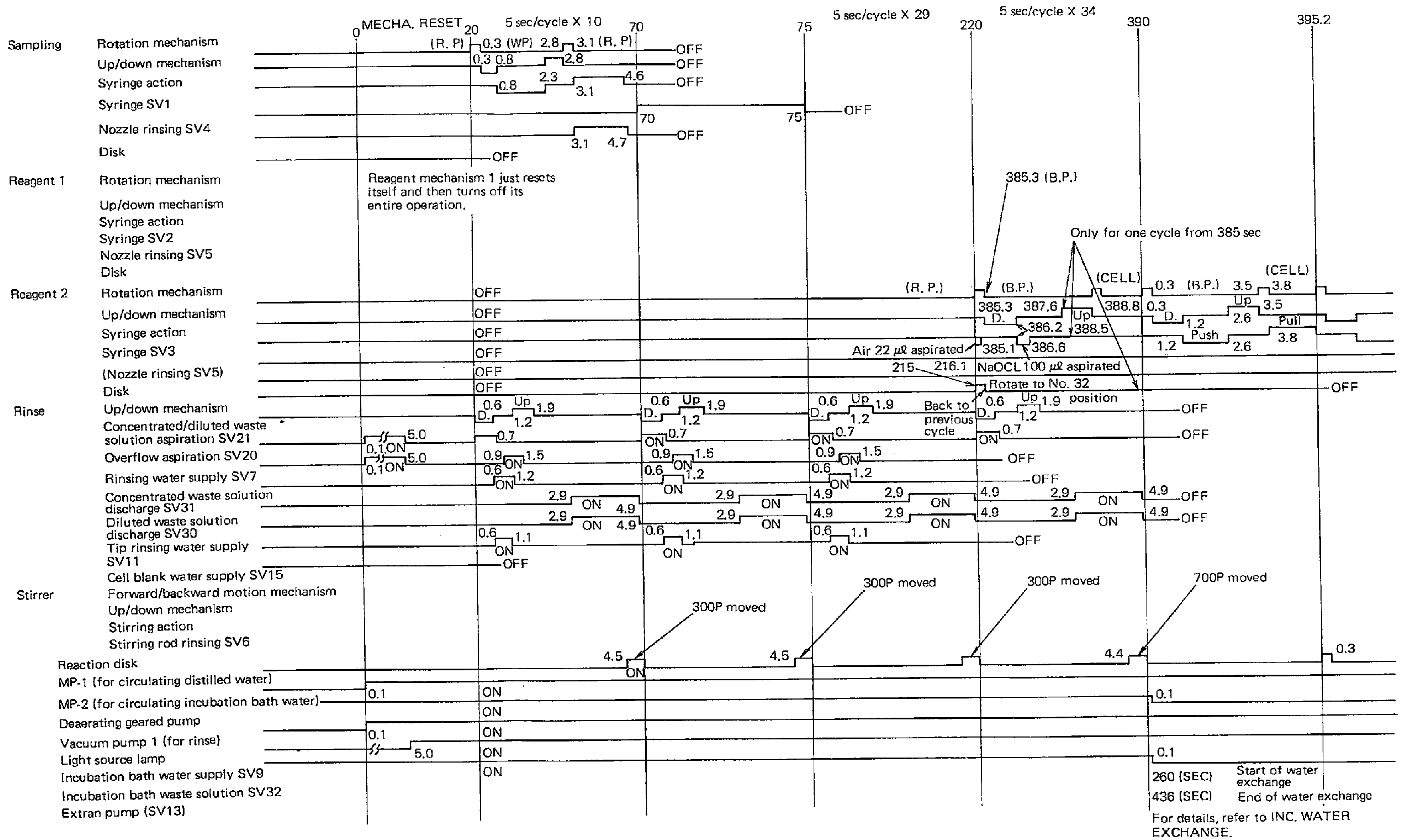


2-5-4 Maintenance Pro. (Cell Blank)

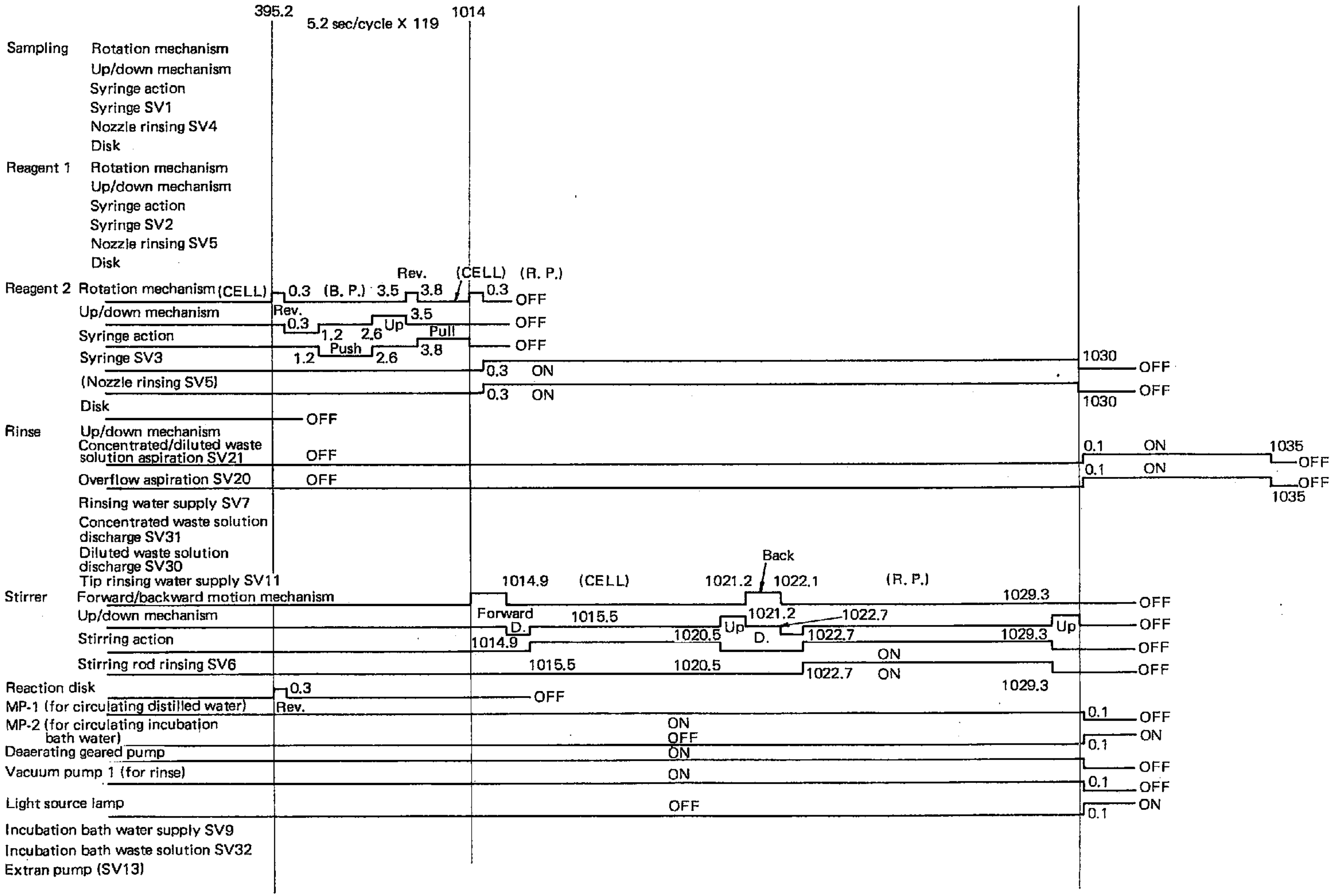


Note: Data is printed out immediately after measurement of each cell.

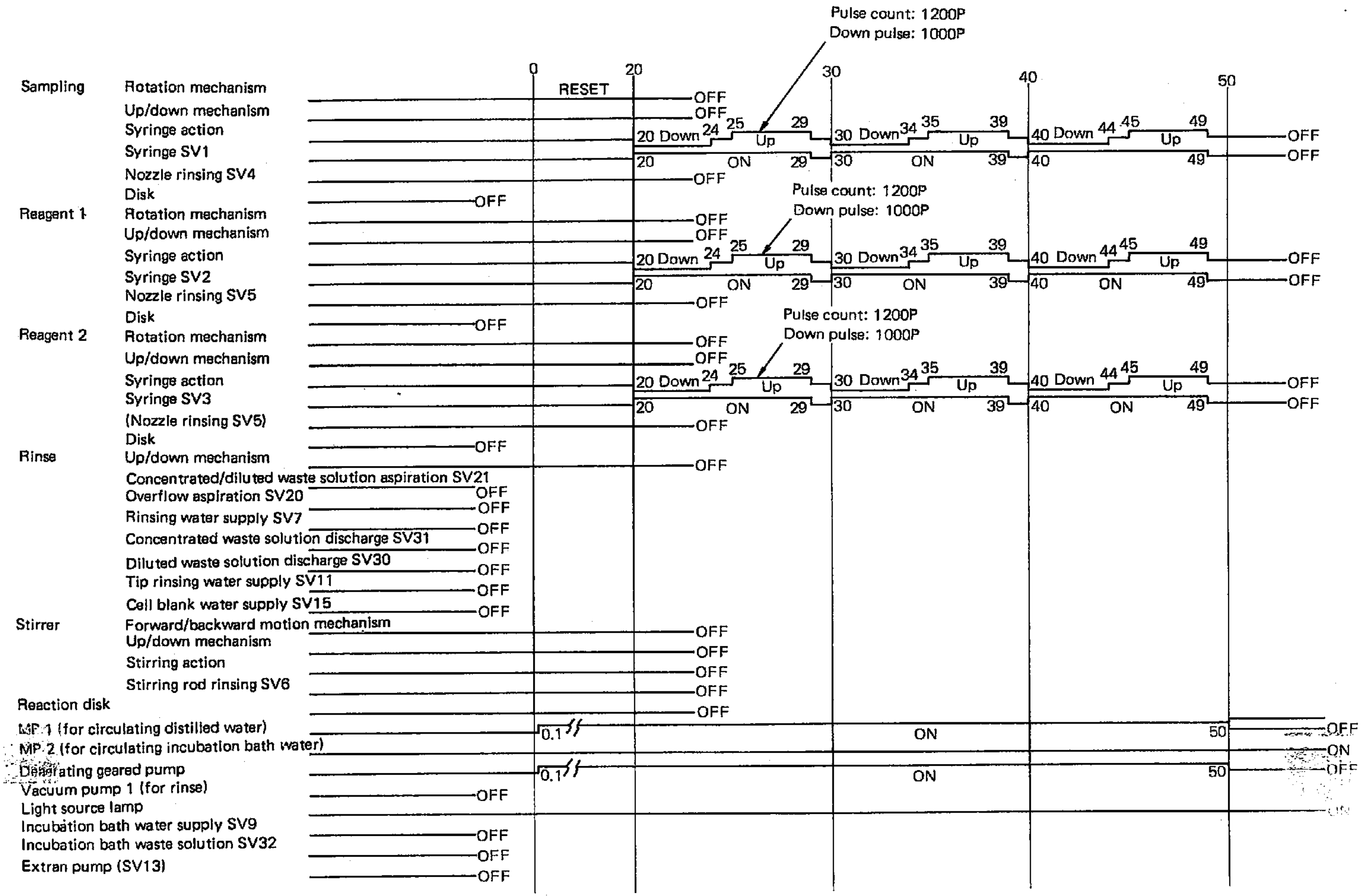
2-5-5 Maintenance Pro. (Cells) Time Chart (1/2)



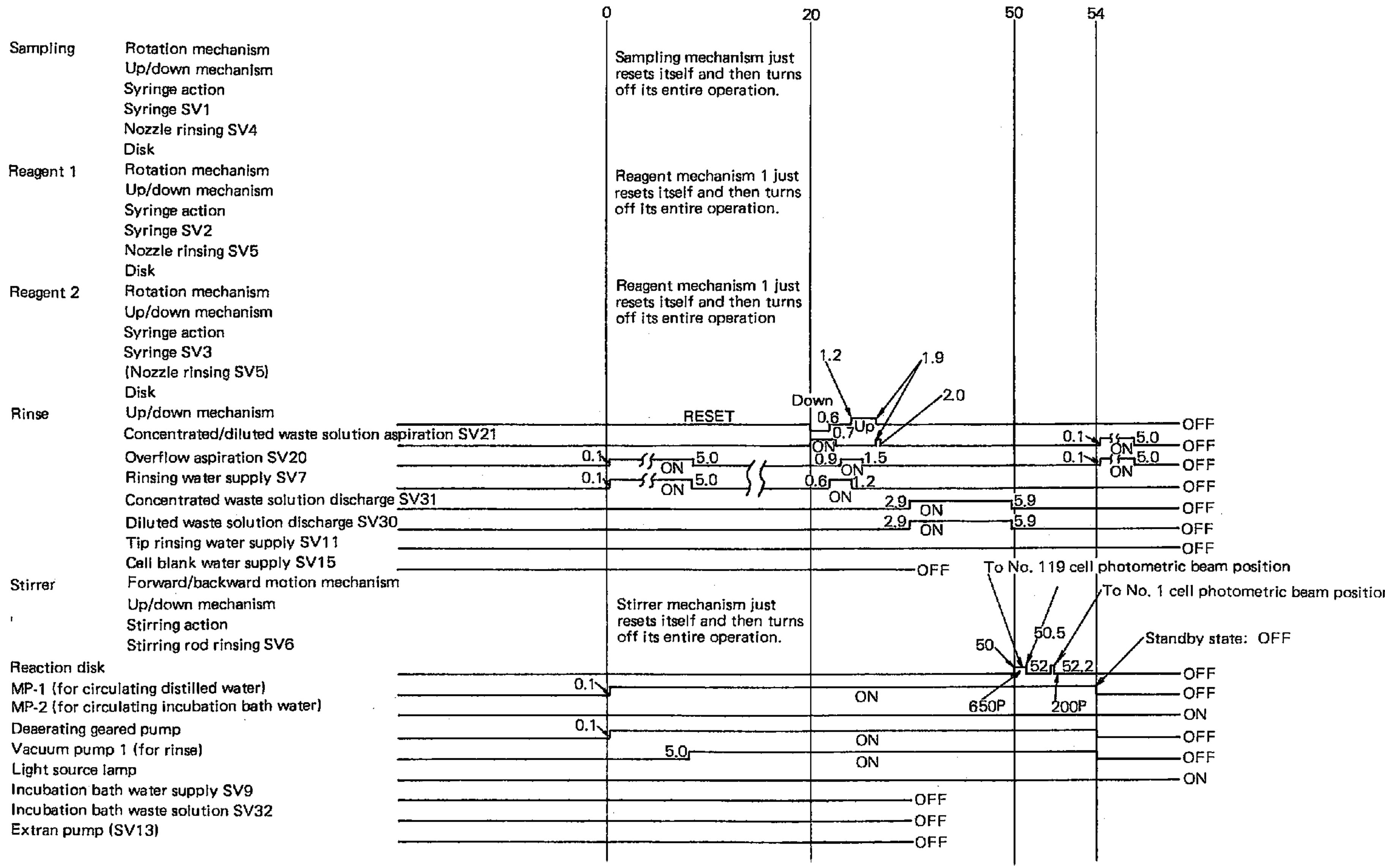
2-5-5 Maintenance Pro. (Cells) Time Chart (E/2)



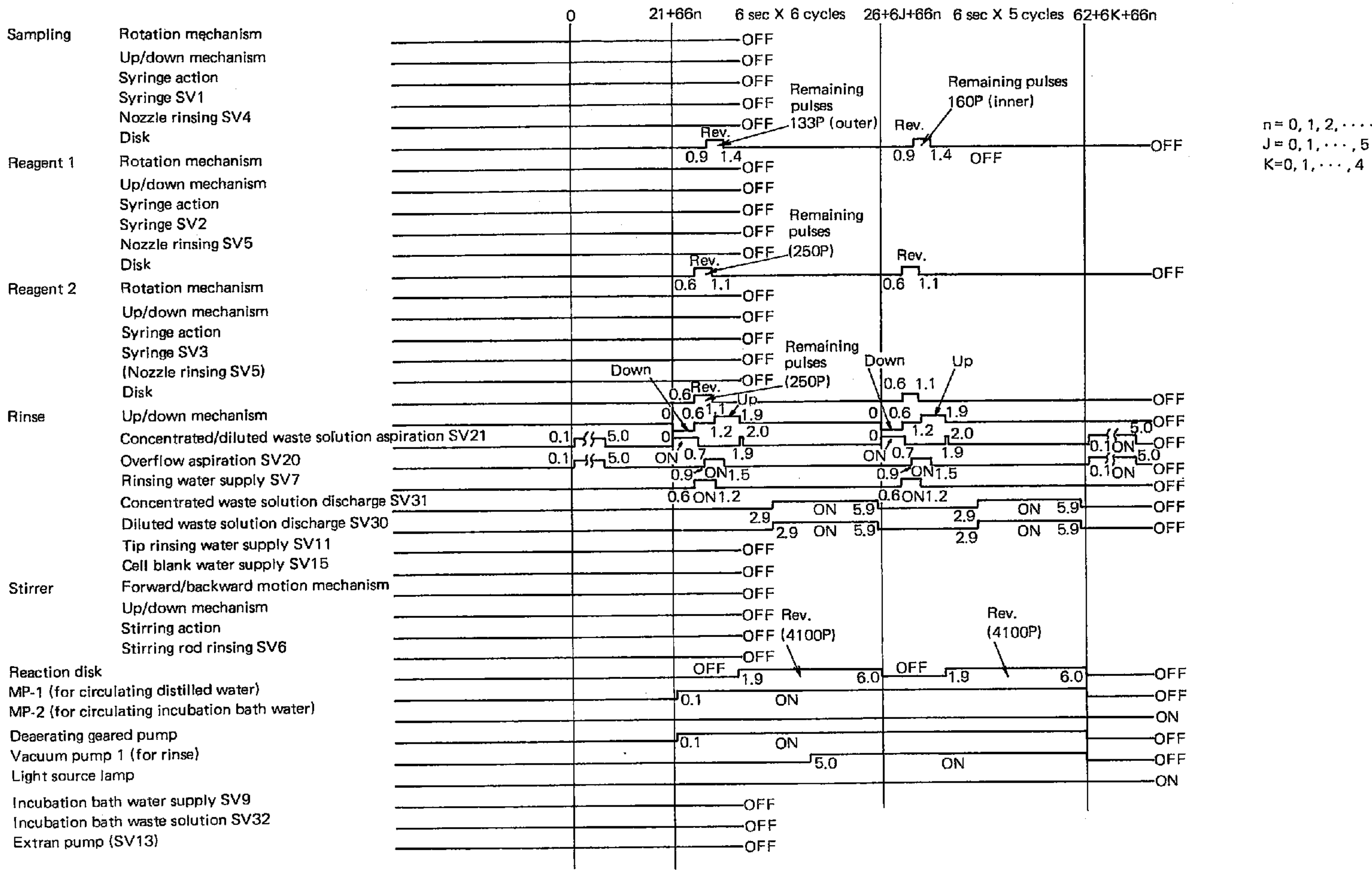
2-5-6 Maintenance Pro. (Air Purge) Time Chart



2-5-7 Maintenance Pro. (Photometer Check) Time Chart



2-5-8 Maintenance Pro. (Disk) Time Chart



3. SYSTEM INTERFACE

3. SYSTEM INTERFACE

3-1 Outline

These specifications define the signal configuration and communication rules for connection of this analyzer and external system via an asynchronous serial signal.

3-2 Hardware Specifications

(1) Communication Speed

2400 bps

(2) Asynchronous System

(3) Code System

7-unit code system (ASCII code)
Start bit + Character bits + Even parity + 2 stop bits

(4) Signal Type

EIA RS-232C or 20 mA current loop

(5) Input/Output Signals

1) RxDATA. . . . .Reception data (← External system) RS-232C
MARK (LOW LEVEL) denotes data "1".

2) TxDATA. . . . .Transmission data (→ External system) RS-232C
MARK (LOW LEVEL) denotes data "1".

3) CTS. . . . . .Clear to send (← External system). RS-232C
This signal indicates whether the external system can receive the data.
SPACE (HIGH LEVEL) denotes data "1".

4) RTS. . . . . .Request to send (→ External system) RS-232C
This signal requests the external system to send the data when the 717 is ready for communication.
SPACE (HIGH LEVEL) indicates request to send, and MARK (LOW LEVEL) denotes the 717 is not ready for communication.

5) DTR . . . . .Data terminal ready (→ External system) RS-232C*
SPACE (HIGH LEVEL) denotes the 717 is ready for data communication.

6) RxDATA+. . . .Reception data (inflow end)

7) RxDATA– . . .Reception data return (outflow end)

(←External system) . . . . . Current loop

SPACE (0 mA) denotes data "0", and MARK (20 mA) denotes data "1".

8) CTS+. . . . . . . .Clear to send (inflow end)

9) CTS– . . . ."Clear to send" return (outflow end)

(← External system) . . . . . Current loop

SPACE (0 mA) denotes the external system can receive the data, and MARK (20 mA) denotes the external system cannot receive the data.

10) RTS+. . . . . . . .Request to send (inflow end)

11) RTS– . . . ."Request to send" return (outflow end)

(→ External system) . . . . . Current loop

SPACE (0 mA) indicates request to send, and MARK (20 mA) denotes communication is impossible.

12) TxDATA+. . . .Transmission data (inflow end)

13) TxDATA– . . .Transmission data return (outflow end)

(→ External system) . . . . . Current loop

SPACE (0 mA) denotes data "0", and MARK (20 mA) denotes data "1".

14) DTR+ . . . . . . .Data terminal ready (inflow end)

15) DTR–. . . . . . ."Data terminal ready" return (outflow end)

(→ External system) . . . . . Current loop*

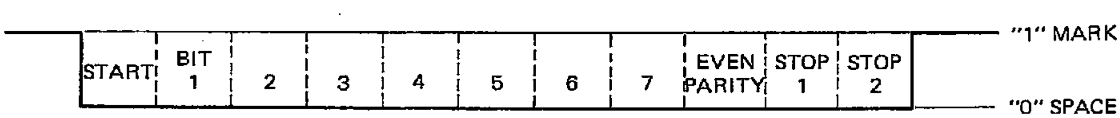
SPACE (0 mA) indicates the 717 is ready for data communication.

Note *: DTR (data terminal ready) is always SPACE, and RTS (request to send) indicates whether the 717 is ready for communication.

(6) Signal Discrimination

Signal \ Signal Type	RS-232C	Current Loop
SPACE (ON)	+3 V or high ("H")	0 mA
MARK (OFF)	–3 V or lower ("L")	20 mA

Note: "H" represents HIGH LEVEL.
"L" represents LOW LEVEL.



3-3 Signal Input/Output Circuits

3-3-1 RS-232C

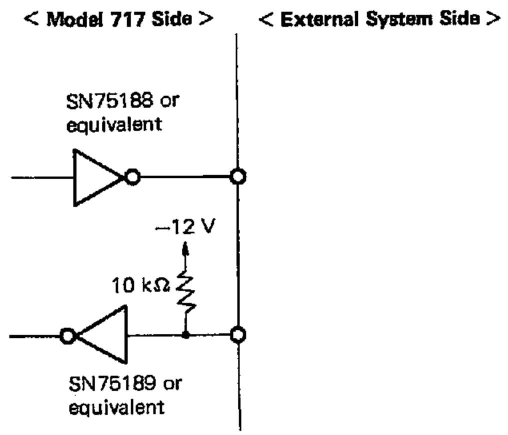


Fig. 3-3-1

3-3-2 Current Loop

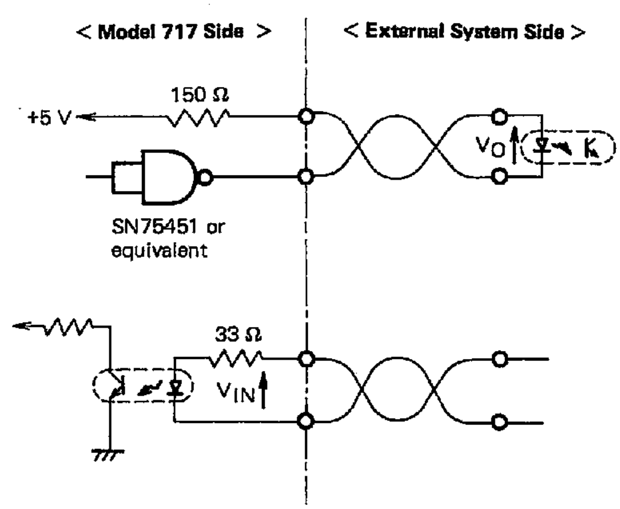


Fig. 3-3-2

Drive current changes due to voltage drop on load side. A current of 20 ± 2 mA flows when V_0 = 1.5 V.
It is necessary to drive a current of 20 ± 2 mA when V_{IN} drops to 1.5 V on input side.

3-3-3 Connector Specification

(1) For connector specification, refer to Table 3-3-1.

(2) Connector Name

- On Model 717
  DB-25S (with lock mechanism)
- On system connecting cord
  Connector type : DB-25P
  (made by Japan Aviation Electronics Ind.)
  Connector cover type: DB-C2-J9
  (made by Japan Aviation Electronics Ind.)

(3) The connector on the system connecting cord is equipped with the Model 717.
If the connector is required before delivery of the Model 717, it should be purchased by the system integrator.

(4) The system connecting cord should be prepared by the system integrator.

(5) The cord should be made of twisted wires with shield, whose thickness is AWG 28 or more.

(6) The cable length should be limited to 50 m for connection via the current loop, and 15 m for connection via the RS-232C.

(7) For use with the RS-232C, turn OFF the SW3-1 on the S. I/F APU board, and turn ON the switch for use with the current loop.

Table 3-3-1 Specifications of Serial Interface Connector

Pin No.	Signal Name	Abbreviation	Signal Type
1	Frame ground	FG	
2	Transmission data	TxDATA	RS-232C
3	Reception data	RxDATA	RS-232C
4	Request to send	RTS	RS-232C
5	Clear to send	CTS	RS-232C
6			
7	Signal ground	SG	
8			
9	Transmission data	TxDATA+	Current loop
10	Transmission data return	TxDATA–	Current loop
11	Request to send	RTS+	Current loop
12	"Request to send" return	RTS–	Current loop
13			
14	Clear to send	CTS+	Current loop
15	"Clear to send" return	CTS–	Current loop
16			
17			
18			
19			
20	Data terminal ready*	DTR	RS-232C
21	Data terminal ready*	DTR+	Current loop
22	"Data terminal ready" return*	DTR–	Current loop
23			
24	Reception data	RxDATA+	Current loop
25	Reception data return	RxDATA–	Current loop

Use a connector which conforms to JIS C 6361.
The pin type should be as follows.
- On Model 717 .... Female (DB-25S)
- On connecting cable .... Male (DB-25P)

Note*: DTR (data terminal ready) is always SPACE.

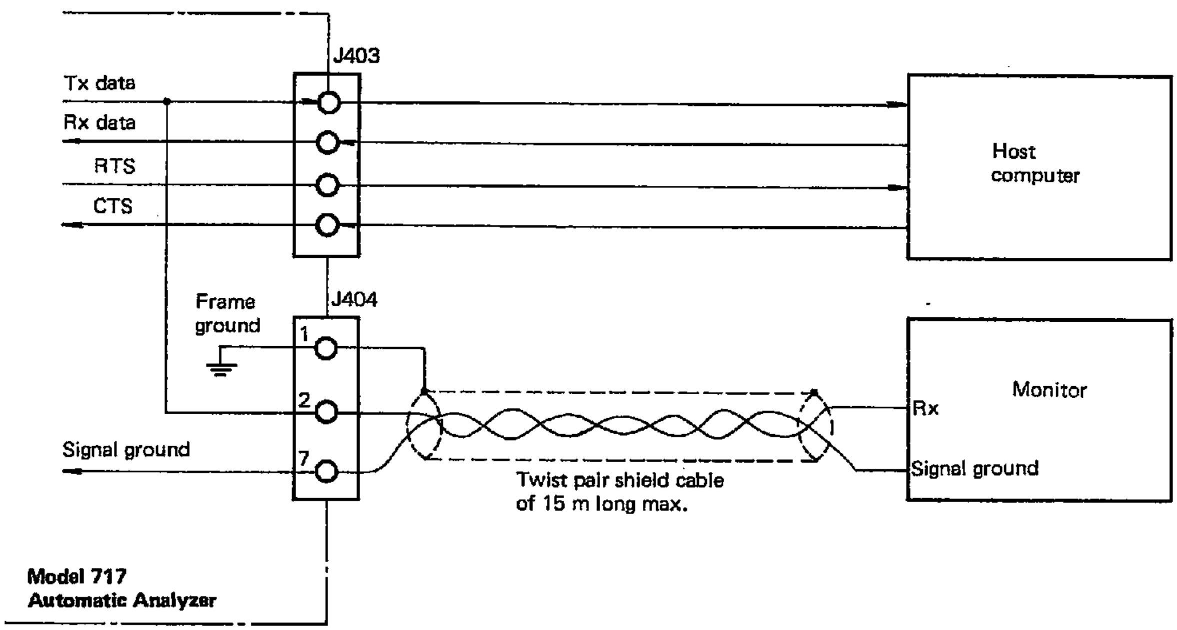
3-3-4 Communication Monitor Output

(1) General

On Model 717 Automatic Analyzer, communication monitor output is available besides the communication system interface with host computer.
By connecting a personal computer or other monitors, data sent from this analyzer to the host computer can be monitored. It is usable for analyzed data monitoring, analysis accuracy control, etc.

(2) Connecting Monitor

(a) Connect the monitor as illustrated below. The monitor connector is J404 on the rear panel.



Note: Connector engaged with J404 must be DB-25P which conforms to JIS C 6361.

Fig. 3-3-3

(b) For communication, only RS-232C is usable. The current loop cannot be used. The communication of the host computer must be by the current loop.

(c) Data sent to the monitor are the same as sent to the host computer. For details of data, refer to the section on the system interface.

(d) For connection with the host computer, refer to the section on the system interface.

3-4 Data Communication Procedures

3-4-1 Outline of Data Communication

(1) The master station is the analyzer and the slave station is the external system. The analyzer starts the communication first.

(2) Functions of communication can roughly be divided into "test selection inquiry communication" for sending and receiving information on analytical items to be measured by samples and "measured data transfer" for sending analyzed data.

(3) The test selection inquiry communication is carried out only for routine and rerun samples. Others are analyzed in accordance with test selection information in the analyzer.

(4) As for measured data transfer, routine, rerun, Stat and control samples, calibration results and original absorbance data (when YES is designated for ORIGINAL ABS) are transmitted.

(5) The communication method is either real time communication executed while the analyzer is measuring or batch mode communication carried out in batch when the analyzer is stopped.

(6) The test selection inquiry communication in real time is selective by option setting. Refer to the table following.

- List of Communication

Table 3-4-1

Function		Real Time Communication	Batch Mode Communication
Test selection inquiry	Test selection inquiry for routine sample	O (X)*1	O
	Test selection inquiry for rerun sample	O (X)*2	O
Results transfer	Results transmission of routine, rerun, Stat and control sample	O	O
	Calibration results transmission	O	X
	Original absorbance data transmission	O	X

In the above table, O denotes executable and X denotes not executable.

Note: *1 Refer to 3-4-2 Real Time Communication (3-1).
*2 Refer to 3-4-2 Real Time Communication (3-3).

Perform operation in accordance with the system or operator convenience.

(7) Outline of Communication Text Format

The communication text has the following configuration.

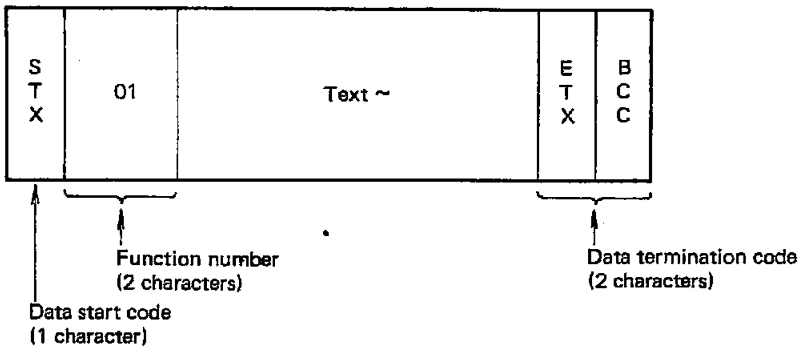
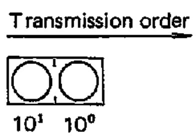


Fig. 3-4-1

(a) Data Start Code

STX code ($(02)_{16}$ in ASCII code)

(b) Function Number



The communication text type is expressed by an integer of 2 decimal digits. Details are as shown in the table below.

Table 3-4-2

Code	Description
01	Test selection inquiry for routine sample (real time)
11	Test selection inquiry for rerun sample (real time)
02	Results transmission of routine, rerun, Stat and control sample (1) (real time)
03	Results transmission of routine, rerun, Stat and control sample (2) (real time)
04	Calibration results transmission (1) (real time)
05	Calibration results transmission (2) (real time)
06	Original absorbance data transmission (real time)
51	Test selection inquiry for routine sample (batch communication)
61	Test selection inquiry for rerun sample (batch communication)
52	Results transmission of routine, rerun, Stat and control sample (batch communication)
53	Edited data transmission (batch communication)
55	Test selection inquiry for routine sample when sample ID accessory is provided and ALL is designated (batch communication)

Note: For (1) and (2) in the above table, refer to (Note) 6 in 3-4-2 (2) Time Chart for Real Time Communication.

(c) Data Termination Code
ETX code ($(03)_{16}$ in ASCII code), BCC

Note: In case of BCC, in horizontal even parity check, counting is performed following STX up to ETX.

3-4-2 Real Time Communication

(1) Outline of Real Time Communication

(a) The following describes specifications of communication carried out while the analyzer is running.

(b) Effective only when COMMUNICAITION is YES on START CONDITIONS screen. Otherwise, no communication is performed.

(c) The analyzer executes analyses in cycles of 6 seconds. The real time communication is executed every 4 analyzing cycles or every 24 seconds.

Note: The cycle described above is referred to as communication cycle.

(d) For test selection inquiry, the first 12 seconds of this communication cycle is used. Up to 4 samples of test selection information are sent.

(e) For results, the latter 12 seconds of the communication cycle is used. Up to 4 samples of data are sent.

(f) When a calibration is designated, calibration results are sent in the latter 12 seconds of communication cycle mixed in results for routine samples, etc.
In this case, data are output by channels. Therefore, when several channels are selected for a calibration, data of several channels are output.
Note that data for 1 channel referred to here corresponds to data of 1 sample stated above.

(g) When ORIGINAL ABS on START CONDITIONS screen is designated for analysis, the analyzer executes an original absorbance measurement.
In this case, no test selection inquiry is carried out at all. Data transmission is made by channels and does not follow the communication cycle but every analyzing cycle (6 seconds). The execution is made only for routine and Stat samples.

(h) When it is not desired to execute a test selection inquiry in real time, refer to (5).

(i) Refer to (6) when it is not desired to execute a test selection inquiry only for rerun samples in real time.

(j) If an error has occurred during a real time test selection inquiry, that error is displayed and analysis is carried out in accordance with the test selection information stored in the analyzer.
Note that the disk number and position number are updated according to the value of START SAMPLE NO. on START CONDITIONS screen.

(k) When COMMUNICATION is not selected on START CONDITIONS screen, the analysis is carried out in accordance with the test selection information stored in the analyzer.
When YES is designated during analysis, an inquiry may be executed regardless of the value of START SAMPLE NO.

(l) Results of samples and calibration are transferred in the order of analysis.
The transfer is executed 10 to 11 minutes after sampling of respective samples.

(2) Time Chart for Real Time Communication

A real time communication is carried out in the timing illustrated below in accordance with a communication cycle (24 sec) of the analyzer.

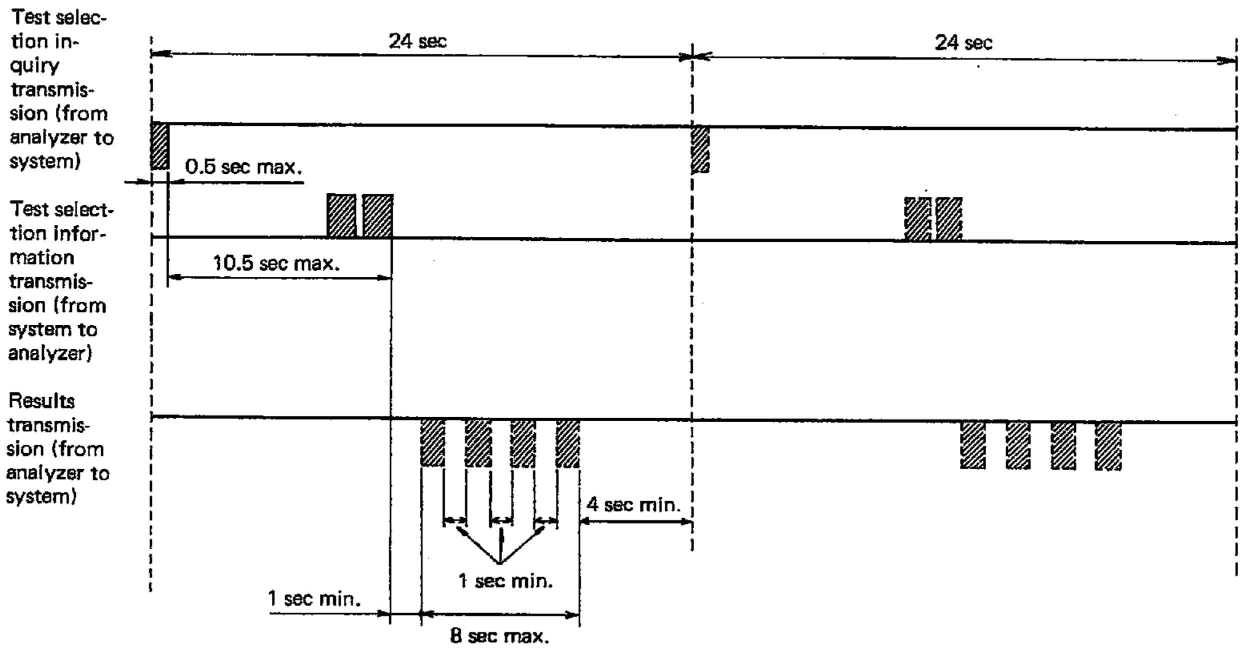


Fig. 3-4-2

Notes:

1. The communication cycle start signal is not transmitted.
2. The dotted area in the time chart above may or may not be communicated.
3. A test selection inquiry is sent when a communication cycle is started. Therefore, send the test selection information within 10.5 seconds after terminating the transmission.
   Otherwise, the analysis would be carried out according to the test selection information stored in the analyzer.
   If a transmission is made after the specified time, it would be ignored.
4. Results are sent 12 seconds after the communication cycle has started.
   Terminate a reception before the next inquiry transmission starts.
5. The analyzer executes communication periodically in 24 second cycles.
   Inquiry and results are transmitted at a predetermined time. The control must always be ready for receiving control signal CTS.
6. Within the latter 12 seconds of communication cycle, up to 4 samples are transmitted including results and calibration data.
   Considering a case of 3 samples or less, the function number in transmission text of data of the last sample in a communication cycle is altered.

(Example 1) In Case of 3 Samples

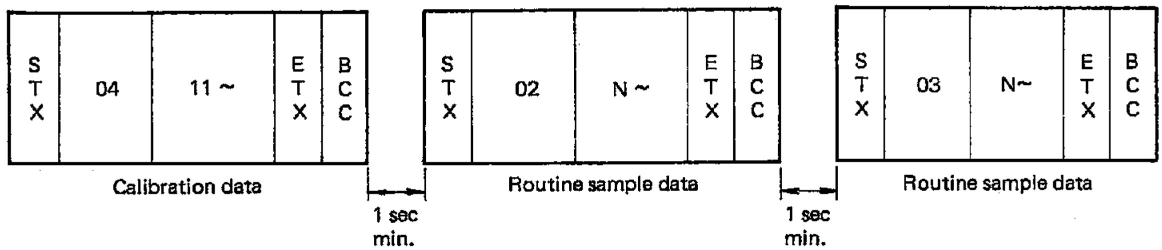


Fig. 3-4-3

(Example 2) In Case of 2 Samples

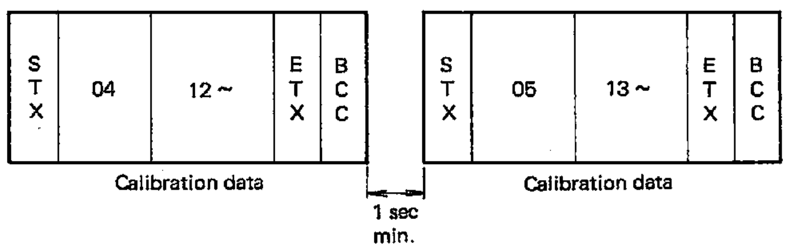


Fig. 3-4-4

7. The original absorbance measurement does not follow the communication cycle as illustrated below but data are sent by channels every analytical cycle (6 sec) of the analyzer. No test selection inquiry is carried out at all.

- Time Chart for Sending Original Absorbance Data

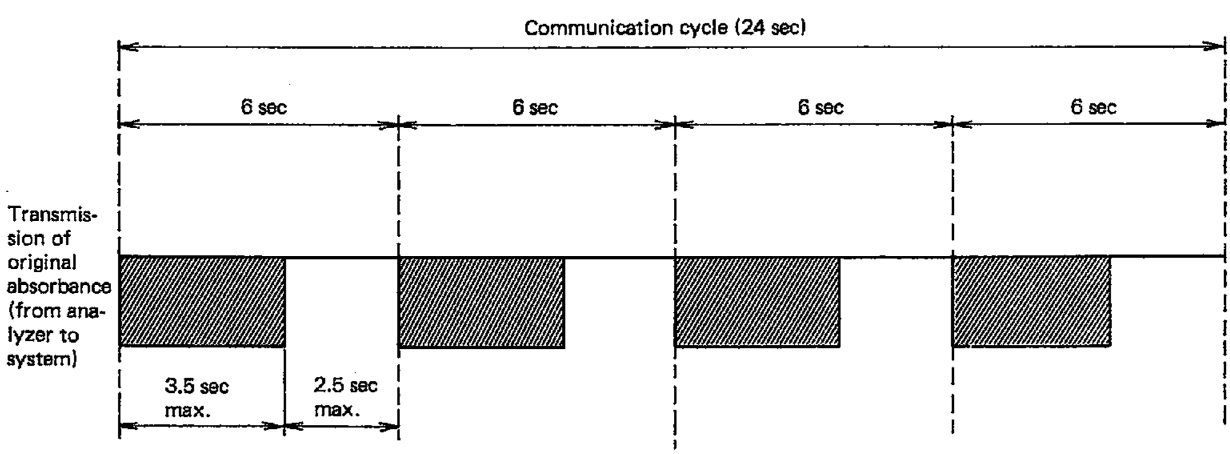


Fig. 3-4-5

(3) Test Selection Inquiry (real time)

(3-1) Transmission of Test Selection Inquiry for Routine Samples (from analyzer to system)

< Format >

STX	01	Sample information 1 (22)	Sample information 2 (22)	Sample information 3 (22)	Sample information 4 (22)	ETX	BCC

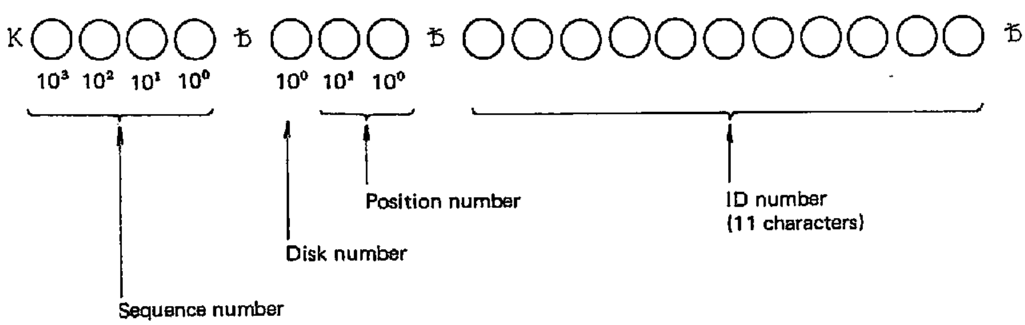
Function number (2)

Fig. 3-4-6

(a) Function Number (2 characters)
Transmit "01".

(b) Sample Information 1 to 4 (22 characters)

Transmission order



Sequence numbers are 1 to 1000, disk numbers are 0 to 9 and position numbers are 1 to 60. They are subjected to zero suppression and leading spacing (ƀ).

Notes:

1. The test selection inquiry is sent only for routine and rerun samples and not for calibration, control or Stat samples, and an analysis is carried out according to the test selection information in the analyzer.
2. Inquired sample information is sent for up to 4 samples.
   In case of 3 samples or less, the remainder is filled with spaces.
3. When the analyzer starts measurement, it successively updates the sample information.
   The sequence number, disk number and position number of inquiry start are values displayed by START SAMPLE NO. on START CONDITIONS screen.
4. When the disk number in the analyzer has been changed, no inquiry is made for a sample of that sequence number and the control becomes a status of sampling stop.
   After the disk is replaced and the control is restarted, the inquiry is resumed at that sample.

(3-2) Download of Test Selection Information for Routine Samples (from system to analyzer)

< Format >

STX	01	Sample information 1 (22)	Comment 1 (41)	Test selection information 1 (35)	Sample information 2 (22)	Comment 2 41)	Test selection information 2 (35)	ETB	BCC

Delimiter code (2)

STX	01	Sample information 3 (22)	Comment 3 (41)	Test selection information 3 (35)	Sample information 4 (22)	Comment 4 (41)	Test selection information 4 (35)	ETX	BCC

Function number (2)

Fig. 3-4-7

(a) Function Number (2 characters)
Transmit "01".

(b) Sample Information 1 to 4 (22 characters)
Send the same sample information as the inquiry sent from the analyzer.
If it is desired to alter the disk number or position number on the system side, send the altered disk or position number.
If ID number is altered, send a new ID number.

Notes:

1. Characters usable for ID number are, in ASCII codes, upper case alphanumerics 0 to 9, A to Z, (,), ", ;, ?, !, <, >, ,, +, −, *, /, · and b̸ (space). Others cause errors. When a sample ID accessory is provided optionally, send the same sample information as sent from the analyzer.
Otherwise an error would be produced.

2. When the disk number is altered on the system, the analyzer becomes a status of sampling stop.
Therefore, after restart, the inquiry is sent again subsequent to the sequence number where the disk number has been altered.

3. When the position number is altered by the system, the position numbers following the last sample information in the test selection information are successively inquired about.

4. Sampling by the analyzer can be stopped by the system. Set the position number to 0 for sample information of inquired sample to be stopped at. (When a sample ID accessory is provided, set the position number to 0 or set the ID number to space plus one or more 0's.)
In this case, the analyzer does not treat it as an error but becomes a status of sampling stop.
Refer to (Note) 2.

(c) Comments 1 to 4 (41 characters)
Send a comment related to the inquired sample. The characters used for the comment must be $(20)_{16}$ to $(5D)_{16}$ in ASCII code.
When a character other than above is sent, the analyzer displays an alarm SYSTEM I/F 91-17 WARNING and registers the entire comment as spaces (ƀ).
For the patient ID number, patient name (alphabet), location, age, sex and others of comment, use 40 characters arbitrarily. The 41st column must be a space.

(b) Test Selection Information 1 to 4 (35 characters)
Send the test selection information for sample information.

Transmission order →

○○○○○○------○○○ ƀ
1 2 3 4 5 6 32 33 34

Channel information

○ is either 0 or 1.
0 denotes that the channel is not requested and 1 denotes that the channel is requested.

Notes:
1. The channels above refer to channels set on the analyzer.
2. When there is a calculation test request, discriminate and request the channel of the test necessary for the relevant calculation.
For example, when there is a request for A/G ratio, send the information deeming the channels of TP (total protein) and ALB (albumin) as requested.
3. Channel 33 is for measuring Na and K, and channel 34 is for measuring Na, K and Cl.
Either of them is effective when the analyzer is optionally provided with an electrolyte analyzer accessory. If not, transmit 0.
4. When the test selection information for a sample corresponding to the sample information inquired by the analyzer has not yet been determined, set to 0 all the test selection information for that sample.
5. The analyzer can determine 2 tests per channel.
In this case (twin tests), even if there is only 1 request test, 2 tests of the corresponding channel are analyzed.
6. When requesting isozyme tests or test for which a correction is required between tests, the opposite test is automatically analyzed but data are not set if there is no request for the opposite necessary for calculation of isozyme or correction between tests.
7. When the sample information inquired from the analyzer is for 3 samples or less, the sample information and test selection information must remain as spaces (ƀ).

(3-3) Transmission of Test Selection Inquiry for Rerun Samples (from analyzer to system)

< Format >

STX	11	Sample information 1 (22)	Sample information 2 (22)	Sample information 3 (22)	Sample information 4 (22)	ETX	BCC

Function number (2)

Fig. 3-4-8

(a) Function Number (2 characters)
Transmit "11".
All others are the same as the routine sample in (3-2).

Note: When RERUN MODE on START CONDITIONS screen is AUTOMATIC, an inquiry is executed only once for routine sample.
Rerun sample is not inquired about but is analyzed according to the test selection information in the analyzer.

(3-4) Download of Test Selection Information for Rerun Samples (from system to analyzer)

< Format >

STX	11	Sample information 1 (22)	Comment 1 (41)	Test selection information 1 (35)	Sample information 2 (22)	Comment 2 (41)	Test selection information 2 (35)	ETB	BCC

STX	11	Sample information 3 (22)	Comment 3 (41)	Test selection information 3 (35)	Sample information 4 (22)	Comment 4 (41)	Test selection information 4 (35)	ETX	BCC

Fig. 3-4-9

(a) Function Number (2 characters)
Transmit "11".
Others are the same as for the routine sample in (3-2) except that ID number cannot be altered. If altered, an error occurs.

Note: When the sample corresponding to the sample information inquired from the analyzer has not yet been measured at all, that sample is not measured at the time of rerun even if the test selection information for rerun sample is successfully sent and received.

(4) Result Data Transmission (real time)

(4-1) Result Data Transmission for Routine, Rerun, Stat and Control Samples (from analyzer to system)

< Format >

STX	02	Sample information (22)	Data 1 (9)	Data 2 (9)	Data 3 (9)			Data n (9)	ETX	BCC

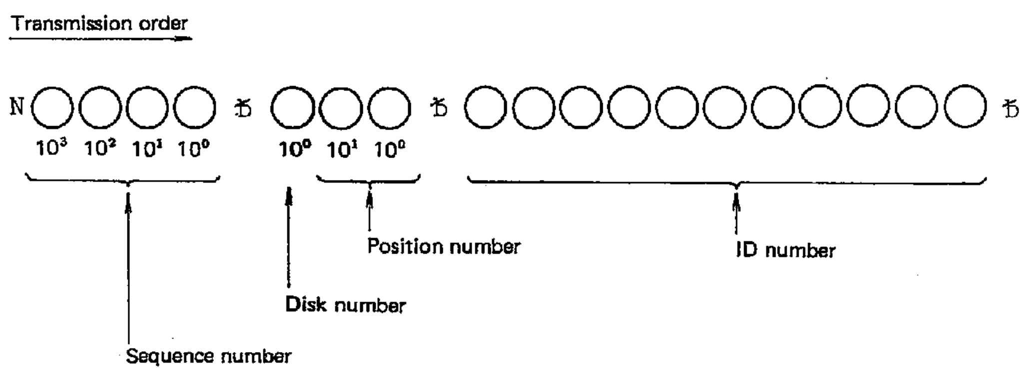
$\underbrace{02}_{\text{Function number (2)}}$

Fig. 3-4-10

(a) Function Number (2 characters)
Transmit "02". Transmit "03" at communication cycle termination.
(Refer to (Note) 6 in (2).)
Transmit "12" in case of a rerun sample or "13" in case of communication cycle termination for a rerun sample.

(b) Sample Information (22 characters)

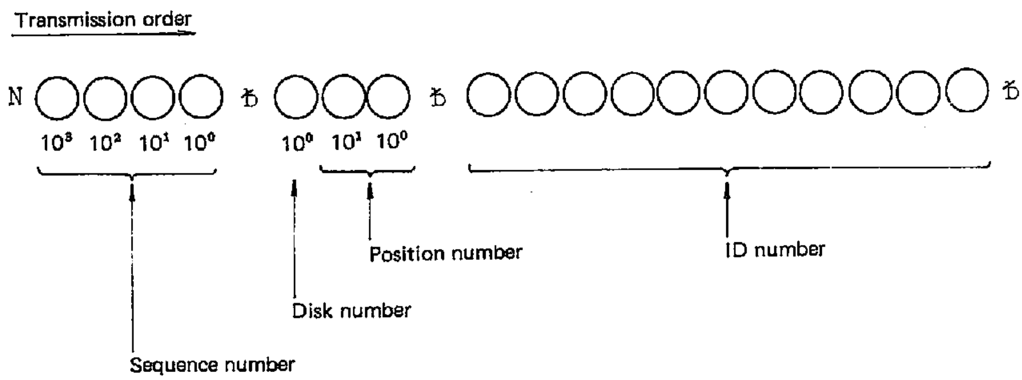
1) Routine Sample



Notes:

1. Sequence numbers are 1 to 1000, disk numbers are 0 to 9 and position numbers are 1 to 60. Perform zero suppression and transfer leading spaces (ъ).
2. The disk number and position number indicate the analyzer sample disk number and disk cup position.

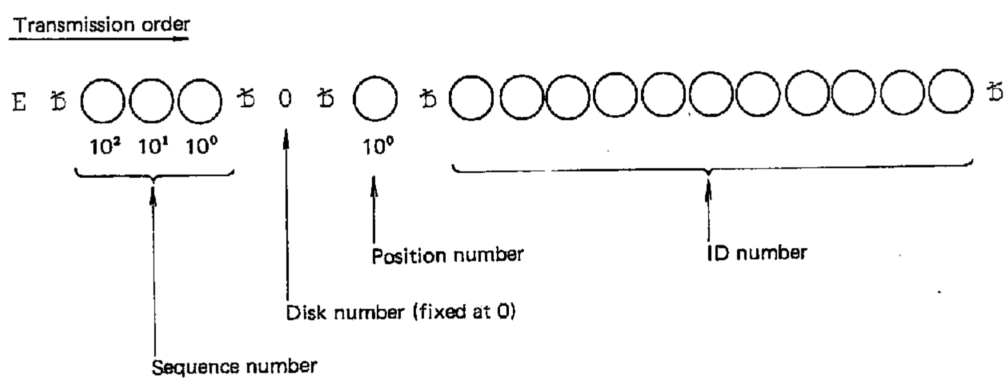
2) Rerun Sample



Notes:

1. Same as (Note) 1 in 1).
2. Same as (Note) 2 in 1).

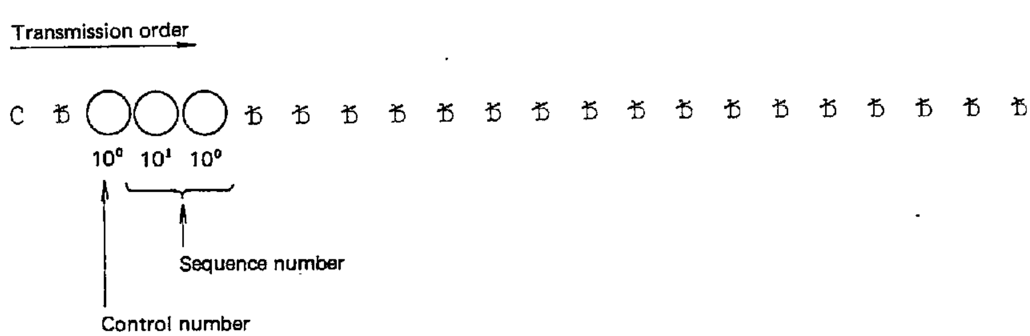
3) Stat Sample



Notes:

1. Sequence numbers are 1 to 100, disk number is 0, and position numbers are 1 to 7. Zero suppression is made and leading spaces (ƀ) are transferred.
2. Same as (Note) 2 in 1).

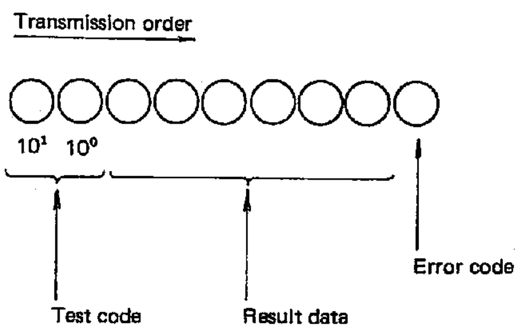
4) Control Sample



Notes: 1. Control numbers are 1 to 6, and sequence numbers are 1 to 30. Zero suppression is made and leading spaces (ƀ) are transferred.

2. For standard samples, refer to the transmission format for calibration data in (4-2).

(c) Result Data 1 to n (9 characters)



Notes: 1. Result data are as follows.

Table 3-4-3

Positive/ Negative	Decimal Point	Number of Maximum Digits	Example
Positive	No	6	1 2 3 4 5 6
	Yes	5	1 2 3 . 4 5
Negative	No	5	– 1 2 3 4 5 – ƀ ƀ 1 2 3
	Yes	4	– 1 2 . 3 4 – ƀ 1 2 . 3

Sign position fixed

2. Test codes are ƀ1 to 46 which correspond to analyzer test codes.

3. For error codes, refer to Table 3-4-4.

4. For A/G, H/L or other calculation channels, data are not transferred. Consider them on the system side.

5. Serum indexes correspond to item numbers 44 to 46, which correspond to lipemic (L), hemolytic (H) and icteric (I).
When serum indexes and print are designated on the analyzer side, serum index data are automatically judged and transmitted regardless of whether there is a measurement request of channel for serum indexes measurement or not.

6. The number n of transmitted data is determined by the number of requested tests.
   The number of simultaneously measured tests on the analyzer is up to 40. Including the serum indexes and options (Na, K, Cl), a total of 46 items of data can be transferred.
7. Data for channel requested are transmitted. If 2 tests are analyzed per channel, data for both tests are transmitted.
   Data for tests of channel for which masking is designated are not transferred.
8. When the number n of tests of transmission data exceeds 23, data are delimited at the 23rd tests and are transmitted as follows.
   In this case, the remaining characters are preceded by the same function number and sample information as the first half of data.

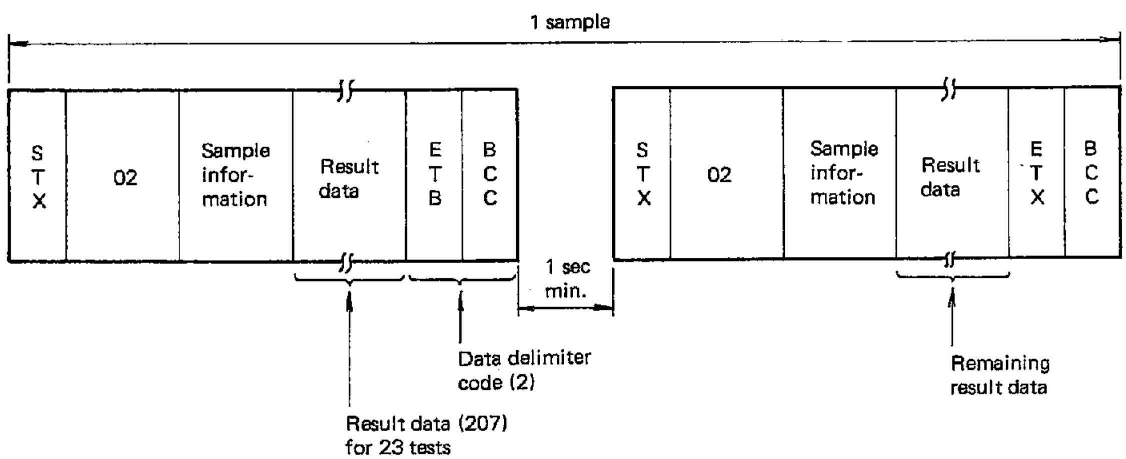


Fig. 3-4-11

The last of the former half of data is provided with data delimiter codes ETB and BCC which are transmitted in this order.

Table 3-4-4 Error Codes

Error Code	Description	Error Code	Description
A	ADC abnormal	G	Conversion error
Q	Cell blank abnormal	N	Noise error (ISE)
V	Sample insufficient	L	Level error (ISE)
T	Reagent insufficient	E	Slope abnormal (ISE)
Z	Absorbance over	R	Prepare abnormal (ISE)
P	Prozone error	D	Internal standard concentration abnormal (ISE)
I	Reaction limit value over (all points)	C	Cross-tests correction error
J	Reaction limit value over (only 1 point OK)	M	Cross-tests correction impossible error (data are ƀ)
K	Reaction limit value over (2 or 3 points OK)	$	Panic range over
W	Linearity abnormal (9 points or more)	@	Random error
F	Linearity abnormal (8 points or less)	#	Systematic error
U	Duplicate error	O	Overflow (data are ƀ)
S	Standard error	X	Calculation impossible (data are ƀ)
Y	Sensitive error	ƀ (space)	Normal
B	CALIB error		

Note: If errors have occurred simultaneously, the first error code produced is sent.

(4-2) Transmission of Calibration Data (from analyzer to system)

< Format >

STX	04	Test information (10)	Data 1 (9)	Data 2 (9)	Data 3 (9)		Data n (9)	ETX	BCC

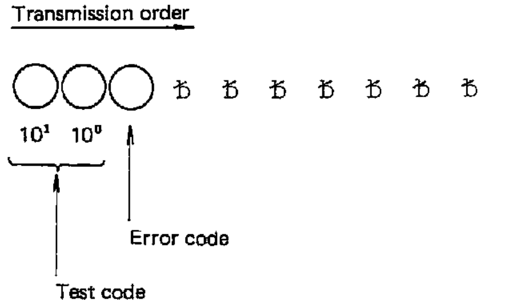
Function number (2)

Fig. 3-4-12

(a) Function Number (2 characters)
Transmit "04". Transmit "05" at communication cycle termination.
(Refer to (Note) 6 in (2).)

(b) Test Information (10 characters)

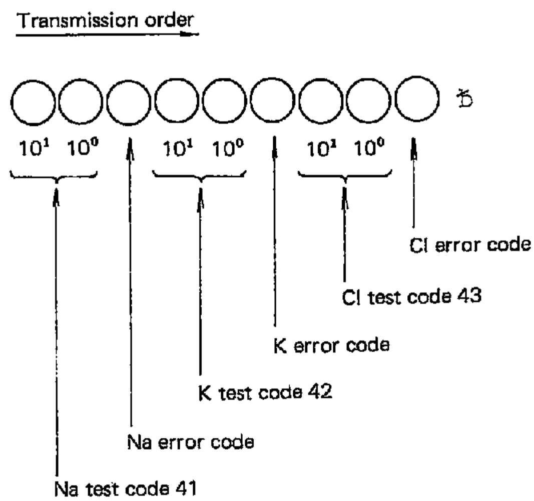
1) General Chemistry



Notes:

1. Test codes 1 to 40 correspond to analyzer test codes.
2. The error code is for the calibration of the test. Refer to "Table 3-4-4 Error Codes".

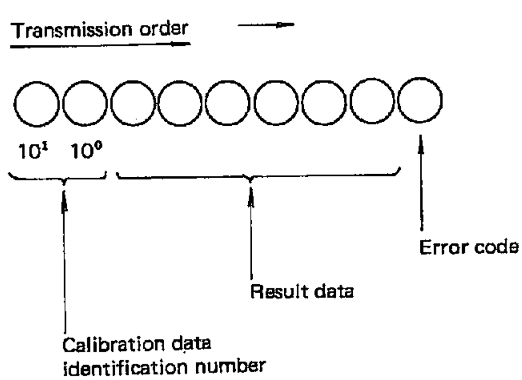
2) Electrolyte Test (only when electrolyte analyzer accessory is provided)



Note:

Test codes are 41 to 43 which correspond to Na, K and Cl.
When only Na and K are designated, Cl test code and Cl error code must be spaces (ƀ).

(c) Result Data (9 characters)



Notes:

1. The error code in this case is only for result data. Refer to "Table 3-4-4 Error Codes".
2. Calibration data identification numbers are ƀ 1 to 25.
   Their details are shown next.

Table 3-4-5

No.	Contents of Data			
	General Chemistry		Electrolyte Test (option)	
1	1st absorbance of standard (1)	($\times 10^{-4}$ ABS)	ISE internal standard emf of Na	(mV)
2	1st initial absorbance of standard (1)	(Ditto)	Standard (1) emf of Na	(Ditto)
3	2nd absorbance of standard (1)	(Ditto)	Standard (2) emf of Na	(Ditto)
4	2nd initial absorbance of standard (1)	(Ditto)	Standard (3) emf of Na	(Ditto)
5	1st absorbance of standard (2)	(Ditto)	Slope value of Na	——
6	1st initial absorbance of standard (2)	(Ditto)	ISE internal standard concentration of Na	(mEq/ℓ)
7	2nd absorbance of standard (2)	(Ditto)	Standard (3) concentration of Na	(Ditto)
8	2nd initial absorbance of standard (2)	(Ditto)	Compensated value of Na	(Ditto)
9	1st absorbance of standard (3)	(Ditto)	ISE internal standard emf of K	(mV)
10	1st initial absorbance of standard (3)	(Ditto)	Standard (1) emf of K	(Ditto)
11	2nd absorbance of standard (3)	(Ditto)	Standard (2) emf of K	(Ditto)
12	2nd initial absorbance of standard (3)	(Ditto)	Standard (3) emf of K	(Ditto)
13	1st absorbance of standard (4)	(Ditto)	Slope value of K	——
14	1st initial absorbance of standard (4)	(Ditto)	ISE internal standard concentration of K	(mEq/ℓ)
15	2nd absorbance of standard (4)	(Ditto)	Standard (3) concentration of K	(Ditto)
16	2nd initial absorbance of standard (4)	(Ditto)	Compensated value of K	(Ditto)
17	1st absorbance of standard (5)	(Ditto)	ISE internal standard emf of Cl	(mV)
18	1st initial absorbance of standard (5)	(Ditto)	Standard (1) emf of Cl	(Ditto)
19	2nd absorbance of standard (5)	(Ditto)	Standard (2) emf of Cl	(Ditto)
20	2nd initial absorbance of standard (5)	(Ditto)	Standard (3) emf of Cl	(Ditto)
21	1st absorbance of standard (6)	(Ditto)	Slope value of Cl	——
22	1st initial absorbance of standard (6)	(Ditto)	ISE internal standard concentration of Cl	(mEq/ℓ)
23	2nd absorbance of standard (6)	(Ditto)	Standard (3) concentration of Cl	(Ditto)
24	2nd initial absorbance of standard (6)	(Ditto)	Compensated value of Cl	(Ditto)
25	SD value at non-linear calibration	——	None	——

3. The total number n of transferred data varies depending on the calibration method. The maximum of n is 25.
Data not measured are not transferred. Blanks are eliminated for transmission.
4. For result data, refer to (Note) 1 in (4-1) (c).
5. In case of twin tests, they are divided into the first test and latter test and are transmitted twice as shown below.
The maximum number of n at this time is 8.

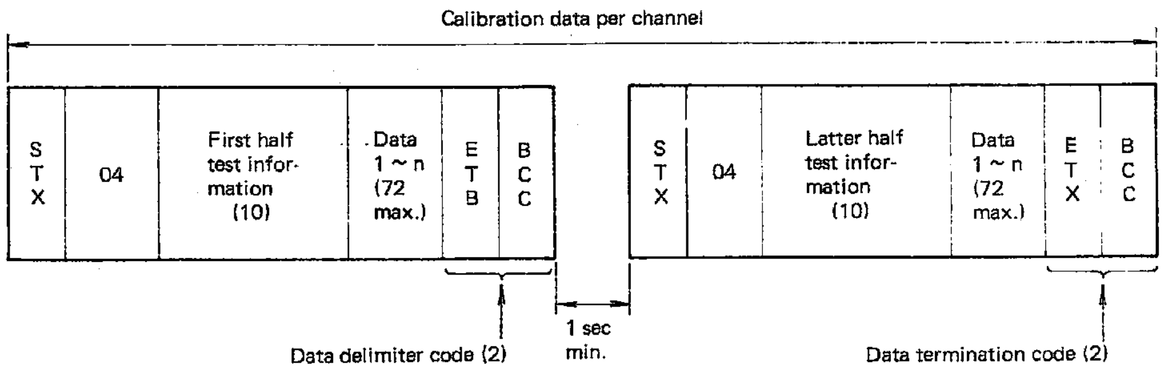


Fig. 3-4-13

As data delimiter code (2 characters), ETB and BCC are transmitted in this order.

(4-3) Transmission of Original Absorbance Data (from analyzer to system)

< Format >

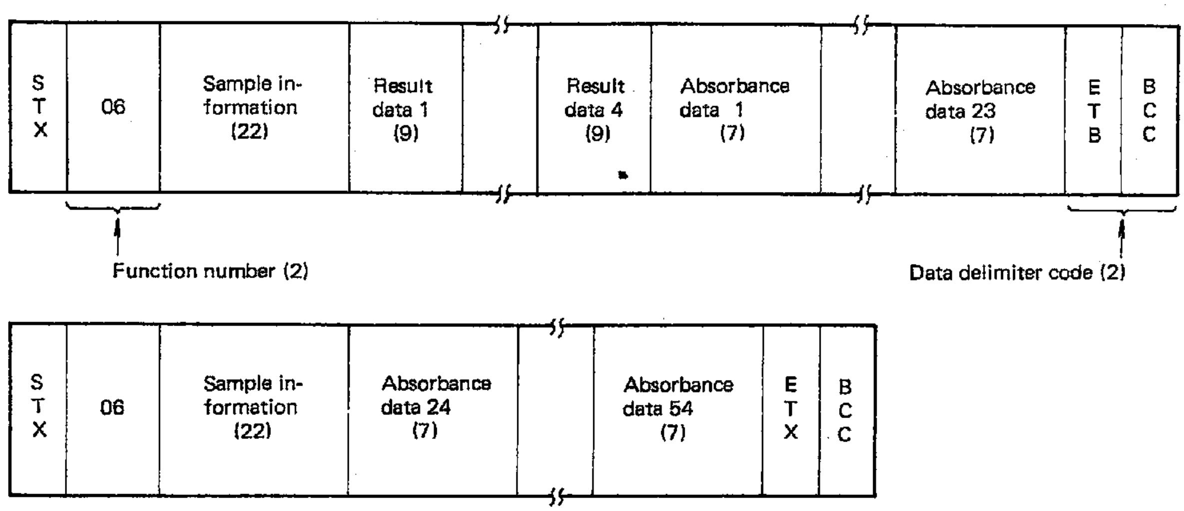


Fig. 3-4-14

(a) Function Number (2 characters)
Transmit "06".

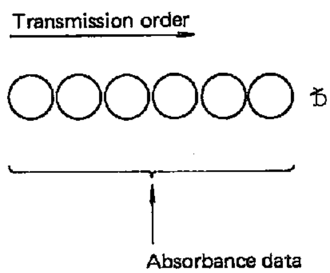
(b) Sample Information (22 characters)
Refer to the routine sample in (4-1) (b).

(c) Result Data

Refer to result data 1 to n in (4-1) (c).

Note: Original absorbance data are transmitted by channels.
Data of 1 item are transmitted when 1 item is designated per channel; data of 2 tests are transmitted when twin tests is designated; and data of up to 4 tests are transmitted when serum indexes measurement is designated.
When there are no data, spaces (ƀ) are transmitted.

(d) Absorbance Data (7 characters)



Notes:

1. Absorbance is an integer in terms of 1×10^{-4} ABS. Refer to (Note) 1 in (4-1) (c).
2. Absorbance data at different measured points are as follows.
   Absorbance data 1 to 4 . . . . Cell blank data
   Absorbance data 5 to 54 . . . Data after adding sample and reagent
   They are data of main wavelength – sub wavelength.
   Absorbance data 5 to 54 are data after cell blank correction.
3. The text exceeds 256 characters and, therefore, it is divided into 2 and is transmitted as illustrated below.

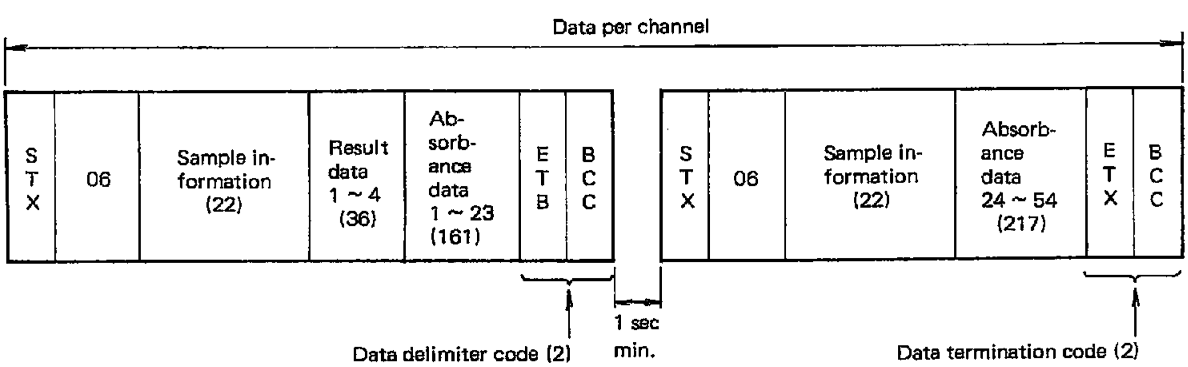


Fig. 3-4-15

The data delimiter code (2 characters) is transmitted in the order of ETB and BCC.

(5) When Transmitting Result Data only without Test Selection Inquiry in Real Time

Turning on the DIP switch (No. 20) in the analyzer selects this mode.
Carry out this work referring to expansion of communication specifications.
In this mode, result data only are transmitted during analysis and no test selection inquiry is performed at all. The analysis is carried out in accordance with the test selection information in the analyzer.

Therefore, the test selection information must be entered before executing the analysis.
A test selection inquiry is available in batch before starting the analysis.
Refer to the batch mode communication at a stopped status of analyzer and test selection inquiry (batch mode communication) in 3-4-3 (2).
For result data transfer, refer to 3-4-3 (3).

(6) Test Selection Inquiry for Routine Samples only without Test Selection Inquiry for Rerun Samples
Turning on the DIP switch (No. 19) in the analyzer selects this mode.
Perform this work referring to expansion of communication specifications.
In this mode, no test selection inquiry is executed during rerun sample analysis.
Details other than during rerun are the same as in 3-4-3 (2) and (3).

3-4-3 Batch Mode Communication at Stopped Status of Analyzer

(1) Outline of Batch Mode Communication

(a) When the analyzer is stopped, the communication is activated on CRT screen of the analyzer.

(b) Designation of COMMUNICATION on START CONDITIONS screen is invalid. Communication is executed regardless of NO designated.

(c) The test selection inquiry is executed separately for routine and rerun samples.
For routine samples, it is activated by DATA RECEIVE on PATIENT TEST SELECTION screen.
For rerun samples, it is activated by DATA RECEIVE on RERUN SAMPLES screen, and all samples in a designated range are inquired about.

(d) Transfer of result data is activated by DATA TRANSFER on DATA REVIEW screen.

(2) Test Selection Inquiry (batch mode)

(2-1) Communication Procedure for Test Selection Inquiry (batch mode)

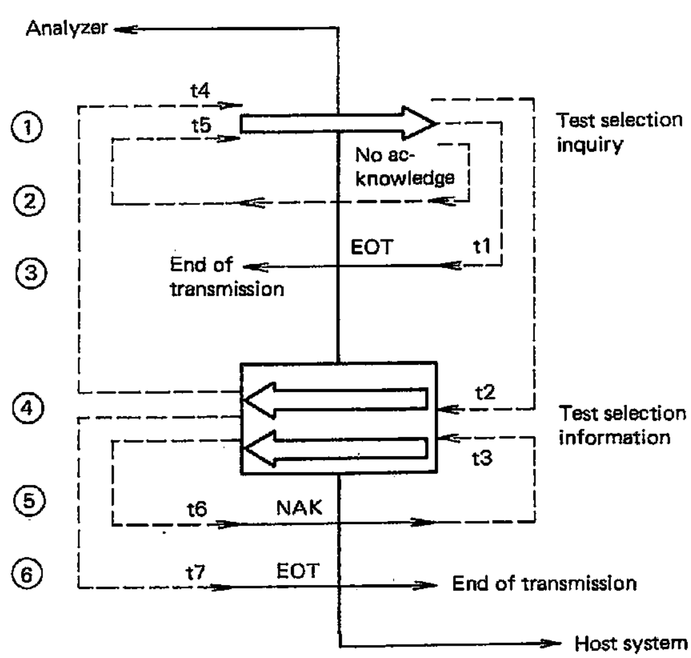


Fig. 3-4-16

• Time Supervision in Analyzer

Table 3-4-6

Symbol	Description	Timer Value	Time-out Processing
t1	Answer time supervision	20 sec	Test selection reinquiry (analyzer side)
t2	Text wait supervision	Ditto	Ditto
t3	Text retransmission wait supervision	Ditto	Ditto
t4	Next text send delay time	120 sec max.	Transmission suspend (system side)
t5	Retransmission delay time	Ditto	Ditto
t6	Answer delay time	Ditto	Ditto
t7	Ditto	Ditto	Ditto

Notes:

1. ACK or NAK need not be sent to ① .
   It is substituted by test selection information sending and no acknowledge. In case of no acknowledge, an inquiry is retransmitted.
2. Retransmission is available up to 4 times.
   If the transmission is still unsuccessful, an error is displayed, EOT is sent and the transmission terminates.
3. When all test selection information registered on the system side has been transmitted, the system side must send EOT instead of test selection information (③).
   Receiving EOT, the analyzer terminates the transmission.
4. If ① , ⑤ or ⑥ is not sent within the specified time, the system side must suspend the transmission.
5. NAK is sent when the text is faulty as shown in ④ (⑤).
   NAK is transmitted up to 4 times. (See (Note) 2.)
6. When the stop key is pressed, EOT is transmitted and the transmission terminates after receiving normal test selection information for an inquiry.
7. ⑥ is sent when the stop key is pressed, the last test selection information is received, the transmission remains unsuccessful after 4 retransmissions or the number of samples in the test selection information accepted by the analyzer is 997 to 1000 in case a sample ID accessory is provided.
   (See (Note) 5 in (2-2) (b).)

(2-2) Test Selection Inquiry Transmission for Routine Samples (from analyzer to system)

< Format >

STX	51	Sample information 1 (22)	Sample information 2 (22)	Sample information 3 (22)	Sample information 4 (22)	ETX	BCC

Function number (2)

Fig. 3-4-17

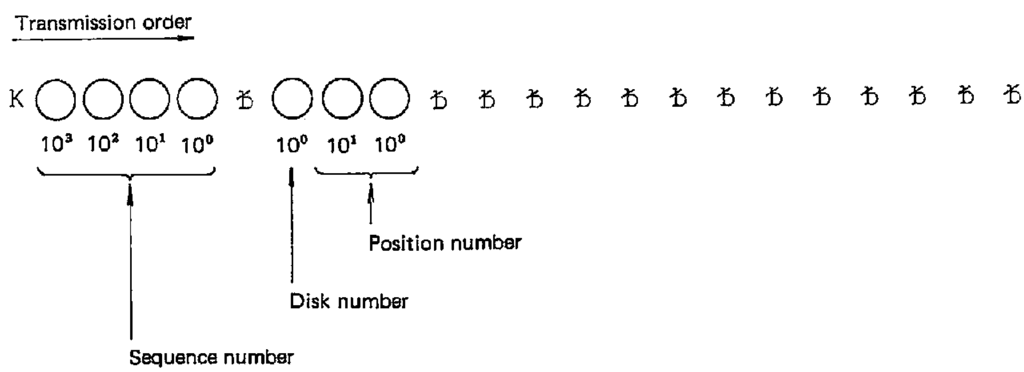
(a) Function Number (2 characters)
Transmit "51".

Note: When a sample ID accessory is optionally provided, 2 function numbers given below are used.

"51" . . . Used for routine ordinary test selection inquiry.
Used when designating (1: NEXT DATA) by DATA RECEIVE on PATIENT TEST SELECTION screen.

"55" . . . Used only in the first text of inquiry from the analyzer when requesting a transmission from the first data of the analyzer requisition list on the system after some problem has occurred.
Used when designating (2: ALL) by DATA RECEIVE.

(b) Sample Information 1 to 4 (22 characters)



Notes:

1. Sequence numbers are 1 to 1000, disk numbers are 0 to 9, and position numbers are 1 to 60. After zero suppression, they are sent with leading spaces (ƀ).
2. Sequence number, disk number and position number are sequentially incremented from the start sequence numbers input by DATA RECEIVE on PATIENT TEST SELECTION screen up to the last sequence numbers.
3. Usually the inquiry is made for 4 samples. In case of 3 samples or less, spaces (ƀ) are sent for the remainder.
Finally, EOT is sent instead of an inquiry and the transmission terminates.
4. When a sample ID accessory is optionally provided, "K" is transmitted for 4 samples as shown below.

Transmission order →

K ␢

␢ ␢ ␢ ␢

5. If the number of samples in test selection information accepted by the analyzer has become 997 to 1000 when a sample ID accessory is optionally provided, an alarm of REQ. FULL 42-1 WARNING is displayed and the inquiry is suspended.
   In this case, EOT is transmitted instead of inquiry and the transmission terminates.

(2-3) Download of Routine Sample Test Selection Information (from system to analyzer)

< Format >

STX	51	Sample information 1 (22)	Comment 1 (41)	Test selection information 1 (35)	Sample information 2 (22)	Comment 2 (41)	Test selection information 2 (35)	ETB	BCC

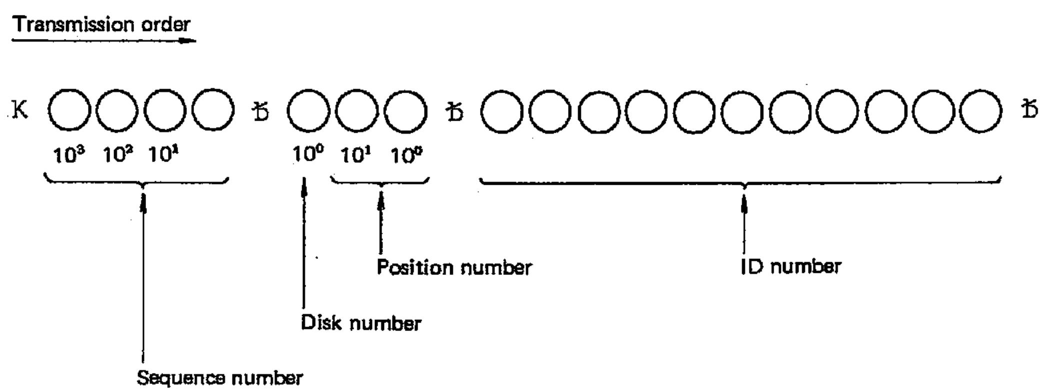
STX	51	Sample information 3 (22)	Comment 3 (41)	Test selection information 3 (35)	Sample information 4 (22)	Comment 4 (41)	Test selection information 4 (35)	ETX	BCC

Function number (2)

Fig. 3-4-18

(a) Function Number (2 characters)
Transmit the same number as inquired from the analyzer.

(b) Sample Information 1 to 4 (22 characters)



Notes: 1. Send back the same sequence, disk and position numbers as sent from the analyzer.
If it is desired to alter the disk or position number on the system side, send back the altered disk or position number.

2. Transmit the ID number for the sequence number.
Refer to (Note) 1 in (3-2) (b) of 3-4-2 Real Time Communication.

3. When a sample ID accessory is optionally provided, send back ID number only.

Transmission order →

K ƀ ƀ ƀ ƀ ƀ ƀ ƀ ƀ ƀ $\underbrace{\bigcirc\bigcirc\bigcirc\bigcirc\bigcirc\bigcirc\bigcirc\bigcirc\bigcirc\bigcirc\bigcirc\bigcirc}_{\text{ID number}}$ ƀ

For ID number, refer to (Note) 1 in (3-2) (b) of 3-4-2 Real Time Communication:

4. When a sample ID accessory is optionally provided, transmit the test selection information for all samples by 4 samples at a time.
In case of 3 samples or less, the remainder must be spaces (ƀ).

STX	51	Sample information 1	~	ETB	BCC

STX	51	ƀ ~ ƀ	ETX	BCC

Fig. 3-4-19 Typical Transmission for 2 Samples or Less

5. When a sample ID accessory is optionally provided, transmit EOT only instead of test selection information after test selection information for all samples has been sent.
The analyzer continues an inquiry until EOT is received.

(c) Comments 1 to 4 (41 characters)
Refer to the format in "3-4-2 Real Time Communication".

(d) Test Selection Information 1 to 4 (35 characters)
Refer to the format in "3-4-2 Real Time Communication".

(2-4) Test Selection Inquiry for Rerun Samples (from analyzer to system)

< Format >

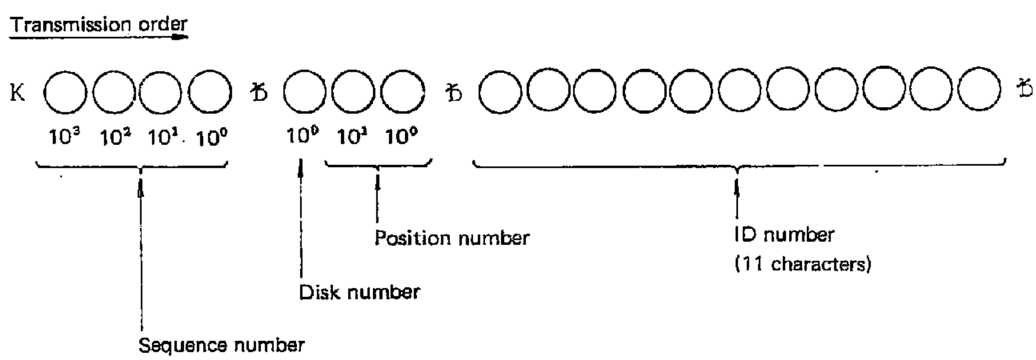
STX	61	Sample information 1 (22)	Sample information 2 (22)	Sample information 3 (22)	Sample information 4 (22)	ETX	BCC

Function number (2)

Fig. 3-4-20

(a) Function Number (2 characters)
Transmit "61".

(b) Sample Information 1 to 4 (22 characters)



Notes:

1. Sequence numbers are 1 to 1000, disk numbers are 0 to 9, and position numbers are 1 to 60.
   After zero suppression, they are sent with leading spaces (ƀ).
2. Transmit the disk, position and ID numbers corresponding to the relevant sequence number.
3. Usually an inquiry is made by 4 samples. In case of 3 samples or less, spaces (ƀ) are put in the remainder.
   Finally EOT is transmitted instead of an inquiry.

(2-5) Download of Test Selection Information for Rerun Samples (from system to analyzer)

< Format >

S T X	61	Sample information 1 (22)	Comment 1 (41)	Test selection information 1 (35)	Sample information 2 (22)	Comment 2 (41)	Test selection information 2 (35)	E T B	B C C

Data delimiter code (2)

S T X	61	Sample information 3 (22)	Comment 3 (41)	Test selection information 3 (35)	Sample information 4 (22)	Comment 4 (41)	Test selection information 4 (35)	E T X	B C C

Function number (2)

Fig. 3-4-21

(a) Function Number (2 characters)
Transmit "61".

(b) Sample Information 1 to 4 (22 characters)
Send back the same sample information as the test selection inquiry sent from the analyzer.
When it is desired to alter the disk or position number on the system side, send back the altered number.
Note that ID number cannot be altered. If altered, an error would be produced.

(c) Comments 1 to 4 (41 characters)
Same as "3-4-2 Real Time Communication".

(d) Test Selection Information 1 to 4 (35 characters).
Same as "3-4-2 Real Time Communication".

Note: Refer to (Note) 1 in (3-2) (b) of 3-4-2 Real Time Communication.

(3) Result Data Transmission (batch mode communication)

(3-1) Transmission Means Related to Result Data Transmission (batch mode communication)

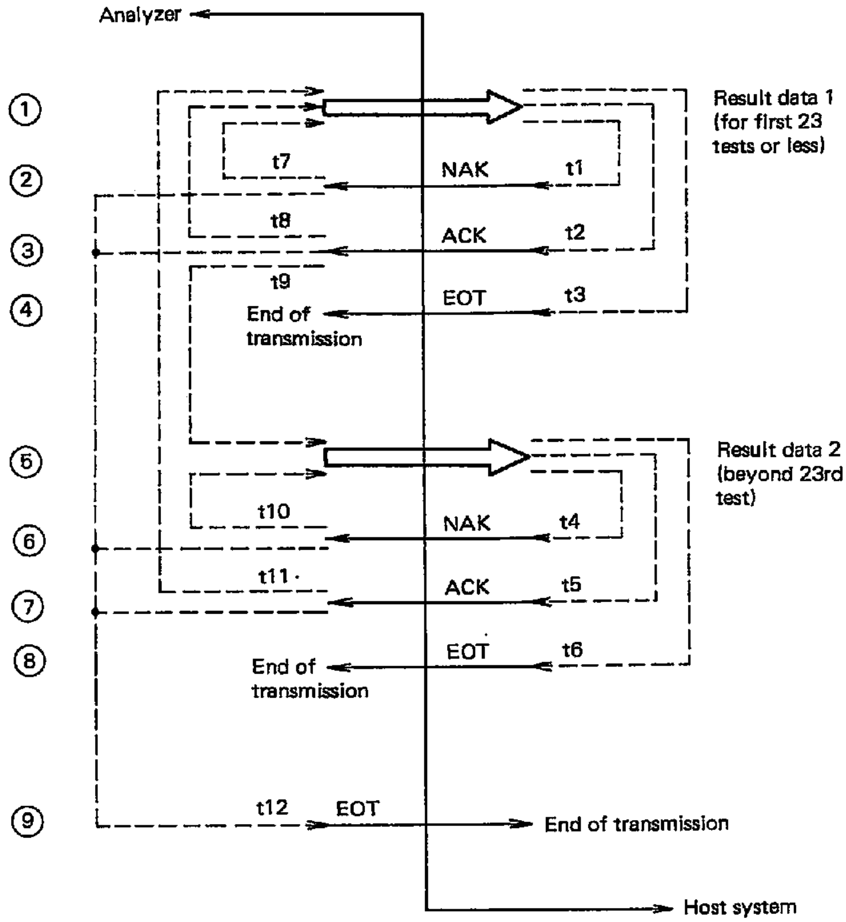


Fig. 3-4-22

• Timing Check in Analyzer

Table 3-4-7

Symbol	Description	Timer Value	Time-out Processing
t1	Response time	10 sec	Data retransmission (analyzer side)
t2	Ditto	Ditto	Ditto
t3	Ditto	Ditto	Ditto
t4	Ditto	Ditto	Ditto
t5	Ditto	Ditto	Ditto
t6	Ditto	Ditto	Ditto
t7	Retransmission delay time	60 sec max.	Transmission suspend (system side)
t8	Next data send delay time	Ditto	Ditto
t9	Ditto	Ditto	Ditto
t10	Retransmission delay time	Ditto	Ditto
t11	Next data send delay time	Ditto	Ditto
t12	Response delay time	Ditto	Ditto

• Precautions in Transmission Procedure

Notes:

1. Retransmission for ② or ⑥ or in case of no acknowledge (time-out) after transmission of ① or ⑤ is performed up to 4 times.
   If the transmission is still unsuccessful, an error is displayed, EOT is sent and the transmission treminates.
2. When the result data are 24 items or more, the control transfers from ③ to ⑤.
   In all other cases, ① to ③ are repeated.
3. If ①, ⑤ or ⑨ is not sent within the specified time in case of ②, ③, ⑥ or ⑦, suspend the transmission on the system side.
4. EOT can be transmitted as an answer to ① or ⑤ (④, ⑧).
   In this case, the analyzer terminates the transmission immediately.
5. When the stop key is pressed, after a transmission procedure for data of 1 sample has normally terminated (after ACK is received), EOT is sent and the transmission terminates.
6. ⑨ is transmitted when the stop key is pressed, transmission of result data within a specified range has terminated or the transmission is unsuccessful after 4 retransmissions.

(3-2) Transmission of Result Data for Routine, Stat and Control Samples (from analyzer to system)

< Format >

STX	52	Sample information (22)	Data 1 (9)	Data 2 (9)	Data 3 (9)			Data n (9)	ETX	BCC

Function number (2)

Fig. 3-4-23

(a) Function Number (2 characters)
Transmit "52" except that "53" must be sent in case of edited result data.

(b) Sample Information (22 characters)
Same as "3-4-2 Real Time Communication".

(c) Result Data (9 characters)
Same as "3-4-2 Real Time Communication".

Notes:
1. When the number of tests exceeds 23 and data are split for sending, a 1 second interval is not put between the first half of data transmitted and the latter half of data to be transmitted.
   The latter half of data is transmitted immediately after receiving an acknowledge (ACK) for the first half of data.
2. When edited result data are designated, only edited sample data are transmitted.

3-4-4 Alteration of Communication Specifications

The analyzer has an expansion function for a part of specifications as shown below. Use it as required.
To provide an expansion function, the switch setting in the analyzer must be altered. Entrust this work to the nearest service station.

(1) Alteration of Data Termination Code (data delimiter code)

A standard transmission is made in the order of EXT (ETB) and BCC.
It can be altered to CR, LF and EXT (ETB); EXT (ETB) only; or EXT (ETB), CR and LF.
In this case, the system side must transmit the same termination (delimiter) code as the analyzer.

(2) Alteration of Communication Speed

The standard is 2400 bps. It can be altered to 4800 bps.

3-4-5 Communication Trace Specifications

(1) General

This auxiliary function stores in F/D the contents of communication executed between the analyzer and system, outputs them and checks them.

(2) Setting of Option

Turning on the DIP switch (No. 17) of TRIADCP circuit board in the analyzer validates this function.
This function is resorted to when a connected system is operated for the first time or the communication has failed. Set it normally to the standard status (off).

(3) Trace Contents

Time of executing a communication, direction of communication and communication text are stored.
When the communication is successful, however, only the function number and sample information are stored.
If an error has occurred during communication, error contents and all characters up to the error occurrence are stored.
(If transmission time-out has occurred during a transmission from the analyzer to the system, only the function number and sample information are stored the same as when normal.)

(4) Trace Timing

During execution of a real time communication, the communication contents are stored in F/D only when the communication has been executed every communication cycle (24 sec).
During a batch communication, 1 cycle consists of transmission from the analyzer and answer to it by the system and, at every cycle, the communication contents are stored in F/D.
If a transmission time-out error has occurred when sending an inquiry in case of a test selection inquiry, however, the communication contents are stored in F/D at once.
The capacity of F/D is about 160 minutes normally in real time communication.

(5) Trace Output

A trace output is performed by designation by LOG OUT on MAINTENANCE screen.
Refer to the screen specifications and printout specifications.

3-4-6 Precautions in Connecting System Interface

(1) Analyzer sequence numbers are 1 to 1000. 1000 is followed by 1.
There are 6 types of control samples and the sequence number is up to 30, which is followed by 1. Stat sample sequence numbers are 1 to 100, followed by 1.
Therefore, when measuring more than 1000 routine samples, 100 Stat samples or 30 control samples, consider it on the system side.

(2) Precautions when inputting START SAMPLE NO. on START CONDITIONS screen after the analyzer has incurred sampling stop on account of alarm etc.

- (a) The routine sample sequence number can be modified.
  Therefore, the same sequence number may be transmitted.
- (b) The control sample sequence number cannot be modified.
  If a cell blank has been measured for some control sample at a sampling stop time, the sequence number transmitted after restart may skip.
- (c) Stat sample sequence number cannot be modified either.
  The same as in (b) above, the sequence number may skip.

(3) Precautions in Restarting after Stop on Account of Alarm, etc.

- (a) Data of samples placed on the reaction table at the time of stop are not transmitted at all. Data are sent for samples pipetted after restart.
- (b) The routine sample sequence numbers are the same as in (a) in (2).
- (c) For control or Stat sample, the sequence number may skip if the sample is on the reaction disk.

3-5 Extended Function of System Interface

The function of System Interface can be extended as shown below.

Table 3-5-1 SW 5 on S. I/F APU PCB

SW. No.								Function	
7	6	5	4	3	2	1	0		
0	0	0						Baud rate	No use
0	0	1							4800
0	1	0							2400*
			0	0	0			Word select	7 bits + 2 stop bits, even parity
						0	0	END CODE of TEXT	ETX, BCC *
						0	1		CR, LF, ETX
						1	0		ETX
						1	1		ETX, CR, LF

Note: 1 is ON, and 0 is OFF.
"*" marked one is standard mode.

3-6 Modification of Model 717 for Online System Connection

In the standard specifications, the Model 717 analyzer is delivered without special presetting for online system connection. Where online system connection is required, alter the internal switch setting in Model 717 as instructed below.

(1) Turn off the POWER switch of Model 717.

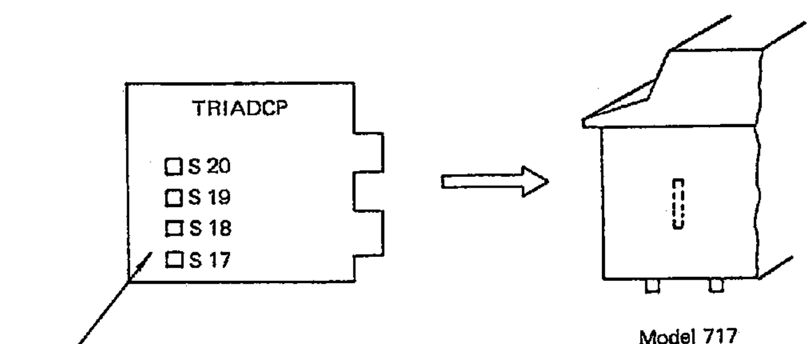
(2) Open the right side door of Model 717 by loosening its retaining screws. Also, remove the internal cover by loosening its six setscrews.

(3) Unplug the TRIADCP circuit board from the PCB cage (third circuit board from right). Then, flip down the switch 18 (second from bottom) on the TRIADCP circuit board. See the figure below.

(4) After returning the TRIADCP circuit board in place, put the internal cover back on. Then, close the right side door and secure its retaining screws.

(5) This completes the internal switch setting for online system connection.
Turning on the POWER switch now allows the Model 717 to set up online system connection.

(6) For S17, S19 and S20, refer to 10-7 Switch Setting.



Flip down switch 18.

I/F SW5

0	1	2	3	4	5	6	7
0	0	1	0	1	0	1	0

End Code
8 bit
2 Stop
No parity
2400

4. INSTALLATION AND MAINTENANCE

4. INSTALLATION AND MAINTENANCE

4-1 Installation

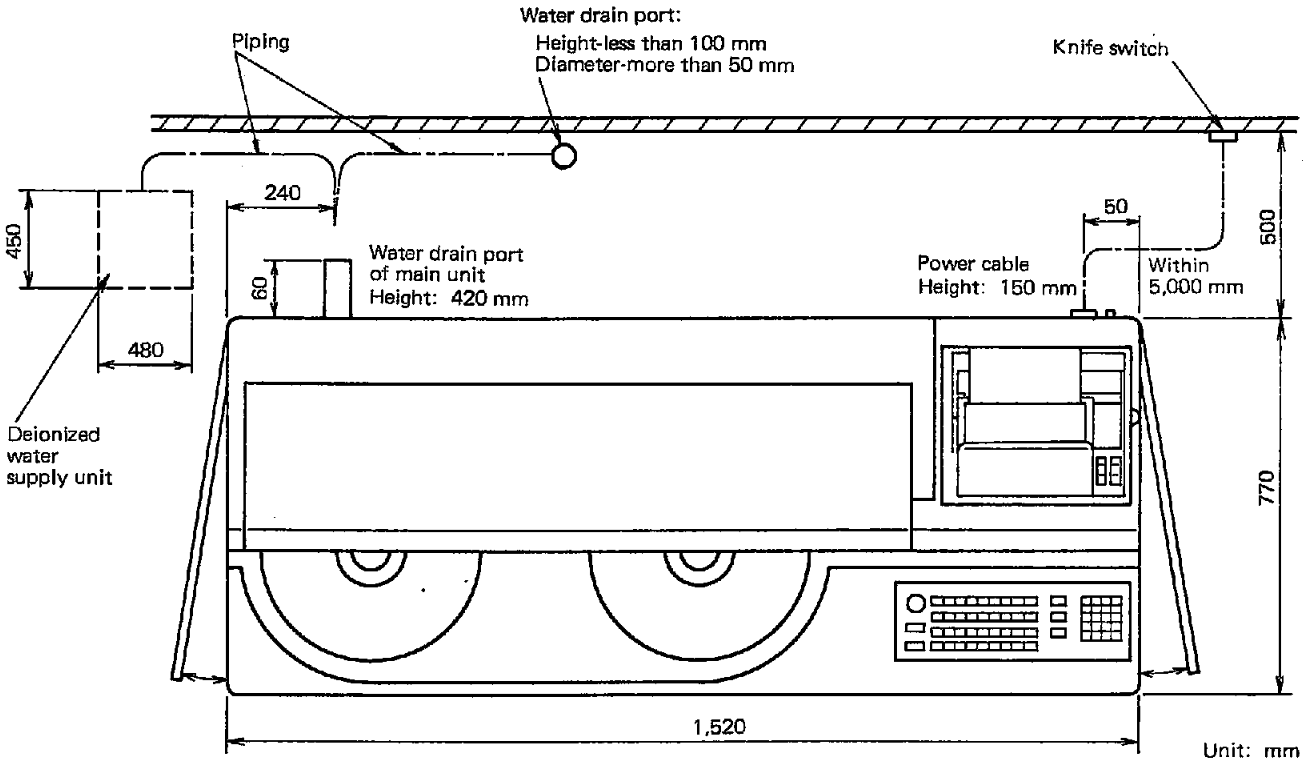


Fig. 4-1-1 Instrument Layout

4-1-1 Installation Conditions

(1)	Space	:	Dimensions of Main Unit 1,520(W) × 770(D) × 1,150(H) mm Space for rear side-500 mm, for front-1000 mm, for left-more than 1000 mm
(2)	Weight	:	Approx. 450 kg
(3)	Power Requirements	:	100 V · 3 kVA (Knife Switch)
(4)	Grounding	:	Less than 10 Ω
(5)	Ambient Temperature	:	15 to 32 degrees C (within ±2 degrees C in operation)
(6)	Ambient Humidity	:	45 to 85 percent RH (Incubation bath-37°C)
(7)	Deionized Water Supply Unit	:	Water pressure of 0.5 to 3.5 kg/cm^2
(8)	Water Drain Port	:	Diameter-more than 50 mm Located at height of 100 mm maximum

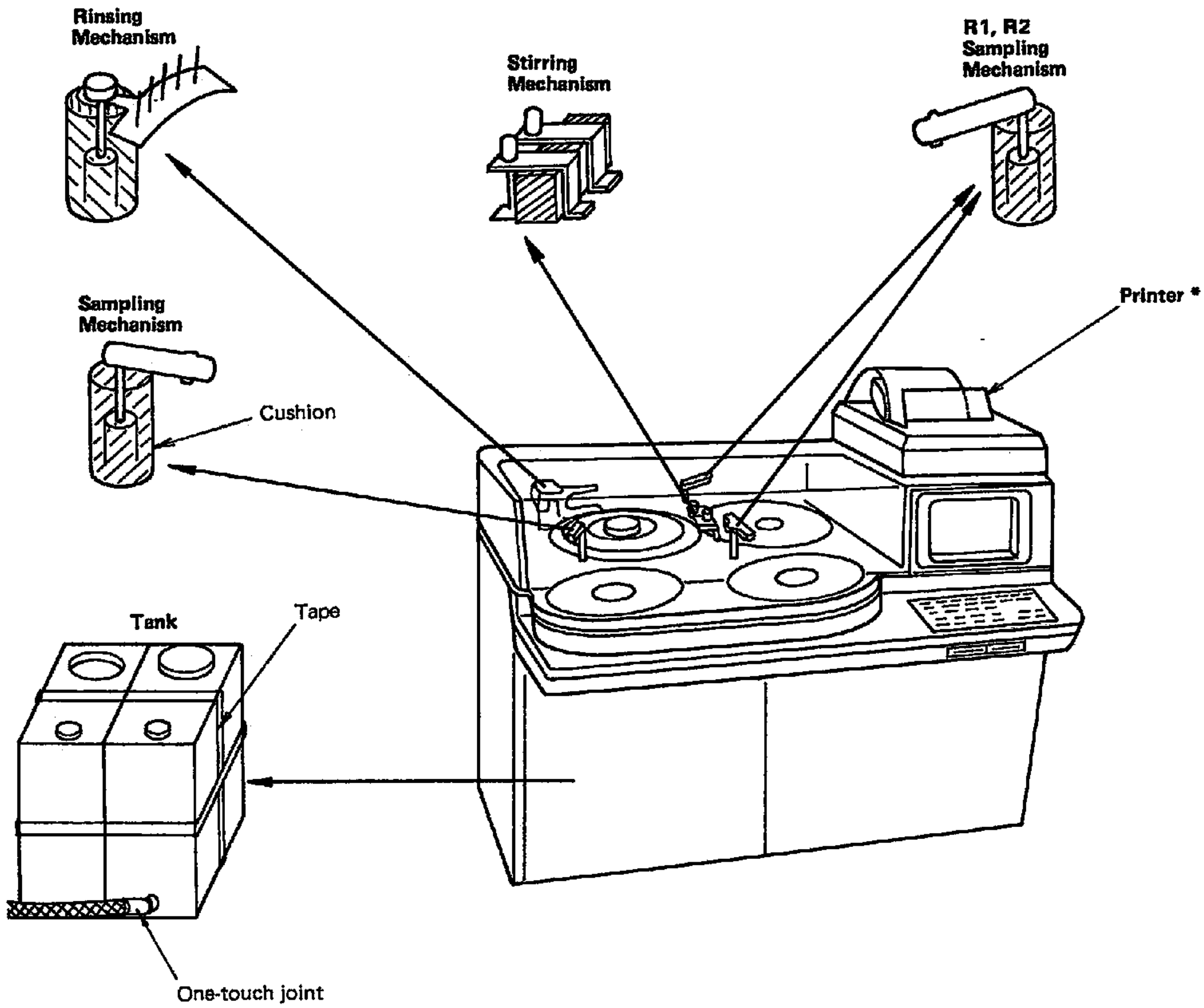
4-1-2 Accessories

(1) Check the number of each accessory with Packing List.

4-1-3 Unpacking

(1) Remove the tapes, ropes and cushions. (See below figure)

(2) When disposing of cushions in accessory, be sure not to dispose of accessories together with them.



Note*: Printer is contained in another box.

Fig. 4-1-2

4-1-4 Installation

(1) Main Unit

(a) Leave a space of at least 50 cm behind the instrument and at least 1 m in front of it as shown in Fig. 4-1-1.

(b) Pull down 4 adjusting feet on main unit bottom and balance the instrument horizontally and vertically.

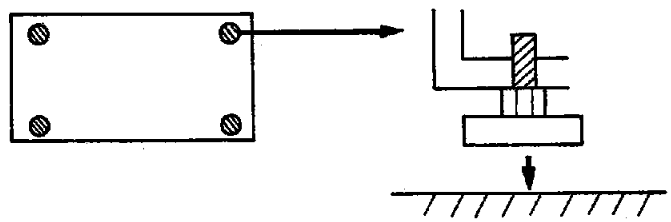


Fig. 4-1-3

Note: Make sure that 4 casters on the main unit bottom are floating 5 mm to 10 mm from the floor.

4-1-5 Piping for Water Supply/Drain

(1) Connect Pipe to Water Drain Port.

(a) Remove rear right cover of main unit and pipe holder.
Then connect L pipe to water drain port of main unit with pipe holder again.
Pay attention to rubber packing in connecting since it is easily broken.
(Apply a little water for easy attachment.)

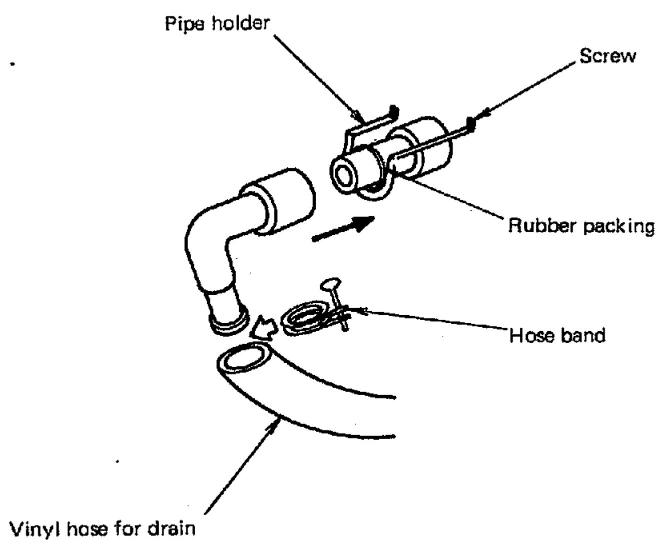


Fig. 4-1-4

(b) Cut gray drain tube at a length equalling the distance from main unit to water drain port. The distance between main unit and drainage should be within 5 m and the height from floor to upper rim of water drain port should be less than 10 cm.

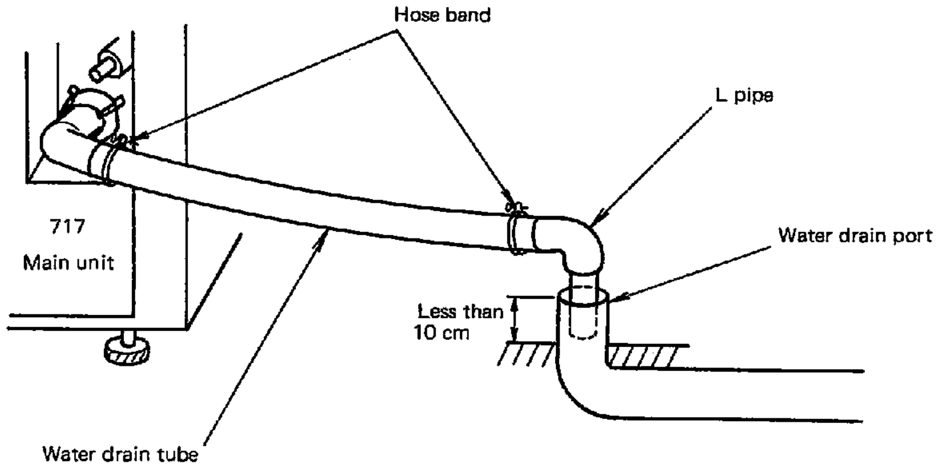


Fig. 4-1-5

(2) Connect Pipe to Water Inlet.

(a) Attach filter case 2 assy to water inlet.

(b) When deionized water supply unit for 717 can be used:
Remove rear right cover of main unit and connect pipes as shown in figure below.

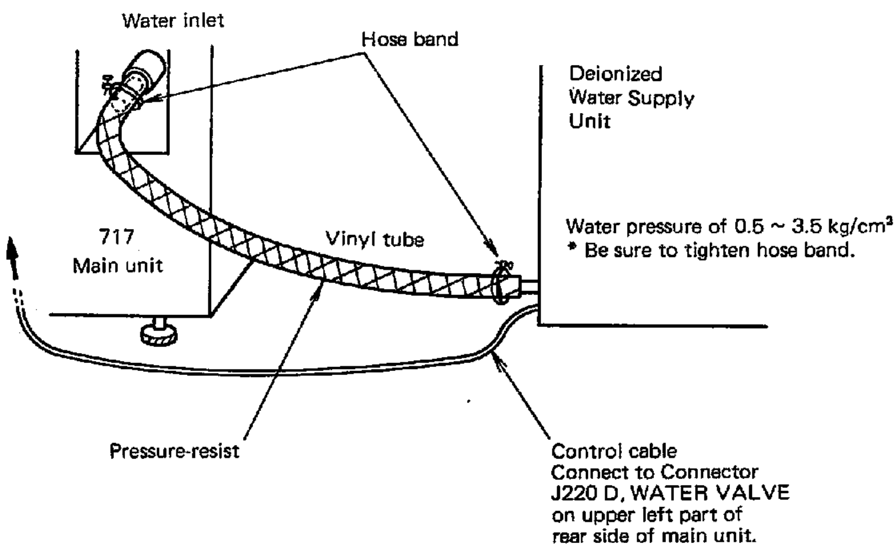


Fig. 4-1-6

(c) When deionized water supply unit for 717 cannot be used:

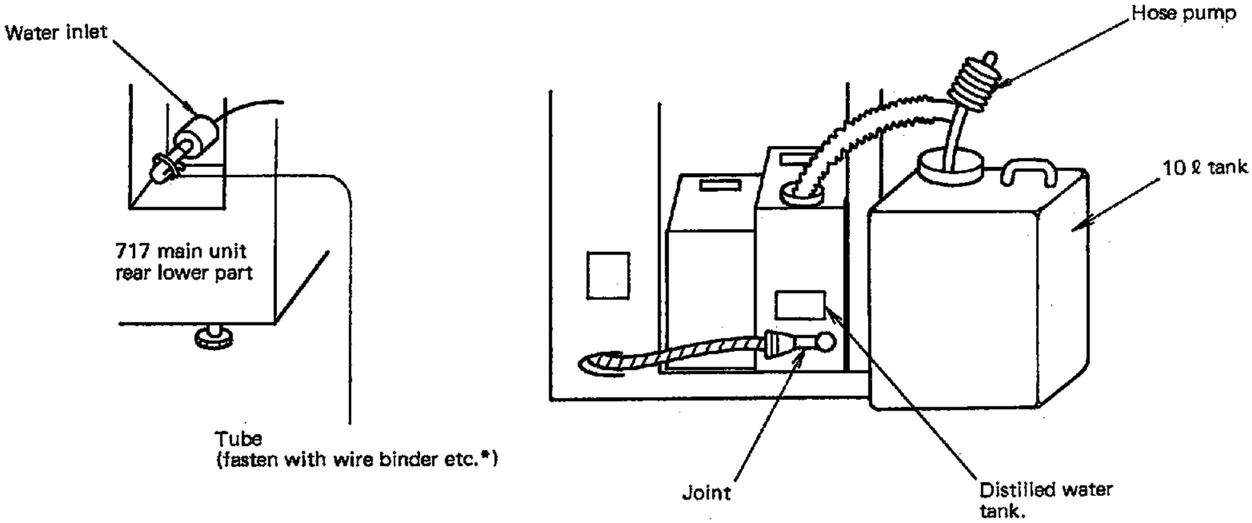


Fig. 4-1-7

Open front left cover of main unit and supply distilled water with hose pump.
If there's not enough water in distilled water tank, an alarm (DISTILLED WATER TANK) appears and sampling stops.

Note*: If not fastened, water sometimes may leak.

4-1-6 Power Source Cable Wiring

(1) Connect Printer to Main Unit.

(a) Take printer out of the box.

(b) Connect cable to main unit and printer.
Be sure to connect signal cable securely and fix it with fixture.

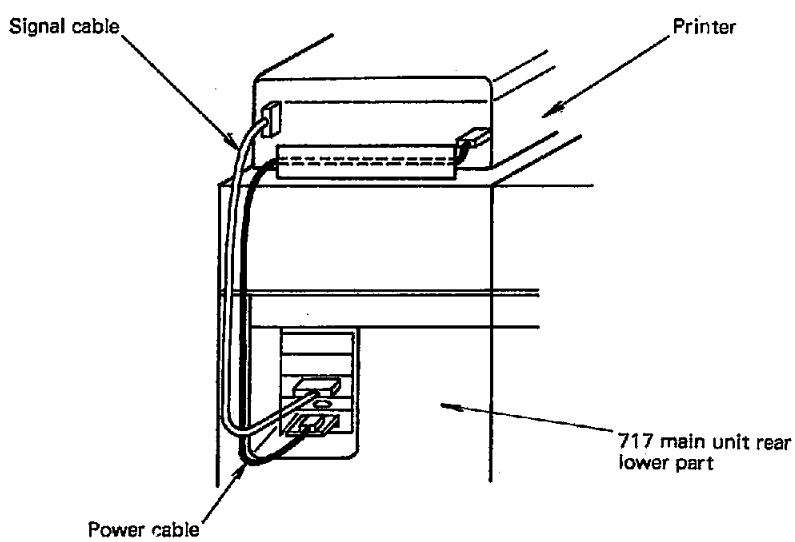


Fig. 4-1-8

(2) Connect to 100 V Power Source.

(a) Check power source.
Use tester to measure 220 V (115 V for USA).
Connect L: brown wire to hot line (To ground, 220 V or 115 V)
N: blue wire to cold line (To ground, 0 V)
G: green/yellow wire to GND (Ground)

(b) Connect as in figure below.

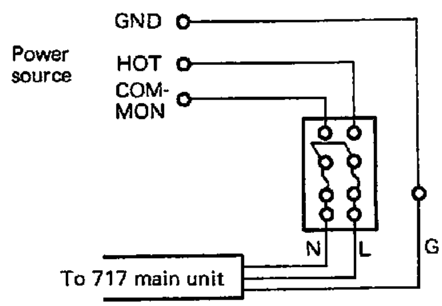


Fig. 4-1-9

(c) Fix power cable which is connected to power source box.
When it cannot be fixed at installation, ask the customer to fix it later.

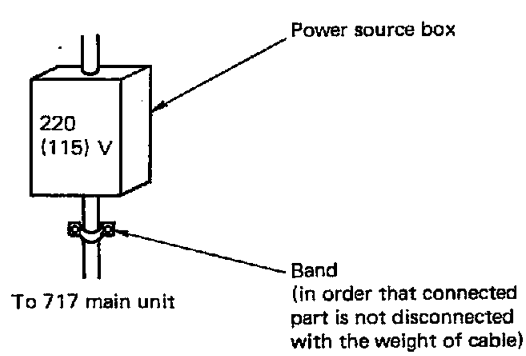


Fig. 4-1-10

4-1-7 Preparation before Operation

(1) Water Supply to Cold Water Tank

(a) Remove rear right cover (cold water tank is positioned in middle lower part of main unit). Remove rubber cap on cold water tank and supply distilled water or deionized water with hose pump.

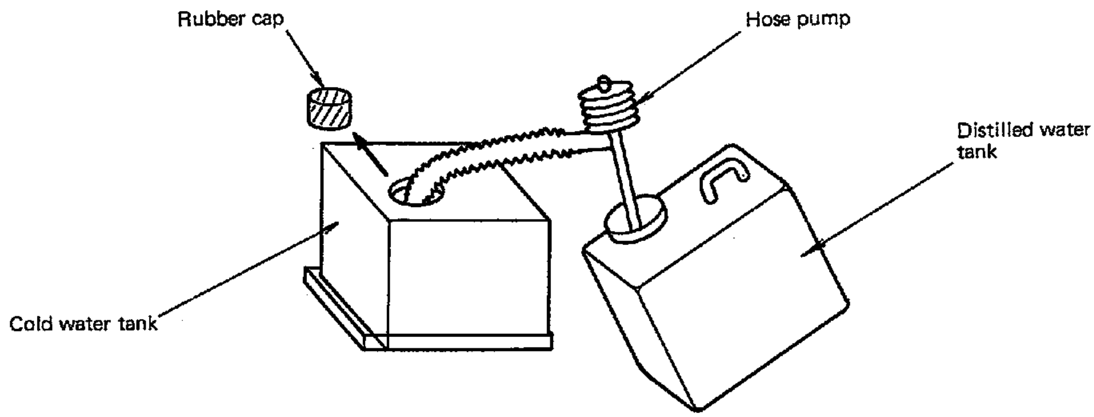


Fig. 4-1-11

(b) Open left side cover, turn the main SW ON at lower left part, then cooling unit starts to run and water level in cold water tank decreases. So repeat (a) and make sure that cold water tank is filled with water.
Turn the main SW OFF and put the rubber cap on.

(2) Water Supply to Distilled Water Tank

(a) Take the distilled water tank out of main unit.
Clean it and supply distilled water or deionized water.

(b) Return the tank to main unit and connect one-touch joint.

(3) Extran Bottle

(a) Install Extran bottle in specified position and insert a tube.

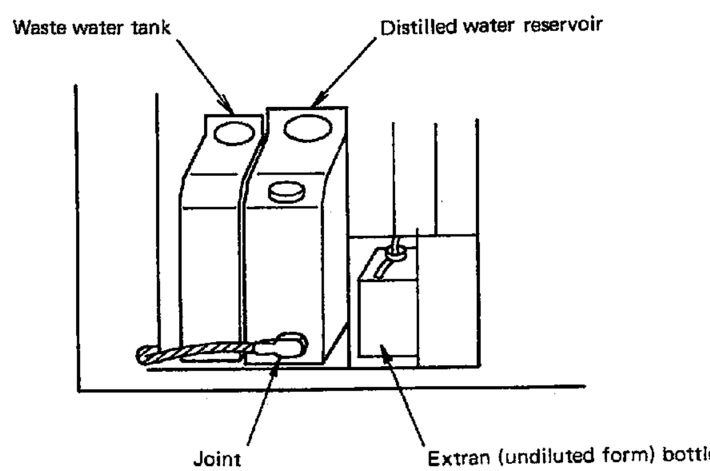


Fig. 4-1-12

(4) Insert F/D.

(a) Remove magnet head protecting sheet from F/D drive.

(b) 'Prepare two floppy disks belonging to the instrument.
- Insert system disk in F/D 1.
- Insert data file disk in F/D 2.

(5) Clean Incubation Bath (only when incubation bath is contaminated).

(a) Remove rinse nozzle.

(b) Clean incubation bath with wet gauze.
Be very careful not to damage photometric window.

(c) Attach rinse nozzle.

4-1-8 Startup

(1) (a) Turn knife SW ON.

(b) Open right side cover of main unit and turn on the main SW on right part. (Only cooling unit begins to run.)

(c) Turn on the SW on main unit operation panel.

(d) F/D drive starts, and RAM CHECK is performed.

(e) Initial screen appears and next OPERATION MONITOR screen is displayed to check instrument status.

(f) Each mechanism begins initial action and water in incubation bath is exchanged once.

(g) At STAND-BY condition, input START (1) at INC. WATER EXCHANGE on MAINTENANCE screen and exchange water.
Till Extran is fully circulated, exchange water 5 or 6 times. (It would be better to use HX-20 program for filling Extran in tubing.)

Note: Before (a), open the water cock and power-on the SW of D. I water supply unit.
Check that water supply unit and main unit water inlet are free of leakage.

(2) Attachment of Sampling Probe, R1 and R2 Probes.

(a) Attachment of Sampling Probe, R1 and R2 Probes.
Attach R1 and R2 probes to R1 and R2 arms.
Do not overtighten so that nozzle seal won't be broken.

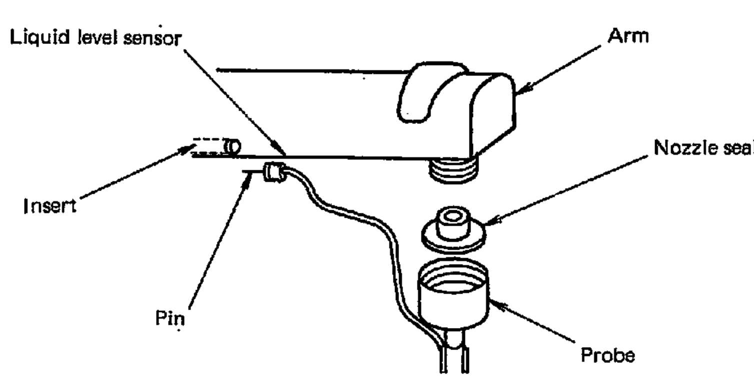


Fig. 4-1-13

(3) Install Reaction Cuvette.

(a) Clean reaction cuvette inside.
(Be very careful not to damage photometric window.)

(b) Install the cuvette as shown in Fig. 4-1-14.

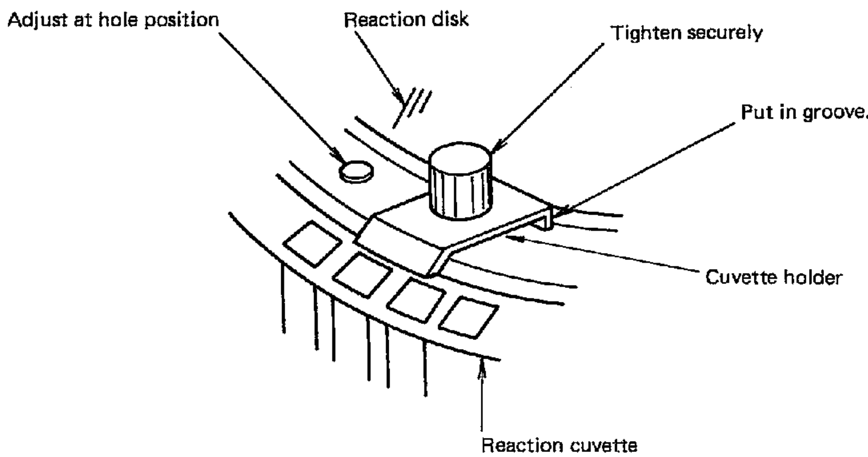


Fig. 4-1-14

(4) Battery Connector (J483)

(a) Open front right cover.

(b) Connect BATT. BACK UP (J483) in front middle.
This connector is for memorizing date and time.
Be sure to connect it.

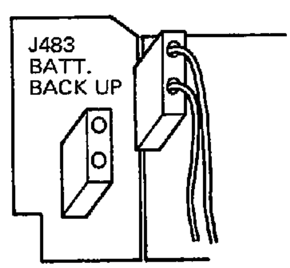


Fig. 4-1-15

(5) Remove Fixing Screw (M5 × 6 screw) for Vacuum Pump.

(a) Open front right cover and remove inner cover.

(b) Unscrew fixing screw as shown in figure below.

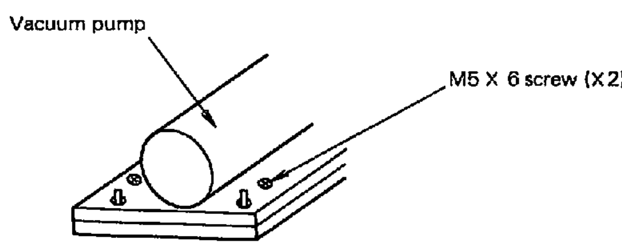


Fig. 4-1-16

4-1-9 Adjustment

(1) Probe Position

(a) Execute "PROBE ADJUST" on MAINTENANCE screen.

(b) Each probe should stop above the cell as shown in Fig. 4-1-17.

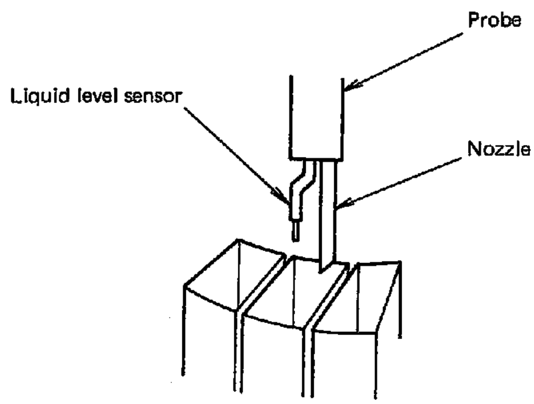


Fig. 4-1-17

(c) Adjust each probe or hex screw on arm so that nozzle tip is located at the center of cell. Sampling probe is lowered into the cell. Adjust sensor and nozzle so that they cannot touch the wall of the cell.

(d) Stop "PROBE ADJUST" with STOP key.

(e) Make sure that each probe does not touch at INITIAL condition. (See figure below.)

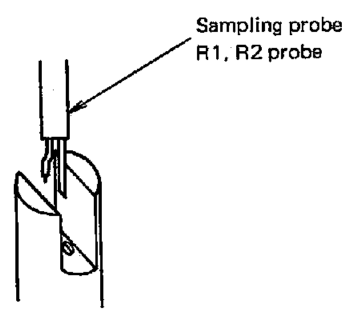


Fig. 4-1-18

(f) Execute "SAMPLING MECHA" on MAINTENANCE screen.
Make sure that sampling nozzle is located at the center of reaction cuvette or sample cup, and press STOP key.

(2) Check Water Volume in Reaction Bath.

(a) Execute "INC. WATER EXCHANGE" on MAINTENANCE screen.

(b) At STAND-BY, check water volume in reaction bath.

(c) Make sure visually that instrument is located vertically.

(3) Check Rinse Volume.

(a) Execute "RINSE" on MAINTENANCE screen.

(b) Make sure that rinsing nozzle descends into the center of the cell.

(c) Check visually that cell is full with 2 mm space from its upper rim. If the cell is not full or water overflows, adjust it as shown in Fig. 4-1-19.

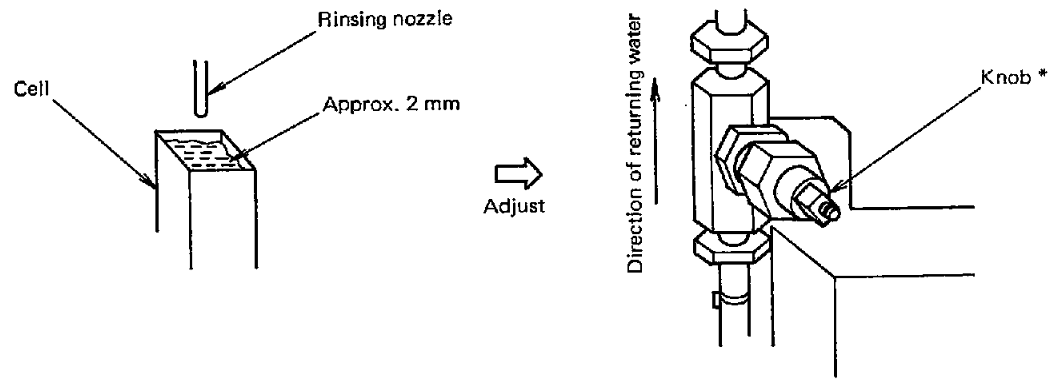


Fig. 4-1-19

Note *: Upon turning the knob clockwise, flowpath is closed, water volume which goes to distilled water reservoir decreases, and rinse water and water dispensed from rinsing bath increase.

(4) Gear Pump Pressure

(a) Open left side cover of main unit.

(b) Check gear pump pressure with pressure gauge. (1.5 kg/cm^2).

(c) If not at 1.5 kg/cm^2, adjust hex screw at gear head with hex wrench.

(5) Location of R1, R2 Stirring Mechanism

(a) Make sure that R1 and R2 stirring rod is not bent.

(b) Execute "STIRRER" on MAINTENANCE screen.

(c) Make sure that R1 and R2 stirring mechanism is at the center of reaction cuvette or rinsing bath when it lowers.

4-1-10 Efficiency Test

(1) Make Sure of F/D Version.

(a) After power ON, screen (1) appears.
Make sure of F/D version.

```
            HITACHI AUTOMATIC ANALYZER
        COPYRIGHT (C) HITACHI, LTD. 1987

     SYSTEM FD VERSION:7176000-01-24
     DATA FD VERSION  :7176001-00-01

               JOB SELECTION KEY?
```

Screen (1)

(b) Call MAINTENANCE screen [screen (2)] and execute "MEMORY CHECK".
Make sure that there is no abnormal sum value on ROM and RAM.

```
 MAINTENANCE

INC. WATER EXCHANGE [      ]
CELL BLANK ---------[      ]
RESET --------------[      ]
PROBE ADJUST -------[      ]
PARAMETER READ/WRITE[      ]
FD UTILITY ---------[             ]
PRECISION CHECK ----[     ]-[     ]
SAMPLING MECHA. ----[     ]
DISK ---------------[     ]
REAGENT1 PIPETTING -[     ]
REAGENT2 PIPETTING -[     ]
STIRRER ------------[     ]
BAR CODE READER ----[     ]
MEMORY CHECK -------[      ]
PRINTER CHECK ------[      ]
LOG OUT ------------[           ]
```

Screen (2)

(c) Execute "PRINTER CHECK" on MAINTENANCE screen.
Make sure that printer runs normally.

(d) Call "1 TEST NAME" screen [screen (3)] of PARAMETER JOB screen.
Make sure that test name is input.

```
 TEST NAME

TEST        [  ]    TEST NAME [      ]

CODE NAME CODE NAME CODE NAME CODE NAME
   1 GOT    16        31        46 I
   2 LDH    17        32        47
   3 TP     18        33        48
   4 IP     19        34        49
   5        20        35        50
   6        21        36        51
   7        22        37        52
   8        23        38        53
   9        24        39        54
  10        25        40
  11        26        41 NA
  12        27        42 K
  13        28        43 CL
  14        29        44 L
  15        30        45 H

 CODE   1-40:NORMAL      41-43:NA,K,CL
       44-46:L,H,I       47-54:CALCULATION
```

Screen (3)

```
CHEMISTRY PARAMETERS
TEST                 [GOT   ]
ASSAY CODE           [RATE-A   ]:[32]-[50]
SAMPLE VOLUME        [15]
R1 VOLUME            [300][100][NO ]
R2 VOLUME            [ 60][100][NO ]
WAVE LENGTH          [405][340]
CALIB. METHOD        [K FACTOR ][0][0]
STD.(1) CONC.-POS.[      0]-[ 1]
STD.(2) CONC.-POS.[      0]-[ 0]
STD.(3) CONC.-POS.[      0]-[ 0]
STD.(4) CONC.-POS.[      0]-[ 0]
STD.(5) CONC.-POS.[      0]-[ 0]
STD.(6) CONC.-POS.[      0]-[ 0]
SD LIMIT             [    0.1]
DUPLICATE LIMIT      [ 1000]
SENSITIVITY LIMIT    [     0]
ABS.LIMIT(INC/DEC)   [ 3000][DECREASE]
PROZONE LIMIT        [      0][LOWER]
EXPECTED VALUE       [      0]-[    150]
PANIC VALUE          [      0]-[   2000]
INSTRUMENT FACTOR [1.00]
```

Screen (4)

(e) Call "2 CHEMISTRY PARAMETERS" screen [screen (4)] of PARAMETER JOB screen. Make sure that chemistry parameters for the test to be measured are input.
At installation, four parameters are GOT, LDH, TP and IP.

(f) Call "2. PATIENT TEST SELECTION" and "3. CALIBRATION and . . . " of ROUTINE JOB screen.
Make sure that above 4 parameters for 30 samples are input.

(g) Select "5. START CONDITIONS" screen and start analysis.

(h) After finishing analysis, make sure that precision satisfies the specifications by executing "PRECISION CHECK" on MAINTENANCE screen.

< INC. WATER EXCHANGE >

- Incubation Water Exchange

(1) Function

Water contained in incubation bath is exchanged twice.

(2) Key-in Procedure

Enter "1" for INC. WATER EXCHANGE shown on the MAINTENANCE display while the Model 717 is in standby status.
Upon completion of exchanging the water, the analyzer is put back again to standby status.
The water exchange cannot be interrupted halfway even by depressing the STOP key.

(3) Operation

Photometer light source lamp OFF MD15RG pump for circulation in incubation bath stopped
↓
Water discharged from incubation bath (60 sec)
↓
Water supplied to incubation bath with MD20RZG magnet pump (32 sec)
↓
Water discharged from incubation bath (60 sec)
↓
Water supplied to incubation bath with MD20RZG magnet pump (32 sec)
↓
Extran supplied with Extran pump (15 sec)
↓
MD15RG pump for circulation in incubation bath rotated
↓
Photometer light source lamp ON MD20RZG pump for water supply to incubation bath OFF

Notes: 1. The incubation bath is not temperature-controlled while water is exchanged.

2. During the water exchange, the following items are not detected.
   - Shortage of water in the distilled water tank (10 ℓ)
   - Temperature of the incubation bath
   - Water volume in the incubation bath

<CELL BLANK>

- Cell Blank Measurement

(1) Functions

- Water blank absorbances (photometer readings with water in each cell) at 12 wavelengths are measured for all cells (cells 1 through 120).
- The cell blank absorbances measured with this function are used for cell blank check in actual measurement.

(2) Key-in Procedure

Enter "START" for the CELL BLANK of the MAINTENANCE display.

(3) Operation

1) The mechanical parts are reset.
2) The cell at the reaction disk rinse start position is rinsed.
3) When the rinsed cell is moved to one step behind the photometric position, it is further fed as much as 1/2 of the cell (until the center portion of the cell is aligned with that of the photometer optical path). Its absorbances are measured at all 12 wavelengths.
   After completing the absorbance measurements, the results are printed out onto the printer.
   Note that the absorbance of the 1st cell is subtracted from those of the 2nd cell onward before they are printed out.
4) Upon completion of measuring all cells (120 cells), the results are written into a floppy disk.

Notes: 1. The operations described in 2) through 4) above are completed within one cycle or 5 seconds.

2. If the STOP key is depressed, or the STOP alarm is issued during the above operation, the system stops the rest of the operation.
   In this case, the measurement results will not be written into a floppy disk.

<RESET>

- Resetting for Maintenance

(1) Function

All mechanical parts are returned to their respective home positions. If any of them is already at the home position, it will be operated once (excluding the rinse mechanism). When no abnormality is found, the part will be put back to the home positon. The operation will be completed within 22 seconds (26 seconds for the 717 with ISE).

(2) Key-in Procedure

Enter "1" for the RESET shown in the MAINTENANCE display while the Model 717 system is in standby status. Once this function is activated, then it cannot be ceased by depressing the STOP key.
After completion of the resetting function, the automatic analyzer will be put back in standby status.

(3) Operation

① Rinse mechanism initialize
↓
② Stirring mechanism initialize
↓
③ Sample probe initialize
↓
④ Reagent probe initialize
↓
⑤ Sample disk initialize
↓
⑥ Reagent disk initialize
↓
⑦ Reaction disk initialize

① Rinse Mechanism Initialize
- (a) The rinse mechanism moves up to the upper dead point.
  If it is already at this point, it remains unmoved.
- (b) Rinse operation is not made.

② Stirring Mechanism Initialize
- (a) The stirring mechanism moves up to the upper dead point.
  If it is already at this point; it remains unmoved.
- (b) The rinse rod comes once to the cell side and is put back to the rinse bath.
- (c) The rod moves down to the rinse bath where it is thoroughly rinsed with deionized water while being rotated.
- (d) The stirring mechanism moves up to the upper dead point.

③ Sample Probe Initialize
- (a) The sample probe moves up to the upper dead point.
  If it is already at this point, it remains unmoved.
- (b) If the probe is at the home position (on the cell side), it is deviated as much as 100 pulses from the home position.
  If not at the home position, the probe remains unmoved.
- (c) The probe is brought back to the home position.
- (d) It is then fed to the rinse bath.
- (e) If the sample syringe is at the upper dead point, it is deviated as much as 170 pulses from the dead point.
  If not at the dead point, it remains umoved.
- (f) The probe then moves down to the rinse bath where its outside is thoroughly rinsed with deionized water.
- (g) The sample syringe moves up to the upper dead point.

④ Reagent Probe Initialize

(a) The reagent probe moves up to the upper dead point.
When the probe is already at this point, it remains unmoved.

(b) If the probe is at the home position (on the cell side), it is deviated as much as 100 pulses from the home position.
If not at the home position, the probe remains unmoved.

(c) The probe moves to the home position.

(d) It is further fed to the rinse bath.

(e) If the reagent syringe is at the upper dead point, it is deviated as much as 170 pulses from the dead point.
If not at the upper dead point, the syringe remains unmoved.

(f) The outside of the reagent probe is thoroughly rinsed with deionized water.

(g) The reagent syringe moves up to the upper dead point.

⑤ Sample Disk Initialize

The sample disk moves to the home position.
Note, however, that if the sample probe is not at the upper dead point, an alarm is issued instead of turning the sample disk.

⑥ Reagent Disk Initialize

The reagent disk moves to the home position.
Note, however, that if the reagent probe is not at the upper dead point, an alarm is issued instead of turning the reagent disk.

⑦ Reaction Disk Initialize

The reaction disk is reset to the home position.
Note, however, that if there is an abnormality in any of the rinse mechanism, stirring mechanism, sample probe, and reagent probe, an alarm is issued instead of resetting the reaction disk.

Notes:

1. The distilled water supply pump is started before starting the RESET.
2. The valves SV20/21 of the rinse mechanism are opened to admit air into the vacuum tank (for 5 seconds) before turning ON the vacuum pump at RESET start.
3. The ADC's for absorbance measurement and temperature control are calibrated upon completion of the RESET.
4. When the RESET is completed, the Model 717 is put in standby status, then the distilled water supply pump and gear pump are turned off, followed by stopping the vacuum pump.
Finally the valves SV20/21 of the rinse mechanism are opened (for 5 seconds) to admit air into the vacuum tank after stopping the vacuum pump.

<PROBE ADJUST>

- Probe Adjustment

(1) Function

The sample probe, reagent probe and stirring rod are rotated to the cell side, where each of them is repositioned.

(2) Key-in Procedure

Enter "1" for the PROBE ADJUST via the MAINTENANCE display while the Model 717 is in standby status.
Upon completion of adjusting the probe, depress the STOP key to complete the adjustment function.
Upon completion of the PROBE ADJUST, the Model 717 is put again in standby status.

(3) Operation

① Probe position adjustment on cell side
↓
② End processing after depressing STOP key

① Probe Position Adjustment on Cell Side
(a) Three probes and stirring rod are brought to the cell side.

② End Processing after Depressing STOP Key
Upon depressing the STOP key, the probes and stirring rod return to the rinse bath position.

<SAMPLING MECHA>

- Sampling Mechanism Test

(1) Function

The sample probe, sample syringe, and other related mechanical parts are tested as many times as specified.

(2) Key-in Procedure

- Place the sample cups containing physiological salt solution (or city water) at the 2 positions on the sample disk (those marked 1 on the outer row, and W on the inner row).
- Specify the number of tests for the SAMPLING MECHA shown on the MAINTENANCE display while the Model 717 is in standby status.
  After the parameter is entered, the testing can be interrupted by depressing the STOP key.
- Upon completion of the testing, the analyzer is put back in standby status. Remove the sample cups containing physiological salt solution (or city water).

(3) Operation

① Mechanism initialize
↓
② Sample probe control
↓
③ Reaction disk control
↓
④ Rinse mechanism control

① Mechanism Initialize
Same as the "Resetting for Maintenance". See page 4-15.

② Sample Probe Control

(a) The sample probe automatically operates as many times as specified for each cycle (6 seconds).

(b) The sample probe performs pipetting once for each cycle, and repeatedly pipets samples on the outer and inner rows in this order.

(c) The probe is fed to the sampling position where it moves down for aspirating 7 $\mu\ell$ of air, 12 $\mu\ell$ of dummy, and 3 $\mu\ell$ of physiological salt solution (or city water), and then moves up.

(d) The probe is then brought to the cell side where it moves down to the cell, and then discharges 3 $\mu\ell$ of physiological salt solution (or city water).

(e) Upon completion of discharging the physiological salt solution (or city water), the probe moves to the rinse bath where it discharges the remaining contents.
After discharging them, the inside and outside of the probe are thoroughly rinsed with deionized water.

(f) The operations (c) through (e) above are repeated as many times as specified.

③ Reaction Disk Control
Same as ② of "Disk Mechanism Test".

④ Rinse Mechanism Control
Same as ⑤ of "Disk Mechanism Test".

<DISK>

- Disk Mechanism Test

(1) Function

The reaction disk, reagent disk, sample disk and rinse mechanism are operated in the same way as in actual analysis to check their operation.
Further, the rinse mechanism is also checked for aspiration and discharge of deionized water.

(2) Key-in Procedure

Specify the number of tests for the DISK shown on the MAINTENANCE display while the Model 717 is in standby status.
After this parameter is specified, then the testing can be ceased by depressing the STOP key.
Upon completion of the testing, the analyzer is put back in standby status.

(3) Operation

1 Mechanism initialize
↓
2 Reaction disk control
↓
3 Reagent disk control
↓
4 Sample disk control
↓
5 Rinse mechanism control

1 Mechanism Initialize
Same as 1 through 7 shown in "Resetting for Maintenance".

2 Reaction Disk Control
The reaction disk is rotated as much as a half turn plus 1 cell on the assumption that 1 cycle is 6 seconds like in actual analysis. (Pause occurs in the cycle.)
This is repeated as many times as specified.

3 Reagent Disk Control
Both R1 and R2 are rotated as much as 1 channel each.

4 Sample Disk Control
The sample disk is rotated as much as 1 cup 6 times on the outer row and 5 times on the inner row.

5 Rinse Mechanism Control
(a) The rinse mechanism moves down to the lower dead point every time the reaction disk stops, where the nozzles aspirate the solution in the reaction cells and discharge deionized water into the cells as well.
(b) The rinse mechanism moves up to the upper dead point after lapse of the specified time.
(c) The operations (a) and (b) are performed as many times as specified (at the same timing as in actual analysis).

<REAGENT 1/2 PIPETTING>

- Reagent Pipetting Mechanism Test

(1) Function

The reagent pipetting mechanisms such as the reagent probe, reagent disk, and reagent syringe are operated as many times as specified in the same way as in actual analysis.
Both the reaction disk and rinse mechanism are also operated to prevent reagent from overflowing.

(2) Key-in Procedure

- Replace the R1 and R2 reagents assigned to CH32 with test reagents or deionized water if necessary.
- Once the parameter is entered, the testing can be interrupted halfway by depressing the STOP key.
- Upon completion of the testing, the analyzer is put back in standby status. Be sure to replace the test reagents or deionized water with the initial ones.

(3) Operation

① Mechanism initialize
↓
② Reagent disk control
↓
③ Reagent probe control
↓
④ Reaction disk control
↓
⑤ Rinse mechanism control

① Mechanism Initialize
Same as the "Resetting for Maintenance".

② Reagent Disk Control

- The reagent disk rotates to the CH32 position within 1 cycle and does not operate after that.

③ Reagent Probe Control

(a) The reagent probe operates as many times as specified on the assumption that 1 cycle is 6 seconds.

(b) The probe performs pipetting of reagent once within 1 cycle.

(c) The probe moves to the reagent pipetting position where it moves down for aspirating 22 $\mu\ell$ of air, 50/16 + 10 $\mu\ell$ of dummy, 17 $\mu\ell$ of BL and 50 $\mu\ell$ of reagent, and then moves up.

(d) The probe then rotates to the cell side where it discharges 50 $\mu\ell$ of reagent into the cell.

(e) After discharging the reagent, the probe is fed to the rinse bath where it discharges the remaining solution.
Upon completion of the above, the inside and outside of the probe are thoroughly rinsed with deionized water.

(f) The operations (c) through (e) above are performed for R1 and R2 as many times as specified.

④ Reaction Disk Control
Same as ② of "Disk Mechanism Test".

⑤ Rinse Mechanism Control
Same as ⑤ of "Disk Mechanism Test".

Note: The volume of reagent remains unchanged even if this test is performed.

<STIRRER>

- Stirring Mechanism Test

(1) Function

The stirring mechanism is allowed to operate in the same way as in actual analysis to check if it works normally.
It will be operated as many times as specified.

(2) Key-in Procedure

Specify the number of test operations for the STIRRER shown on the MAINTENANCE display while the Model 717 is in standby status.
Once this parameter is entered, then the testing can be ceased by depressing the STOP key.
Upon completion of the testing, the analyzer comes to standby status.

(3) Operation

1 Mechanism initialize
↓
2 Stirring mechanism control

1 Mechanism Initialize
Same as 1 through 7 of the "Resetting for Maintenance".

2 Stirring Mechanism Control

(a) The stirring mechanism moves to the cell side where the stirring rod moves down to the cell, and is rotated for the specified time.
Upon completion, the rod moves up.

(b) The stirring rod is fed to the rinse side where it moves down into the rinse bath, and is rotated for the specified time.
Upon completion, the rod moves up.

(c) The operations (a) and (b) above are performed on both R1 and R2 within 1 cycle set to 6 seconds. They are repeated as many times as specified.

< LOG OUT >

(1) LOG OUT (DAILY)

(a) Input "1" at LOG OUT in Maintenance screen, and then print out daily LOG OUT.

(b) The contents of this LOG OUT are Alarm & Retry information occurring after power on. (Max. 1,000 cycles)

(c) The order of printing is latest one to old.

(d) This LOG OUT information is cleared by completion of printing LOG OUT, depressing STOP key during printing LOG OUT, and power OFF.

(e) Details of this LOG OUT;

i) Alarm

09:15 7 10 A 020 – 030 – 001 100 – 065 – 002........

Occurrence time in cycle (X 100 msec)

Alarm code

Indication of alarm

No. of occurrence

Status of instrument (status code)

Hour : min.

Table 4-2-1 Status Codes

No.	STATUS	No.	STATUS
1	Initialize	12	ISE PRIME (IS, DIL)
2	Stand-by	13	ISE PRIME (KCL)
3	Preparation for operation	14	Inc. water exchange
4	Operation	15	Cell blank
5	E. Stop	16	Reset
6	Photometer check	17	Probe adjust
7	WASH (ALL)	18	Sampling mecha.
8	WASH (CELLS)	19	Disk mecha.
9	WASH (ISE)	20	R1 mecha.
10	WASH (AIR PURGE)	21	R2 mecha.
11	ISE PRIME (START UP)	22	Stirrer mecha.
		23	Bar-Code reader

ii) Retry

09:15 7 1 R 100 – 001 – 005 101 – 005 – 002.........

Occurrence time in cycle (X 100 msec)

Retry times

Retry code

Indication of retry

No. of occurrence

Status of instrument (status code)

Hour : min.

Note: In both Alarm and Retry, eight kinds of alarm (Retry) in 4 cycles can be memorized in F/D. (At power on, it is cleared.)
If Alarm (Retry) occurred in more than eight kinds, only the first eight kinds are memorized while the rest are not.

(2) LOG OUT (CUMULATIVE)

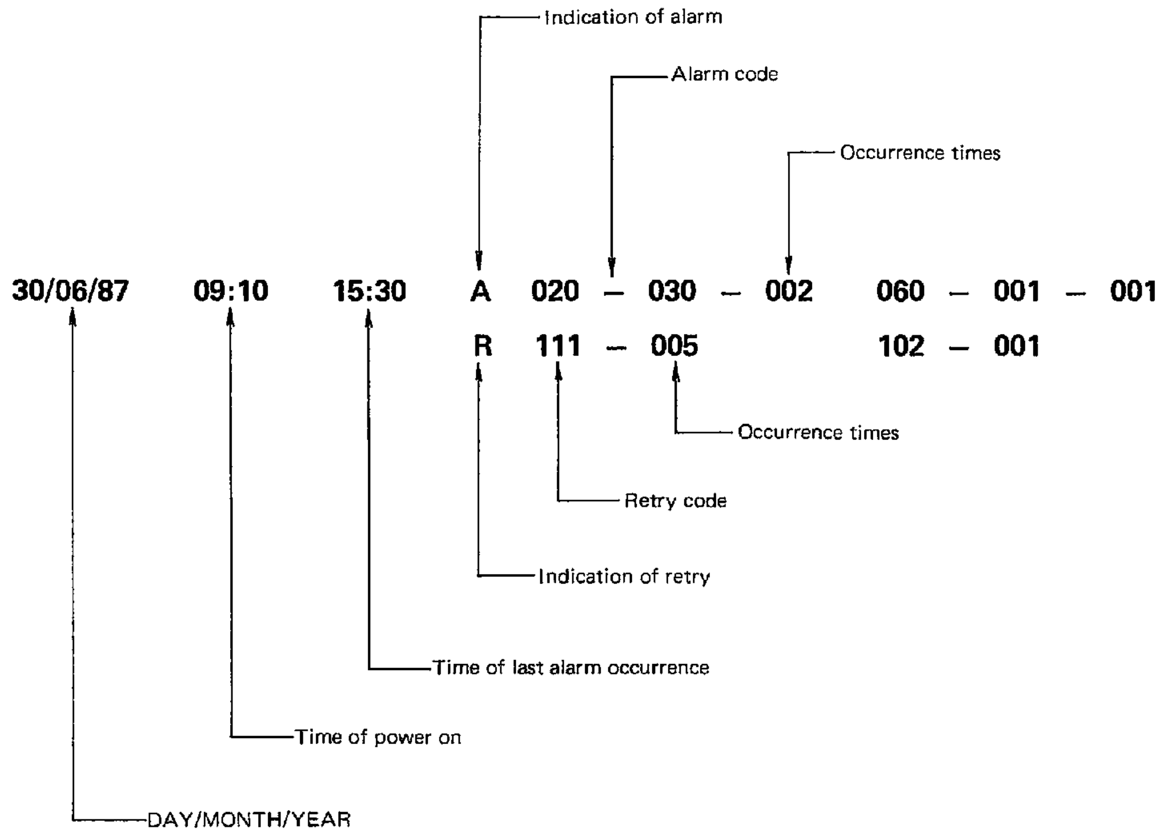
(a) Input "2" at LOG OUT in maintenance screen, and then this LOG OUT is printed out.

(b) Alarm & Retry information occurring between power on and power off are memorized as one day's information. (Max. 256 days)
In case of 24 hours power on, Alarm or Retry information will be memorized automatically when changing date as one day's information.
After this point, Alarm & Retry information will be memorized as next day's information.

(c) In case no Alarms & Retrys occurred in a day, only date is printed out.

(d) In case power on and off are done several times in a day and there are some Alarms or Retrys, they are memorized individually. (One time of power on/off is counted as one day even if done several times in a day.)

(e) This LOG OUT information is cleared by completion of printing out this LOG OUT, or by depressing STOP key during printing out this LOG OUT.



(3) Operation Sum Trace

(a) Input "3" at LOG OUT in maintenance screen, and then this trace is printed out.

(b) Cumulative power-on time, cumulative operation time, and cumulative test count are memorized in CMOS RAM. (Can be reset through HX-20 program.)

(c) F/D access count is reset at F/D copy. (Copied F/D is reset, original F/D is not reset.)

(4) Communication Trace

(a) Input "4" at LOG OUT in maintenance screen, and this trace is printed out.

(b) This trace is activated in case of setting SW 17 of TRI ADC PCB on.

(c) Details;

Start time of communication (717 → HOST) or time of assuming waiting condition for receiving (HOST → 717)

Finished time of communication

Direction of communication

Error message

10:40:13 – 10:40:14 717 → HOST TIMEOUT ERROR

STX

51K 405 3 5 KLMNOPQ ← Contents of TEXT

Table 4-2-2 Error Messages

ERROR MESSAGE	DESCRIPTION	PRINTING TEXT in List
ALL SPACE	Normal communication	Comm. function No. & sample inf.
TIME OUT ERROR (717 → HOST)	At sending TEXT to HOST, sending TIME OUT occurred.	Same as above
TIME OUT ERROR (HOST → 717)	At receiving TEXT from HOST, receiving TIME OUT occurred.	All data until TIME OUT occurred are printed.
RECEIVE ERROR (HOST → 717)	Receiving ERROR occurred.	ALL data are printed out.
CHARACTER ERROR (HOST → 717)	Invalid character in TEXT.	All data until invalid character are printed.
FORMAT ERROR (HOST → 717)	The length of TEXT was wrong.	All data are printed.
BCC ERROR (HOST → 717)	BCC error was found.	All data except BCC char. are printed.

4-3 WASH Functions

<WASH ALL>

(1) Functions

"WASH ALL" has the following two functions.

1) The sample probe, reagent probe, reaction cell, and stirring rod are rinsed with deionized water.

2) The sample probe and reagent probe are moved to the rinse bath where each of them is rinsed with deionized water, and at the same time air bubbles are purged from water in tubes.

(2) Key-in Procedure

- Enter either "1" or "2" for the WASH shown in the START CONDITIONS display while the Model 717 is in standby status.
  Upon completion of the rinse operation, the analyzer is put in standby status.
- Of these 2 functions, 2) cannot be interrupted after each mechanical part is reset.
  On the contrary, the function 1) can be ceased at any desired time.
- For the function 1), it is necessary to replace the reagent bottle on CH32 of the R2 disk with rinse water bottle in advance and set rinse water at position "W" of the sample disk.
  Note that the rinse water bottle on CH32 of the R2 disk should be replaced with the reagent bottle upon completion of the rinsing.

(3) Operation

- Processing of Function 1)

(1) Mechanism initialize
↓
(2) Sample probe rinse
↓
(3) Reaction cell rinse
↓
(4) Stirring mechanism rinse
↓
(5) Reagent probe rinse

(1) Mechanism Initialize
Same as (1) through (7) of "Resetting for Maintenance".

(2) Sample Probe Rinse

(a) The sample disk rotates until the rinse cup on the inner row of the disk comes to the sampling position.

(b) The sample probe aspirates 40 $\mu\ell$ of rinse water, and then is fed to the rinse bath.

(c) The probe discharges the rinse water, and then its inside is rinsed with deionized water.

(d) In the same condition, the outside of the probe is rinsed with deionized water.

(e) The operations (b) through (d) are repeated 10 times with 1 cycle set to 5 seconds.

③ Reaction Cell Rinse
(a) The reagent disk rotates until the reagent bottle assigned to CH32 of the R2 disk comes to the reagent pipetting position.
(b) The reaction disk rotates as much as 3 cells each while the cells are rinsed with the rinse mechanism (40 cycles).
Then, the disk rotates as much as 7 cells each while aspirating rinse water with the rinse mechanism.
(c) The reagent probe moves to the R2 aspirating position where it aspirates 500 $\mu\ell$ of rinse water, and then moves to the cell position.
(d) The probe then moves down toward the cell for the specified distance for discharging the rinse water. After this, it is further rinsed in the rinse bath.
(e) The reaction disk rotates as much as 1 cell.
(f) The steps (c) to (e) are repeated for all cells (120 cells) for pipetting rinse water to them with 1 cycle set to 5.2 seconds.

④ Stirring Mechanism Rinse
(a) Upon completion of the above, the stirring mechanism is rinsed.
(b) The stirring mechanism rotates to the cell side where it moves down, and then lets the stirring rod rotate in the reaction cell filled with rinse water.
Upon completion of being rinsed, the rod moves up.
(c) The mechanism comes back to the rinse water bath where the stirring rod moves down into the bath and is rinsed while being rotated for the specified time.
Upon completion of the rinse, the rod moves up.

- Processing of Function 2)

① Mechanism initialize
↓
② Sample probe rinse and air purge
↓
③ Reagent probe rinse and air purge
↓
④ Air purge from deionized water in stirring mechanism rinse system

① Mechanism Initialize
Same as ③ and ④ of the "Resetting for Maintenance".

② Sample Probe Rinse and Air Purge
(a) The sample probe is fed to the rinse bath where it moves down.
(b) The probe and sample probe rinse system discharge deionized water for 9 seconds to rinse both the inside and outside and purge air bubbles.
At this time, the syringe moves down and up.
(c) The discharge of deionized water is stopped for 1 second.
(d) The operations (b) and (c) are repeated 3 times for completely discharging the deionized water in tube and the probe.

③ Reagent Probe Rinse and Air Purge

(a) The probe and reagent probe rinse system discharge deionized water for 9 seconds to rinse both the inside and outside of the probe and to purge air bubbles.
At this time, the syringe moves down and up.

(b) The discharge of deionized water is stopped for 1 second.

(c) The operations (a) and (b) are repeated 3 times for completely discharging the deionized water in tube and the probe.

Note: The operations ② and ③ are started at the same time.

< Initialize >

- The following describes the "Initialize" processing to be performed at power ON.

1. Activation of distilled water supply pump, water circulation pump for incubation bath, water circulation pump for heater unit, and gear pump
2. 24 V DC ON
3. Mechanism initialize and vacuum pump ON
   Same as ① through ⑦ described in "Resetting for Maintenance".
4. Calibration of ADC's for both absorbance measurement and temperature control
5. Incubation bath water exchange
   Same as "Incubation Water Exchange" in maintenance.
6. Photometer light source ON
7. Air purge from deionized water
   Same as "WASH ALL" for maintenance (see 4-3).

Note: When the Model 717 is put in standby status, the distilled water supply pump, gear pump and the vacuum pump are turned off.
The suction valves SV20 and 21 of the rinse mechanism are opened for 5.0 seconds to admit air into the vacuum tank (to reduce vacuum degree in the tank) after stopping the vacuum pump.

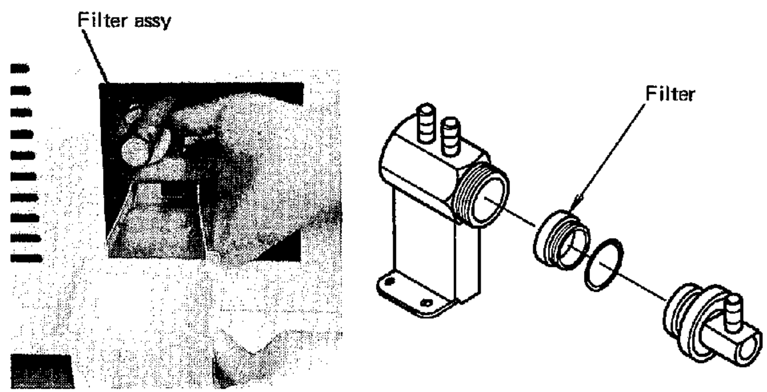
4-4 Preventive Maintenance Procedure

4-4-1 Maintenance Log

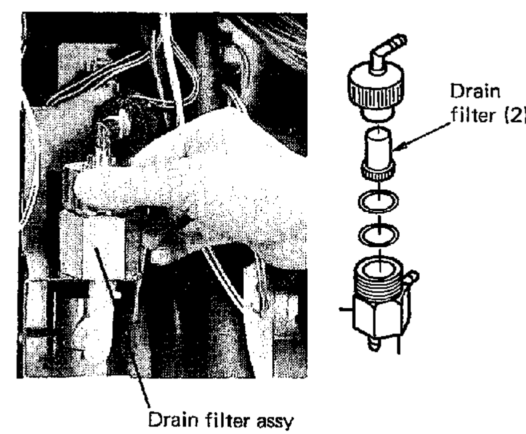
Table 4-4-1 Interval: 3 Months (1/6)

Mark: V: Visual Check E: Exchange C: Cleaning O: Overhaul A. Adjust

Item	Check Points	Mark	Procedure
Reaction bath	Water volume, level, temperature, circulation (MD15R)	V	Execute "Inc. WATER EXCHANGE" screen, and then measure distilled water consumption (approx. 2.0 ℓ), check the level of the reaction bath water, check the INCUBATOR TEMP. 25/30/37°C ± 0.2°C on OPERATION MONITOR screen.
	Window (crack, dirty)	V C	Take out the reaction disk with cuvettes. Then check the window of reaction bath and wipe the window with gauze while carefully protecting from scratches.
	Reaction bath (dirty, filter)	C	Wipe the reaction bath inside with gauze. Remove the filter (1) and drain filter (2) (refer to below) and clean filter with water or brush.



(Inside of left side)



(Middle of rear side)

Filter (1) and Drain Filter (2)

Table 4-4-1 Interval: 3 Months (2/6)

Item	Check Points	Mark	Procedure
Reaction bath	Level sensor (dirty)	C	Take out the level sensor from reaction bath assy and wipe the electrode of level sensor with alcohol.
	Reaction cuvettes (crack, scratch)	E	Remove the cuvettes from reaction disk and replace with new ones.
Photometer	Lamp (poor light, fitting)	V	Execute "PHOTOMETER CHECK" on START CONDITIONS screen. • Specification: less than 16000
	Lamp cooling water circulation	V	Take out the reaction disk and touch the lamp housing. If temperature is too high, check if tubing is bent or clogged.
	CELL BLANK Value	V	Execute "PHOTOMETER CHECK" on START CONDITIONS screen. • Specification: less than 16000
S. probe mecha.	Nozzle (dirty, clogging, damage)	C E	Wipe the nozzle outside with alcohol. Loosen the probe retaining nut and remove the probe. Then insert a stainless steel wire of 0.3 mm dia. from the probe top and run it through for cleaning. If the nozzle has been damaged, it should be replaced with a new one.
	Level sensor (dirty, damage)	C E	Wipe the electrode of level sensor with ether. Replace with a new one if damaged.
	Cushion condition	V A	Execute "SAMPLING MECHA." on MAINTENANCE screen. If the S. Probe could not be cushioned in reaction cuvettes during SAMPLING MECHA, check if S. Probe moves up and down by hand and adjust the S. Probe height. (check it with spacer)
R1/R2 probe mecha.	Nozzle (dirty, clogging, damage)	C/E	Same as S. Probe Mecha.
	Level sensor (dirty, damage)	C/E	Same as S. Probe Mecha.
	Cushion condition	V/A	Same as S. Probe Mecha.

Table 4-4-1 Interval: 3 Months (3/6)

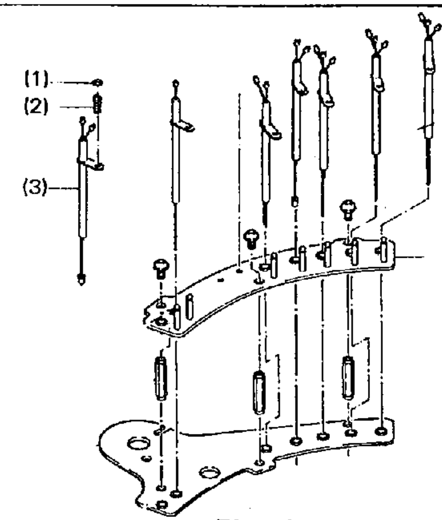
Item	Check Points	Mark	Procedure
Rinse mecha.	Nozzle (dirty, clogging, damage)	C	Wipe the nozzle outside with ether. Remove the rinse nozzle from rinse mecha. and insert a stainless steel wire of 0.5 mm dia. from the nozzle top and run it through for cleaning.
		E	If the nozzle has been damaged, it should be replaced with a new one.
	Water supply & drain tubing (dirty, clogging)	C	Execute "WASH" on START CONDITIONS screen.
		E	Replace with a new one if damaged.
	Cushion condition	V	Execute "DISK" on MAINTENANCE screen.
		C	If the spring (2) does not work, remove the snap ring E (1) from rinse arm assy and the spring (2) and nozzle (3). Then wipe the nozzle (3) with ether, or replace spring.  Rinse Arm Assy
	Nozzle tip (dirty, damage)	C	Wipe the nozzle tip with alcohol.
		E	Replace with a new one from PARTS CARRIER (P/N 704-1228), if damaged.

Table 4-4-1 Interval: 3 Months (4/6)

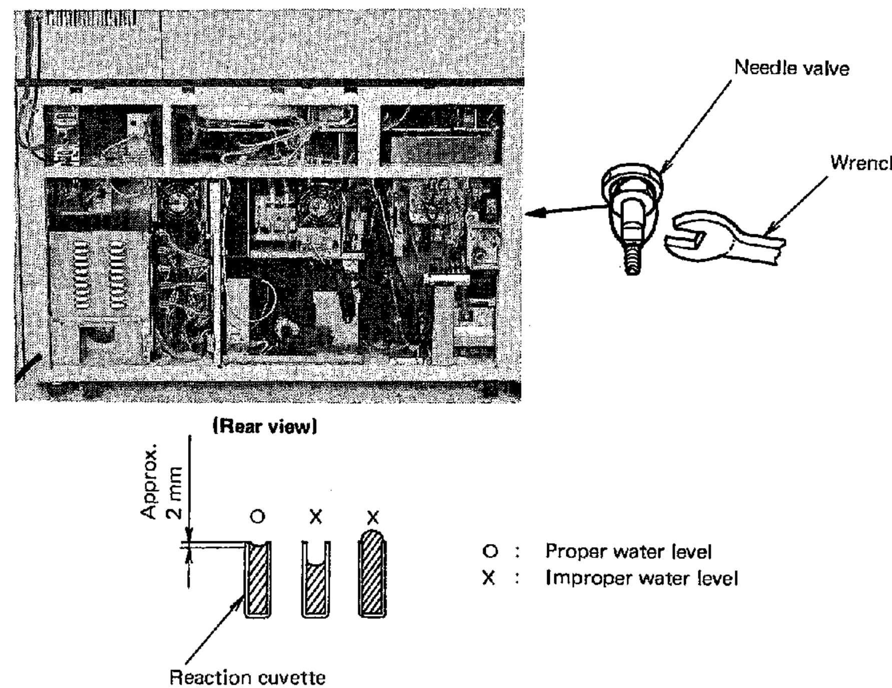
Item	Check Points	Mark	Procedure
Rinse mecha.	Rinse water volume	V A	Execute "DISK" on MAINTENANCE screen. The needle valve should be adjusted to a proper position.  **Adjustment of Rinse Water Volume**
Stirrer mecha.	Stirring rod (dirty, damage)	C E	Wipe the stirring rod with alcohol. If the stirring rod has been damaged, replace with new one.
Disk mecha.	Sample disk cover fitting. R1/R2 disk cover fitting.	V V	Sample disk cover put on the sample disk. R1/R2 disk cover put on the R1/R2 disk.

Table 4-4-1 Interval: 3 Months (5/6)

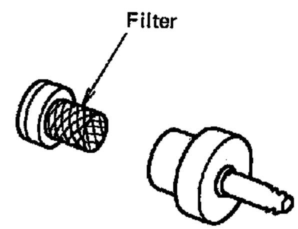
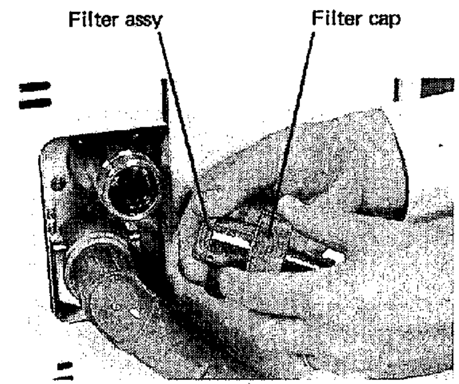
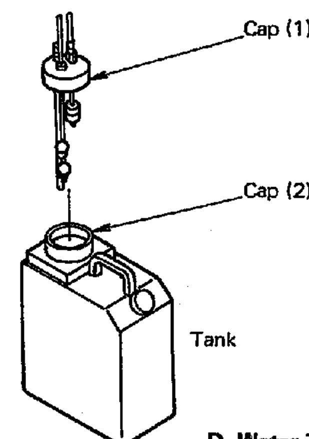
Item	Check Points	Mark	Procedure
Cooling unit	Cooling function	V	Check the reagent temperature of R1/R2 inside refrigerator. Approx: 8 to 12°C
Water tubing	Filter of water supply (dirty, clogging)	C	Turn off the power switch and the water supply unit. Then loosen the filter cap and take out filter assy. Remove the filter from filter assy. Clean the filter with water.   **Filter Assy**
	D. Water tank (dirty)	C	Disconnect the joint at the bottom of the tank. Take out the tank and cap(1) from the tank. Then rinse it a few times with distilled water. If contamination is heavy, remove the cap(2) and rub the tank with a brush by hand and rinse it with distilled water adequately.  **D. Water Tank**

Table 4-4-1 Interval: 3 Months (6/6)

Item	Check Points	Mark	Procedure
Water tubing	Extran bottle fitting	V	Execute "Inc. WATER EXCHANGE" on MAINTENANCE screen, and Extran enters reaction bath once during Inc. WATER EXCHANGE PROGRAM.
Syringes	Syringes (rubber packing, plunger)	E	Replace with new ones and wipe the plunger with gauze.
	Syringe filter (dirty, clogging)	C	Remove the syringe filter from syringe assy and clean the filter with water.
	Leakage, air bubbles	V	Retighten the nipple.

Table 4-4-2 Interval: 6 Months (1/5)

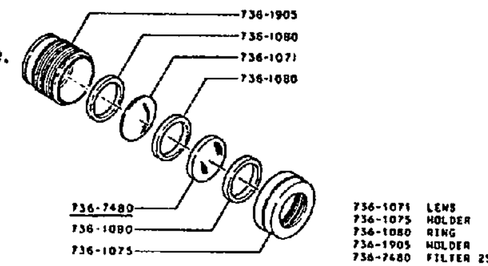
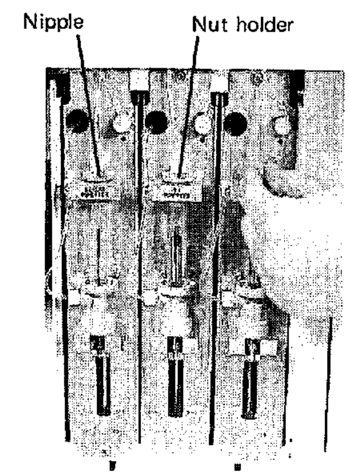
Item	Check Points	Mark	Procedure
Reaction bath	PCP D101, D102, D103 (dirty, damage)	V	Check the voltage of each pcp (D101: between No. 10 pin of J419 to GND, D102: between No. 13 pin of J419 to GND, D103: between No. 16 pin of J419 to GND) and it should be more than 4 V. When the PCP gives low volt, wipe the PCP with alcohol. Again check it.
		E	When the PCP voltage is less than 4 V, replace with new one. **Remarks:** The PCP voltage should change from 4 V to 0 V when cut or open between PCP photo-detector.
Photometer	Cut filter (dirty, damage)	E	When the filter (P/N 736-7480) is dirty or cloudy, replace with new one.  Lens Holder Assy
S. probe mecha.	Tubing (dirty, damage)	C	Clean the tubing of serum pipetter. 1) Prepare the hypochlorite soda detergent, 10 % dilution. 2) Remove the nipple as shown in figure. Then connect tube to the nipple. 3) Using the syringe, repeat suction and discharge of hypochlorite soda aqueous solution 10 times. 4) Rinse the inside of tubing with water thoroughly, and then wipe off water with gauze. 5) Replace the nipple. Then, execute "SAMPLING MECHA" on MAINTENANCE screen.  Serum Pipetter

Table 4-4-2 Interval: 6 Months (2/5)

Item	Check Points	Mark	Procedure
S. probe mecha.	PCP D102, D103, D104 (dirty, damage)	V	Check the voltage of each PCP (D102: between No. 12 pin of P4214 to GND, D103: between No. 6 pin of P421 to GND, D104: between No. 9 pin of P421 to GND), and it should be more than 4 V. **Remark:** Same as reaction bath.
Rinse mecha.	PCP D101, D102 (dirty, damage)	V E	Check the voltage of each PCP (D101: between No. 7 pin of J428 to GND, D102: between No. 10 pin of J428 to GND), and it should be more than 4 V. Replace with new ones if damaged.
	Tubing (dirty, damage)	E	Replace with new ones if damaged.
Stirrer mecha.	PCP D101, D102, D103, D104 (dirty, damage)	V E	Check the voltage of each PCP (D101: between No. 3 pin of J425 to GND, D102: between No. 6 pin of P425 to GND, D103: between No. 9 pin of P425 to GND, D104: between No. 12 pin of J425 to GND), and it should be more than 4 V. Replace the PCPs with new ones if damaged.
R1/R2 probe mecha.	Tubing (dirty, damage)	C	Clean the tubing of R1/R2 pipetter. • Same as serum pipetter.
	PCP D101, D102, D103, D104 (dirty, damage)	V E	Check the voltage of each PCP, and it should be more than 4 V. • R1 Probe Mecha. ; D102: between No. 12 pin of J426 to GND, D103: between No. 6 pin of P426 to GND, D103: between No. 9 pin of P426 to GND • R2 Probe Mecha. ; D102: between No. 12 pin of J422 to GND, D103: between No. 6 pin of P422 to GND, D103: between No. 9 pin of P422 to GND Replace the PCPs with new ones if damaged.

Table 4-4-2 Interval: 6 Months (3/5)

Item	Check Points	Mark	Procedure
S. disk mecha.	PCP D101, D102, D103 (dirty, damage)	V	Check the voltage of each PCP (D101: between No. 2 pin of J420 to GND, D102: between No. 5 pin of P420 to GND, D103: between No. 8 pin of P420 to GND), and it should be more than 4 V.
		E	Replace the PCPs with new ones if damaged.
R1/R2 disk mecha.	PCP D101, D102 (dirty, damage)	V	Check the voltage of each PCP, and it should be more than 4 V. • R1 Disk Mecha. ; D101: between No. 10 pin of J424 to GND, D102: between No. 13 pin of P424 to GND • R2 Disk Mecha. ; D101: between No. 10 pin of J423 to GND, D103: between No. 13 pin of P422 to GND
		E	Replace the PCPs with new ones if damaged.
Cooling unit	Radiator (dirty, damage)	C	Clean the condenser with gauze, or a vacuum cleaner.
Vacuum unit	Vacuum tank (dirty, damage)	C	Clean the vacuum tank with distilled water thoroughly.
	Tubing (dirty, damage)	E	Replace the tubing with new ones if damaged.
	Vacuum glass vessel (dirty, damage)	C	Execute "WASH ALL" on START CONDITIONS screen.
Rinsing bath	Sample/R1, R2 reagent probe/stirrer rinsing bath (dirty, damage)	C	Clean each rinsing bath. 1) Pour 100 mℓ of hypochlorite soda detergent (10 % dilution) into each rinsing bath. 2) Then, pour one liter of water into each rinsing bath.
	Tubing (dirty, clogged)	E	Replace the tubing with new ones if damaged.
Water supply tubing	Tubing (dirty, clogged)	E	Replace the tubing with new ones if damaged.
	Distilled water tank (dirty)	C	Clean it using a brush and then rinse with distilled water thoroughly.

Table 4-4-2 Interval: 6 Months (4/5)

Item	Check Points	Mark	Procedure
Syringes	PCP of each pipetter (dirty, damage)	V	Check the voltage of each PCP for the pipetter. Should be more than 4 V. • Serum pipetter ; between No. 13 pin of J414 to GND • R1 reagent pipetter ; between No. 13 pin of J415 to GND • R2 reagent pipetter ; between No. 13 pin of J416 to GND
Printer	Paper feed function	V	Check the paper feed function. 1) Depress the ONLINE key on panel of the printer, so as to put it off line. 2) Depress the FF key on panel of printer, and paper should move to start position. 3) Depress the LF key on panel of printer, and paper should move one line. 4) Depress the NLQ key on panel of printer, and paper should return one page. 5) Depress the ONLINE key to set up an online ribbon cassette with new one.
	Printing condition, printer check	V E	Execute the PRINTER on MAINTENANCE screen. When printed characters cannot be read, replace the ribbon cassette with new one.
CRT	Screen (dirty, bright)	C A	Clean the screen of CRT. 1) Loosen the cover locking 5 screw located at the top right side, then remove the cover. 2) Wipe the screen with softened gauze. Adjust the brightness of CRT by using VR located below CRT screen.
FDD	When the specified usage count of floppy disk (100 thousand times accessed) is reached.	C	Refer to 4-3-23 Cleaning of Floppy Disk of INSTRUCTION MANUAL (P/N 717-9001)

Table 4-4-2 Interval: 6 Months (5/5)

Item	Check Points	Mark	Procedure
DC power supply	OUTPUT voltage (+5 V, +12 V, +24 V, ±15 V)	V	Check the voltage of each check point located at the right side, open the cover of right side. • Specification: +5 V . . . . +5.3 ± 0.05 V +12 V (CRT) . . . . +12.3 ± 0.05 V +12 V (LAMP) . . . . . . +12.3 ± 0.05 V +24 V . . . . +24.2 ± 0.1 V +15 V . . . . +15 V ± 0.75 V –15 V . . . . –15 V ± 0.75 V **Remarks:** ±15 V can not be adjusted.

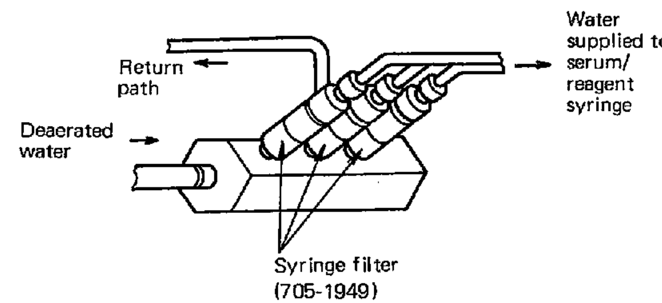
Table 4-4-3 Interval: 12 Months (1/3)

Item	Check Points	Mark	Procedure
Reaction bath	Window (crack, dirty, damage)	C E	Take out the reaction disk with cuvettes. Then check the window of reaction bath and wipe the window with gauze. When the window is cracked, replace with new one.
Photometer	PHOTOMETER window (crack, dirty, damage) (P/N 736-1101)	C E	Take out the reaction bath. Then check the window of PHOTOMETER and wipe the window with gauze. When the window is cracked, replace with new one.
S. Probe mecha.	Mecha. movement (change nut, spring condition)	O	Execute the "SAMPLING MECHA." on MAINTENANCE screen. When the S. Probe movement is not smooth and can not be cushioned in the reaction cuvette, replace or adjust or lubricate. (Refer to "REPLACEMENT AND ADJUSTMENT OF PARTS" of section 8.)
	Tension condition of belt	A	Refer to "REPLACEMENT AND ADJUSTMENT OF PARTS" of section 8.
R1/R2 probe mecha.	Mecha. movement (change nut, spring condition)	O	Execute the "R1 PIPETTER/R2 PIPETTER" on MAINTENANCE screen When the R1/R2 probe movement is not smooth, replace or adjust or lubricate. Check the spring condition of R1/R2 probe by hand. (Refer to "REPLACEMENT AND ADJUSTMENT OF PARTS" of section 8.)
	Tension condition of belt	A	Refer to "REPLACEMENT AND ADJUSTMENT OF PARTS" of section 8.
Rinse mecha.	Mecha. movement (UP and DOWN, spring condition)	O	Execute the "DISK" on MAINTENANCE screen. When the rinse mecha. movement is not smooth and rinse nozzle can not be cushioned, replace or adjust or lubricate. (Refer to "REPLACEMENT AND ADJUSTMENT OF PARTS" of section 8.)
Stirrer mecha.	Mecha. movement (UP and DOWN, rotation)	O	Execute the "STIRRER" on MAINTENANCE screen. When the stirrer movement is not smooth in up/down and rotation, replace or adjust or lubricate. (Refer to "REPLACEMENT AND ADJUSTMENT OF PARTS" of section 8.)

Table 4-4-3 Interval: 12 Months (2/3)

Item	Check Points	Mark	Procedure
Disk mecha.	Reaction disk movement (rotation) Sample disk movement (rotation) R1/R2 disk movement (rotation)	O	Execute the "DISK" on MAINTENANCE screen. When the R. disk/S. disk/R1, R2 disk rotation is not smooth, replace or adjust or lubricate. (Refer to "REPLACEMENT AND ADJUSTMENT OF PARTS" of section 8.)
Cooling unit	Cooling bath (dirty, level, leaking)	C	Clean the cooling bath inside. 1) Turn off the power switch of BREAKER (P/N 717-4135) located at the right side, open the cover of right side. 2) Remove the rear right cover. 3) Open the cap of cooling bath, then drain the water in cooling bath and add distilled water by hose pump. 4) Turn on the power switch of BREAKER. 5) Add distilled water to cooling bath. After ten minutes, check the water level in cooling bath.
	Pump MD15RG function (circulation)	V	Measure temperature of reagent in R1/R2 JACKET. • Approx: 8 to 12°C
Vacuum unit	Vacuum pump function Degasser pump function	O	When SIPPER and DEGASSER alarm is issued, replace or repair.
Extran pump	Extran pump function	O	Execute the "Inc. WATER EXCHANGE" on MAINTENANCE screen. When the Extran cannot be added to bath, replace or repair. (Refer to "REPLACEMENT AND ADJUSTMENT OF PARTS" of section 8.)
SYRINGE assy	Serum pipetter function Dispenser syringe function	O	When the serum pipetter/dispenser syringe movement is not smooth, replace or adjust. (Refer to "REPLACEMENT AND ADJUSTMENT OF PARTS" of section 8.)

Table 4-4-3 Interval: 12 Months (3/3)

Item	Check Points	Mark	Procedure
SYRINGE filter	SYRINGE filter (dirty, clogged)	E	Open the front left door, and the syringe filter will appear above the distilled water tank. Replace the syringe filter with a new one.  **Syringe Filter**

Interval: 12 months

Item	Points	
Lubrication **(Refer to Section 8)**	1. With grease BRB No. 1 (1) DRIVING MECHA. ASSY S & Disk. (a) FLAT GEAR 20 (b) SPUR GEAR 200 (2) REACTION TABLE DRIVE ASSY (a) FLAT GEAR 20 (b) GEAR 200 (3) RINSE MECHA. ASSY (a) SHAFT (b) SLIDER (c) SLIDER ASSY (4) SAMPLING MECHA. ASSY S & R (a) SPRING GUIDE (b) SHAFT (5) EXTRAN PUMP (a) PUMP HEAD (6) PIPETTER ASSY (a) SLIDER (b) BASE (7) STIRRER ASSY (a) RACK (b) GUIDE ASSY (c) CRANK ASSY	2. Tri-Flon oil (1) SAMPLING MECHA. ASSY S & R (a) GUIDE (b) CHANGE NUT (2) EXTRAN PUMP (a) CAM (b) SUPPORT (3) PIPETTER ASSY (a) GEAR 180 (b) RACK (4) STIRRER ASSY (a) SHAFT

4-4-2 PREVENTIVE MAINTENANCE FOR ISE

Table 4-4-4 (1/3)

Item	Check Points	Interval	Mark	Procedure
Tubing	Sipper tubing (pinch tube dirty, damage)	3 months	E	Replace the tubing (P/N 717-0843) with new one. (This tube must be 0.8 mm in inside diameter and 7.5 cm in length.)
	Sipper nozzle (dirty) IS, DIL tubing (dirty) IS, DIL nozzle (dirty) Dilution vessel (dirty) Drain trap (dirty) IS, DIL syringe (plunger, seal dirty)	3 months	C	Rinse the flow path by the following procedure: 1) Replace IS/DIL with aqueous sodium hypochlorite solution of available chlorine 0.5 %. 2) Call ROUTINE JOB/5 START CONDITIONS screen. Then enter 1 (ALL) or 3 (ISE). 3) Wipe off aqueous sodium hypochlorite solution adhering to the outside of tube and replace reagents. 4) Press start key: 5) Perform calibration. (Check the result of calibration.) • slope factor Na, K : 38.0 mV ~ 68.0 mV Cℓ : –30.0 mV ~ –68.0 mV Remarks: Do not replace Ref. electrode solution.
	Sipper nozzle (clogged) IS, DIL nozzle (clogged)	3 months	C	If the sipper nozzle is clogged, clean it by using a stainless wire with a diameter of 0.5 mm. If the IS/DIL nozzle is clogged, clean it by using a stainless wire with a diameter of 0.3 mm.

Table 4-4-4 (2/3)

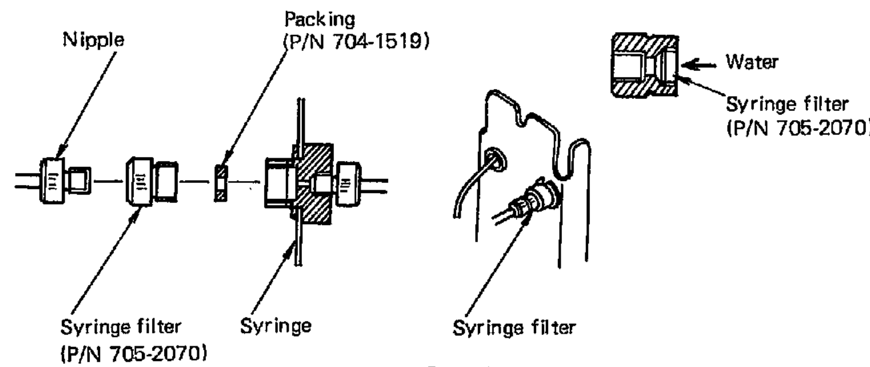
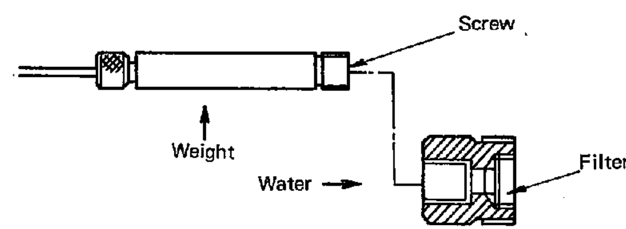
Item	Check Points	Interval	Mark	Procedure
Syringe filter for IS/DIL syringe	Syringe filter (clogged, damage)	3 months	C	Turn off the power switch of main unit. Remove the syringe filter from the syringe section. Flush the filter as shown below in order to remove dust. If dust accumulated in the syringe filter can not be removed, replace with a new one.  **< Front face of syringe >** **Syringe Filter** **Remarks:** Attach the filter after confirming that the packing is fitted.
Reagent suction port filter	Suction port filter (dirty, clogged)	3 months	C	Take the weight out of the reagent bottle and remove the filter by loosening the screw. Run water as shown below until dust is washed out. If dust can not be eliminated from the filter, replace with a new one.  **Reagent Suction Port Filter**

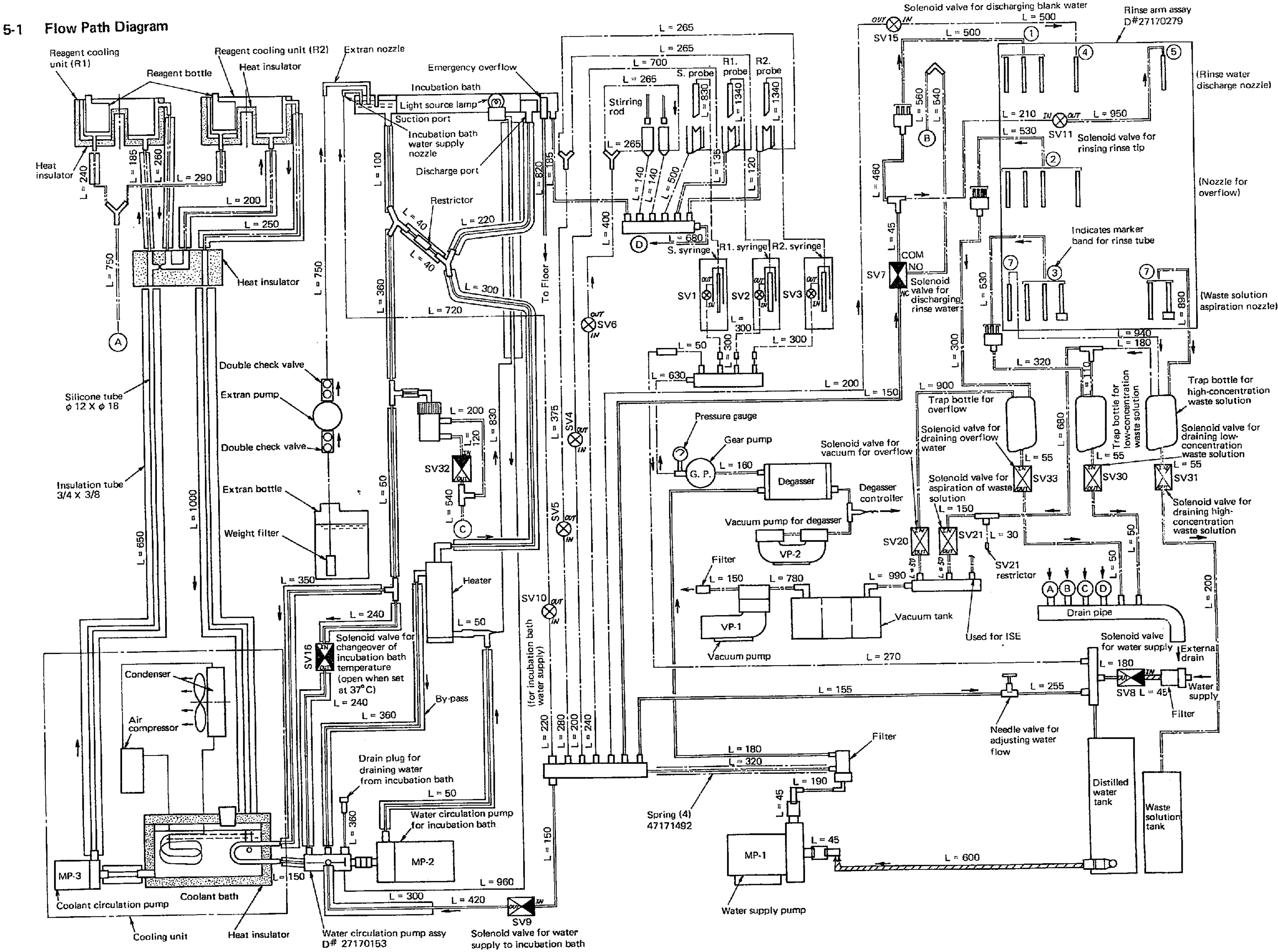
Table 4-4-4 (3/3)

Item	Check Points	Interval	Mark	Procedure
S. probe mecha.	Mecha. movement (spring condition)	6 months	A	Execute the "SAMPLING" on MAINTENANCE screen. When the S. Probe can not be cushioned in the dilution vessel, adjust the S. Probe height.
Measuring unit	Shutter (moving condition)	6 months	E	Execute the "SAMPLING" on MAINTENANCE screen. When the shutter movement is not smooth, replace with a new one.
	Vacuum suction, nozzle (moving condition)	6 months	E	Execute the "RESET" on MAINTENANCE screen. When the vacuum suction nozzle movement is not smooth, repair or replace with a solenoid.
	PCP of vacuum suction nozzle	6 months	E	Execute the "RESET" on MAINTENANCE screen. When VACUUM NOZZLE alarm is issued, check if J434 No. 3 or No. 5 pin voltage is low. Replace the pcp with a new one.
ISE compartment	Insulation on electrode	6 months	V	Insulation resistance should be 3 MΩ or more when measured with a 1000 V megger. (Refer to ISE Troubleshooting of SERVICE MANUAL.)
	INCUBATOR TEMP.	6 months	V	INCUBATOR temperature should be approx. 37/30/25°C when measured with a thermometer.
	PCP of ISE DOOR.	6 months	E	ISE door is open, but ISE DOOR alarm is not issued. Check if J433 No. 3 pin voltage is not changed. Replace with a new one.

5. FLOW PATH DIAGRAM

5. FLOW PATH DIAGRAM

5-1 Flow Path Diagram



Kind of Tube	Name
G153001	Tygon tube R3603 φ 3.17 X φ 6.35 (transparent)
G153002	Tygon tube R3603 φ 1.58 X φ 3.17 (transparent)
G153014	Silicone rubber tube 4 X 2 T (brown)
G153025	Silicone rubber tube 8 X 2 T (red brown)
G153056	Insulation tube 1/2 in. X 3/8 in.
G153170	Silastic tube φ1 X φ3
G153171	Silastic tube φ 8 X φ 14
F274152	Junflon FEP tube 1.5 X 0.4 T
F274178	Junflon tube 0.8 X 0.3 T
F221020	Pressure-resistant vinyl hose 9 X 15
47171531	Heat-insulation hose (2)
47041614	Heat-insulation tube (1) (tube furnished with cooling unit used)
47052128	Water supply tube

Fig. 5-1-1

5-2 Rinsing Outside of Probe (R1/R2) and Stirring Rod

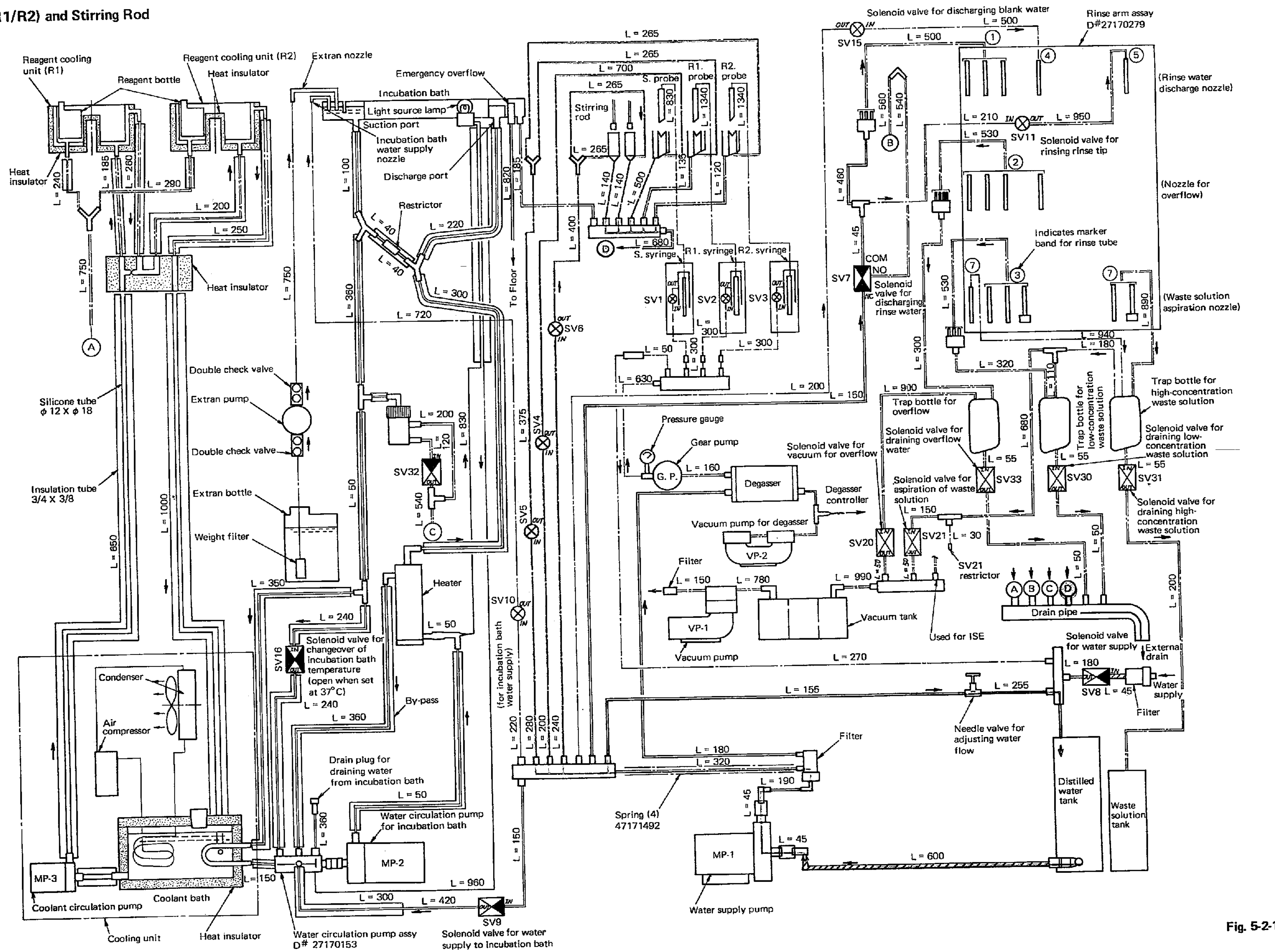


Fig. 5-2-1

5-3 Rinsing Inside of Syringe (S./R1/R2) and Probe

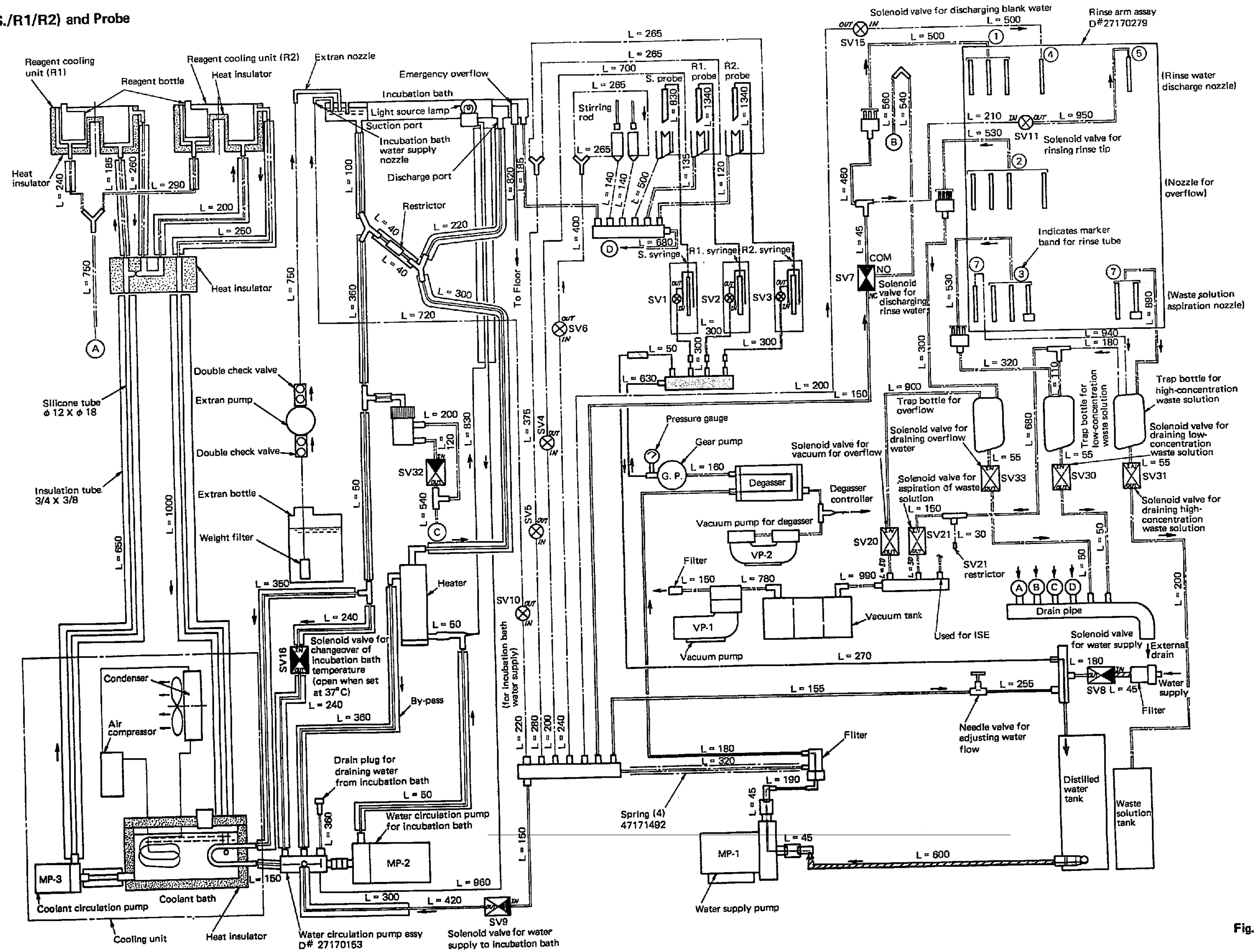


Fig. 5-3-1

5-4 Coolant Piping for Reagent Cooling Unit

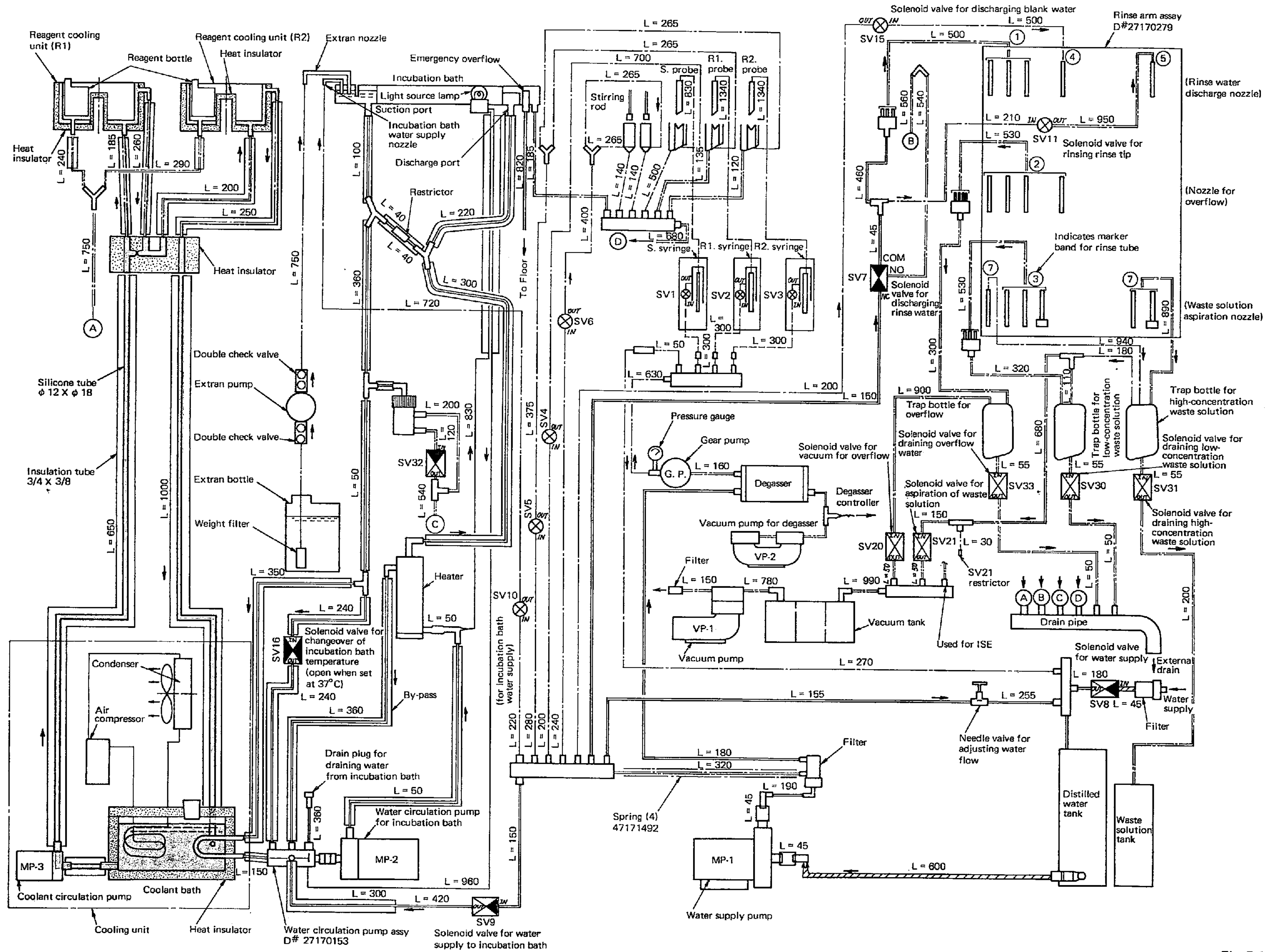


Fig. 5-4-1

5-5 Flow Path for Water Drain upon Water Exchange

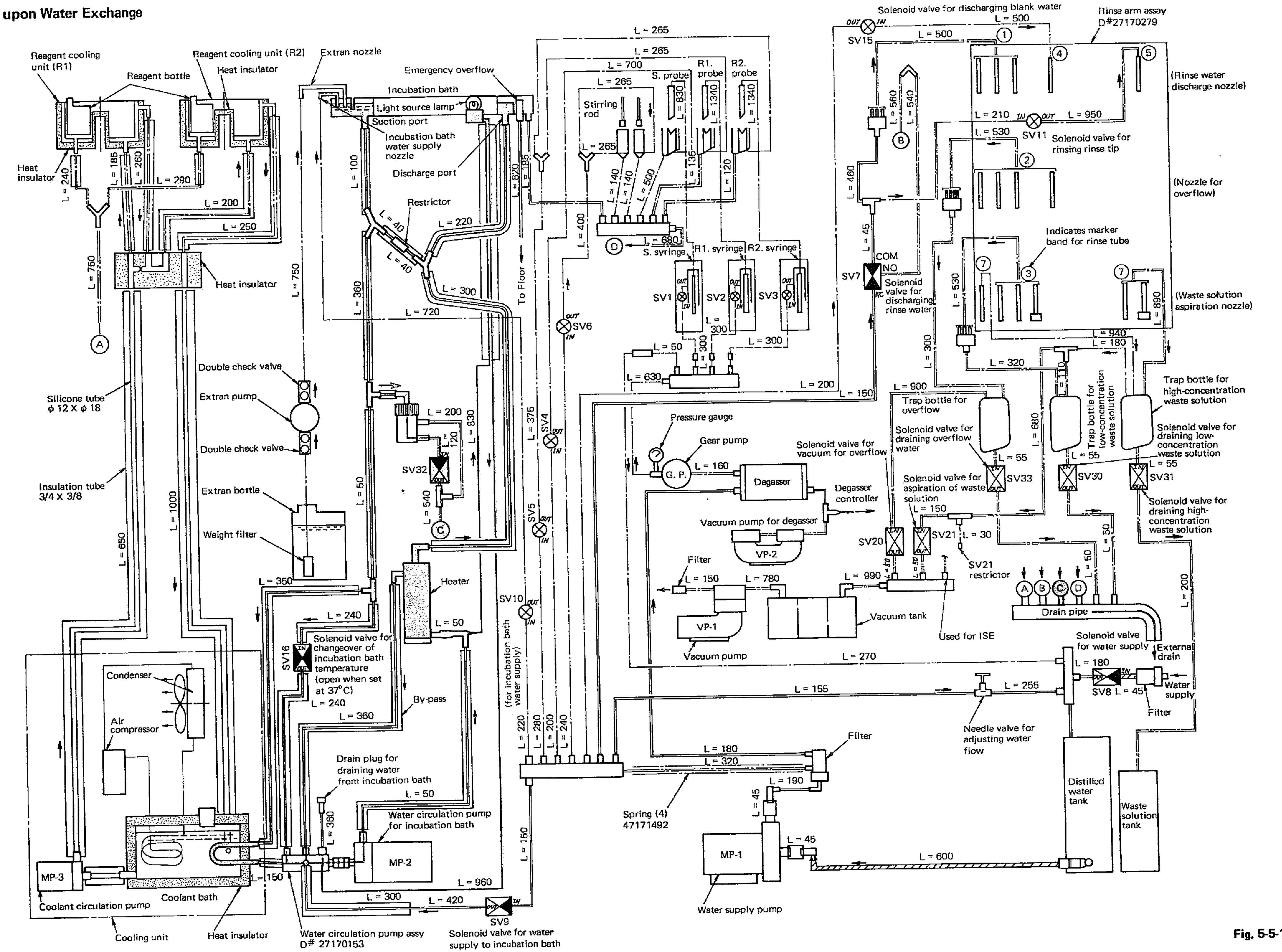


Fig. 5-5-1

5-6 Flow Path for Water Supply upon Water Exchange

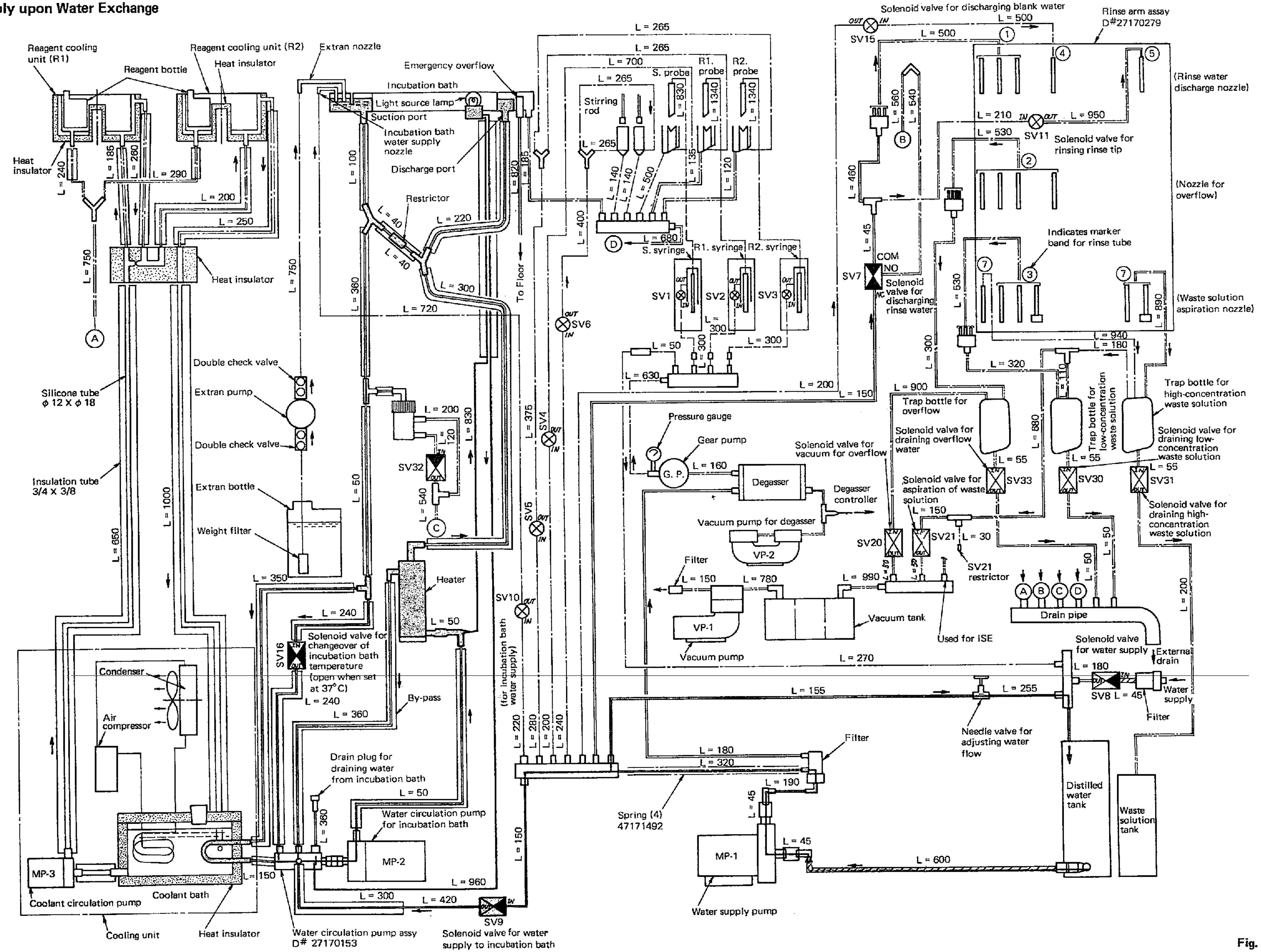


Fig. 5-6-1

5-7 Flow Path for Extran Injection upon Water Exchange

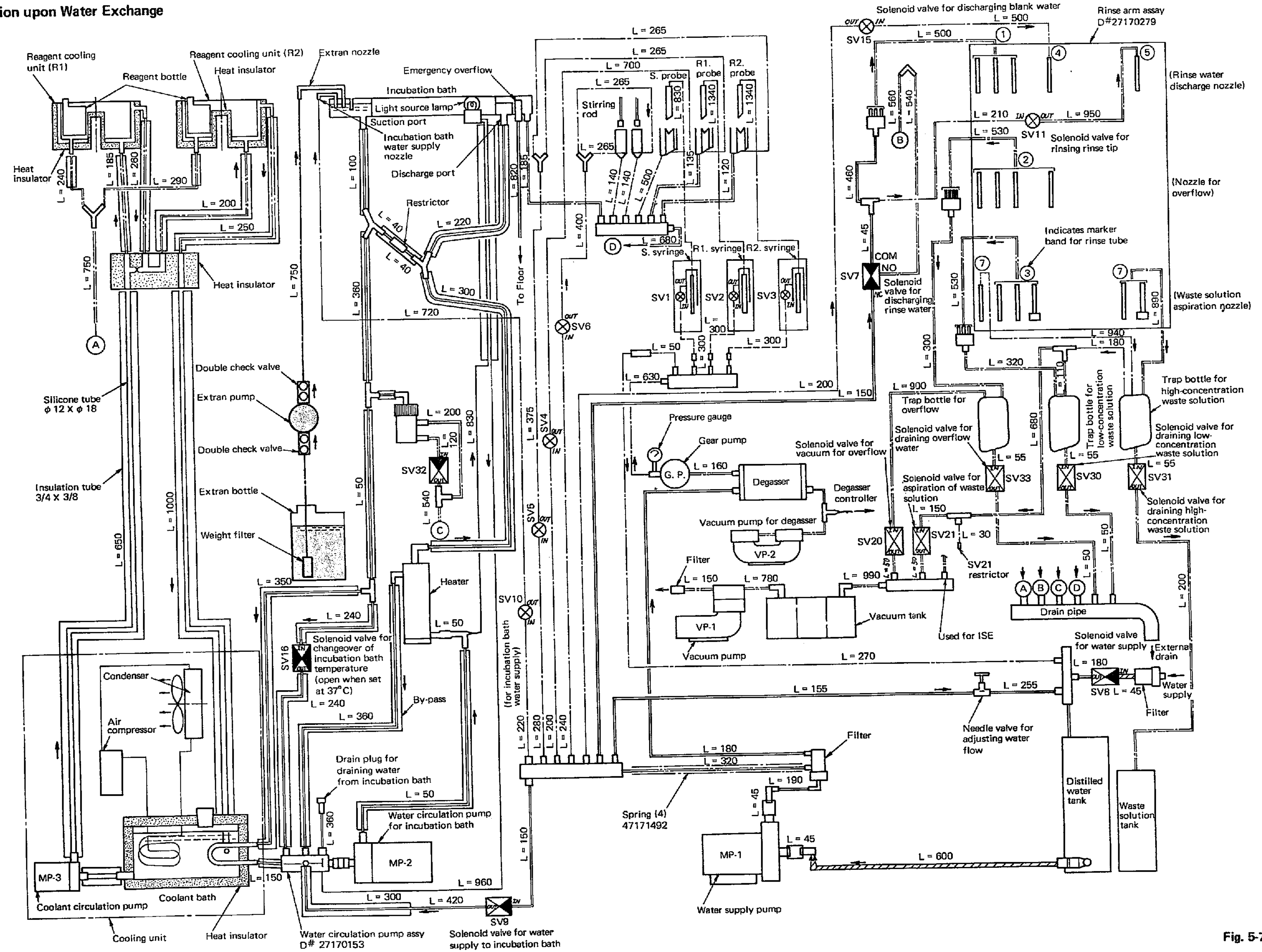


Fig. 5-7-1

5-8 Flow Path for Circulation of Temperature-Controlled Water (37°C)

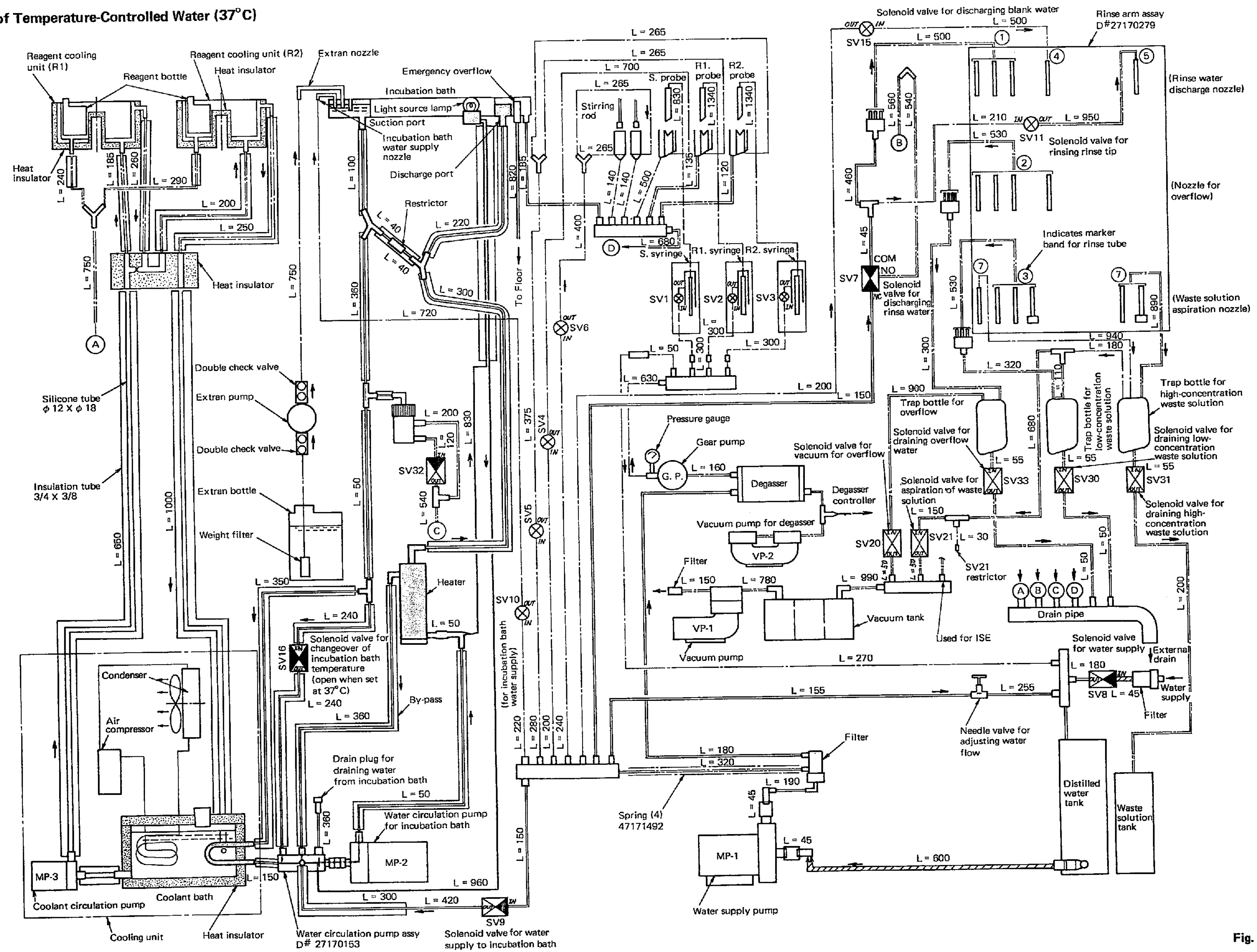


Fig. 5-8-1

5-9 Flow Path for Circulation of Temperature-Controlled Water (25/30°C)

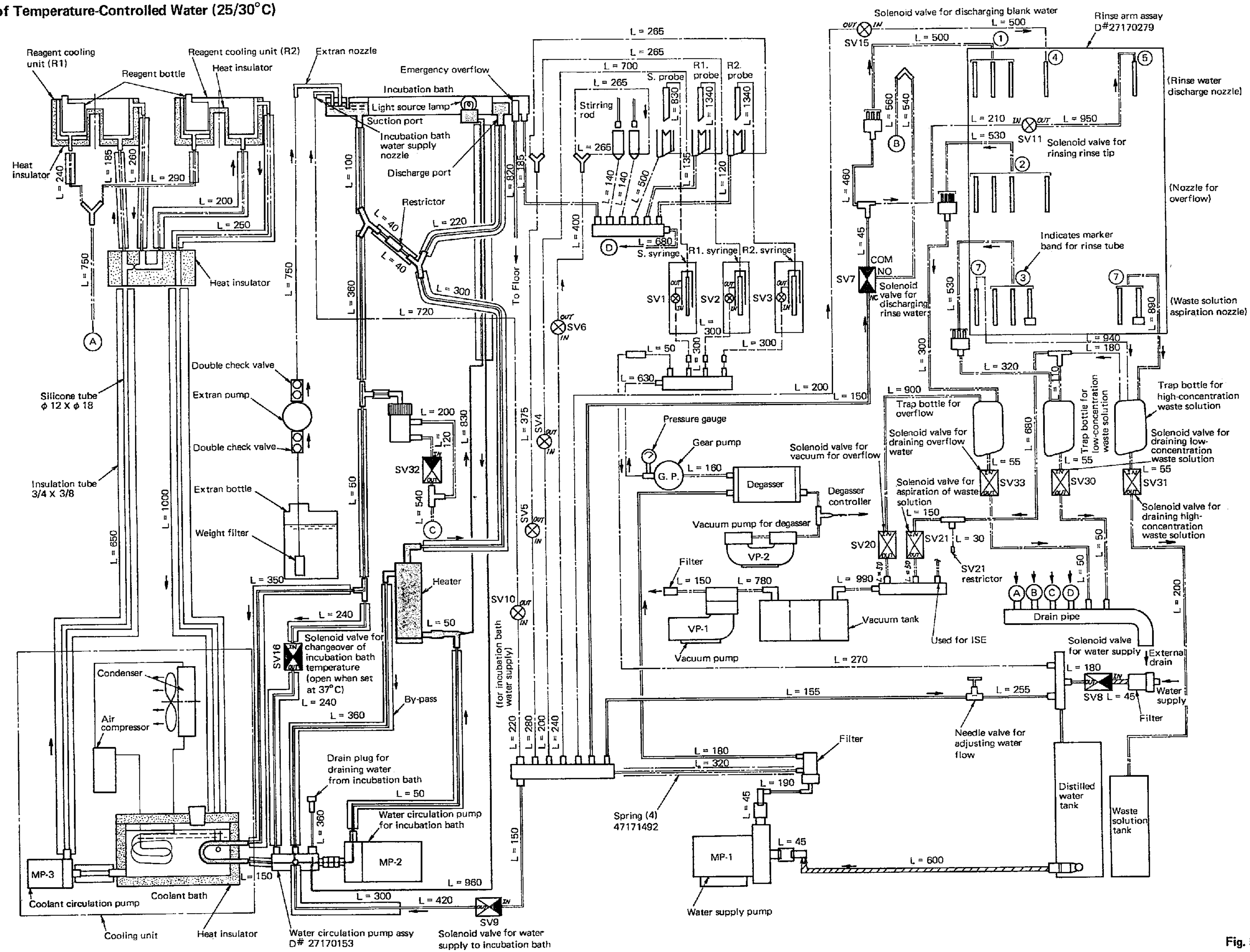


Fig. 5-9-1

5-10 Aspiration of Water in Cell upon Execution of Cell Rinse

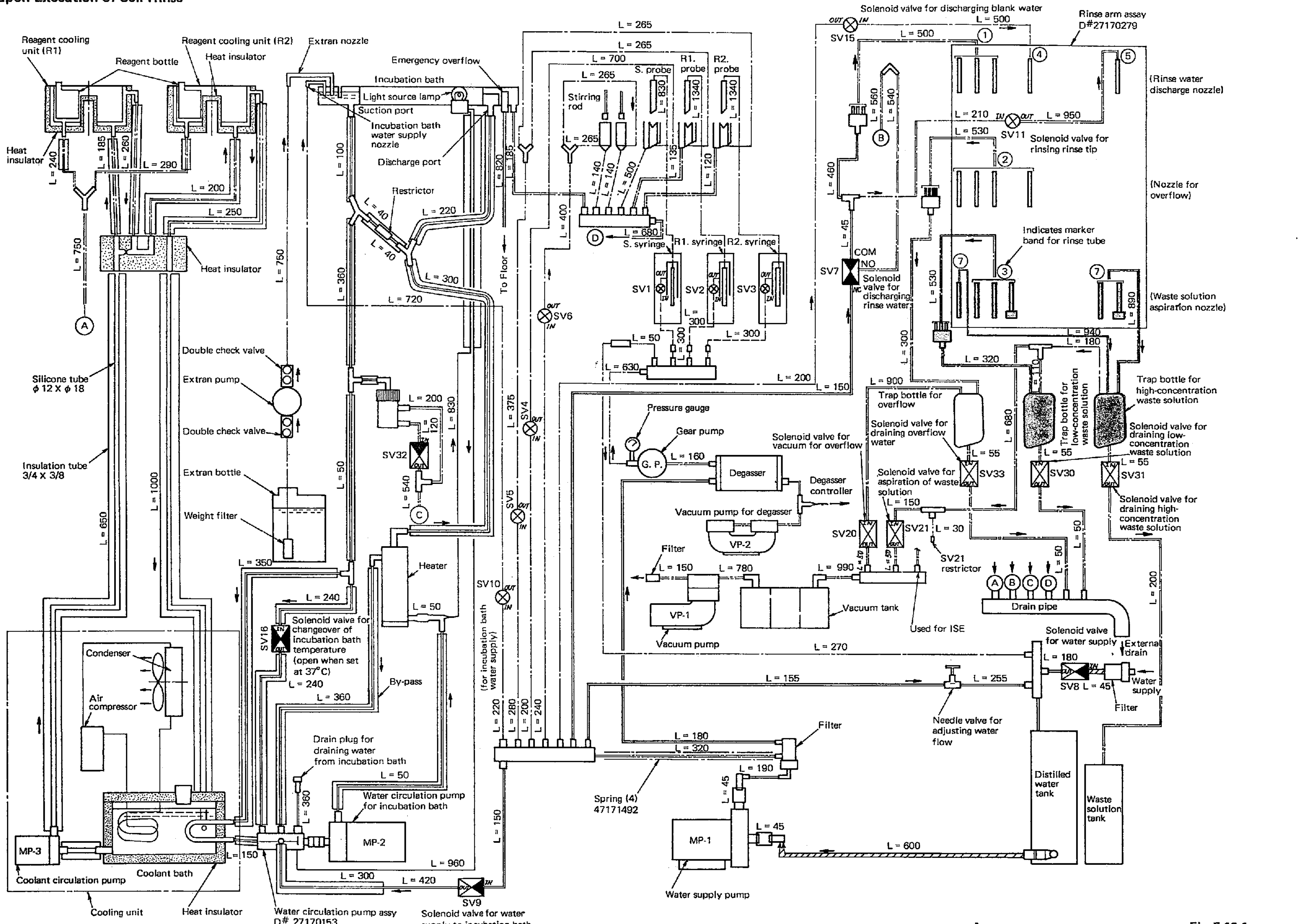


Fig. 5-10-1

5-11 Injection of Rinse Water upon Execution of Cell Rinse

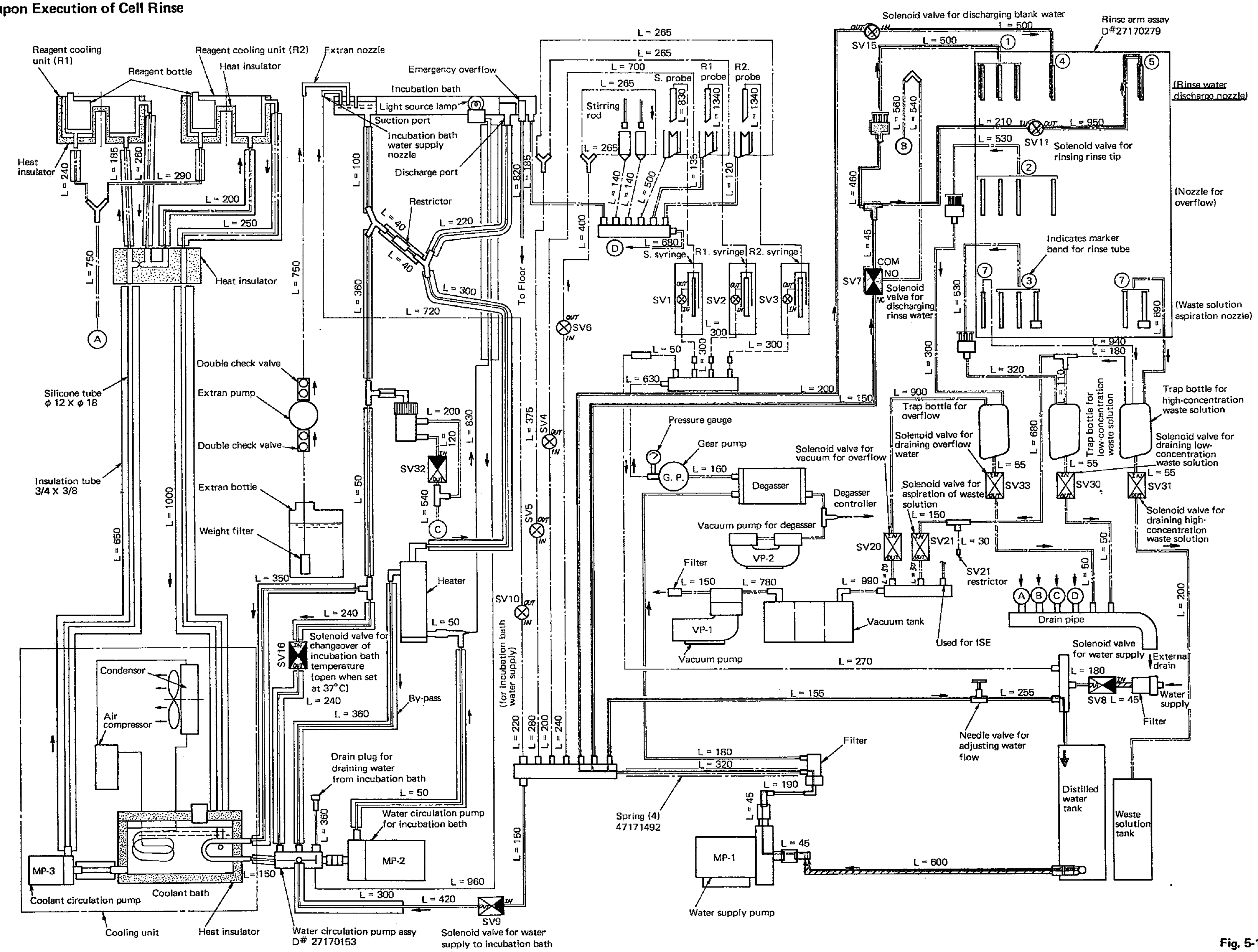


Fig. 5-11-1

5-12 Aspiration of Overflow upon Execution of Cell Rinse

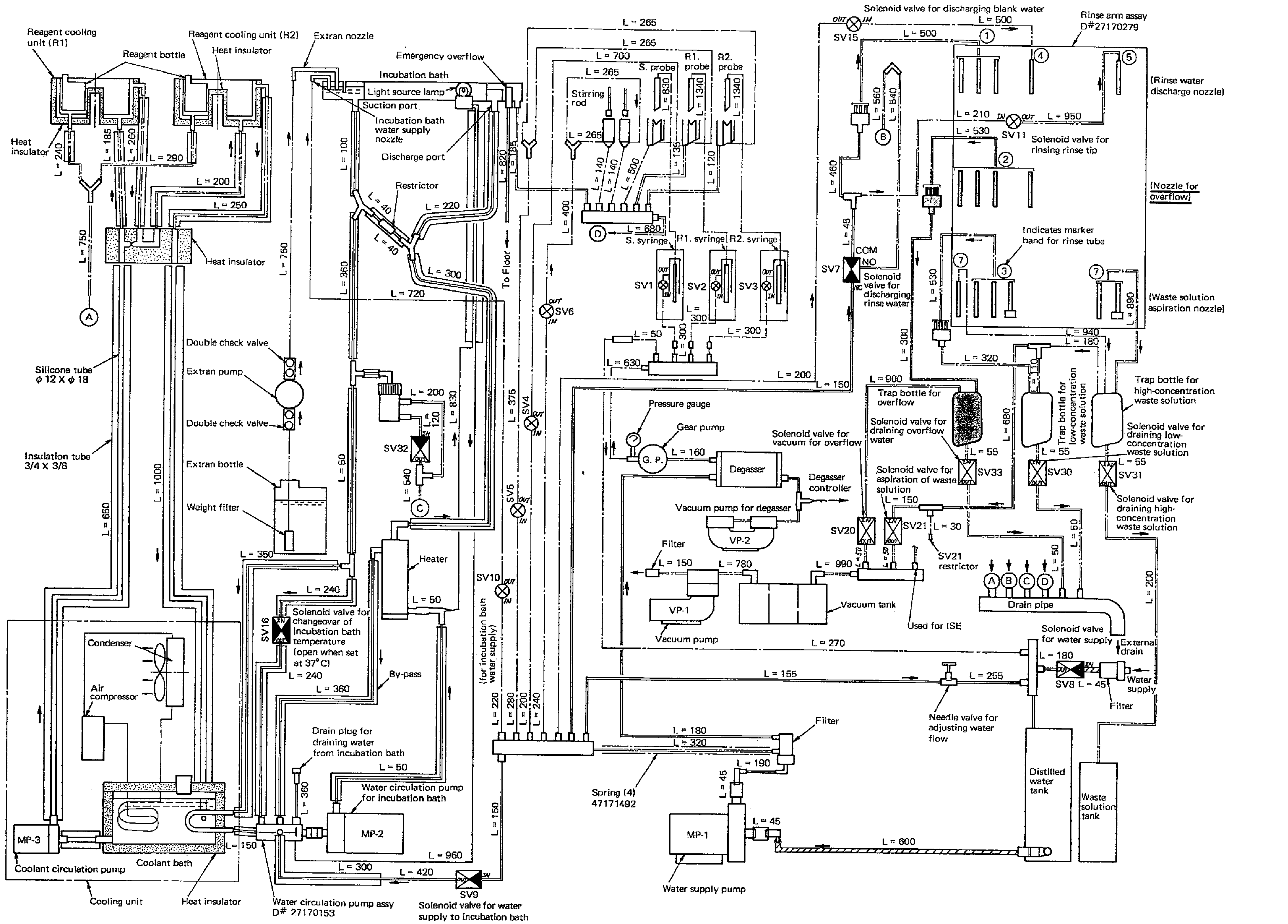


Fig. 5-12-1

5-13 Discharge of Aspirated Water upon Execution of Cell Rinse

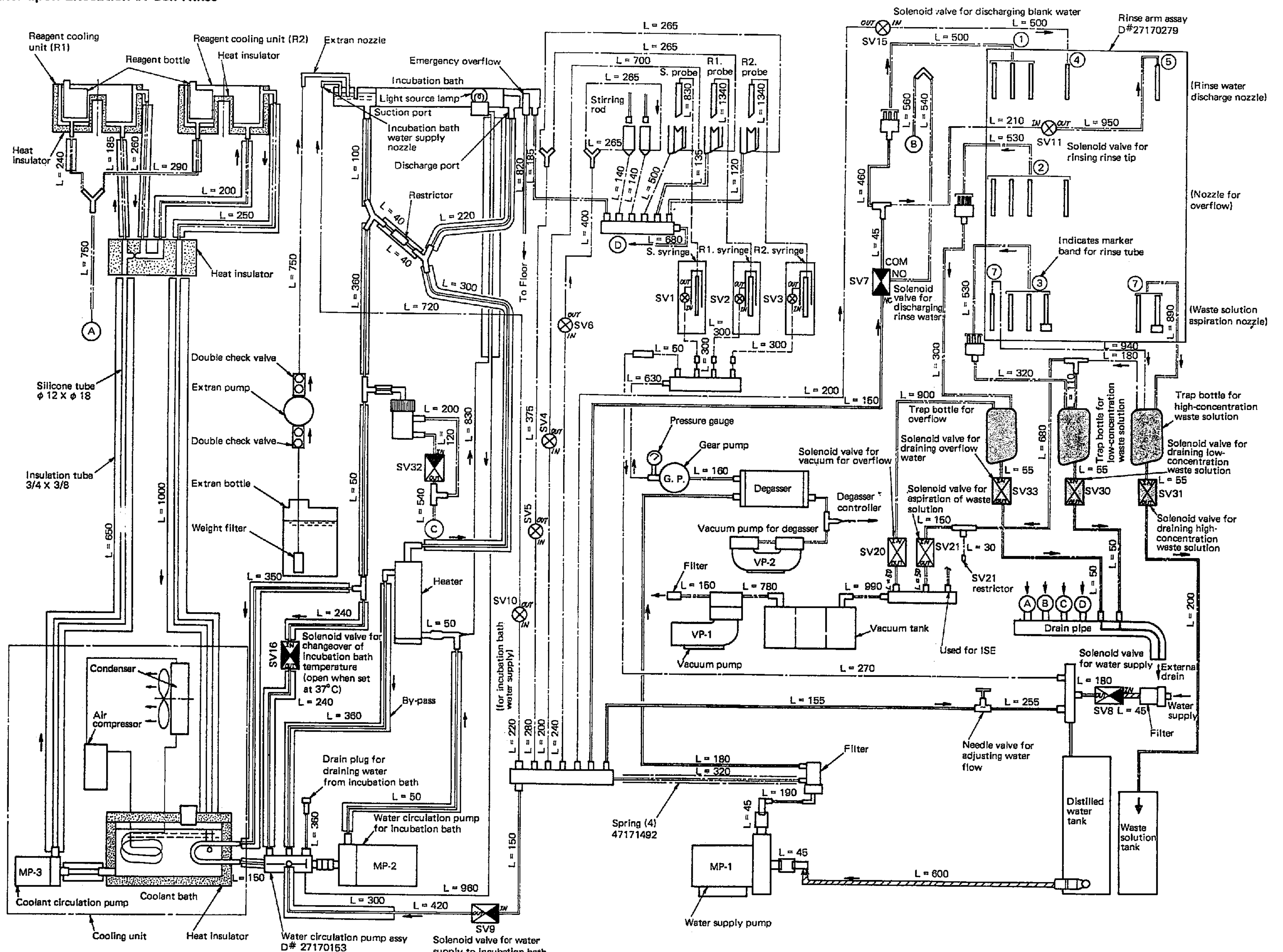


Fig. 5-13-1

6. TROUBLESHOOTING

6. TROUBLESHOOTING

6-1 Error Messages After Power On

Table 6-1-1

No.	Error Message	Meaning	Countermeasure
1	SYSTEM NOT FOUND . . . PLEASE CHECK FLOPPY DISK & RETRY	The system disk cannot be found.	Close the FDD (drive 1) door, or take the same countermeasure as for error message no. 5.
2	OS RAM ERROR	The OS RAM is defective. (bank no. $00 to $13)	Replace the FSBC board.
3	FO. FF. ROM	The check sum of boot ROM is not $01 in lower 2 digits.	Same as above.
4	KEY CONTROLLER ERROR	An error has occurred upon self-check of the one-chip key controller.	Same as above. Replace keyboard.
5	DOS LOAD ERROR	An error has occurred upon loading the DOS program.	Clean the FDD head, or replace the FD, FDD or FSBC board.
6	BOOT FILE LOAD ERROR	An error has occurred upon loading the user boot program.	Check if the disk is set correctly, or take the same countermeasure as for error message no. 5.
7	OS LOAD ERROR	An error has occurred upon loading the FOS program.	Take the same countermeasure as for error message no. 5.
8	FSBC RAM ERROR	RAM error has occurred upon RAM check.	Replace the FSBC board.
9	EXT. MEM1 RAM ERROR	Same as above.	Replace the EXT. MEM board of the FSBC.
10	EXT. MEM2 RAM ERROR	Same as above.	Same as above.
11	PROGRAM LOAD ERROR	An error has occurred upon loading a program.	Take the same countermeasure as for error message no. 5.
12	PARAMETER LOAD ERROR	An error has occurred upon loading parameters.	Same as above.

6-2 Data Alarms

Listed below are the data alarms to be issued in this instrument.

Table 6-2-1 Data Alarms (1/3)

<table>
<tr><th>Alarm</th><th>Printout Message</th><th>Display on Data Monitor</th><th>Meaning</th><th>Countermeasure</th></tr>
<tr><td>ADC abnormal</td><td>ADC?</td><td>A</td><td>The ADC counter for photometry/electrolyte assay does not work normally.</td><td>(1) See alarm code ADC? (27-1 to 27-4).</td></tr>
<tr><td>Abnormal cell blank</td><td>CELL?</td><td>Q</td><td>A difference in absorbance is more than 0.1 Abs between the current cell blank and the previous cell blank measured with 'CELL BLANK' maintenance function.</td><td>(1) See alarm code CELL BLANK (22-1 to 22-6).</td></tr>
<tr><td>Insufficient sample</td><td>SAMPL</td><td>V</td><td>Sample volume is insufficient in the sample cup.</td><td>(1) Add sample and rerun.</td></tr>
<tr><td>Insufficient reagent</td><td>REAGN</td><td>T</td><td>The remaining volume of reagent is below the minimum level of 10-test volume.</td><td>(1) See alarm code REAGENT SHORT (21-1 to 21-64).</td></tr>
<tr><td>Excessive absorbance</td><td>ABSI</td><td>Z</td><td>The upper absorbance limit of 3.3 Abs is exceeded.</td><td>(1) Check if there is an obstacle on the photometric path.
(2) Check if the reaction (incubation) bath is contaminated.
(3) Check if the reagent has been prepared properly.
(4) Check if the reagent is placed at a proper position.</td></tr>
<tr><td>Prozone error</td><td>xxxxxP ('xxxxx' indicates the prozone check value.)</td><td>P</td><td>In two-point assay or one-point prozone check assay, the prozone check (PC) value exceeds the specified upper or lower limit. Shown below is the relationship between PC values and upper/lower limit.
<table>
<tr><th rowspan="2">Analytical method</th><th rowspan="2">PC value</th><th colspan="2">Erroneous PC value and upper/lower limit</th></tr>
<tr><th>L LOWER</th><th>UPPER</th></tr>
<tr><td>One-point assay</td><td>$\frac{1}{2}(A_m + A_{m-1}) - k(A_\ell + A_{\ell-1})$</td><td rowspan="2">PC value < Limit value</td><td rowspan="2">PC value > Limit value</td></tr>
<tr><td>Two-point assay</td><td>$\dfrac{\frac{A_m - A_{26}}{m - 26}}{\frac{A_{27} - A_{26}}{27 - 26}} \times 100$</td></tr>
</table>
Note: (ℓ) and (m) are photometric points.</td><td>(1) Verify the specified upper/lower limit.
(2) Check if the reagent has been prepared properly or it is placed at a proper position.</td></tr>
<tr><td rowspan="3">Reaction limit exceeded (only for rate assay)</td><td>LIMT0</td><td>I</td><td>The main wavelength absorbance exceeds the reaction limit (ABS. LIMIT input value corrected automatically) at all photometric points used for calculation.</td><td rowspan="3">(1) Dilute the sample and rerun.</td></tr>
<tr><td>LIMIT1</td><td>J</td><td>The main wavelength absorbance exceeds the reaction limit at the second and subsequent photometric points used for calculation (except the first photometric point).</td></tr>
<tr><td>LIMIT2</td><td>K</td><td>The main wavelength absorbance exceeds the reaction limit at the third and subsequent photometric points used for calculation (except the first and second photometric points).
Note: If the input photometric range parameters (ℓ) and (m) do not satisfy '$\ell + 2 < m$', the reaction limit is exceeded always.</td></tr>
</table>

Table 6-2-1 Data Alarms (2/3)

Alarm	Printout Message	Display on Data Monitor	Meaning	Countermeasure
Abnormal linearity (only for rate assay)	LIN.	W	In comparison check of the absorbance variation rates at the first and last six points in the specified photometric range, it has been found that there is a difference exceeding the allowable value. (For details, refer to 3-7 (6) in the instruction manual.)	(1) Check the stirring mechanism. (2) Dilute the sample and rerun. (3) Condition of linearity check ΔAuv > 6 m ABS, ΔAf − ΔAb > 6 m ABS.
	LIN. 8	F	Where there are less than eight photometric points within the reaction limit range, comparison check of the absorbance variation rates at the first and last three points has found a difference exceeding the allowable value. (For details, refer to 3-7 (6) in the instruction manual.)	
Duplicate error	DUP	–	In calibration, a difference between standard solution absorbances measured twice is larger than the duplicate limit.	(1) Verify the duplicate limit value. (2) Carry out calibration again.
Standard error	STD?	–	(1) In calibration, any one of the following alarms is encountered: ADC abnormal, abnormal cell blank, insufficient sample, insufficient reagent, excessive absorbance, reaction limit exceeded, abnormal linearity, prozone error, duplicate error, calculation disabled. Noise error, level error (for electrolyte analysis) (2) In calibration, the APU error has occurred (error in arithmetic processor: code 95-1 to 95-4)	(1) See alarm code STANDARD? (50-1 to 50-40).
Sensitivity error	SENS	–	Sensitivity is checked for linear, nonlinear and isozyme-P calibration. This error is indicated if a difference between the absorbance of STD(1) and STD(N)$^{\text{Note 1)}}$ is smaller than the sensitivity limit (input value). **Note 1)** N: = 2 .... Linear, or isozyme-P calibration = 3 to 6..... Nonlinear calibration (Calibration point input) **Note 2)** If only either one of STD(1) and STD(N) is measured, the previous absorbance of currently non-measured STD is used for sensitivity check.	(1) See alarm code SENSITIVITY? (53-1 to 53-40).
Convergence error	SDI	–	In nonlinear calibration, the residual value is larger than the SD limit (input value).	(1) See alarm code CALIB. SD? (52-1 to 52-40).
Calibration error	CALIB	–	In calibration for photometric assay, the current K factor differs from the previous value by more than ±20%.	(1) See alarm code CALIBRATION (51-1 to 51-40).
Test-to-test compensation error	CMP.T	C	(1) In test-to-test compensation calculation, other than the data alarms shown below is indicated at the compensation data. (2) In isozyme-Q concentration calculation, other than the data alarms shown below is indicated at isozyme-P concentration data. Calculation disabled, test-to-test compensation disabled, overflow, random error, systematic error, normal upper/lower limit exceeded	(1) Check related data.
Test-to-test compensation disabled	CMP. T!	M	1) Denominator becomes zero in test-to-test compensation calculation. 2) The test used for test-to-test compensation has not been measured yet. 3) Any test used for test-to-test compensation has the data alarm 'calculation disabled' or 'test-to-test compensation disabled'. **Note:** Blank space is left for data.	(1) Same as above.
Panic value exceeded	PANIC	$	The measured value is out of the panic value range.	(1) Rerun and verify the rerun result.

Table 6-2-1 Data Alarms (3/3)

Alarm	Printout Message	Display on Data Monitor	Meaning	Countermeasure
Random error			A random error has been found in the realtime quality control. (For details, refer to 3-11 (3) — Realtime Quality Control.)	(1) See alarm code CONTROL RANDOM (54-1 to 54-43).
Random error 1	RANDM1	@		
Random error 2	RANDM2	@		
Systematic error			A systematic error has been found in the realtime quality control. (For details, refer to 3-11 (3) — Realtime Quality Control.)	(1) See alarm code CONTROL SYSTEM (55-1 to 55-43).
Systematic error 1	SYSTM1	#		
Systematic error 2	SYSTM2	#		
Systematic error 3	SYSTM3	#		
Systematic error 4	SYSTM4	#		
Systematic error 5	SYSTM5	#		
Systematic error 6	SYSTM6	#		
Calculation test error	CALC?	—	Other than the data alarms shown below is indicated at the test used for calculation. Calculation disabled, test-to-test compensation disabled, normal upper/lower limit exceeded	(1) Check related data.
Overflow	OVER	O	The concentration or activity value cannot be output within the specified number of digits. **Note:** Blank space is left for data.	(1) Try rerun.
Calculation disabled	???	X	(1) Denominator becomes zero in calculation. (2) An overflow occurs in logarithmic or exponentiation calculation. (3) The APU (arithmetic processor unit) error occurs during calculation. (4) In isozyme-Q concentration calculation, the data alarm 'calculation disabled' is indicated at isozyme-P channel data or the isozyme-P channel is not measured. (5) With ORIGINAL ABS., concentration calculation is attempted through isozyme-Q channel. **Note:** Blank space is left for data.	(1) Check if there is a logical error in formulas.
Normal upper/lower limit exceeded	H	—	The test result is larger than the normal upper limit. **Note:** This error is not indicated for the control sample and serum index data.	
	L		The test result is smaller than the normal lower limit. **Note:** This error is not indicated for the control sample and serum index data.	

6-3 Instrument Alarms

Table 6-3-1 Instrument Alarms (1/17)

Alarm	Code	Level	Description	Note	Check and Remedy
STIRRER	1-1	STOP	The stirrer does not stop at the upper dead point in ascending motion.		(1) Disconnect the connector (P425), and manually check operation. (2) Replace the photocoupler (D101) if defective.
	1-2	STOP	The stirrer does not reach the upper dead point in ascending motion (on the rinsing bath side).		(1) and (2) Same as 1-1.
	1-3	STOP	The stirrer does not reach the upper dead point in ascending motion (on the cuvette side).		(1) Same as 1-1, (1).
	1-4	STOP	The stirrer does not stop at the lower dead point in descending motion.		(1) Same as 1-1, (1). (2) Replace the photocoupler (D102) if defective.
	1-5	STOP	The stirrer does not reach the lower dead point in descending motion (on the rinsing bath side).		(1) and (2) Same as 1-4.
	1-6	STOP	The stirrer does not reach the lower dead point in descending motion (on the cuvette side).		(1) Same as 1-1, (1).
	1-7	STOP	The stirrer does not stop at the cuvette position.		(1) Same as 1-1, (1). (2) Replace the photocoupler (D103) if defective.
	1-8	STOP	The stirrer does not reach the cuvette position.		(1) and (2) Same as 1-7.
	1-9	STOP	The stirrer does not stop at the rinsing bath position.		(1) Same as 1-1, (1). (2) Replace the photocoupler (D104) if defective.
	1-10	STOP	The stirrer does not reach the rinsing bath position when it moves to the rinsing bath side.		(1) and (2) Same as 1-9.
	1-11	STOP	In resetting, the stirrer is not at the upper nor lower dead point on the cuvette side, and also the reaction disk is not at the stop position.		(1) Same as 1-1, (1).
	1-12	STOP	In resetting, the stirrer is not at the upper dead point, lower dead point, cuvette side position, nor rinsing bath side position.		(1) Same as 1-1, (1).
	1-13	STOP	In resetting, the stirrer cannot be removed from the rinsing bath side.		(1) and (2) Same as 1-9.
RINSE	2-1	STOP	The rinsing mechanism does not stop at the upper dead point in ascending motion.		(1) Disconnect the connector (J428), and manually check operation. (2) Replace the photocoupler (D101) if defective.
	2-2	STOP	The rinsing mechanism does not reach the upper dead point in ascending motion.		(1) and (2) Same as 2-1.
	2-3	STOP	The rinsing mechanism does not stop at the lower dead point in descending motion.		(1) Same as 2-1, (1). (2) Replace the photocoupler (D102) if defective.
	2-4	STOP	The rinsing mechanism does not reach the lower dead point in descending motion.		(1) and (2) Same as 2-3.

Table 6-3-1 Instrument Alarms (2/17)

Alarm	Code	Level	Description	Note	Check and Remedy
RINSE	2-5	STOP	In resetting, the rinsing mechanism is not at the upper nor lower dead point, and also the reaction disk is not at the stop position.		(1) Same as 2-1, (1).
R. DISK	3-1	STOP	The reaction disk cannot detect its stop position.		(1) This trouble is liable to occur after the reaction disk is cleaned. Be sure to wipe water droplets off the bottom side of reaction disk thoroughly. (2) Check if water droplets adhere to the detector located below the reaction disk. (3) Replace the photocoupler (D102) if defective.
	3-2	STOP	The reaction disk does not stop at the specified position.		(1) to (3) Same as 3-1.
	3-3	STOP	In resetting, the reaction disk cannot detect its home position.		(1) and (2) Same as 3-1. (3) Replace the photocoupler (D101) if defective.
	3-4	STOP	In resetting, the first cuvette on reaction disk does not stop at the specified position.		(1) and (2) Same as 3-1. (3) Replace the photocoupler (D102) if defective.
SAMPLE PROBE	4-1	S. STOP	The serum probe does not reach the upper dead point in ascending motion (on other than the cuvette side).		(1) Disconnect the connector (P421), and manually check operation. (2) Replace the photocouplers (D104) if defective.
	4-2	STOP	The sample probe does not reach the upper dead point in ascending motion (on the cuvette side).		(1) Same as 4-1, (1).
	4-3	S. STOP	The sample probe moves down abnormally in descending action (on other than the cuvette side).		(1) Same as 4-1, (1). (2) Replace the photocoupler (D103) if defective. (3) Check if the sample probe is bent. If so, carry out 'PROBE ADJUST' on the MAINTENANCE screen, and repair the sample probe. (4) Check if the sample cup is distorted.
	4-4	STOP	The serum probe moves down abnormally in descending action (on the cuvette side).		(1) Same as 4-1, (1). (2) Check if the sample probe is bent. If so, execute 'PROBE ADJUST' in the MAINTE-NANCE screen, and repair the sample probe. (3) Check if the sample cup is distorted.
	4-5	S. STOP	The serum probe does not go down from the upper dead point in descending motion (on other than the cuvette side).		(1) Same as 4-1, (1). (2) Replace the photocoupler (D104) if defective.
	4-6	STOP	The serum probe does not go down from the upper dead point in descending motion (on the cuvette side).		(1) and (2) Same as 4-5.
	4-7	WARNING	Detection of abnormal descending motion of sample probe remains on.		(1) Check if the cushioning of sample probe is normal. (2) Replace the photocoupler (D103) if defective.

Table 6-3-1 Instrument Alarms (3/17)

Alarm	Code	Level	Description	Note	Check and Remedy
SAMPLE PROBE	4-8	S. STOP	The liquid level sensor of sample probe remains on.		(1) Remove water droplets settling in between the sample probe and liquid level sensor.
	4-9	S. STOP	When the sample probe travels to the cuvette side, the cuvette position cannot be detected.		(1) Disconnect the connector (P421), and manually check operation. (2) Replace the photocoupler (D102) if defective.
	4-10	S. STOP	The sample probe does not move off from the cuvette position in its traveling action from the cuvette side to other position.		(1) Same as 4-1, (1).
	4-11	S. STOP	Serum sampling probe has fallen abnormally upon sample discharge in electrolyte test.		(1) Execute SAMPLING MECHA. on MAINTENANCE screen, and if instrument doesn't return to normal, check photocoupler (D103).
SAMPLE DISK	5-1	S. STOP	The sample disk cannot detect its stop position on outer track.		(1) Disconnect the connector (P420), and manually check operation. (2) Replace the photocoupler (D101) if defective.
	5-2	S. STOP	The sample disk does not stop at the specified position on outer track.		(1) and (2) Same as 5-1.
	5-3	S. STOP	The sample disk cannot detect its stop position on inner track.		(1) Same as 5-1, (1). (2) Replace the photocoupler (D102) if defective.
	5-4	S. STOP	The sample disk does not stop at the specified position on inner track.		(1) and (2) Same as 5-3.
	5-5	S. STOP	In resetting, the sample disk cannot detect its home position.		(1) Same as 5-1, (1). (2) Replace the photocoupler (D104) if defective.
	5-7	S. STOP	The sample disk is not mounted at the start of operation.		(1) Mount the sample disk.
	5-8	S. STOP	The sample disk ID is found to have other than '0' to '9' at the start of operation.		(1) Check the sample disk no. (2) Check the ID detection position.
	5-9	WARNING	On start of analysis, ID of sample disk is other than 0 to 9.		(1) Check mounting of disk ID sensor plate in sample disk. Also check the plate for presence/absence. (2) Check ID sensor.
	5-10	STOP	On execution of maintenance program "BAR CODE READER", sample disk ID is other than 0 to 9.		Ditto
SAMPLE SYRINGE	6-1	S. STOP	The serum syringe does not reach the upper dead point.		(1) Disconnect the connector (J414), and manually check operation. (2) Replace the photocoupler (D101) if defective.
	6-2	S. STOP	The serum syringe does not go down from the upper dead point.		(1) and (2) Same as 6-1.
REAGENT 1 PROBE	7-1	STOP	The R1 probe does not reach the upper dead point in ascending motion (on other than the cuvette side).		(1) Disconnect the connector (P426), and manually check operation. (2) Replace the photocoupler (D104) if defective.

Table 6-3-1 Instrument Alarms (4/17)

Alarm	Code	Level	Description	Note	Check and Remedy
REAGENT 1 PROBE	7-2	STOP	The R1 probe does not reach the upper dead point in ascending motion (on the cuvette side).		(1) Same as 7-1, (1).
	7-3	STOP	The R1 probe moves down abnormally in descending action (on other than the cuvette side).		(1) Check if the reagent vial is not covered with the lid. (2) Check if the acrylic cover position is deviated. (3) Check that the lead wire of liquid level sensor and the acrylic cover do not come in contact with each other when the probe moves down into the reagent vial containing a small amount of reagent. (4) Replace the photocoupler (D103) if defective.
	7-5	STOP	The R1 probe does not go down from the upper dead point in descending motion (on other than the cuvette side).		(1) Same as 7-1.
	7-6	STOP	The R1 probe does not go down from the upper dead point in descending motion (on the cuvette side).		(1) Same as 7-1, (1).
	7-7	WARNING	Detection of abnormal descending motion of R1 probe remains on.		(1) Check if the R1 probe cushioning is normal. (2) Replace the photocoupler (D103) if defective.
	7-8	STOP	The liquid level sensor of R1 probe remains on.		(1) Remove water droplets settling in between the R1 probe and liquid level sensor.
	7-9	STOP	When the R1 probe travels to the cuvette side, the cuvette position cannot be detected.		(1) Disconnect the connector (P426), and manually check operation. (2) Replace the photocoupler (D102) if defective.
	7-10	STOP	The R1 probe does not move off from the cuvette position in its traveling action from the cuvette side to other position.		(1) and (2) Same as 7-9.
REAGENT 2 PROBE	8-1	STOP	The R2 probe does not reach the upper dead point in ascending motion (on other than the cuvette side).		(1) Disconnect the connector (P422), and manually check operation. (2) Replace the photocoupler (D104) if defective.
	8-2	STOP	The R2 probe does not reach the upper dead point in ascending motion (on the cuvette side).		(1) Same as 8-1, (1).
	8-3	STOP	The R2 probe moves down abnormally in descending action (on other than the cuvette side).		(1) Check if the reagent vial is not covered with the lid. (2) Check if the acrylic cover position is deviated. (3) Check that the lead wire of liquid level sensor and the acrylic cover do not come in contact with each other when the probe moves down into the reagent vial containing a small amount of reagent. (4) Replace the photocouple (D103) if defective.
	8-5	STOP	The R2 probe does not go down from the upper dead point in descending motion (on other than the cuvette side).		(1) Disconnect the connector (P422), and manually check operation. (2) Replace the photocoupler (D104) if defective.

Table 6-3-1 Instrument Alarms (5/17)

Alarm	Code	Level	Description	Note	Check and Remedy
REAGENT 2 PROBE	8-6	STOP	The R2 probe does not go down from the upper dead point in descending motion (on the cuvette side).		(1) Same as 8-1, (1).
	8-7	WARNING	Detection of abnormal descending motion of R2 probe remains on.		(1) Check if the R2 probe cushioning is normal. (2) Replace the photocoupler (D103) if defective.
	8-8	STOP	The liquid level sensor of R2 probe remains on.		(1) Remove water droplets settling in between the R2 probe and liquid level sensor.
	8-9	STOP	When the R2 probe travels to the cuvette side, the cuvette position cannot be detected.		(1) Disconnect the connector (P422), and manual check operation. (2) Replace the photocoupler (D102) if defective.
	8-10	STOP	The R2 probe does not move off from the cuvette position in its traveling action from the cuvette side to other position.		(1) and (2) Same as 8-9.
REAGENT 1 DISK	9-1	STOP	The R1 disk cannot detect its stop position.		(1) Disconnect the connector (P424), and manually check operation. (2) Replace the photocoupler (D101) if defective.
	9-2	STOP	The R1 disk does not stop at the specified position.		(1) and (2) Same as 9-1.
	9-3	STOP	The R1 disk cannot detect tis home position.		(1) Same as 9-1, (1). (2) Replace the photocoupler (D102) if defective.
REAGENT 2 DISK	10-1	STOP	The R2 disk cannot detect its stop position.		(1) Disconnect the connector (P423), and manually check operation. (2) Replace the photocoupler (D101) if defective.
	10-2	STOP	The R2 disk does not stop at the specified position.		(1) and (2) Same as 10-1.
	10-3	STOP	The R2 disk cannot detect its home position.		(1) Same as 10-1, (1). (2) Replace the photocoupler (D102) if defective.
REAGENT 1 SYRINGE	11-1	STOP	The R1 syringe does not reach the upper dead point.		(1) Disconnect the connector (J415), and manually check operation. (2) Replace the photocoupler (D101) if defective.
	11-2	STOP	The R1 syringe does not go down from the upper dead point.		(1) and (2) Same as 11-1.
REAGENT 2 SYRINGE	12-1	STOP	The R2 syringe does not reach the upper dead point.		(1) Disconnect the connector (J416), and manually check operation. (2) Replace the photocoupler (D101) if defective.
	12-2	STOP	The R2 syringe does not go down from the upper dead point.		(1) and (2) Same as 12-1.
TEMP CONTROL	13-1	WARNING	The temperature of reaction (incubation) bath exceeds 39°C		(1) Check if the radiator filter equipped on the frot right cover is clogged with dust or dirt.
	13-2	WARNING	The temperature of reaction (incubation) bath is out of the following ranges: 25 ± 0.5°C 30 ± 0.5°C 37 ± 0.5°C	Check during operation only.	(1) Check if the room temperature is within a range of 15 to 32°C. (2) Check if the radiator filter equipped on the front right cover is clogged with dust or dirt.

Table 6-3-1 Instrument Alarms (6/17)

Alarm	Code	Level	Description	Note	Check and Remedy
INCUBATOR WATER	14-1	WARNING	The water level of reaction (incubation) bath is too low.		(1) Check if the snap-in joint of distilled water tank is connected securely. (2) Check if the pump (MD-20RZG) contains air. If so, call up the MAINTENANCE screen, and carry out 'INC. WATER EXCHANGE' several times. (3) Check if the pump filter is clogged. (Refer to 4-3-13 in the instruction manual.)
REFRESH WATER	15-1	WARNING	A time period of 24 hours has elapsed after exchanging water in the reaction (incubation) bath.		(1) Carry out 'INC. WATER EXCHANGE', or turn power off and then on.
SIPPER	16-1	STOP	The negative pressure of vacuum pump is not enough.	Check when vacuum sucking is performed.	(1) Check if there is air leakage from the rubber plug on vacuum tank.
DISTILLED WATER	17-1	S. STOP	The water level of distilled water tank is too low.		(1) Check if the distilled water tank is supplied with water. Also, check the water pressure, water cock, deionizer, and water supply paths. (2) Check if the water supply filter is clogged.
RESERVOIR	18-1	WARNING	The waste solution tank (reservoir) is full.		(1) Make the waste solution tank empty.
ROOM TEMP	19-1	WARNING	The temperature of power supply unit exceeds 70°C.		(1) Check if the cooling fan is running. (2) Check if the room temperature is too high.
DC POWER	20-1	E. STOP	24 V DC power supply abnormal (for other than pulse motor drive)		(1) Check if the fuse is blown (located on the right side of instrument). (2) Check if the output volts of DC power unit is too low.
	20-3	STOP	15 V DC power supply abnormal		
	20-4	STOP	−15 V DC power supply abnormal		
	20-5	WARNING	12 V DC power supply abnormal (for lamp)		
	20-6	STOP	12 V DC power supply abnormal (for FDD)		
	20-7	E. STOP	24 V DC power supply abnormal (for pulse motor drive)		
REAGENT SHORT	21-1 to 64	WARNING	The remaining reagent volume is insufficient, i.e. its count is less than ten tests. R1: Channels 1 to 32 . . . Codes 1 to 32 R2: Channels 1 to 32 . . . Codes 33 to 64	Not checked for ISE.	(1) Call up the REAGENT VOLUME CHECK screen, and check if any reagent is insufficient. (2) Set a new volume of reagent. (3) Check if distilled water is set mistakenly in place of reagent.
CELL BLANK	22-1 to 6	WARNING	In four repeated measurements of cell blank (after injection of cell blank water), abnormal blank absorbance is encountered twice or more (see 'Note'). Relevant cell block number is indicated with code.	Note: A difference from the blank absorbance measured in execution of 'CELL BLANK' on the MAINTENANCE screen exceeds the allowable limit of 0.1 Abs.	(1) Check if the reaction cuvette has contamination or crack. (2) Check if air bubbles are generated in the reaction cuvette. (3) Check if dust or dirt is left in the reaction (incubation) bath. (4) Check if the rinsing water is sufficient. (5) Check if 'CELL BLANK' has been executed (after replacement of lamp, cuvettes or floppy disk.)

Table 6-3-1 Instrument Alarms (7/17)

Alarm	Code	Level	Description	Note	Check and Remedy
PHOTOMETER LAMP	23-1	S. STOP	In cell blank measurements, abnormal blank absorbance is encountered three times or more.	Abnormal if approx. 3.3 Abs is exceeded.	(1) Check if the lamp filament is burned out.
	23-2	WARNING	In cell blank measurements, abnormal blank absorbance is encountered less than three times.		
VACUUM NOZZLE	24-1	WARNING/ STOP	Vacuum nozzle has not reached uppermost position.		(1) Execute RESET on MAINTENANCE screen. (2) Check photocoupler for vacuum nozzle. (3) Check up/down motion manually, and if not normal, check solenoid valve (2) and vacuum nozzle assy.
	24-2	WARNING/ STOP	Vacuum nozzle cannot leave uppermost position.		
ISE SYRINGE	25-1	WARNING/ STOP	Sipper syringe has not reached uppermost position.		Execute SAMPLING MECHA. on MAINTENANCE screen, and if instrument doesn't return to normal, check photocoupler of uppermost position detection.
	25-2	WARNING/ STOP	Sipper syringe cannot move from uppermost position.		
	25-3	WARNING/ STOP	Diluent syringe has not arrived at uppermost position.		
	25-4	WARNING/ STOP	Diluent syringe cannot move from uppermost position.		
	25-5	WARNING/ STOP	Internal standard solution syringe has not yet been located at uppermost position.		
	25-6	WARNING/ STOP	Internal standard solution syringe has got stuck at uppermost position.		
ISE DOOR	26-1	WARNING	Door of ISE compartment is left open.		Close the door securely. Check photocoupler.
ADC? (ADC abnormal)	27-1	WARNING	The ADC for subordinate (secondary) wavelength in photometric assay does not work properly.		(1) Check the photocoupler (D103) of the reaction disk. (2) Check TRI ADC 717.
	27-2	WARNING	The ADC for main (primary) wavelength in photometric assay does not work properly.		
	27-3	WARNING	ADC for electrolyte test does not function normally.		Execute RESET on MAINTENANCE screen. (1) Check TRI ADC 717 P.C.B..
	27-4	WARNING	The ADC for temperature control does not work properly.		(1) Check FSBC PCB.
ADC CALIB?	28-1	WARNING	In the photometric assay subordinate wavelength ADC, the reference voltage ADC count is abnormal.		(1) Check the TRIADCP board connector (P71).
	28-2	WARNING	In the photometric assay main wavelength ADC, the reference voltage ADC count is abnormal.		
	28-3	WARNING	ADC for electrolyte test provides abnormal reference voltage ADC count.		(1) Execute RESET on MAINTENANCE screen. (2) Same as above 28-1, (1).
	28-4	WARNING	In the temperature control ADC, the reference voltage ADC count is abnormal.		(1) Check FSBC PCB.
CRAM	29-1	WARNING	An error is encountered with the CRAM.		(1) Check the CPU board connectors (P6/P12). (2) Check the TEMP AMP board connectors (P444/ P445/P482). (3) Replace EXT. MEM717 PCB, if defective.

Table 6-3-1 Instrument Alarms (8/17)

Alarm	Code	Level	Description	Note	Check and Remedy
FUSE	30-1	E. STOP	The fuse has blown.		(1) Check if the fuse has blown (on the right side of instrument).
VACUUM TANK	31-1	WARNING	The vacuum tank contains water.		(1) Check if the vacuum tank contains water. (2) Check if the solenoid valves are clogged (SV30, SV31 and SV33 located on the left side of instrument). (3) Replace EXT. MEM 717 PCB if defective.
COLD WATER TANK	32-1	WARNING	The water level of cooling water bath is too low.		(1) Replenish the cooling water bath with purified water. (Refer to 4-3-15 in the instruction manual.)
ROUTINE START NO.?	33-1	WARNING	The start sample number assigned on the START CONDITIONS screen is illegal.		(1) Verify 'START SAMPLE DISK No. on the START CONDITIONS screen.
SAMPLING END	34-1	WARNING	There is no routine sample to be measured. The end of sampling is indicated.		
INTERRUPT ERROR	35-1	WARNING	Interrupt error in FIRQ	○ Displayed on the screen at power-on.	(1) Replace TRIADCP PCB. (2) Replace FSBC5 PCB. (3) Replace S. I/F APU PCB.
	35-2	WARNING	Interrupt error in IRQ		
	35-3	WARNING	Interrupt error in NMI		
POWER FAIL	36-1	WARNING	AC power supply has gone down.	○ Displayed on the screen at power-on.	(1) This warning informs the user of occurrence of power failure (momentary power failure).
	36-2	WARNING	5 V DC power supply has gone down.		
MOTOR CONTROLLER	37-1 to 16	STOP	In data writing to the motor controller, the previous data is not taken in yet. Or, in data reading from it, the relevant data is not found. (For codes 1 to 16, see the next column.)		(1) Replace MCONT1 or MCONT2 PCB. (2) Replace ISE CONT PCB.
MOTOR TIMEOUT	38-1 to 16	E.STOP	The motor controller does not accept other than the stop command while the motor is running. (For codes 1 to 16, see the next column.)		(1) Replace MCONT1 and MCONT2 PCB. (2) Replace ISE CONT PCB.

Code	Motor	Code	Motor
1	Serum sampling arm up/down	9	R2 pipetting arm rotation
2	Serum sampling arm rotation	10	R2 disk rotation
3	Reaction disk rotation	11	Rinsing/stirring mechanism up/down
4	Sample disk rotation	12	Pump x 5
5	R1 disk rotation	13	Stirring mechanism back/forth, or serum syringe up/down
6	R1 pipetting arm up/down	14	R1 and R2 syringe up/down
7	R1 pipetting arm rotation		
8	R2 pipetting arm up/down		

Code	Motor
15	Internal standard syringe up/down (ISE)
16	Sipper or diluent syringe up/down (ISE)

Table 6-3-1 Instrument Alarms (9/17)

Alarm	Code	Level	Description	Note	Check and Remedy
BAR CODE READER?	39-1 to 60	WARNING	One of the errors below has occurred at sample position corresponding to relevant code. (1) Parity error in communication with bar code reader. (2) Framing error in communication with bar code reader. (3) Overrun error in communication with bar code reader. (4) BCC error in communication with bar code reader. (5) Data reception from bar code reader is not completed before ID reception time is over. (read error due to wrong label or bar code reader defective).	(1) Code numbers 1 through 60 stand for sample position numbers. (2) This alarm is displayed in the following way. 1) On screen during analysis (OPERATION MONITOR screen). 2) Mark "*" printed out while check program on MAINTENANCE screen is running.	(1) Confirm that bar code label at position corresponding to relevant code is present, correct and properly oriented/positioned. (2) Check operation by running "BAR CODE READER" of maintenance program. Check CCD reader and decoder.
PM DRIVE TEMP	40-1	WARNING	Excessively high temperature on the pulse motor drive circuit board 1.	This alarm is issued if the temperature is higher than 70°C.	(1) Check if the cooling fan is running properly. (2) Check if the room temperature is too high.
	40-2	WARNING	Excessively high temperature on the pulse motor drive circuit board 2.		
DEGASSER	41-1	WARNING	The vacuum level of degasser (deaerator) is too low.		(1) Replace DEGASSER CONTROL unit. (2) Replace vacuum pump for DEGASSER.
REQ. FULL	42-1	WARNING	Sample reception became impossible during use of sample ID function. (1) Reception from PATIENT TEST SELECTION screen has been made in excess of 1001 samples. (2) Reception has been made beyond 997 samples when reading bar code for inquiring of real-time test selection to host computer. (3) Reception by inquiry of batch mode test selection to host computer has exceeded 997 samples.		Analyze received samples and output data or transmit data to host computer. Then clear the contents of reception and receive remaining samples.
ISE STOP OK?	43-1	WARNING	Electrolyte function is withheld due to alarm. (This alarm is presented upon restart in SAMPLING STOP status. On this occasion, photometric line functions, but electrolyte line cannot be activated.)		Take remedy against the presented alarm for electrolyte test, and then restart it.

Table 6-3-1 Instrument Alarms (10/17)

Alarm	Code	Level	Description	Note	Check and Remedy
STANDARD?	50-1 to 40 (test codes)	WARNING	In photometric assay: (1) STD absorbance data is alarmed during calibration. (2) Nonlinear calibration calculation is disabled. (3) The APU error (arithmetic processor unit error: codes 95-1 to 4) is encountered during calibration.	Neither updating of calibration result nor saving to FD is performed.	In photometric assay: (1) Verify the duplicate limit value specified on the CHEMISTRY PARAMETERS screen. (2) Check if the standard solution and reagent are sufficient. (3) Check if the cell blank alarm has been issued. (4) Check if an absorbance of 3.3 Abs is exceeded. (5) Check if the reaction limit is exceeded. (6) Check if the ADC alarm has been issued. (7) Check if the linear alarm has been issued.
STANDARD? **(standard error)**	50-41 (Na) 50-42 (K) 50-43 (Cℓ)	WARNING	Calibration is invalidated because of abnormal ADC, insufficient sample, noise error, level error or suspended calculation.		Take remedy against alarm added to electromotive force of internal standard solution or concentration of standard solution. Then conduct calibration again.
CALIBRATION	51-1 to 40 (test codes)	WARNING	In photometric assay: The K factor determined in calibration differs from the previous value by more than ±20 %.	Updating of calibration result is carried out, but saving to FD is not performed.	In photometric assay: (1) Verify the previous K factor value stored on floppy disk. (2) Check if the standard sample material has been changed. (3) Check if the quality of reagent has been changed.
CALIBRATION **(calibration error)**	51-41 (Na) 51-42 (K) 51-43 (Cℓ)	WARNING	Measured concentration of calibrator (STD 3) or slope factor has fluctuated beyond COMPENSATE LIMIT (%) in comparison with the previous value. (Refer to "5-2 ISE PARAMETERS Screen" of Section 5.)		Confirm standard solution and calibrator, and then perform calibration again.
CALIB. SD?	52-1 to 40 (test codes)	WARNING	In nonlinear calibration, the residual convergence error is larger than the SD limit (input value).	Same as above.	(1) Verify the SD limit value specified on the CHEMISTRY PARAMETERS screen. (2) Check if the quality of reagent has been changed. (3) Check if the standard solution is set properly. (4) Verify the input concentration value of standard solution.
SENSITIVITY?	53-1 to 40 (test codes)	WARNING	In linear, nonlinear or isozyme-P calibration, a difference between mean STD(1) absorbance and mean STD(N) Note 1) is smaller than the sensitivity limit (input value). **Note 1), 2)**	Neither updating of calibration result nor saving to FD is performed.	(1) Verify the sensitivity limit value specified on the CHEMISTRY PARAMETERS screen. (2) Check if the quality of reagent has been changed. (3) Verify the input concentration value of standard solution. (4) Check if the quality of standard solution has been changed.

Note 1) and 2) : N: = 2 . . . . Linear, or isozyme-P calibration
= 3 to 6 . . . Nonlinear calibration (Calibration point input)
If only either one of STD(1) and STD(N) is measured, the previous absorbance of currently non-measured STD is used for sensitivity check.

Table 6-3-1 Instrument Alarms (11/17)

Alarm	Code	Level	Description	Note	Check and Remedy
CONTROL RANDOM	54-1 to 43 (test codes)	WARNING	A random error has occurred in realtime quality control.		(1) Verify the $\overline{X}$ and SD values specified on the REAL TIME QC screen. (2) Check if there are air bubbles on the inside or outside wall of reaction cuvette. (3) Check if reproducibility is normal. (4) Check if the degasser (deaerator) and seal piece are normal. (5) Check if the reagent or deionized water is contaminated. (6) Check if the photometer is normal (carry out 'PHOTOMETER CHECK').
CONTROL SYSTEM	55-1 to 43 (test codes)	WARNING	A systematic error has occurred in realtime quality control.		(1) to (6) Same as above. (7) Check if the control serum is proper. (8) Check if the quality of control serum has been changed. (9) Check if the control serum has been adjusted properly.
ISE. LEVEL (level error)	60-1 (Na) 60-2 (K) 60-3 (Cℓ)	WARNING	Electromotive force of internal standard solution is abnormal. This emf is outside the range below. Na, K : −90 to −10 mV Cℓ : 80 to 160 mV		Confirm reagent. Check inside of ISE compartment for liquid leakage.
ISE. NOISE (noise error)	61-1 (Na) 61-2 (K) 61-3 (Cℓ)	WARNING	Noise has surged during measurement. Rise of noise level beyond the following. Na : 0.7 mV K : 1.0 mV Cℓ : 0.8 mV		Confirm proper quantity of reagent. Check inside of ISE compartment for liquid leakage. Refer to 7-1-6 ISE troubleshooting.
ISE. PREPARE (electrode preparation)	62-1 (Na) 62-2 (K) 62-3 (Cℓ)	WARNING	Slope level has dropped as a result of calibration, or electrode response has degraded. Slope level is within the following. Na, K : 32 mV ≦ SLOPE ≦ 37.9 mV, 68.1 mV ≦ SLOPE Cℓ : −29.9 mV ≦ SLOPE ≦ −25 mV, −68.0 mV ≦ SLOPE		(1) Refer to 7-1-6 ISE troubleshooting. (2) Prepare new electrode, if necessary.

Table 6-3-1 Instrument Alarms (12/17)

Alarm	Code	Level	Description	Note	Check and Remedy
ISE. SLOPE **(slope abnormal)**	63-1 (Na) 63-2 (K) 63-3 ($C\ell$)	WARNING	Slope level has dropped as a result of calibration, or electrode response has degraded. Slope level is within the following. Na, K : SLOPE < 32.0 mV $C\ell$: SLOPE > −25.0 mV		Replace electrode. Refer to 7-1-6 ISE troubleshooting.
ISE. I. STD. **(concentration of internal standard solution abnormal)**	64-1 (Na) 64-2 (K) 64-3 ($C\ell$)	WARNING	Concentration of internal standard solution is abnormal as a result of calibration. Concentration of internal standard solution is outside the following. Na : 120 to 160 mEq/ℓ K : 3 to 7 mEq/ℓ $C\ell$: 80 to 120 mEq/ℓ		Confirm reagent.
CH. ASSIGN.? (CH.)	70-1 to 32 (ch.)	WARNING	The channel assignment is erroneous as mentioned below. (1) The channel assignment is made only for TEST2. (2) Although the channel assignment is made for both TEST1 and TEST2, the assay codes assigned for them are not identical. (3) Although the channel assignment is made for both TEST1 and TEST2, the twin test assay codes are not given to them. (4) The same test code is specified for TEST1 and TEST2. (5) Where only TEST1 is selected, the twin test assay code is given.	Analytical operation cannot be started.	(1) Cancel 'TEST2' assignment except for the channel where twin test assay (3-point assay, 1-point and rate assay, rate-B assay) is specified. (2) Enter necessary parameter for 'TEST2' corresponding to the twin test channel.
ISOZYME CH.? (QCH.)	71-1 to 32 (ch.)	WARNING	The isozyme-P calibration method is not parameterized for the preceding channel.	Analytical operation cannot be started.	(1) Use consecutive channels for isozyme-P and isozyme-Q assays.
CHEM. PARA.? (T.C.)	72-1 to 40 (test codes)	WARNING	The parameter setting for relevant test is improper. (1) The relationship between assay code and photometric point is improper. (2) The relationship between assay code and calibration method is improper. (3) Necessary STD position is not specified. (4) For nonlinear calibration method, a model number or calibration points are not specified. (5) The R1 or R2 pipetting volume (including diluent) exceeds 350 μL.	(1) Analytical operation cannot be started. (2) Not checked for tests undefined on the CHANNEL ASSIGNMENT screen.	(1) Examine the relationship between analytical method and test parameters. (2) For the nonlinear calibration test, specify a model number and calibration points on the CHEMISTRY PARAMETERS screen. (3) Reduce the R1 or R2 pipetting volume below 350 μL.

Table 6-3-1 Instrument Alarms (13/17)

Alarm	Code	Level	Description	Note	Check and Remedy
RANGE? (T.C.)	73-1 to 43, 47 to 54 (test codes)	WARNING	In parameterization of expected or panic value corresponding to the relevant test, the low value is larger than the high value.	Analytical operation cannot be started.	(1) Verify test parameters specified on the CHEMISTRY PARAMETERS screen.
CMP. TEST? (F. NO.)	74-1 to 8 (formula numbers)	WARNING	The formula number setting is improper. (1) An undefined compensation test is specified. (2) A compensated test is not included in the formula. (3) Where the photometric assay is selected as a compensated test, the electrolyte parameter is specified.	(1) Analytical operation cannot be started. (2) Not checked for ORIGINAL ABS.	(1) Check the related original parameters.
SERUM INDEXES (T.C.)	75-1 to 40 (test codes)	WARNING	Although the serum index measurement is selected, the rate-A assay code is not specified.	Analytical operation cannot be started.	(1) Specify the rate-A assay code for serum index channel.
PRINTER	90-1	WARNING	(1) Hardware failure (The acknowledge signal is not returned from printer.) (2) Timeout error		
	90-2	WARNING	(1) Chart paper is not loaded on the printer. (2) The printer select button is off. (3) The printer connector is unplugged.		(1) Load chart paper on the printer. (2) Turn on the select button. (3) Plug in the connector securely.
	90-3	WARNING	(1) Self-check error		(1) FSBC5 PCB defective.
	90-4	WARNING	(1) An illegal character has been transferred.	Illegal characters: Other than ASCII codes \$20 to \$7B, \$CD, \$CA, \$OC, and \$04.	(1) FSBC5, S. I/F APU PCB, printer.
	90-5	WARNING	(1) In report mode, the result data (routine, stat and control samples) cannot be printed within a line count range specified by PAGE LENGTH parameter.	Output timing: On completion of printing out the result data of one sample.	(1) Verify the PAGE LENGTH parameter value specified on the REPORT FORMAT screen.
SYSTEM I/F	91-1	WARNING	The text cannot be received from the system within the predetermined period of time.	Timeout error in data transfer from host to 717	(1) Check if the host computer is put in service. (2) Check if the connector is plugged in properly. (3) Check if the connector remains plugged in during data transmission.
	91-2	WARNING	The received text contains an illegal character.	Character error in data transfer from host to 717	
	91-3	WARNING	The character count in received test is out of the allowable range. (1) The character count between STX to ETX is out of the predetermined range. (2) The communication protocol is ignored in text transfer from system to 717.	Format error in data transfer from host to 717	
	91-4	WARNING	A vertical parity error has been found in data reception.	Receiving error in data transfer from host to 717	

Table 6-3-1 Instrument Alarms (14/17)

Alarm	Code	Level	Description	Note	Check and Remedy
SYSTEM I/F	91-5	WARNING	An overrun error has occurred in data reception.	Same as above.	(1) Check if the host computer is put in service. (2) Check if the connector is plugged in properly. (3) Check if the connector remains plugged in during data transmission.
	91-6	WARNING	A framing error has occurred in data reception.	Same as above.	
	91-7	WARNING	A BCC error has been found in received test.	BCC error in data transfer from host to 717	
	91-8	WARNING	Data cannot be transmitted to the system within the predetermined period of time.	Timeout error in data transfer from 717 to host	
	91-9	WARNING	In batch mode communication, the system has returned an NAK signal for the fourth transfer retry.		
	91-10	WARNING	Communication has been attempted regardless of an unsuccessful initialization of the buffered controller.		
	91-11	WARNING	A command cannot be issued to the buffered controller.		
	91-12	WARNING	The end-of-command interrupt is not returned from the buffered controller.		
	91-13	WARNING	An illegal command or invalid data write has been attempted to the buffered controller.		
	91-14	WARNING	An error has occurred in accessing the FIFO memory of buffered controller.		
	91-15	WARNING	The serial interface LSI circuit of buffered controller is faulty.		
	91-16	WARNING	An invalid interrupt has been issued from the buffered controller.		
	91-17	WARNING	The comment data received from the system is not displayable.	The comment data is handled as blank.	
KEY CODE?	92-1	WARNING	An nonexistent keycode has been input.		(1) FSBC5. (2) Keyboard.
C-RAM ERROR	93-1	WARNING	An error has occurred in the C-RAM for control ID No. 1.	The codes 1 to 6 correspond to the control ID numbers. (Daily QC)	(1) FSBC5 PCB.
	93-2	WARNING	An error has occurred in the C-RAM for control ID No. 2		
	93-3	WARNING	An error has occurred in the C-RAM for control ID No. 3.		
	93-4	WARNING	An error has occurred in the C-RAM for control ID No. 4.		
	93-5	WARNING	An error has occurred in the C-RAM for control ID No. 5.		
	93-6	WARNING	An error has occurred in the C-RAM for control ID No. 6.		

Table 6-3-1 Instrument Alarms (15/17)

Alarm	Code	Level	Description	Note	Check and Remedy
REAL TIME CLOCK	94-1	WARNING	A read error has been encountered with the realtime clock.		(1) FSBC5 PCB
APU ERROR	95-1	WARNING	An APU reset timeout has occurred (APU: Arithmetic processor unit).	Checked once at power-on.	(1) S. I/F APU PCB.
	95-2	WARNING	A data ready timeout has occurred.		
	95-3	WARNING	A status ready timeout has occurred.		
	95-4	WARNING	A command execution timeout has occurred.		
FD DOOR OPEN	100-1	WARNING	The FDD door is left open, or the disk is not inserted completely (on the system FDD).	FDD: Floppy disk drive	(1) Insert the disk properly.
	100-2	WARNING	The FDD door is left open, or the disk is not inserted completely (on the data FDD).		
WRONG FD?	101-1	WARNING	A wrong disk has been inserted (on the system FDD).		(1) Put the system disk into drive 1, and the data disk into drive 2.
	101-2	WARNING	A wrong disk has been inserted, or the disk has been exchanged during analytical operation (on the data FDD).		
FD READ?	102-1	WARNING	During execution of logout (daily QC alarm), a hardware error has occurred in a read of alarm data.		(1) Clean the floppy disk drive. (Refer to 4-3-23 – Cleaning of Floppy Disk Drive.) (2) Check if the floppy disk (medium) has reached the end of its useful time. (Lifetime: Up to 100 thousand accesses are allowed.) (For the access count of the disk being used, refer to 6-14 in the instruction manual.)
	102-2	WARNING	During execution of logout (cumulative alarm), a hardware error has occurred in a read of alarm data.		
	102-3	WARNING	A hardware error has occurred in a read of cumulative quality control data.		
	102-4	WARNING	A hardware error has occurred in a read of calibration trace data.		
	102-5	WARNING	A hardware error has occurred in a read of parameters.		
	102-13	WARNING	A hardware error has occurred in a read of routine/rerun smaple test selection data.		
	102-14	WARNING	A hardware error has occurred in a read of calibration/control test selection data.		
	102-15	WARNING	During execution of photometer check, a hardware error has occurred in a read of previously measured value.		
	102-16	WARNING	A hardware error has occurred in a read of test results of routine/rerun samples.		
	102-18	WARNING	A hardware error has occurred in a read of test results of stat samples.		

Table 6-3-1 Instrument Alarms (16/17)

Alarm	Code	Level	Description	Note	Check and Remedy
FD READ?	102-19	WARNING	A hardware error has occurred in a read of calibration data for realtime printout.		
	102-20	WARNING	During execution of logout (communication trace), a hardware error has occurred in a read of trace data.		
	102-30	WARNING	(1) During execution of FD copy command, a hardware error has occurred in the drive 1. (2) During execution of FD check command, a hardware error has occurred. (3) During execution of logout (operation count), a hardware error has occurred in a read of operation count. (4) During power initialization, an error has occurred in a read of FD part number/revision number.		
FD WRITE?	103-1	WARNING	A hardware error has occurred in a write of daily alarm.		(1) Same as for 'FD READ?' alarm.
	103-2	WARNING	A hardware error has occurred in a write of cumulative alarm.		
	103-3	WARNING	A hardware error has occurred in accumulation/deletion of daily quality control data.		
	103-4	WARNING	A hardware error has occurred in a write of trace data of photometric/electrolyte assay calibration result.		
	103-5	WARNING	A hardware error has occurred in a write of parameters.		
	103-7	WARNING	A hardware error has occurred in a write of remaining reagent volume.		
	103-8	WARNING	A hardware error has occurred in a write of photometric assay calibration result.		
	103-9	WARNING	A hardware error has occurred in a write of electrolyte assay calibration result.		
	103-10	WARNING	A hardware error has occurred in a write of serum index blank value.		
	103-11	WARNING	A hardware error has occurred in a write of reagent blank level value.		
	103-12	WARNING	During cell blank measurement, a hardware error has occurred in a write of all cell's measured results.		

Table 6-3-1 Instrument Alarms (17/17)

Alarm	Code	Level	Description	Note	Check and Remedy
FD WRITE?	103-13	WARNING	A hardware error has occurred in a write of routine/rerun sample test selection data.		(1) Same as for 'FD READ?' alarm.
	103-14	WARNING	A hardware error has occurred in a write of calibration/control test selection data.		
	103-15	WARNING	During execution of photometer check, a hardware error has occurred in a write of current measured value.		
	103-16	WARNING	A hardware error has occurred in a write of test results of routine samples.		
	103-17	WARNING	A hardware error has occurred in a write of test results of return samples.		
	103-18	WARNING	A hardware error has occurred in a write of test result of stat samples.		
	103-19	WARNING	An error has occurred in an attempt of temporarily saving the calibration result for realtime printout into floppy disk.		
	103-20	WARNING	A hardware error has occurred in a write of communication trace data.		
	103-30	WARNING	(1) During execution of FD copy command, a hardware error has occurred in the drive 2. (2) The FD head cleaning or FD formatting has been unsuccessful.		
FD WRITE PROTECT	104-1	WARNING	The write-protected disk has been inserted (on the system FDD).		(1) Check if the correct floppy disk has been loaded.
	104-2	WARNING	The write-protected disk has been inserted (on the data FDD).		
EXCHANGE FD	105-1	WARNING	The disk operation count exceeds '100,000' (on the system FDD).	Alarm indicated only at power-up	(1) Clean the FDD read/write head using the cleaning disk. Then, replace the floppy disk with a new one. (For operation count, refer to 6-14 in the instruction manual. For cleaning, refer to 4-3-22.)
	105-2	WARNING	The disk operation count exceeds '100,000' (on the data FDD).		

(Note) WARNING/STOP (Alarm level of ISE)

In case of functions (ISE PRIME, WASH (ISE)) only for electrolyte analysis, "STOP" appears, while "WARNING" is displayed for other functions, followed by stoppage of only the actions associated with electrolytes.

6-4 Retry Code Table

Table 6-4-1 Retry Code Table (1/5)

Code	Description	Allowable No. of Retries	Remarks
1	FIRQ interrupt abnormality	100/cycle	CPU stops when exceeding 100 times.
2	IRQ interrupt abnormality	↑	
3	NMI interrupt abnormality	↑	
4	————		
5	————		
6	————		
7	————		
8	————		
9	————		
10	————		
11	Water drops between reagent probe and sensor (R1)	2	
12	Water drops between reagent probe and sensor (R2)	↑	
13	Fuse off	1	
14	Spare	1	
15	15 V abnormality	1	
16	−15 V abnormality	↑	
17	Lamp 12 V abnormality	↑	
18	FDD 12 V abnormality	↑	
19	24 V abnormality	↑	
20	24 V abnormality (P. M.)	1	
21	Vacuum tank liquid level abnormality	↑	
22	Waste solution tank full	↑	
23	Water level in coolant bath	↑	
24	Water level in incubation bath	↑	
25	Distilled water insufficient	10	
26	Electric rack temperature abnormality	1	
27	Vacuum abnormality	↑	
28	Degasser abnormality	↑	
29	Stepping motor drive board 1 temperature abnormality	↑	
30	Stepping motor drive board 2 temperature abnormality	↑	
31	ISE door open	1	
32 ~ 40	Spare		

Table 6-4-1 Retry Code Table (2/5)

Code	Description	Allowable No. of Retries	Remarks
41	There is "START" key-in for operation from STANDBY.	∞	
42	Same as code 41. (Note that there is RERUN AUTOMATIC input.)	↑	
43	Same as code 41. (Note that there is RERUN ONLY input.)	↑	
44	There is START key-in for original ABS from STANDBY.	↑	
45	There is START key-in from S. STOP.	↑	
46	There is S. STOP key-in.	↑	
47	There is STOP key-in.	↑	
48	————————		
49	————————		
50	There is photometric check activation input.	∞	
51	There is WASH (ALL) activation input.	↑	
52	There is WASH (CELLS) activation input.	↑	
53	There is WASH (ISE) activation input.	↑	
54	There is WASH (AIR PURGE) activation input.	↑	
55	There is ISE PRIME (START UP) activation input.	↑	
56	There is ISE PRIME (IS/DIL) activation input.	↑	
57	There is ISE PRIME (KCL) activation input.	↑	
58	There is incubation bath water exchange activation input.	↑	
59	There is cell blank measurement activation input.	↑	
60	There is reset activation input.	↑	
61	There is probe adjustment activation input.	↑	
62	There is sampling mechanism test activation input.	↑	
63	There is disk mechanism test activation input.	↑	
64	There is R1 reagent mechanism test activation input.	↑	
65	There is R2 reagent mechanism test activation input.	↑	

Table 6-4-1 Retry Code Table (3/5)

Code	Description	Allowable No. of Retries	Remarks
66	There is stirrer mechanism test activation input.	∞	
67	There is bar code reader activation input.	↑	
68			
69			
70 ∫ 100	Spare		
101	Drive no. specification error	0	
102	File no. specification error	↑	
103	Duplicate file-opening error	↑	
104	Unopened file access error	↑	
105	EOF over access error	↑	
106	There is file protect code.	↑	
107	System is not ready to seek for track 0 of system disk.	1	
108	System is not ready to read data from system disk.	↑	
109	System is not ready to write data to system disk.	↑	
110	System is not ready to format data stored on system disk.	↑	
111	Volume name check error occurs when opening system disk file.	0	
112	File name check error occurs when opening system disk file.	↑	
113	Attempt is made to write data to write-protected system disk.	5	
114	Attempt is made to format data on write-protected system disk.	↑	
115	CRC error occurs in data section when reading data from system disk.	↑	
116	Hardware error occurs when formatting data on system disk.	↑	
117	CRC error occurs in ID section when reading data from system disk.	↑	
118	Missing address mark appears when reading data from system disk.	↑	
119	NODATA error occurs when reading data from system disk.	↑	
120	CRC error occurs in ID section when writing data to system disk.	↑	

Table 6-4-1 Retry Code Table (4/5)

Code	Description	Allowable No. of Retries	Remarks
121	Missing address mark appears when writing data to system disk.	5	
122	NODATA error occurs when writing data to system disk.	↑	
123	Hardware error occurs when seeking for track 0 of system disk.	↑	
124	Overrun error occurs when reading data from system disk.	↑	
125	End of cylinder error occurs when reading data from system disk.	↑	
126	Overrun error occurs when writing data to system disk.	↑	
127	End of cylinder error occurs when writing data to system disk.	↑	
128	Another hardware error occurs when writing data to system disk.	↑	
129	System is not ready to seek for track 0 of data disk.	1	
130	System is not ready to read data from data disk.	↑	
131	System is not ready to write data to data disk.	↑	
132	System is not ready to format data stored on data disk.	↑	
133	Volume name check error occurs when opening data disk file.	0	
134	File name check error occurs when opening data disk file.	↑	
135	Attempt is made to write data to write-protected data disk.	5	
136	Attempt is made to format data stored on write-protected data disk.	↑	
137	CRC error occurs in data section when reading data from data disk.	↑	
138	Hardware error occurs when formatting data stored on data disk.	↑	
139	CRC error occurs in ID section when reading data from data disk.	↑	
140	Missing address error occurs when reading data from data disk.	↑	
141	NODATA error occurs when reading data from data disk.	↑	
142	CRC error occurs in ID section when writing data to data disk.	↑	

Table 6-4-1 Retry Code Table (5/5)

Code	Description	Allowable No. of Retries	Remarks
143	Missing address error occurs when writing data to data disk.	5	
144	NODATA error occurs when writing data to data disk.	↑	
145	Hardware error occurs when seeking for track 0 of data disk.	↑	
146	Overrun error occurs when reading data from data disk.	↑	
147	End of cylinder error occurs when reading data from data disk.	↑	
148	Overrun error occurs when writing data to data disk.	↑	
149	End of cylinder error occurs when writing data to data disk.	↑	
150	Another hardware error occurs when writing data to data disk.	↑	
151 ~ 199	Spare		

Note: If each allowable number of retries is exceeded, an alarm is issued. An alarm is also issued when retry occurs 6 times or more in total. In this case, an alarm code is generated according to the last retry.

Table 6-4-2 Retry Code Table (system interface task)

Code	Allowable No. of Retries	Description	Remarks
200	4	Text cannot be received from system side within the predetermined period of time.	(HOST → 717) TIMEOUT ERROR
201	↑	Received text contains an illegal character.	(HOST → 717) CHARACTOR ERROR
202 203	↑	The character count in received text is out of the allowable range. (1) The character count between STX and ETX is out of the predetermined range. (2) Communication protocol is ignored in text transfer from system to 717.	(HOST → 717) FORMAT ERROR
204	↑	Vertical parity error has been found in data reception.	(HOST → 717) RECEIVE ERROR
205	↑	Overrun error has occurred in data reception.	(HOST → 717) RECEIVE ERROR
206	↑	Framing error has occurred in data reception.	(HOST → 717) RECEIVE ERROR
207	↑	BCC error has been found in received text.	(HOST → 717) BCC ERROR
208	↑	Data cannot be sent to system within the predetermined period of time.	(717 → HOST) TIMEOUT ERROR
209	↑	After transfer of test results, NAK has been sent from system side.	
210	–	100 or more invalid interrupts have been issued from controller.	
211 ∫ 256		Spare	

Note: Only for communication in batch mode.
If any of the above errors occurs, text/data is transmitted again or NAK is sent.
When the number of retries exceeds 4, an alarm is issued according to the last retry.

7. OPTIONS

7. OPTIONS

7-1 Electrolyte Analyzer Accessory

7-1-1 Operating Principle

(1) Principle of Measurement

Ion selective electrodes generate an electromotive force as expressed by the following equation according to the ion activity in a solution.

$$E = E_0 + 2.303 \times \frac{RT}{nF} \times \log ai \quad \cdots\cdots (1)$$

$$ai = f \times Ci \quad \cdots\cdots (2)$$

where, E .... Electromotive force
E_0 .... Constant potential determined by measuring system
R .... Gas constant ($8.31441\ J \cdot mol^{-1} \cdot K^{-1}$)
T .... Absolute temperature ($t^\circ C + 273.15$) ($^\circ K$)
F .... Faraday constant ($9.648456 \times 10^4\ C \cdot mol^{-1}$)
ai .... Ion (i) activity
f .... Activity factor
Ci .... Ion (i) concentration
n .... No. of charges of ion (i)
(cation is positive, anion is negative)

(2) Principle of Operation

The sampling probe aspirates a sample and injects it into the dilution container. Then the diluent syringe operates, and a fixed amount of diluent is discharged into the dilution container from the diluent nozzle whereby the sample is diluted.
The diluted sample is then aspirated via the sipper nozzle and fed to the electrodes in the incubation bath. The sample temporarily stops flowing within the electrodes, and the electromotive force produced due to the concentration of Na^+, K^+ and $C\ell^-$ in the sample is measured.
After the sample remaining in the dilution container is evacuated, the container is rinsed out with internal standard solution.
The internal standard solution is discharged into the dilution container via the internal standard solution nozzle before and after sample measurement, whereby the solution is aspirated into the electrodes and the electromotive force is measured. Drift of the measured values is prevented in this way.

7-1-2 Standard Specifications

(1) Standard Specifications

1) Use .... Quantitative analysis of Na, K, Cℓ in human serum
2) Method .... Ion selective electrode method (flow type)
3) Analytical items .... Na, K and Cℓ, or Na and K simultaneously
4) Measuring range .... Na : 80 to 180 mEq/ℓ
K : 1.5 to 10 mEq/ℓ
Cℓ : 60 to 120 mEq/ℓ
5) Throughput .... 75 tests/hr (electrolytes alone)
6) Sample volume .... 20 $\mu\ell$/sample
7) Diluent volume .... 600 $\mu\ell$/sample (31-times dilution)
8) Electrode incubation bath .... 25, 30, 37°C
9) Correction .... Correction of drift with internal standard solution (for each sample)
Bias correction through measurement with calibrator

(2) Reagent Consumption

Tables 7-1-1 and 7-1-2 show the reagent consumption per sample in routine analysis.

(a) In Continuous Measurement of Electrolytes

Table 7-1-1 Reagent Consumption (1)

	Int. Stand Soln.	Diluent	Ref. Elec. Soln.
Dilution container rinsing	800 $\mu\ell$	——	——
Internal standard solution measurement	800 $\mu\ell$	——	65 $\mu\ell$
Sample measurement	——	600 $\mu\ell$	65 $\mu\ell$
Total	1600 $\mu\ell$	600 $\mu\ell$	130 $\mu\ell$

(b) In Intermittent Measurement of Electrolytes

Table 7-1-2 Reagent Consumption (2)

	Int. Stand. Soln.	Diluent	Ref. Elec. Soln.
Dilution container rinsing	800 $\mu\ell$	——	——
Internal standard solution measurement	800 $\mu\ell$	——	65 $\mu\ell$
Sample measurement	——	600 $\mu\ell$	65 $\mu\ell$
Dilution container rinsing	800 $\mu\ell$	——	——
Internal standard solution measurement	800 $\mu\ell$	——	65 $\mu\ell$
Total	3200 $\mu\ell$	600 $\mu\ell$	195 $\mu\ell$

Note: When an electrolyte analysis is not requested for 12 minutes or longer during operation, then the internal standard solution is measured once.

(3) Lifetime of Electrodes

The electrodes should be replaced when the slope value deviates from the usable range, based on the replacement cycle or number of tests shown in the table below.

Table 7-1-3 Lifetime of Electrodes

Electrode	Replacement Cycle	No. of Tests	Usable Range (slope value)
Na electrode	2 months	9000	38.0 ~ 68.0 mV
K electrode	2 months	9000	38.0 ~ 68.0 mV
Cℓ electrode	1 month	3000	– 30.0 ~ – 68.0 mV

7-1-3 Switch Setting

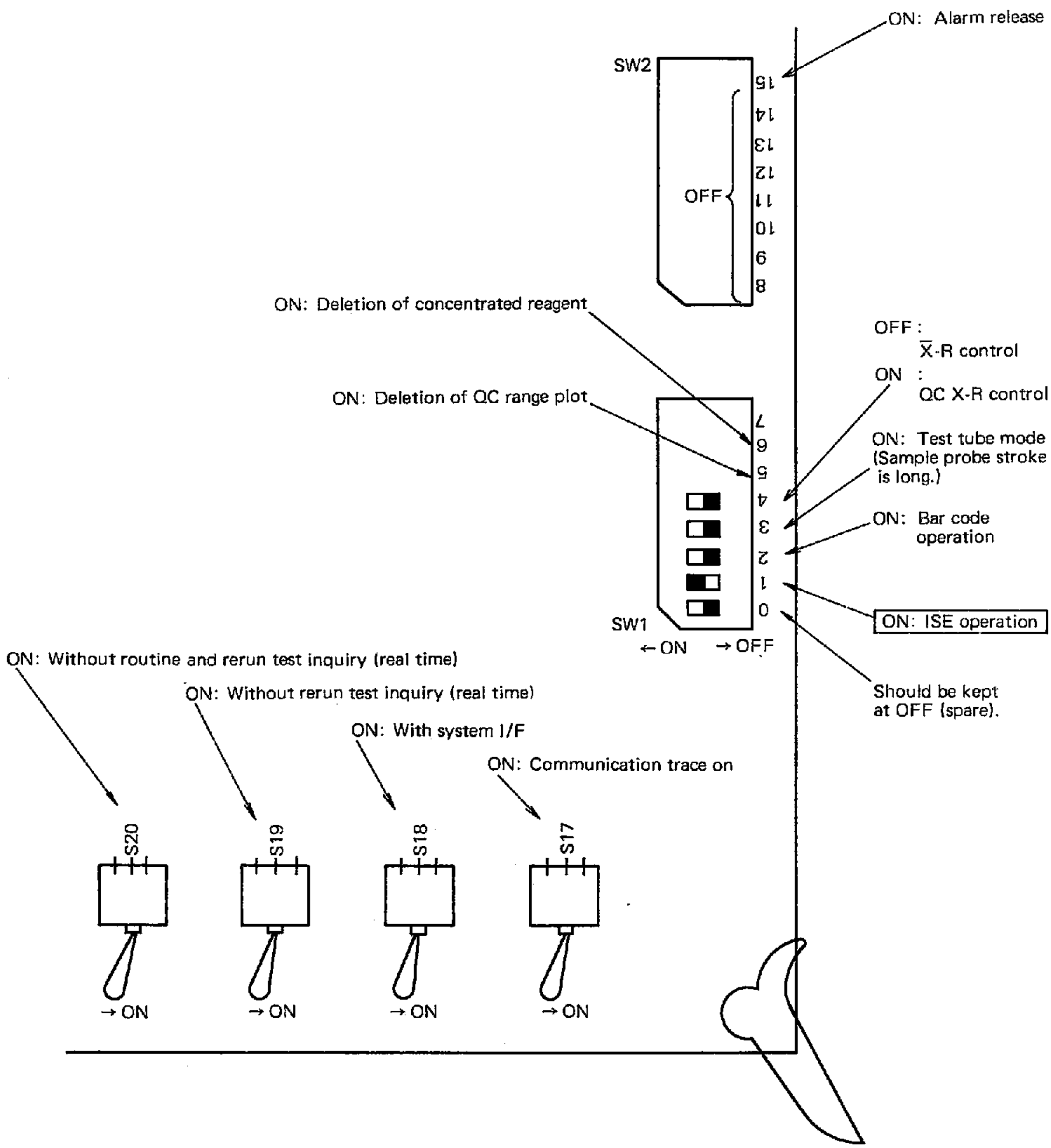


Fig. 7-1-1 Setting of DIP Switches on TRI ADCP Board

7-1-4 Flow Diagram

No.	Turbe Name
1	Junflon tube 1.5 X 0.4T, 125 mm
2	Same as above, 240 mm
3	Same as above 0.8 X 0.4T, 470 mm
4	Same as above 1.5 X 0.4T, 380 mm
5	Same as above, 340 mm
6	Same as above, 430 mm
7	Junflon tube 0.8 X 0.4T, 165 mm
8	SUS 316 tube ϕ0.8
9	Silicone tube ϕ0.8, 75 mm
10	SUS 316 tube ϕ0.8
11	Junflon tube 1.5 X 0.4T, 600 mm
12	Same as above, 600 mm
13	Same as above, 60 mm
14	Same as above, 520 mm
15	Same as above, 420 mm
16	Tygon tube ϕ1.58 X ϕ3.17
17	Tygon tube ϕ3.17 X ϕ6.35
18	Same as above
19	Tygon tube ϕ1.58 X ϕ3.17
20	Junflong tube 1.5 X 0.45T, 2050 mm

No.	Turbe Name
21	Same as above, 290 mm
22	Same as above, 270 mm
23	Same as above, 2100 mm
24	Same as above, 270 mm
25	Same as above, 260 mm
26	Tygon tube ϕ3.17 X ϕ6.35
27	Junflon tube 1.5 X 0.4T, 310 mm

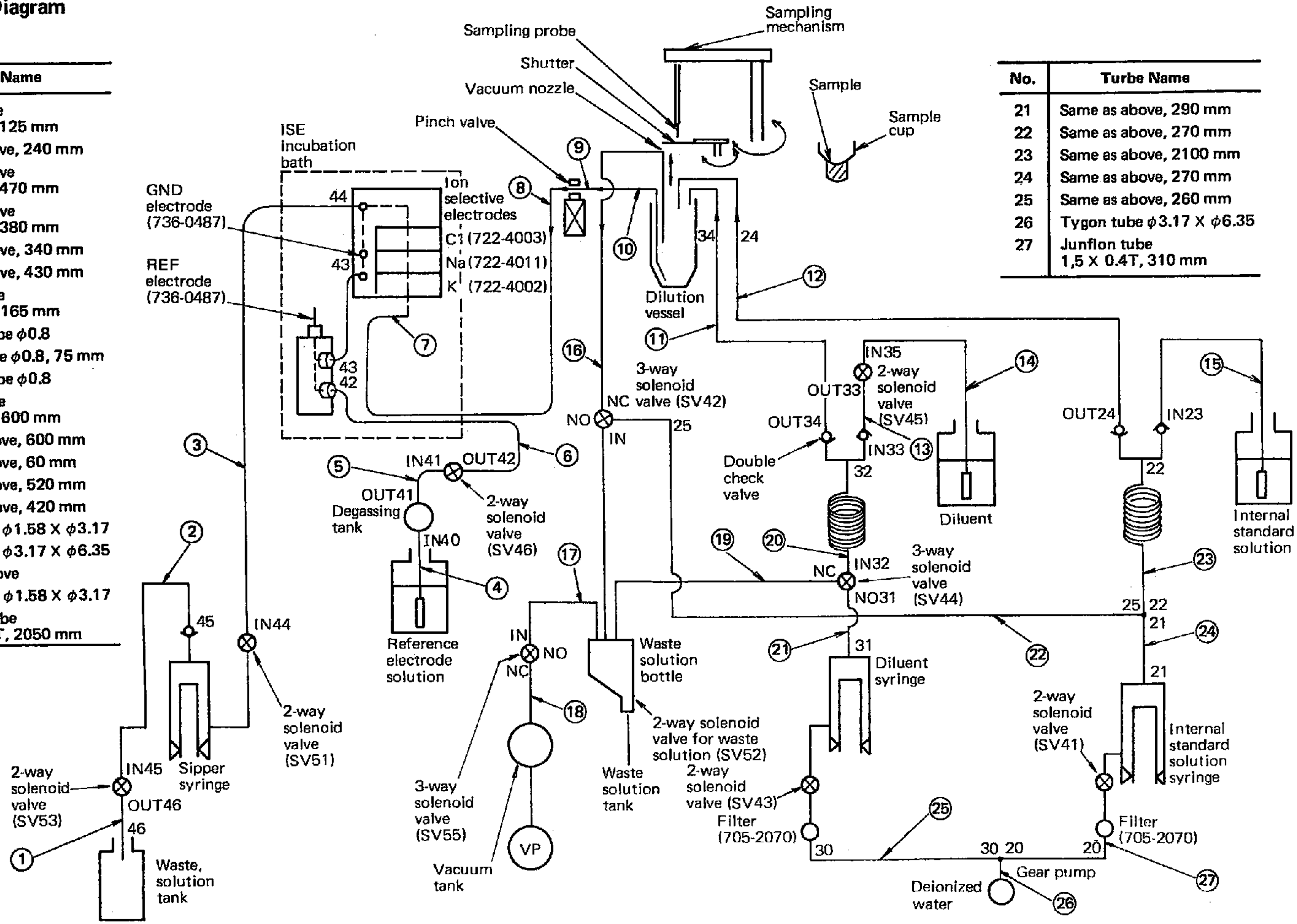


Fig. 7-1-2 Flow Path Diagram (1)

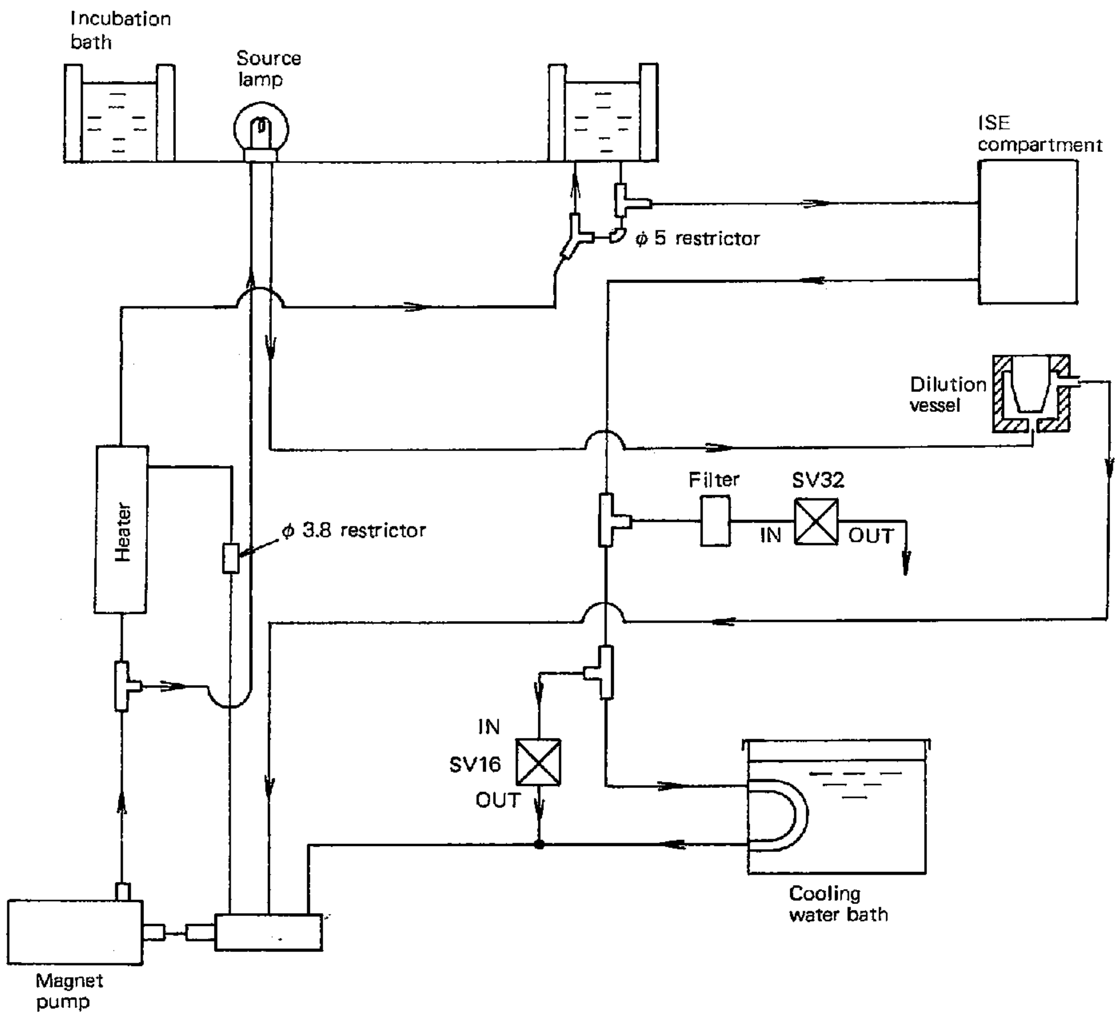
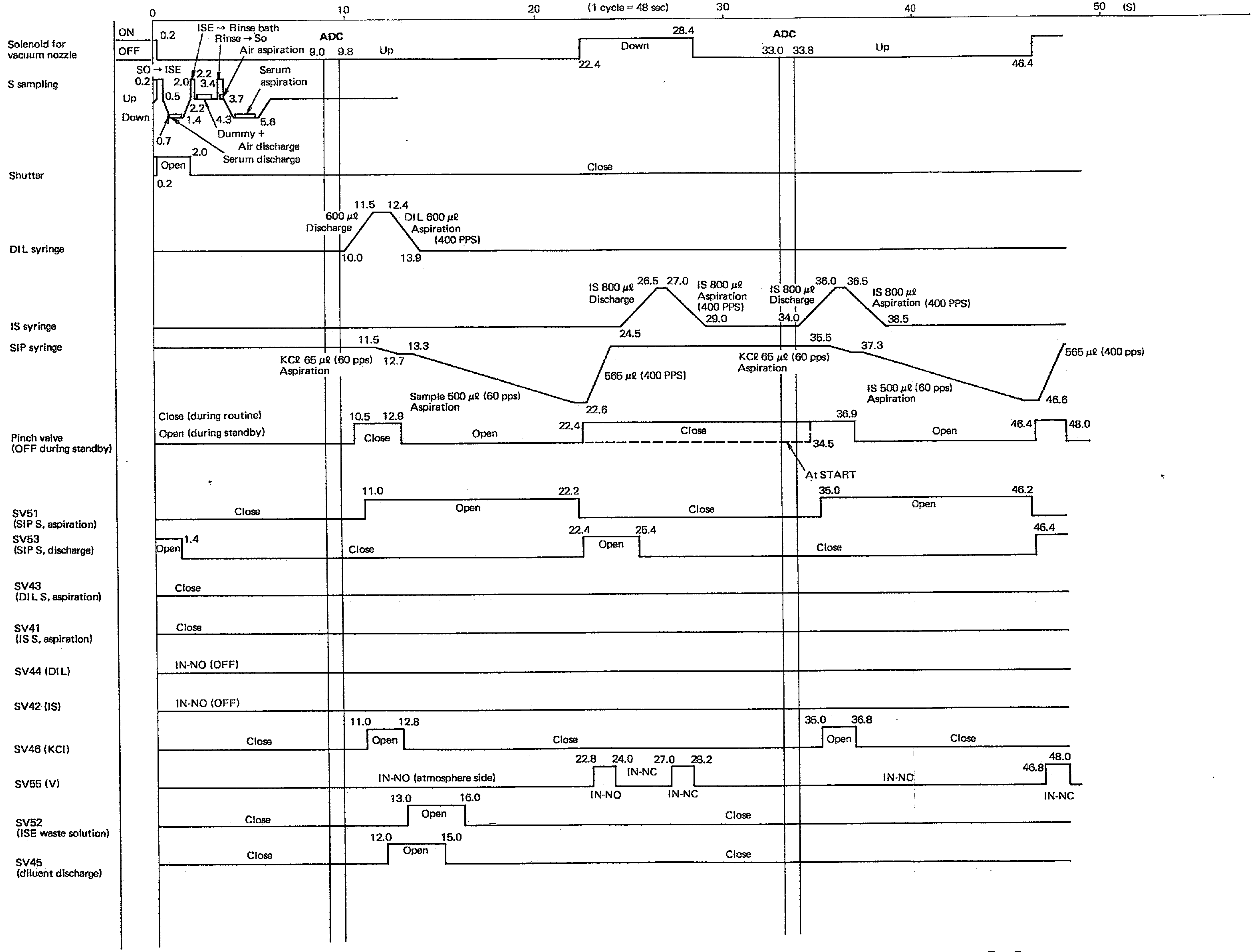


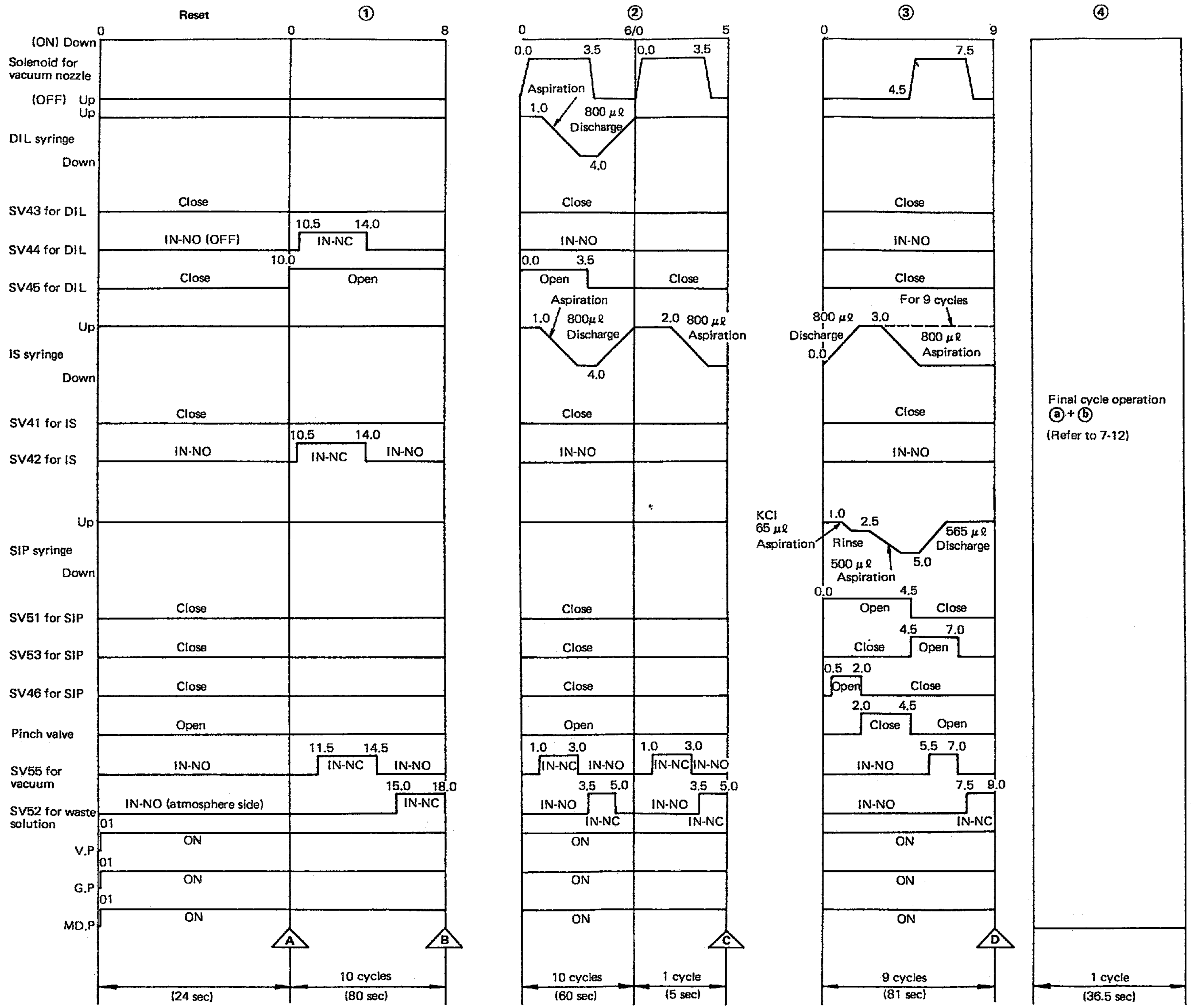
Fig. 7-1-3 Flow Path Diagram (2)

7-1-5 Timing Chart

(1) ISE Operation



(2) WASH



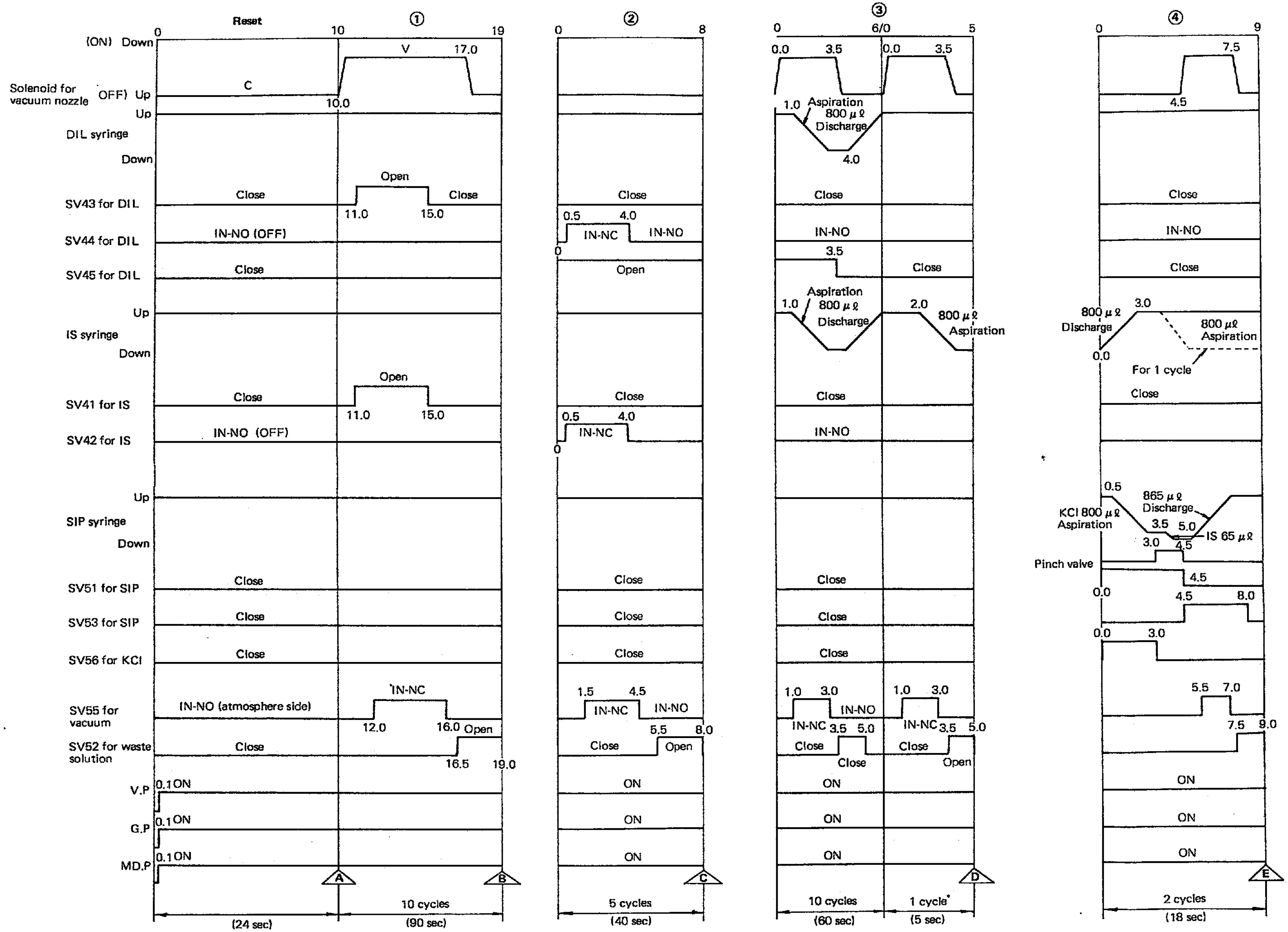
① Evacuate air to aspirate cleaning agent until the flow path before the IS and DIL syringes is filled with the agent.

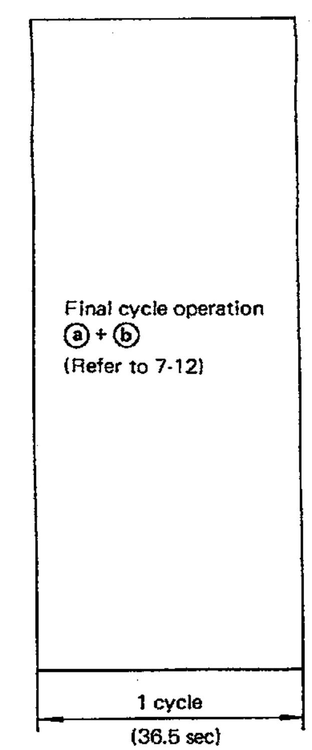
② Operate the IS and DIL syringes up and down to discharge the cleaning agent into the dilution vessel. The cleaning agent is now admitted into the IS and DIL nozzles.

③④ Operate the IS syringe to discharge the cleaning agent into the dilution vessel, and then aspirate the agent with the sipper syringe.
The cleaning agent is now filled in sipper syringe line and electrode.

Note: When a mechanism alarm is issued, the sequence described here is completed with any of A, B, C and D.
If STOP command is input during reset or ①/② execution, the sequence is completed with any of A, B, and C.
If STOP command is input during ③ execution, the sequence is completed after executing ④ (subsequently to D).

(3) ISE PRIME (START UP)



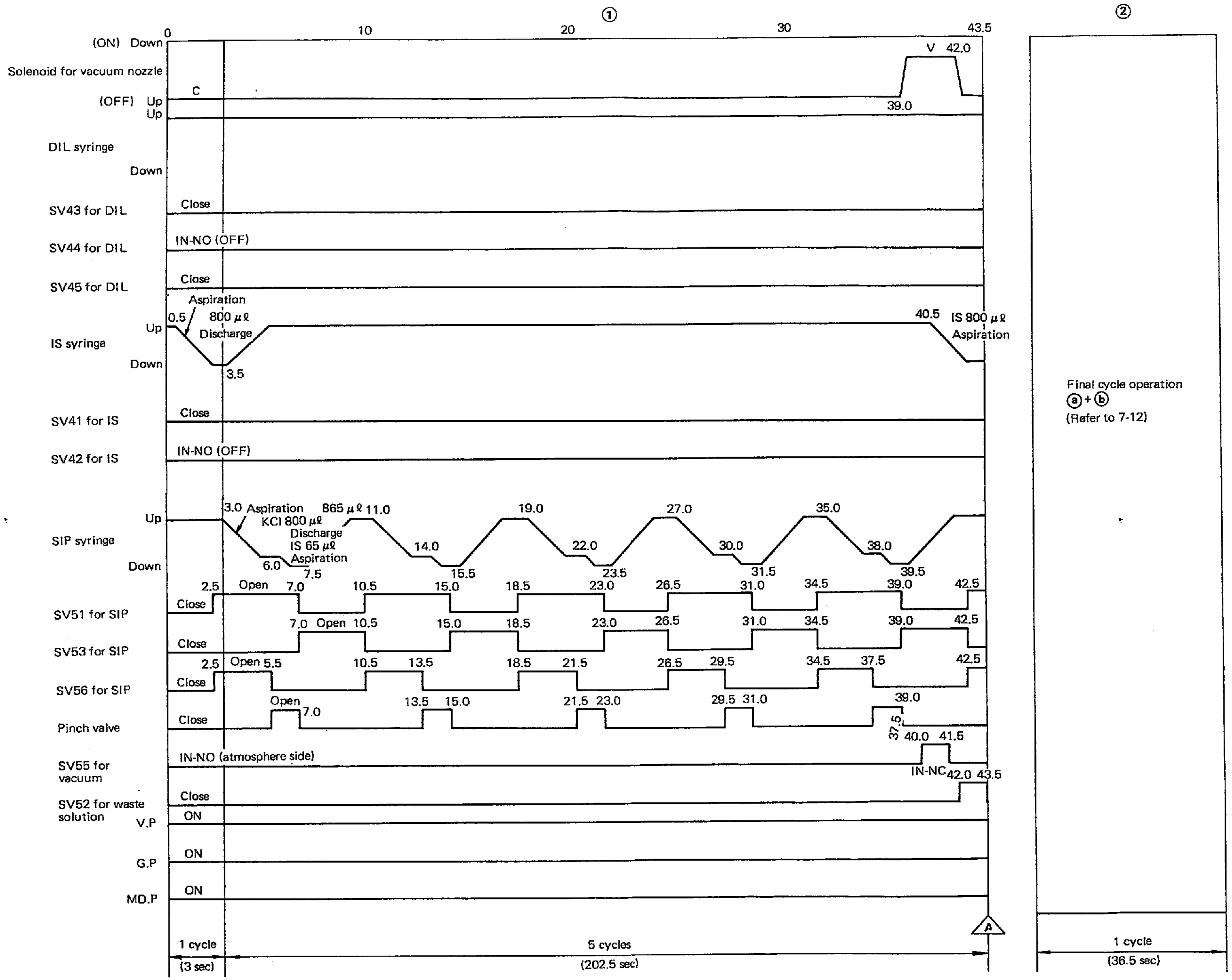


①
②
③
④
⑤
Same as ISE PRIME (IS, DIL)

Notes:

1. If mechanism alarm is issued during reset or execution of ①, ②, ③, and ④, the sequence is completed with A, B, C, D, and E, respectively.
2. If STOP command is input during reset or execution of ①, ②, and ③, the sequence is completed with A, B, C, and D, respectively.
3. If STOP command is input during execution of ④, the sequence is continued down to ⑤ before being completed.

(4) ISE PRIME (KCL)

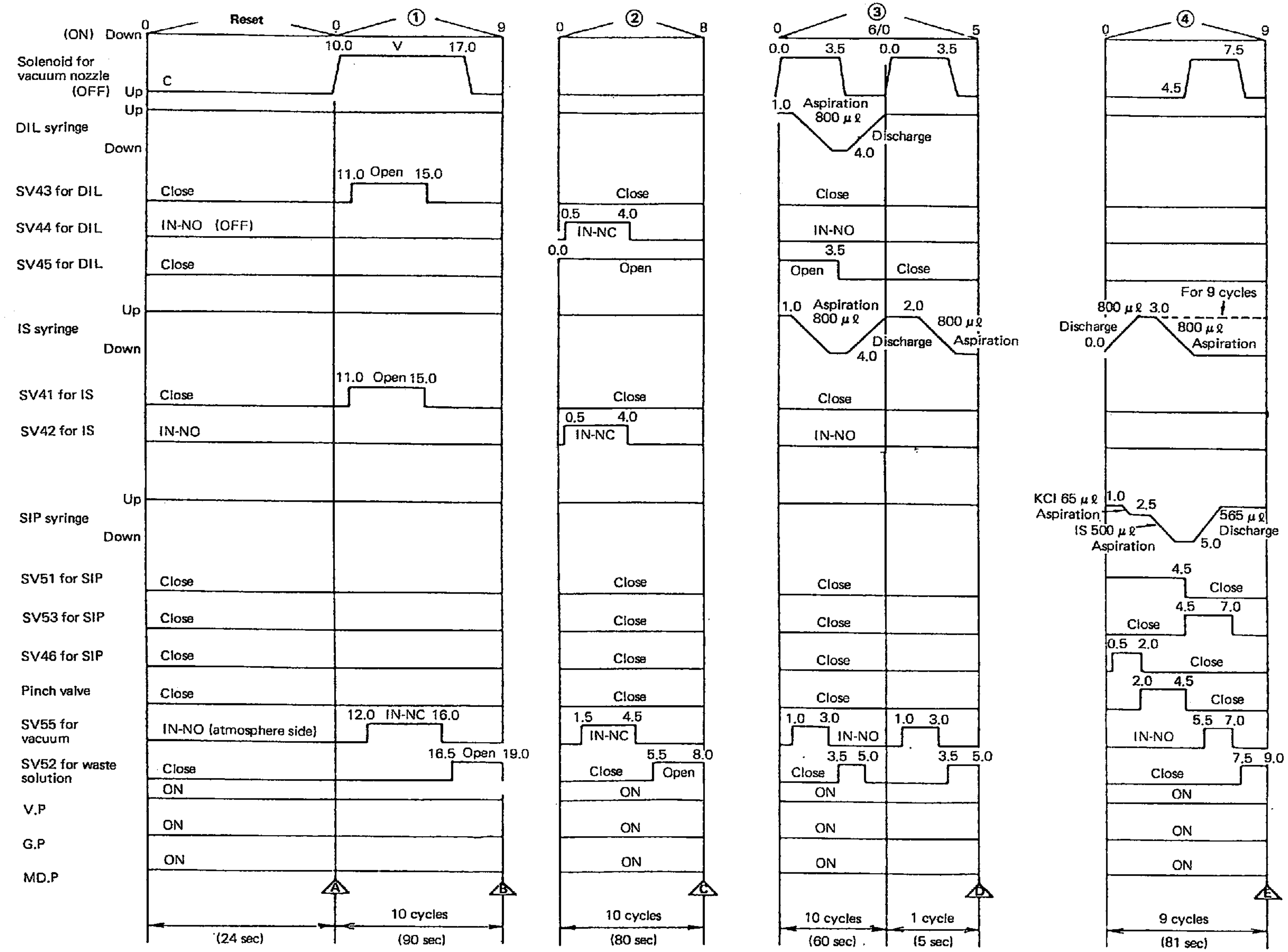


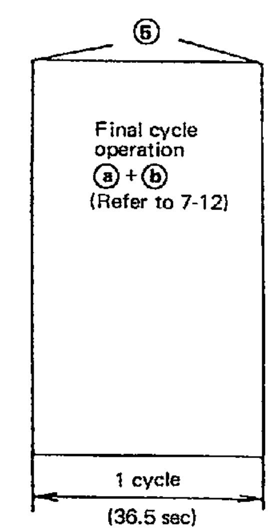
① KCl is aspirated by the sipper syringe. (800 μℓ x 25 times)

② IS is discharged into the ISE changeover valve, and is then aspirated by the sipper syringe. (IS is now within electrode.)

Notes: 1. Reset is executed before executing ①.
2. If STOP command is input or mechanism alarm is issued during reset, the sequence is completed without executing ①.
3. If an alarm is issued during execution of ①, the sequence is completed with Ⓐ.
4. If STOP command is input during execution of ①, the sequence is completed after executing ② (subsequently to Ⓐ).

(5) ISE PRIME (IS, DIL)





① Water is discharged to the dilution vessel through IS/DIL nozzle. (The water is now admitted into IS/DIL nozzle.)

② Air is evacuated from the IS and DIL until reagent is admitted into the flow path just before the syringes.

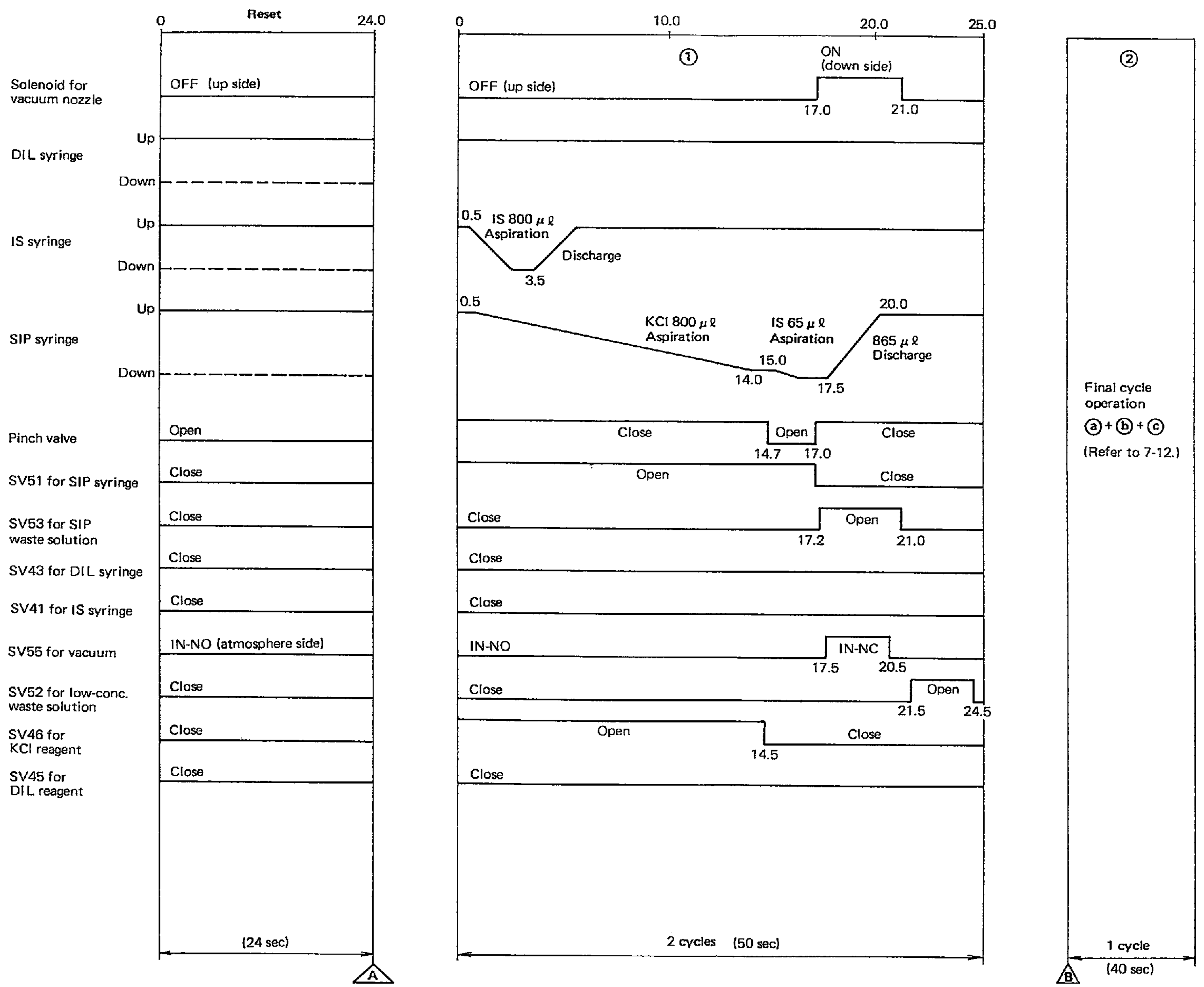
③ The reagent is discharged to the dilution vessel through the IS and DIL nozzles. (The reagent is now admitted into the IS and DIL nozzles.)

④⑤ IS is discharged to the dilution vessel, and is then aspirated by the sipper syringe. (The IS is now admitted into the electrode.)

Notes:

1. If mechanism alarm is issued during reset or execution of ①, ②, ③, and ④, the sequence is completed with A, B, C, D, and E respectively.
2. If STOP command is input during reset or execution of ①, ②, and ③, the sequence is completed with A, B, C, and D, respectively.
3. If STOP command is input during execution of ④, the sequence is completed after executing ⑤ subsequently to E.

(6) PREPARATION



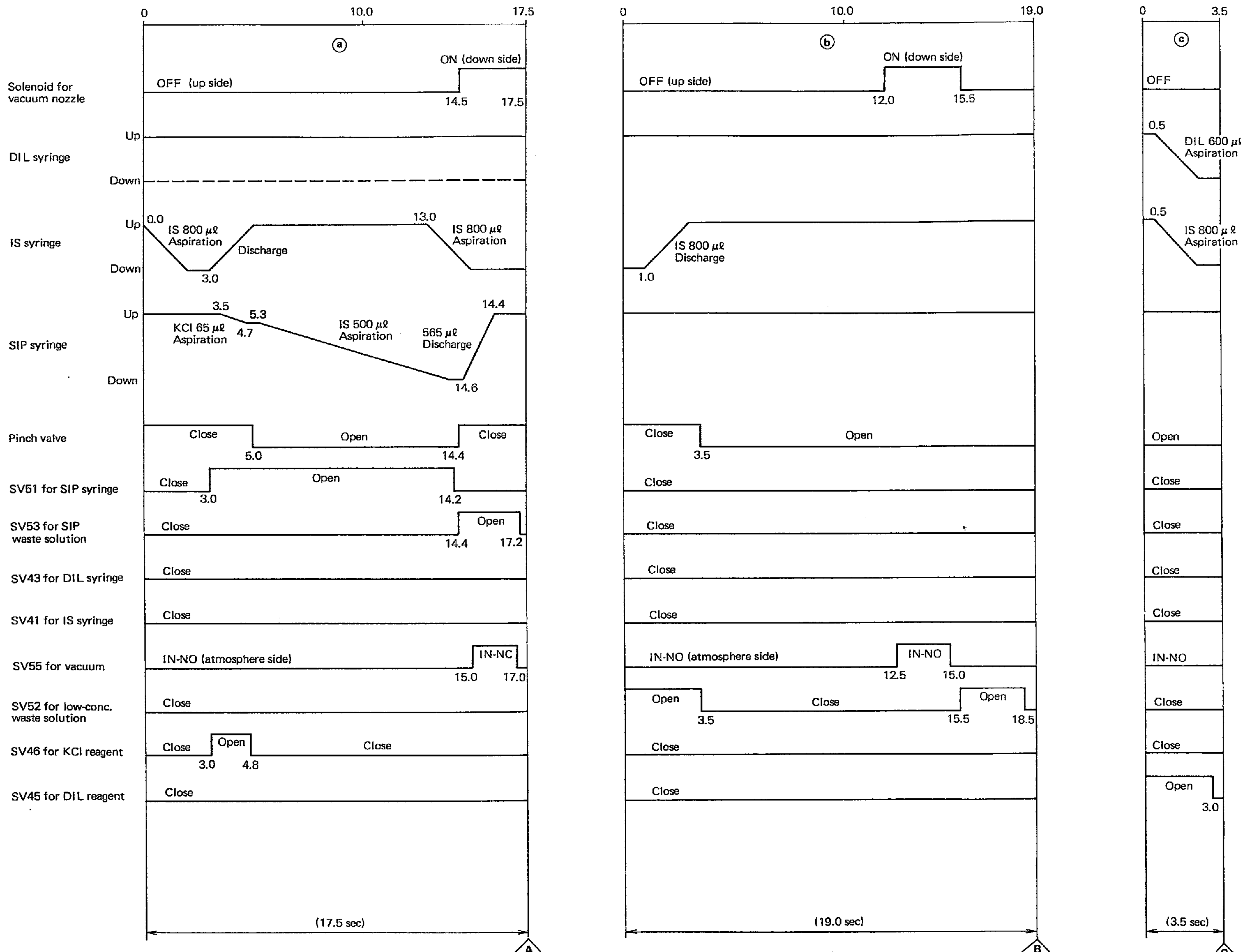
① KCl exchange within electrode

② IS exchange within electrode

Notes:

1. If mechanism alarm is issued during reset or execution of ①, the sequence is completed with A and B.
2. If STOP command is input during reset, the sequence is completed with A.
3. If STOP command is input during execution of ①, the sequence is completed after executing ② (subsequently to B).

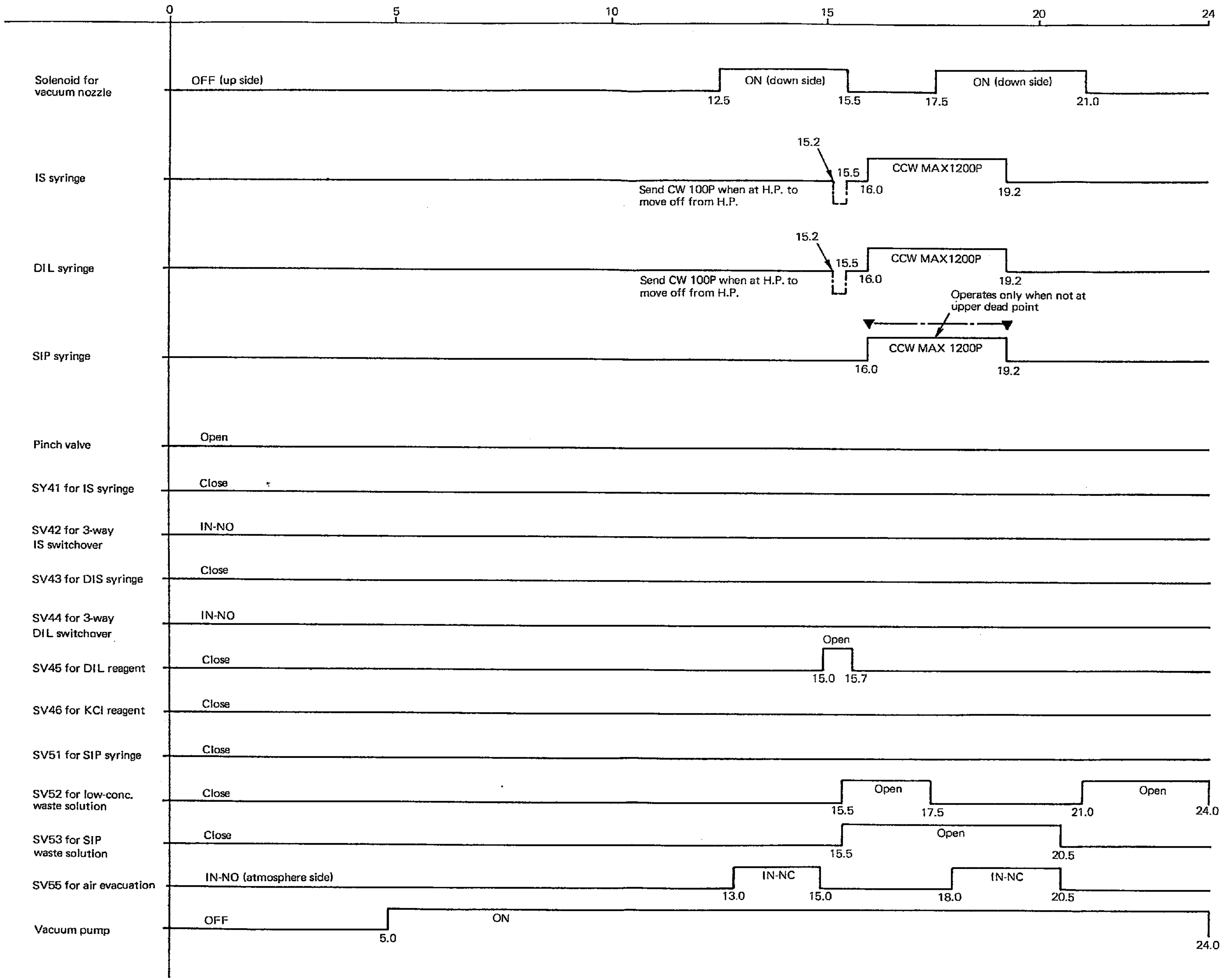
(7) Final Cycle



Notes: 1. When the IS syringe has already aspirated 800 μl of internal standard solution, aspiration is not performed.

2. If mechanism alarm is issued during execution of ⓐ, ⓑ, and ⓒ, the sequence is completed with A, B, and C, respectively.

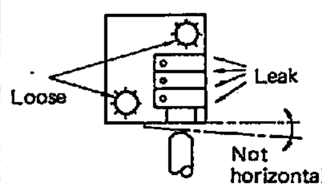
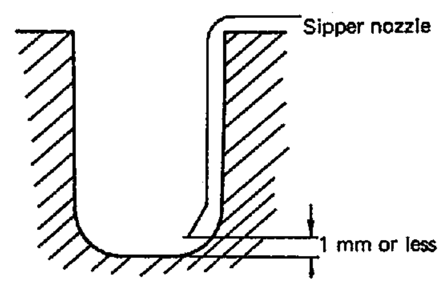
(8) RESET



0
5
10
15
20
24
Solenoid for vacuum nozzle
OFF (up side)
ON (down side)
12.5
15.5
17.5
21.0
IS syringe
15.2
15.5
CCW MAX1200P
Send CW 100P when at H.P. to move off from H.P.
16.0
19.2
DIL syringe
Operates only when not at upper dead point
SIP syringe
CCW MAX 1200P
Pinch valve
Open
SY41 for IS syringe
Close
SV42 for 3-way IS switchover
IN-NO
SV43 for DIS syringe
SV44 for 3-way DIL switchover
SV45 for DIL reagent
15.0
15.7
SV46 for KCl reagent
SV51 for SIP syringe
SV52 for low-conc. waste solution
24.0
SV53 for SIP waste solution
20.5
SV55 for air evacuation
IN-NO (atmosphere side)
IN-NC
13.0
18.0
Vacuum pump
OFF
ON
5.0

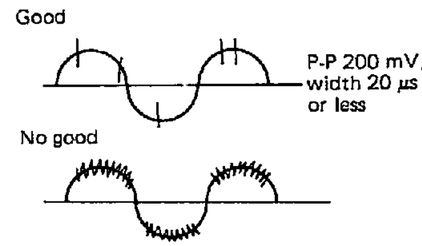
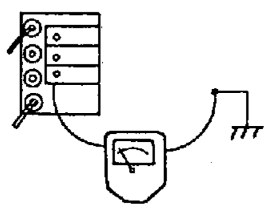
7-1-6 ISE Troubleshooting

Table 7-1-4

Item	Problem	Cause	Solution
1	Abnormal data (1) Air is included in flow path. Imprecision, or abnormal data alarm is issued. ① LEVEL ② NOISE ③ OVER ④ ? ? ?	(a) DIL/IS/KCL is leaking from joint nipple.	(a) Retighten the joint nipple, or recondition the tube.
		(b) Sipper tube is clogged with foreign material.	(b) ① Clean the sipper tube with NaClO (0.5%). ② Clean the tube with a cleaning wire. ③ Replace the sipper tube.
		(c) Cartridge is installed improperly after replacement. 	(c) ① Remove the cartridge, and place acrylic block so that it is levelled up with preheat tube. ② Check if O-ring is provided on the cartridge. ③ Check if there is foreign material on the O-ring.
		(d) Air is admitted into sipper nozzle.	(d) ① Install the sipper nozzle so that its tip is placed at least 1 mm above the bottom of dilution vessel as shown below.  ② Internal standard/diluent is leaking. See 1-(1) (a).
		(e) Solution is leaking through cartridge O-ring.	(e) ① Check if there is foreign material on the O-ring. ② Replace the O-ring. ③ Cartridge O-ring fitting surface is rough. Replace the cartridge.
		(f) Seal piece is worn.	(f) ① Retighten the seal piece. ② Replace the seal piece. ③ Check if plunger is scratched. If so, replace the plunger.

Item	Problem	Cause	Solution
1		(g) Packings are attached improperly to reference electrode and GND electrode.	(g) ① Check if the packings are attached properly. If missing, attach them. ② Check if there is any foreign material on the packings. If so, remove it. ③ Check if nipple is tightened completely. If not, retighten it.
		(h) There is pinhole in tube.	(h) Replace the tube.
		(i) Prime is inadequate after maintenance.	(i) Prime the tube referring to the instruction manual.
		(j) Sipper tube is scratched.	(j) Replace the tube at the specified interval.
	(2) Imprecision. Data alarm is issued. ① Level error ② Noise error	(a) Flow path is contaminated.	(a) ① Wash the tube with NaClO (0.5%). For details, refer to the instruction manual. ② Replace the SV53 and the tube following the SV53 on the waste solution flow path.
		(b) Tube is sharply bent.	(b) Replace the tube. **Note:** Take care especially when ISE incubation bath is removed.
		(c) Diluent is dripping from the nozzle tip. Imprecision, or abnormal (poor) data are acquired without alarm issuance.	(c) ① Check for leakage from the flow path referring to 1-(1) (a). ② Replace the diluent nozzle. **Reference:** Data error (for Na) caused by diluent drip 5 μℓ: About 0.5 mEq/ℓ or less 10 μℓ: About 1.0 mEq/ℓ or less 20 μℓ: About 2.0 mEq/ℓ or less
		(d) SV53 is clogged.	(d) Refer to 1-(2) (a).
		(e) Diluent nozzle is clogged.	(e) Replace the diluent nozzle. **Note:** Air bubbles are seen abnormally in the dilution vessel.
		(f) There is noise on AC line.	(f) Check if the ISE incubation bath, AMP circuit board, and incubation bath are grounded to the electrolyte analyzer. If not, ground them. **Check procedure:** 1. Pull out the ISE AMP circuit board. 2. Connect a synchroscope to the output terminal (Na, K, Cl) of circuit board (J3) to observe waveform.

(cont'd)

Item	Problem	Cause	Solution
1			③ Make sure that the AC noise observed by the synchroscope is as follows. 
		(g) There is poor insulation on electrode. 	(g) Remove the electrode, wash the contaminated vessel with reagent, and dry the vessel completely. **Leakage check procedure:** Disconnect lead wire from each electrode, and measure insulation resistance between the electrode and ground. **Reference:** 1. Insulation resistance should be 3 MΩ or more when measured with a 1000 V megger. 2. Refer to analog data.
		(h) Reagent is improper.	(h) Replace the reagent. **Note:** Be sure to activate PRIME at least twice after the reagent is replaced.
		(i) Electrode is faulty.	(i) Replace the electrode.
		(j) Sampling is improper.	(j) Replace the nozzle seal packing. **Check procedure:** Check through colorimetric imprecision.
		(k) Diluent amount is improper.	(k) Replace the seal piece packing.
		(l) Sample cup is contaminated.	(l) Use a new sample cup. **Note:** Use deionized water for washing the sample cup.
	(3) Calibration is made improperly. Calibration alarm is issued. ① PREP ② SLOPE ③ I. STD ④ CALIB ⑤ STD ?	(a) LOW and HIGH standard solution settings are wrong.	(a) Set the LOW and HIGH standard solutions properly. **Reference:** 1. EMF (Na) : –20 to –40 mV (K) : –20 to –50 mV (Cl) : 110 to 150 mV 2. S1EMF – S2EMF = ΔEMF Na : Approximately 8 mV K : Approximately 20 mV Cl : Approximately 6 to 8 mV

Item	Problem	Cause	Solution
1			3. S1EMF < ISEMF < S2EMF (Na, K) ISEMF = (S1EMF + S2EMF)/2 S1EMF > ISEMF > S2EMF (CL)
		(b) Reagent is improper.	(b) Replace the reagent. **Note:** Refer to 1-(2) (h).
		(c) Standard solution concentration is improper.	(c) Replace the standard solution.
		(d) Air is included in flow path.	(d) Refer to 1-(1) (a) to (j).
		(e) Cleaning water is improper.	(e) Use deionized water.
		(f) PREAMP circuit board is faulty.	(f) ① Replace the PREAMP circuit board. ② Check the circuit board, and readjust it. **Note:** For details, refer to "Circuit Board Adjustment".
		(g) Reference electrode is faulty.	(g) Replace the electrode. **Reference:** The AgCl part should be 1/2 or more. Be sure to replace the GND electrode together with the reference electrode.
		(h) Flow path is clogged.	(h) Refer to 1-(1) (a) to (j). **Reference:** IS concentration during calibration Na : 140 ± 10 mEq/ℓ K : 5.0 ± 1.0 mEq/ℓ Cl : 100 ± 10 mEq/ℓ
	(4) Day-to-day precision is poor.	(a) Calibrator is faulty.	(a) EMF of Na, K, and Cl is too high (too low). ① Calibrator dissolution is poor. ② Calibrator lot is changed. ③ Correct calibrator is not used. ④ There are water drops on sample cup. EMF of Na, K, or Cl is too high (low). ⑤ Sample cup is contaminated. • It is not washed with distilled water. • New cup is not used.
		(b) Electrode is faulty.	(b) Day-to-day precision is poor (for each test). Electrode response is poor. Replace the cartridge.

Item	Problem	Cause	Solution
1		(c) Flow path is contaminated.	(c) Day-to-day precision is poor (for each test). Wash the flow path.
		(d) Temperature stability is faulty.	(d) Check if there is any variation in result of colorimetric enzyme assay. ① Incubation bath temperature changes during analysis. Thermistor is faulty, or the contact is poor. ② ISE incubation bath is exposed to an external air conditioner. ③ ISE START is activated before incubation bath temperature is stabilized (after power ON).
	(5) Correlation of electrolyte analyzer does not match with those of other units.	(a) Calibrator is faulty.	(a) Use correct calibrator.
		(b) Sample is improper.	(b) ① Check if a coagulant is used for blood-collecting tube. ② Check if the serum has been sampled from a diabetic patient. ③ Check if the sample has been adversely affected by medication.
		(c) Electrode is faulty.	(c) EMF does not follow up the sample concentration due to reduction of response.
		(d) Flow path is contaminated.	(d) Carry-over becomes too large due to contamination. Wash the flow path.
	(6) Water drips from tip of S probe. Serum drips from S probe.	(a) S probe is clogged.	(a) Clean or replace the S probe.
		(b) There is a slow leakage from SV1.	(b) ① SV1 is poor in sealing effect. ② Check if P414 ② → DIST J327 ② B → DIST J301 ⑨ A → J116 ⑨ A ON/OFF voltage is normal. E ON < 1.0 V, E OFF > 20 V For details, refer to MECHA CONT2 circuit diagram.
		(c) Air bubbles are included.	(c) Retighten the parts from which air is admitted.
	(7) Sample carry-over is too large.	(a) SV1 does not open.	(a) ① Check if MECHA CONT2 signal is ON or OFF. ② Contact is poor, or lead wire is disconnected. ③ Solenoid valve is clogged or faulty. Clean or replace the valve.
		(b) Filter of S. pipetter is clogged.	(b) Clean the filter.
		(c) Gear pump pressure is improper.	(c) Adjust the pressure to 1.5 kg/cm^2 when flow path is closed.
	(8) IS is discharged insufficiently, or IS drips from the nozzle tip.	(a) IS nozzle is clogged.	(a) Clean or replace the IS nozzle.
		(b) There is a slow leakage on IN side of SV42.	(b) ① Check if P435 ② → ISE CONT J82-3 ② A ON/OFF voltage is normal. E ON < 1.0 V, E OFF > 20 V

Item	Problem	Cause	Solution
1			For others, refer to ISE CONT circuit diagram. ② Check if +24 V is grounded. ③ Solenoid valve is clogged or faulty. Clean or replace the valve.
		(c) IS pipetter filter is clogged.	(c) Clean the filter.
		(d) Gear pump pressure is improper.	(d) Adjust the pressure to 1.5 kg/cm^2 when flow path is closed.
		(e) There is a slow leakage from SV41.	(e) ① The valve is poor in sealing effect due to contamination. ② DIST ON/OFF voltage is not normal. Check the voltage at D439 ② → DIST J330 ⑮ B → DIST J302 ⑩ A → MOTHER J117 ⑩ A.
		(f) Air bubbles are included.	(f) Retighten the part from which air is admitted.
		(g) Check valve is faulty.	(g) There is a slow leakage on the check valve. Clean or replace the valve.
	(9) DIL is discharged insufficiently, or DIL is leaking from the nozzle tip.	For SV44 and SV43, refer to (a) through (g) above.	Same as (a) through (g) above except for: SV44 : ISE CONT J82-3 ③ A ← P435 ④ SV43 : ISE CONT J82-3 ⑧ A ← P438 ②
		(h) There is a slow leakage from SV45, or the valve does not open.	(h) ① Check if P436 ② → ISE CONT J82-3 ⑥ A ON/OFF voltage is normal. ② Solenoid valve is clogged or faulty. Clean or replace the valve.
	(10) There are air bubbles in sipper line.	(a) Pinch valve remains closed.	(a) ① Check if J434 ⑨ → DIST J331 ⑧ A → MOTHER J117 ⑧ A ON/OFF voltage is normal. ② Sipper tube is so old that it is adherent. ③ Pinch valve is faulty. Replace the valve.
		(b) SV51 remains closed.	(b) ① Check if J437 ② → DIST J330 ② B → DIST J302 ⑭ B → MOTHER J117 ⑭ B ON/OFF voltage is normal. ② Solenoid valve is clogged or faulty. Clean or replace the valve.
		(c) SV46 remains closed.	(c) ① Check if P436 ④ → ISE CONT J82-3 ⑦ A ON/OFF voltage is normal. ② Solenoid valve is clogged or faulty. Clean or replace the valve.
	(11) Data are drifting.	(a) Pinch valve remains open, so KCl recharge amount is not enough.	Refer to (a) ① to ③ in item (10) above.

Item	Problem	Cause	Solution
1	(12) Carry-over is too high. KCl consumption is too large. IS level varies, or data are scattered.	(a) SV46 remains open. Sample aspiration amount is insufficient.	Refer to (c) ① and ② of item (10) above.
	(13) Reproducibility is slightly unstable. Analog data are slightly unstable.	(a) SV51 remains open. So negative pressure in tube is unstable at ADC, and thus data varies.	Refer to (b) ① and ② of item (10) above.
	(14) Liquid leaks from sipper syringe or nearby parts. Data are unstable due to liquid contact with GND.	(a) SV53 remains closed.	(a) ① Check if P436 ⑥ → ISE CONT J82-3 ⑧ A ON/OFF voltage is normal. ② Solenoid valve is clogged or faulty. Clean or replace the valve.
	(15) Sample is not aspirated into sipper line. Air bubbles are reversely admitted into sipper syringe. Data are abnormal.	(a) SV53 remains open.	(a) Refer to (a) ① and ② of item (14) above.
	(16) Waste solution flows into vacuum tank.	(a) SV52 remains closed. (b) SV55 does not open to atmosphere.	(a) ① Check if P435 ⑥ → RELAY2 J312 ⑭ B ON/OFF voltage is normal. ② Solenoid valve is clogged or faulty. Clean or replace the valve. (b) ① Check if P435 ⑥ → ISE CONT J82-3 ④ A ON/OFF voltage is normal. ② Solenoid valve is clogged or faulty. Clean or replace the valve.
	(17) Waste solution is aspirated improperly. Dilution vessel liquid overflows.	(a) SV52 remains open. (b) SV55 remains closed.	Refer to (a) ① and ② of item (16) above. Refer to (b) ① and ② of item (16) above.
	(18) SAMPLE PROBE alarm (4-11) is issued.	(a) ISE shutter does not open.	(a) ① Check if J434 ⑦ → DIST J331 ⑦ A → DIST J302 ⑮ B → MOTHER J117 ⑮ B ON/OFF voltage is normal. ② Rotary solenoid valve is faulty. Replace the valve.
	(19) VACUUM NOZZLE alarm (24-1/24-2) is issued.	(a) Vacuum nozzle fails to operate.	(a) ① Check if J434 ⑤ → DIST J331 ⑥ A → DIST J302 ⑪ B → MOTHER J117 ⑪ B ON/OFF voltage is normal (200 pps). ② Solenoid is faulty. Replace the solenoid.

(cont'd)

Item	Problem	Cause	Solution
1	(19) VACUUM NOZZLE alarm (24-1/24-2) is issued.	(b) Nozzle descending motion detecting photo-coupler is faulty.	(b) ① Check if J434 ③ → DIST J331 ④ A → DIST J302 ⑫ B → MOTHER J117 ⑫ B ON/OFF voltage is normal. ② Photocoupler is contaminated or faulty. Clean or replace the photo-coupler.
	(20) ISE DOOR alarm (26-1) is issued.	(a) ISE door is open. (b) Door photocoupler is faulty.	(a) Close the ISE door. (b) ① Check if J433 ③ → DIST J331 ② A → DIST J302 ⑫ A → MOTHER J117 ⑫ A ON/OFF voltage is normal. ② Photocoupler is contaminated or faulty. Clean or replace it. ③ Check if the photocoupler is affected by external light, when it is attached outside.
	(21) ISE SYRINGE alarm (25-1 to 6) is issued.	(a) Each cylinder fails to operate normally.	(a) ① Sipper syringe 60 pps Check if P437 ⑧ (ϕ1)/ ⑦ (ϕ2)/ ⑥ (ϕ3)/ ⑤ (ϕ4) → DIST J330 ⑤ B (ϕ1)/ ④ A (ϕ2)/ ④ B (ϕ3)/ ③ A (ϕ4) → DIST J302 ④ A (ϕ1)/ ④ B (ϕ2)/ ⑤ A (ϕ3)/ ⑤ B (ϕ4) → MOTHER J117 ④ A (ϕ1)/ ④ B (ϕ2)/ ⑤ A (ϕ3)/ ⑤ B (ϕ4) ON/OFF voltage is normal. ② IS syringe 400 pps Check if P439 ⑧ (ϕ1)/ ⑦ (ϕ2)/ ⑥ (ϕ3)/ ⑤ (ϕ4) → DIST J330 ⑱ B (ϕ1)/ ④ A (ϕ2)/ ④ B (ϕ3)/ ③ A (ϕ4) → DIST J302 ⑧ A (ϕ1)/ ⑧ B (ϕ2)/ ⑨ A (ϕ3)/ ⑨ B (ϕ4) → MOTHER J117 ⑧ A (ϕ1)/ ⑧ B (ϕ2)/ ⑨ A (ϕ3)/ ⑨ B (ϕ4) ON/OFF voltage is normal. ③ DIL syringe 400 pps Check if P438 ⑧ (ϕ1)/ ⑦ (ϕ2)/ ⑥ (ϕ3)/ ⑤ (ϕ4) → DIST J330 ⑪ A (ϕ1)/ ⑪ B (ϕ2)/ ⑩ A (ϕ3)/ ⑩ B (ϕ4) → DIST J302 ⑥ A (ϕ1)/ ⑥ B (ϕ2)/ ⑦ A (ϕ3)/ ⑦ B (ϕ4) → MOTHER J117 ⑥ A (ϕ1)/ ⑥ B (ϕ2)/ ⑦ A (ϕ3)/ ⑦ B (ϕ4) ON/OFF voltage is normal.
		(b) Photocoupler for detecting the upper dead position of each syringe is faulty.	(b) ① Sipper syringe Check if P437 ⑬ → DIST J330 ⑦ B → DIST J302 ① A → MOTHER J117 ① A ON/OFF voltage is normal. Photocoupler is contaminated or faulty. Clean or replace the photocoupler.

(cont'd)

Item	Problem	Cause	Solution
1	(21) ISE SYRINGE alarm (25-1 to 6) is issued.	(b) Photocoupler for detecting the upper dead position of each syringe is faulty.	(b) ② IS syringe Check if P439 ⑬ → DIST J330 ⑳ B → DIST J302 ② B → MOTHER J117 ② B ON/OFF voltage is normal. Photocoupler is contaminated or faulty. Clean or replace the photocoupler. ③ DIL syringe Check if J438 ⑬ → DIST J330 ⑬ A → DIST J302 ① B → MOTHER J117 ① B ON/OFF voltage is normal. Photocoupler is contaminated or faulty. Clean or replace the photocoupler.
	(22) ADC CALIB? alarm (28-3) is issued.	(a) ISE AMP is adjusted improperly. (b) ISE AMP is faulty.	(a) ① Adjust the reference voltage level (2 V, 8 V) in accordance with ISE AMP adjustment procedure prepared separately. (b) Readjust or replace the ISE AMP circuit board.

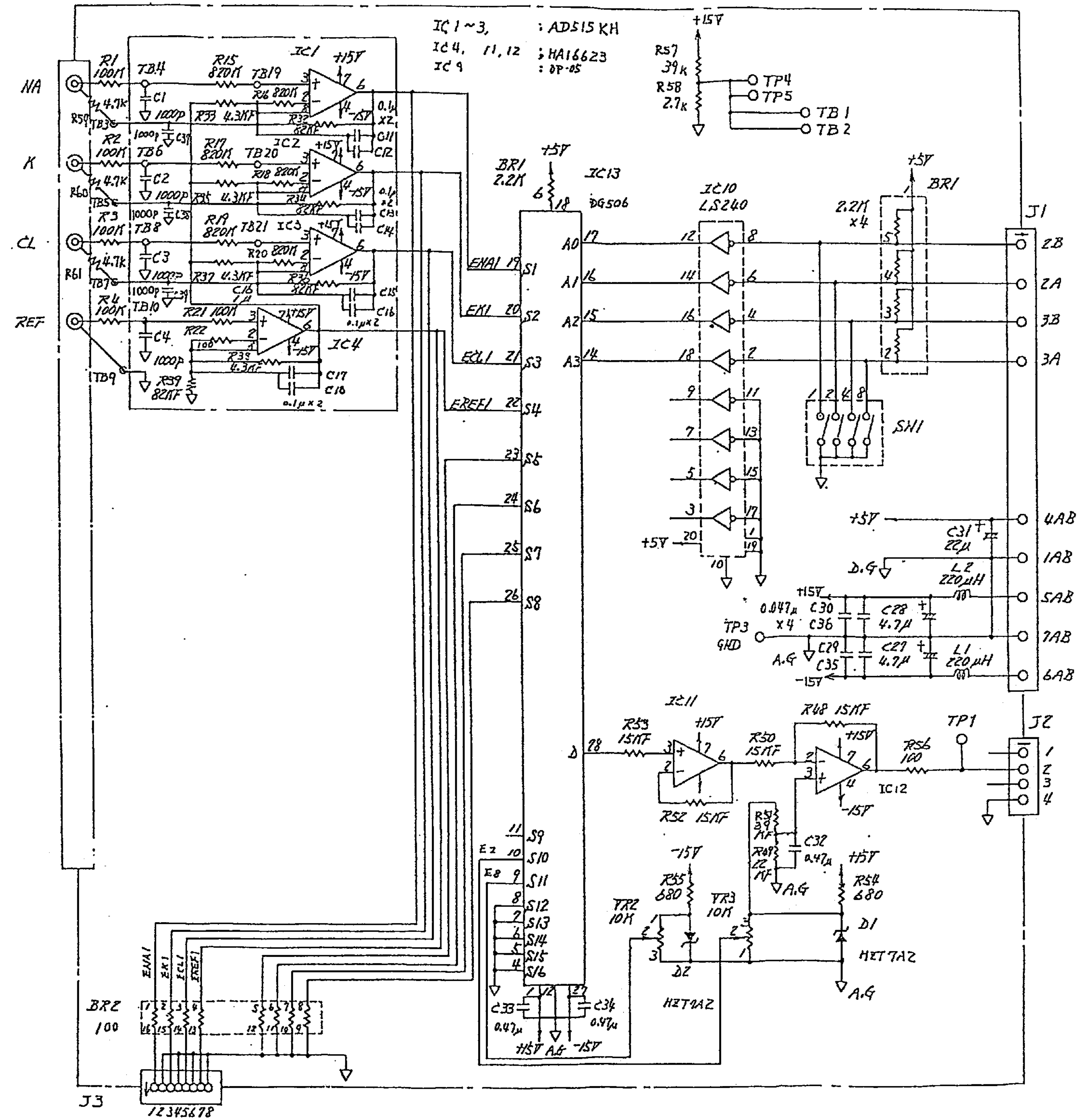


Fig. 7-1-4 ISE AMP PCB P/N 704-5039

7-2 Sample ID Accessory

7-2-1 Composition and Comparison

Table 7-2-1

No.	Item	Model 737 (new type of Bar Code Reader)	Model 736	Model 717
1	Composition 1) Scanner a. Sensor b. No. of scannings c. Focal length	 BA-521 CCD 10.5 times/sec 20 mm	 BA-521 CCD 22 times/sec 20 mm	 BA-521 CCD 22 times/sec 20 mm
	2) Decoder	BD-1500x	BD-1500x	BD-1500x
	3) Sampler	Turntable	Rack	Turntable
	4) Applicable test tube	10 mℓ	10 mℓ	10 mℓ 7 mℓ 5 mℓ
	5) ID sample	All samples	All samples	Samples on outer row only
	6) ID label position	Lower part of test tube	Upper part of test tube	Upper part of test tube
2	Label specifications 1) Usable codes	 NW7 Code 39 Interleaved 2 of 5	 NW7 Code 39 Interleaved 2 of 5	 NW7 Code 39 Interleaved 2 of 5
	2) No. of readable digits	6	11 max.	11 max.
3	Readout position on same label	2 places (shift of label)	2 places (shift of scanner)	2 places (shift of label)

7-2-2 Specifications

(1) Readout System .... Direct readout using CCD sensor
(Bar code label attached to test tube is automatically read out.)

(2) Usable Bar Code Symbols .... NW7 (Codabar)
Code 39
Interleaved 2 of 5

(3) Check Digit .... Usable

(4) No. of ID Digits

1) NW7 .... 3 to 11 digits (without check digit)
6 + 1 digit (with check digit)

2) Code 39 .... 3 to 11 digits (without check digit)
3 to 11 + 1 digit (with check digit)

3) Interleaved 2 of 5 .... 2 to 10 digits (without check digit)
3 to 11 + 1 digit (with check digit)

In case of NW7 and Code 39, it is permitted to use different nos. of digits which are within the range given above.
But the no. of ID digits is fixed (even number) in the case of interleaved 2 of 5.

(5) Characters Usable for ID

1) NW7 .... 0 to 9, –, /, ·, +

2) Code 39 .... 0 to 9, A to Z, –, ·, space, /, +

3) Interleaved 2 of 5 .... 0 to 9

(6) Bar Code Readout Range

The bar code reader can read out in the range shown in Fig. 7-2-1.
The bar code should thus be kept within the bar code range shown.

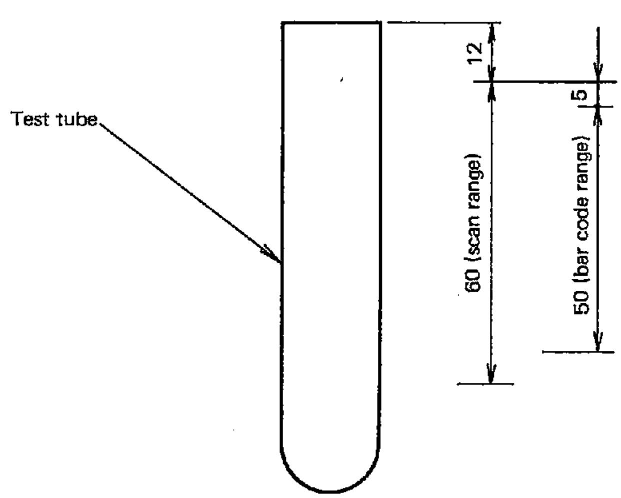


Fig. 7-2-1 Bar Code Readout Range

(7) Bar Code Label

(a) Label Size

Fig. 7-2-2 shows the label size when attaching the label by aligning it with the top end of the test tube.

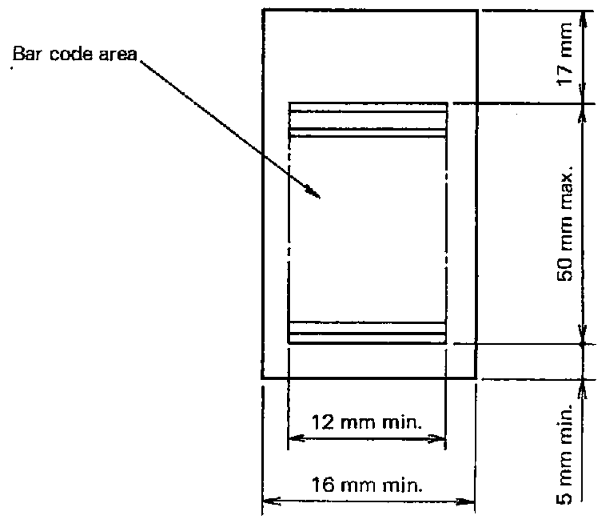


Fig. 7-2-2 Label Size

(b) Bar and Space

1) Minimum bar (space) width ..... 0.2 mm

2) Ratio of narrow bar (space) to thick bar (space) ..... 1 : 2.5 to 3

(c) Reflectance and PCS Value

1) Reflectance of space .... 70 % or more

2) PCS value .... 0.7 or more

(d) Color

1) Bar .... Black

2) Space .... White

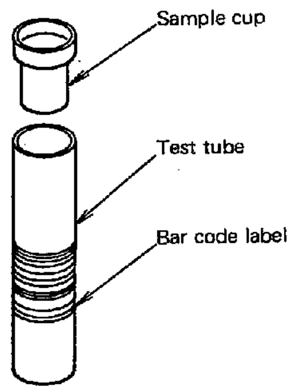
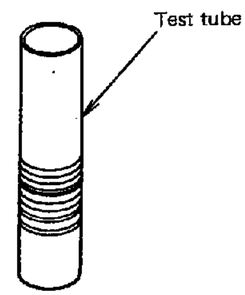
(e) Other

There should be no smearing of the printed bars, nor any stain on the label surface.

(8) Sample Container

Sample containers meeting the following test tube specifications should be prepared.

Table 7-2-2

Type	**Case 1**	**Case 2**
	Sample Cup + Test Tube	**Test Tube alone**
Assembling method		
Test tube dimensions	ϕ 16 mm x 75 mm ϕ 16 mm x 100 mm	ϕ 13 mm x 75 mm ϕ 13 mm x 100 mm ϕ 16 mm x 75 mm ϕ 16 mm x 100 mm

Both cases 1 and 2 can be used together.
But if there is no sample in the sample cup, then abnormal descent of the sampling nozzle will be detected and sampling will be stopped.
An exclusive adapter should be attached when using a test tube of ϕ13 mm.

The allowance in the outer diameter of the test tube is as follows.

ϕ 13 mm tube .... ϕ 12 to 13 mm
ϕ 16 mm tube .... ϕ 15 to 16 mm

7-2-3 Switch Setting

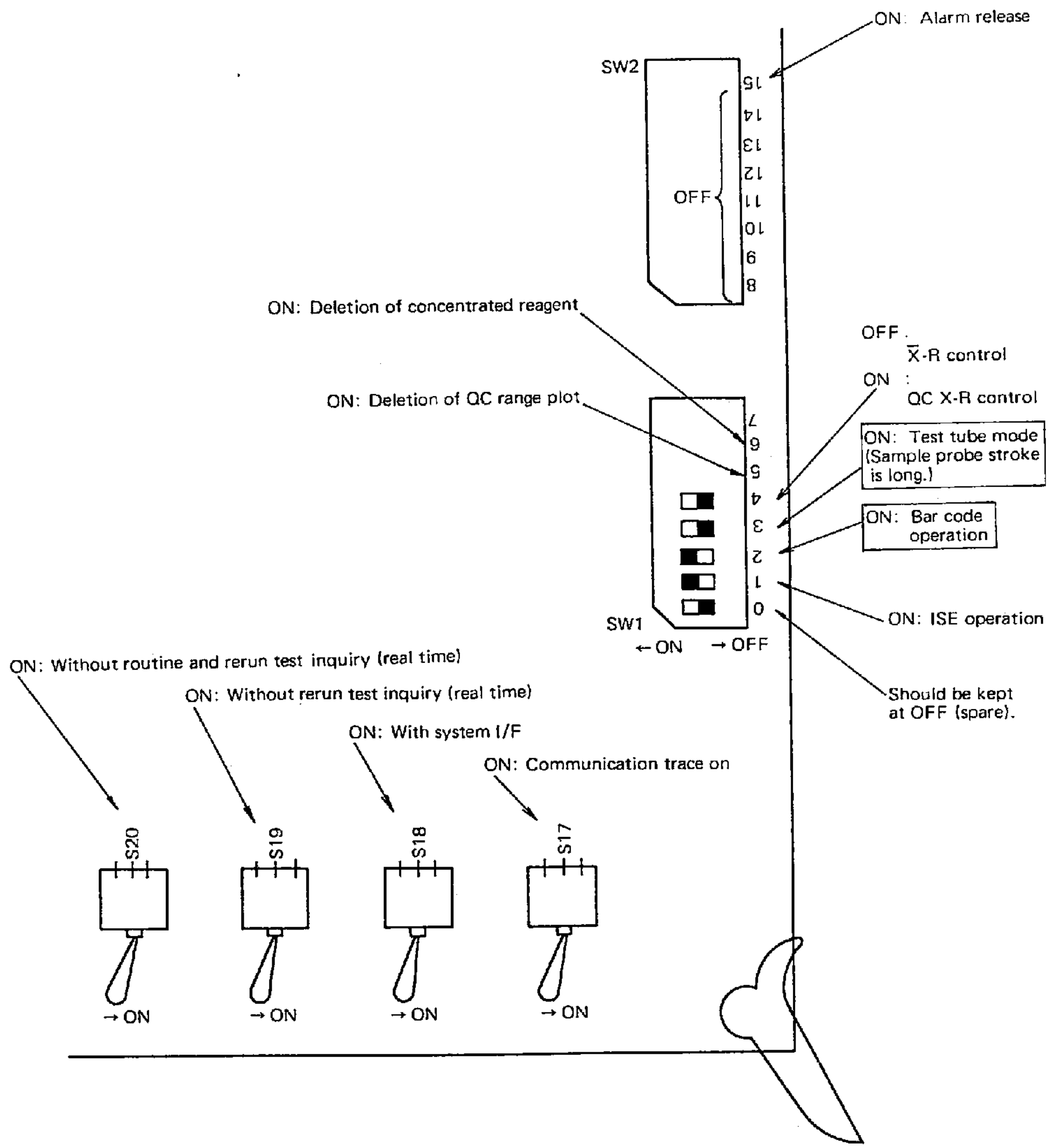


Fig. 7-2-3 Setting of DIP Switches on TRI ADCP Board

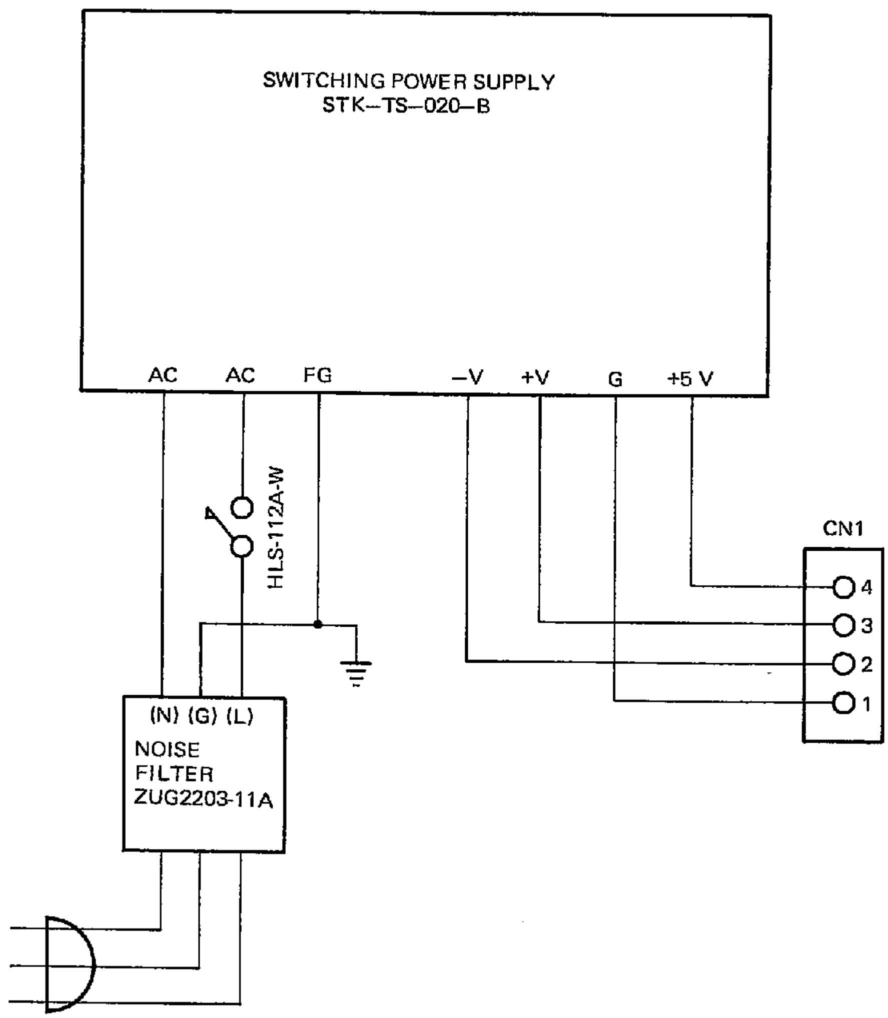
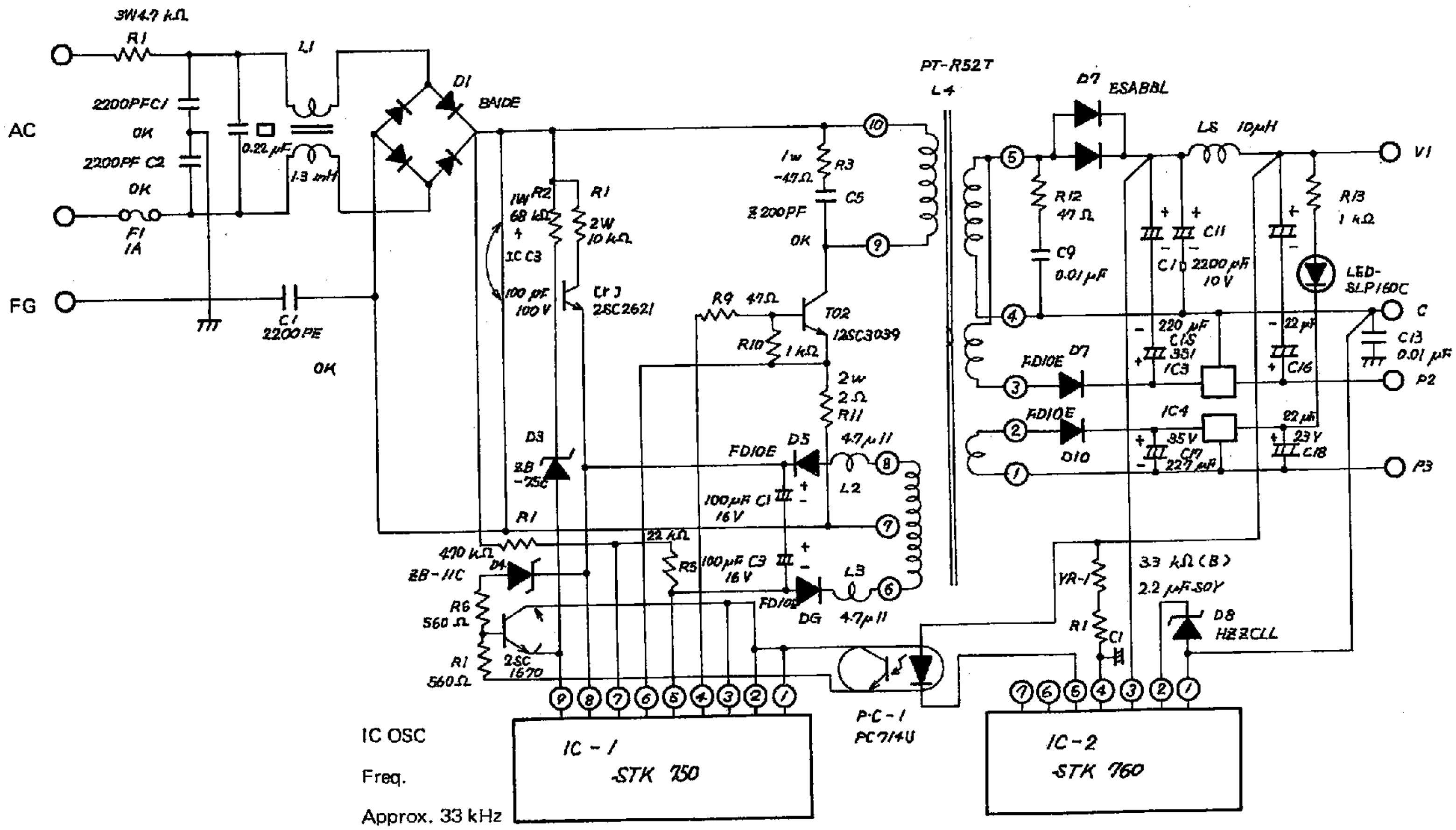
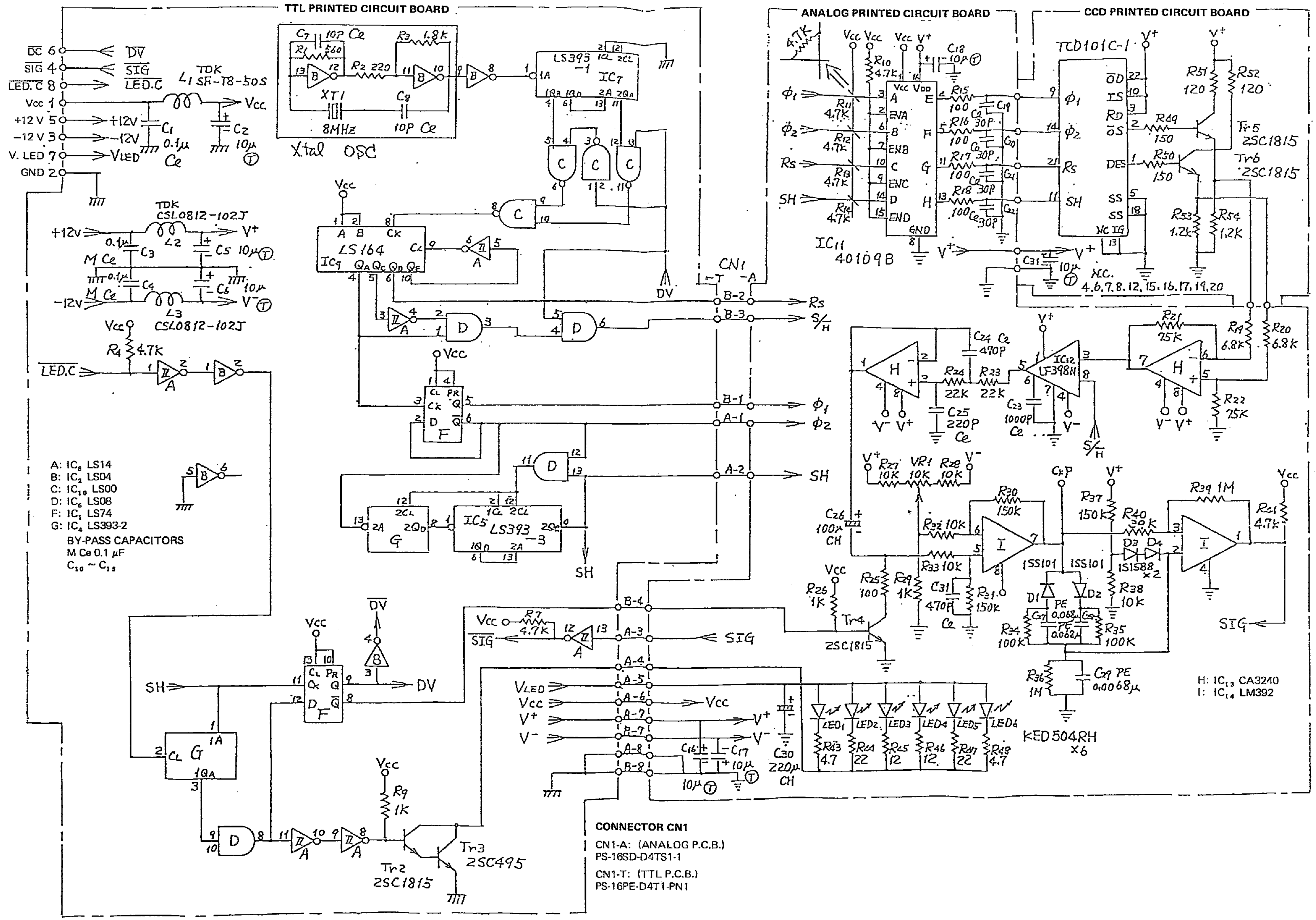


Fig. 7-2-4 Barcode Reader Circuit Diagram (AC Input/DC Power)



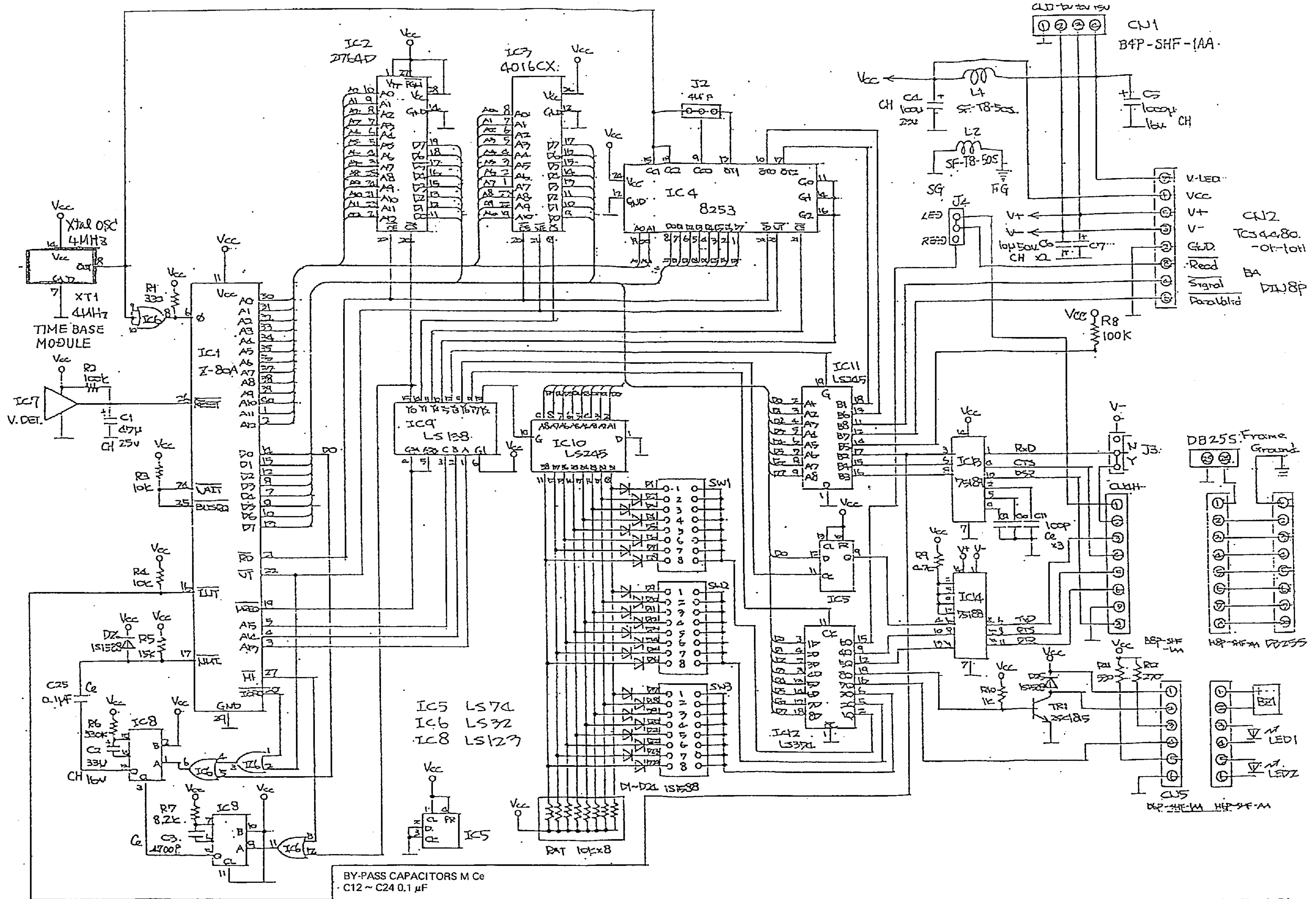
IC3: LT8M12 IC4: TA78L012AP

Fig. 7-2-5 Barcode Reader Circuit Diagram (Switching Regulator)



Notes: Ce → CERAMIC CAPACITOR, CH → ALUMINUM ELECTROLYTIC CAPACITOR, T → TANTALUM ELECTROLYTIC CAPACITOR,
PE → POLYESTER FILM CAPACITOR, M Ce → MONOLITHIC CERAMIC CAPACITOR

Fig. 7-2-6 BARCODE READER Circuit Diagram (Scanner)



Notes: Ce → CERAMIC CAPACITOR, CH → ALUMINUM ELECTROLYTIC CAPACITOR,
M Ce → MONOLITHIC CERAMIC CAPACITOR

Fig. 7-27 Barcode Reader Circuit Diagram (Decoder)

Table 7-2-3 Functional Description for Dip Switches

SW 1										Standard Dip SW Setting for 717	Remarks
1	2	3	4	5	6	7	8	Function			
0	0							Selection of barcode symbol code	NW7	O	Set label code symbol
0	1								Code 39		
1	0								Interleaved 2 of 5		
		0	0					Selection of mode	737 mode		Fixed
		0	1						736 mode		
		1	0						Normal mode	O	
				0				Selection of NW7	NW7	O	Fixed
				1					NW7-HEX		
					0			Check digit	Without check digit		Set if check digit is used
					1				With check digit	O	
						0		Modulus check, character output	No output	O	Fixed
						1			Output		
							0	Read data output	Output when data is read once		Fixed
							1		Output when data which are read twice identical	O	

SW 2										Standard Dip SW Setting for 717	Remarks
1	2	3	4	5	6	7	8	Function			
0	1	0						Selection of baud rate	300 bps		Fixed
0	1	1							600 bps	O	
1	0	0							1,200 bps		
1	0	1							2,400 bps		
1	1	0							4,800 pbs		
1	1	1							9,600 pbs		
			0					Construction of data bit	7 bits	O	Fixed
			1						8 bits		
				0				Yes or No of parity check	No check		Fixed
				1					Check	O	
					0			Type of parity	Even	O	Fixed
					1				Odd		
						0		Construction of stop bit	1 bit		Fixed
						1			2 bits	O	
							0	Sounding buzzer in decoder in case of correct decoding	No sounding		Fixed
							1		Sounding	O	

SW 3										Standard Dip SW Setting for 717	Remarks
1	2	3	4	5	6	7	8	Function			
0	0							Transmitting format	No procedure CR section		Fixed
0	1								No procedure CR. LF section		
1	0								Basic procedure		
1	1								STX, ETX, BCC	O	
		0						Use of hand shake line	No use	O	Fixed
		1							Use		
			0					Continuous reading for test	One time reading auto-stop	O	Fixed
			1						Continuous reading (test mode)		
				0				Start, stop character output of NW7, Code 39	No output	O	Fixed
				1					Output		
					0	0	0	Data length of interleaved 2 of 5 (indude Cd)	2 digits		Set data length of interleaved 2 of 5
					0	0	1		4 digits		
					0	1	0		6 digits		
					0	1	1		8 digits	O	
					1	0	0		10 digits		
					1	0	1		12 digits		

8. REPLACEMENT AND ADJUSTMENT (MECHANISM and ELECTRONICS)

8. REPLACEMENT AND ADJUSTMENT (MECHANISM and ELECTRONICS)

8-1 Driving Mechanism Assy S.Disk

< Preparation >

(1) Remove OPERATION PANEL (P/N 717-0218).

(2) Remove Jacket. S.

(3) Disconnect connectors P420 and P519.

(4) Remove fixing screws of this assy (3 screws).

(5) Take out this assy from main unit.

< Lubrication Part >

(1) With grease BRB No. 1
 (a) FLAT GEAR 20 (P/N 705-1344) ⑦
 (b) SPUR GEAR 200 (P/N 717-1257) ①

< Adjustment >

(1) The gap between flat gear 20 ⑦ and detector plate ③ should be 1.3 mm.
In case of replacement of PULSE MOTOR (P/N 717-0219) ⑥ or flat gear 20 ⑦, this adjustment is required.

< Replacement >

(1) SPUR GEAR 200 (P/N 717-1257) ①
 (a) Detach HEAD (P/N 717-1484) ② by loosening 2 hex. screws (Ⓐ).
 (b) Remove DETECTOR PLATE (P/N 717-1021) ③.
 (c) Remove 3 fixing screws (Ⓑ).
 (d) Replace gear.

(2) BALL BEARING (P/N L111060) ④
 (a) Follow same procedure as in (1), (a) to (c).
 (b) Loosen 2 screws (Ⓒ).
 (c) Detach SHAFT (P/N 704-1057) ⑤.
 (d) Replace bearing.

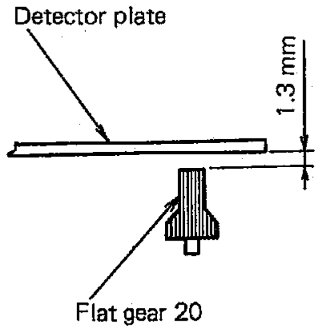
(3) PULSE MOTOR (P/N 717-0219) ⑥
 (a) Remove 4 fixing screws (Ⓓ).
 (b) Detach FLAT GEAR 20 ⑦.
 (c) Replace motor.
 (d) After this replacement, adjustment mentioned above should be done.

(4) DETECTOR PLATE (P/N 717-1021) ③

(a) Remove 3 fixing screws (Ⓔ).

(b) Replace plate.

717-0282 DRIVING MECHANISM ASSY S.DISK



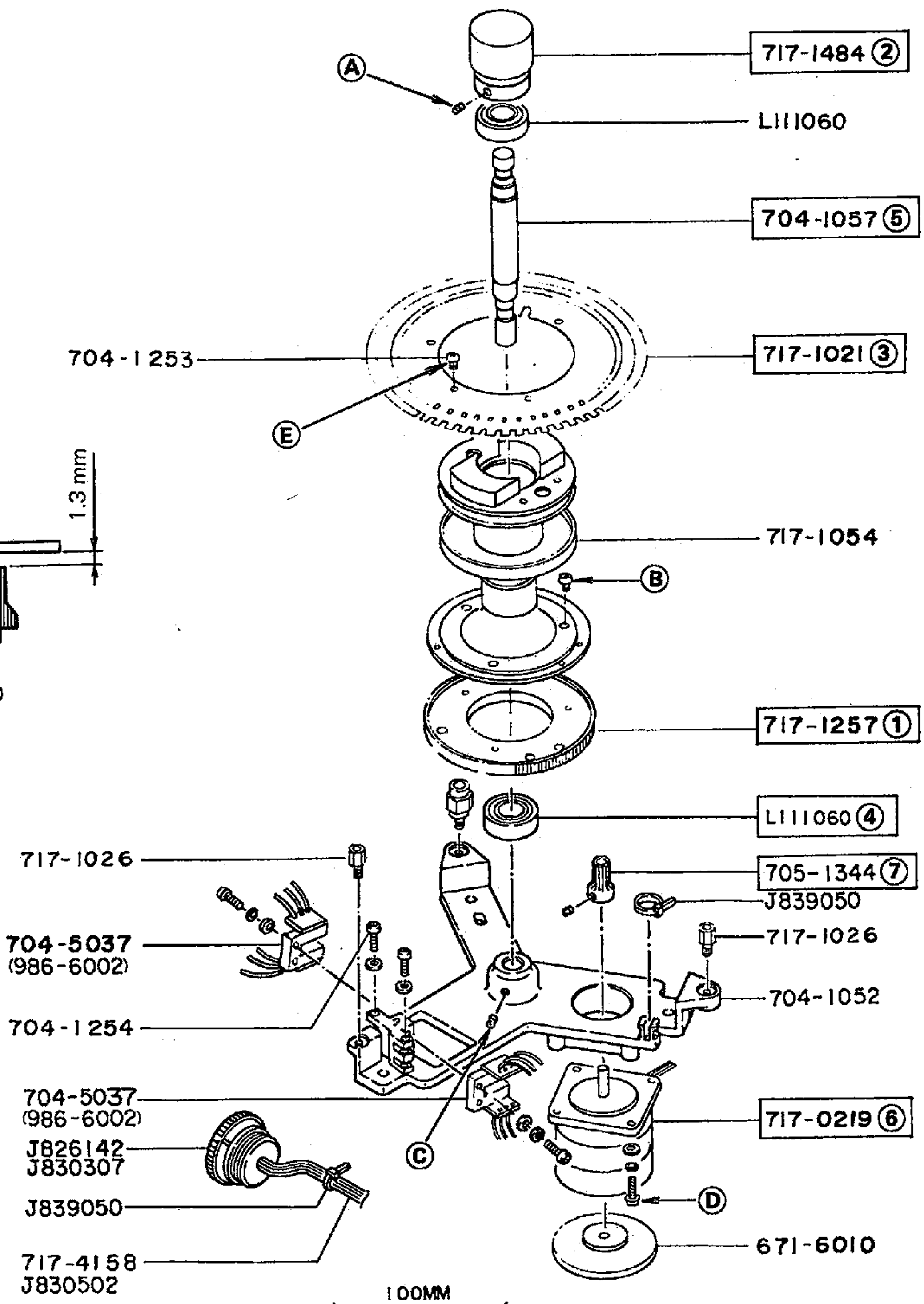


Fig. 8-1-1

8-2 Driving Mechanism Assy R1.Disk

< Preparation >

(1) Drain water from cold water bath.

(2) Remove OPERATION PANEL (P/N 717-0218).

(3) Remove COVER ASSY RU (P/N 717-0122).

(4) Remove INSIDE COVER (P/N 717-1428).

(5) Remove TABLE COVER R (P/N 717-1424).

(6) Detach tubing from jacket.R1 (3 tubes).

(7) Remove jacket.R1.

(8) Disconnect connector P424.

(9) Remove fixing screws of this assy (3 screws).

(10) Take out this assy from main unit.

< Lubrication Part >

(1) With grease BRB No. 1
- (a) FLAT GEAR 20 (P/N 705-1344) ⑦
- (b) SPUR GEAR 200 (P/N 704-1055) ①

< Adjustment >

(1) The gap between flat gear 20 and detector plate should be 1.3 mm.
In case of replacement of PULSE MOTOR (P/N 717-0219) ⑥ or flat gear 20, this adjustment is required.

< Replacement >

(1) SPUR GEAR 200 (P/N 704-1055) ①
- (a) Detach SUPPORT (P/N 704-1599) ② by loosening 2 hex. screws (Ⓐ).
- (b) Remove detector plate ③.
- (c) Remove 3 fixing screws (Ⓑ).
- (d) Replace gear.

(2) BALL BEARING (P/N L111060) ④
- (a) Follow same procedure as in (1), (a) to (c).
- (b) Loosen 2 screws (Ⓒ).
- (c) Detach SHAFT (P/N 704-1057) ⑤.
- (d) Replace bearing.

(3) PULSE MOTOR (P/N 717-0219) ⑥
- (a) Remove 4 fixing screws (Ⓓ).
- (b) Detach flat gear 20 ⑦ by loosening screws.
- (c) Replace motor.

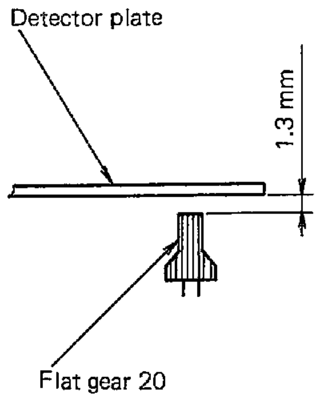
(d) After this replacement, adjustment mentioned above should be done.

(4) DETECTOR PLATE (P/N 717-1017) ③

(a) Remove 3 fixing screws (Ⓔ).

(b) Replace plate.

717-0283 DRIVING MECHANISM ASSY R1. DISK



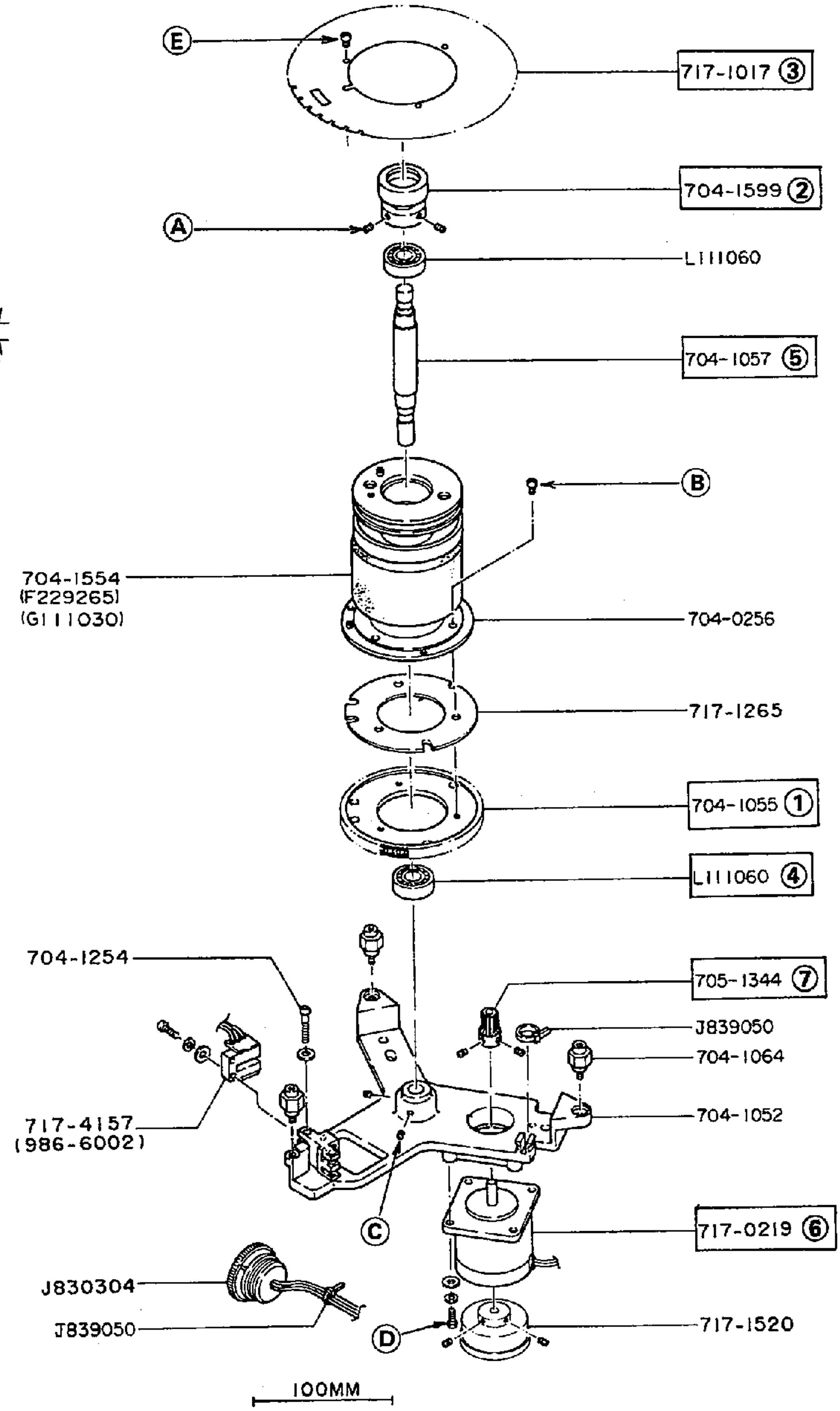


Fig. 8-2-1

8-3 Driving Mechanism Assy R2. Disk

< Preparation >

(1) Drain water from cold water bath.

(2) Remove OPERATION PANEL (P/N 717-0218).

(3) Remove INSIDE COVER (P/N 717-1428).

(4) Detach tubing from jacket. R2 (3 tubes).

(5) Remove jacket R2.

(6) Disconnect connector P423.

(7) Remove fixing screws of this assy (3 screws).

(8) Take out this assy from main unit.

< Lubrication Part >

(1) With grease BRB No. 1
- (a) Flat gear 20 (P/N 705-1344) (7)
- (b) Spur gear 200 (P/N 704-1055) (1)

< Adjustment >

(1) The gap between flat gear 20 and detector plate should be 1.3 mm.
In case of replacement of PULSE MOTOR (P/N 717-0219) or flat gear 20, this adjustment is required.

< Replacement >

(1) SPUR GEAR 200 (P/N 704-1055) (1)
- (a) Detach SUPPORT (P/N 704-1599) (2) by loosening 2 hex. screws ((A)).
- (b) Remove detector plate (6).
- (c) Remove 3 fixing screws ((B)).
- (d) Replace gear.

(2) BALL BEARING (P/N L111060) (3)
- (a) Follow same procedure as in (1), (a) to (c).
- (b) Loosen 2 screws ((C)).
- (c) Detach SHAFT (P/N 704-1057) (4).
- (d) Replace bearing.

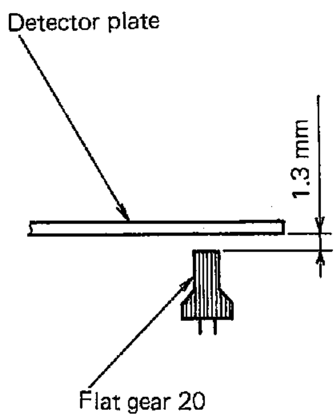
(3) PULSE MOTOR (P/N 717-0219) (5)
- (a) Remove 4 fixing screws ((D)).
- (b) Detach flat gear 20 (7) by loosening screws.
- (c) Replace motor.
- (d) After this replacement, adjustment mentioned above should be done.

(4) DETECTOR PLATE (P/N 717-1018) ⑥

(a) Remove 3 fixing screws (Ⓔ).

(b) Replace plate.

717-0284 DRIVING MECHANISM ASSY R2. DISK



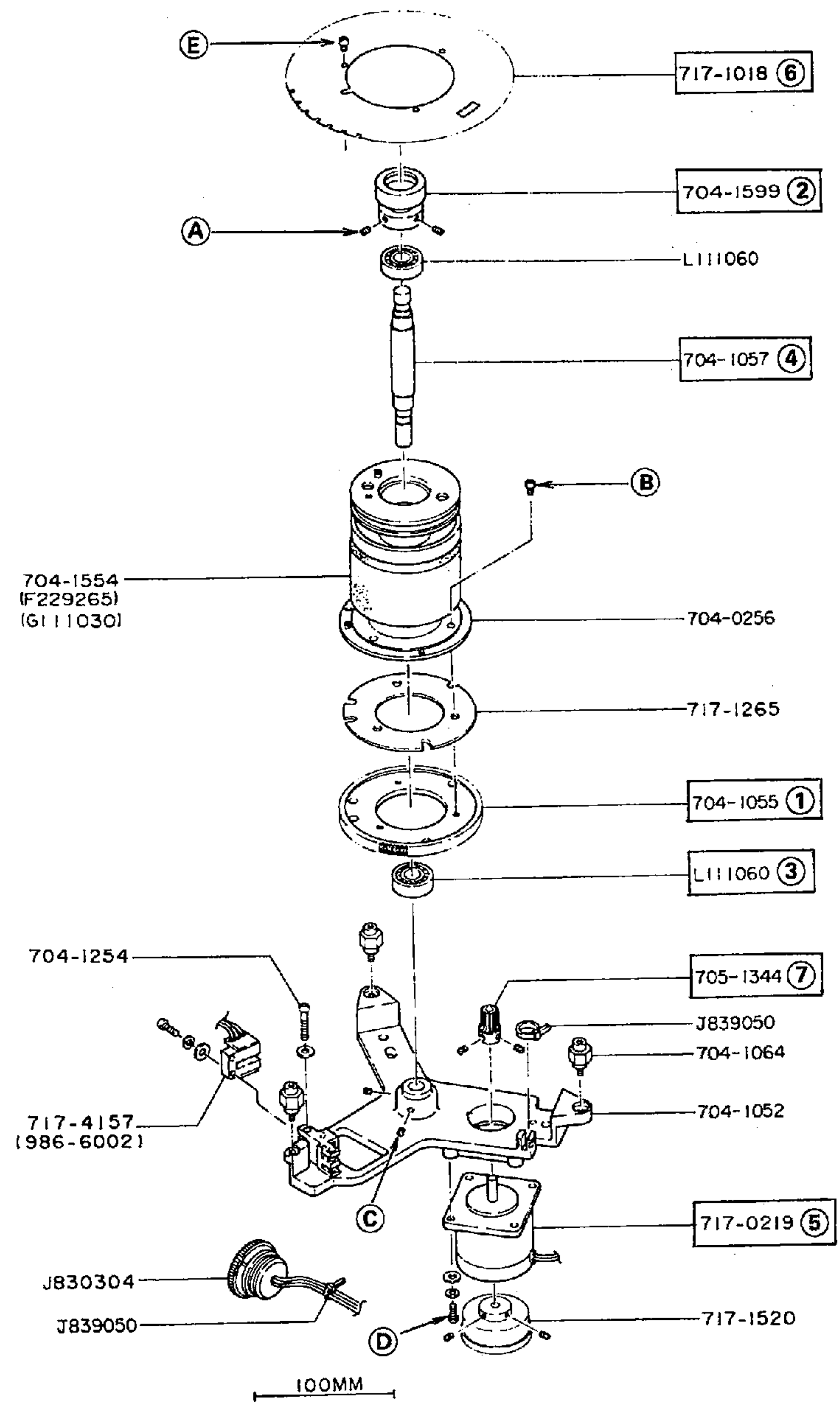


Fig. 8-3-1

8-4 Reaction Bath Assy

< Disassembly >

(1) Remove DRAIN PLUG (P/N 717-1410) beside MD-15RG in order to discharge incubation water.

(2) Take out 4 fixing screws of INSIDE COVER (P/N 717-0299).

(3) Detach inside cover.

(4) Take out 3 fixing screws and one screw beside window.

(5) Detach PIPE ASSY (P/N 717-0188) by removing 2 fixing screws.

(6) Detach liquid level sensor.

(7) Detach 2 tubings for circulating inc. bath water.

(8) Detach overflow tubing and excess-overflow tubing.

(9) Take out reaction bath assy.

8-5 Reaction Table Drive Assy

< Preparation >

(1) Follow same procedure as for Driving Mechanism assy R1. disk.

(2) Remove Reaction Bath assy (Refer to Reaction Bath assy).

< Lubrication Part >

(1) With grease BRB No. 1
 (a) FLAT GEAR 20 (P/N 705-1344) ①
 (b) GEAR 300 (P/N 717-1006) ②

< Replacement >

(1) PULSE MOTOR (P/N 717-0219) ③
 (a) Disconnect connector P427.
 (b) Remove 4 fixing screws.
 (c) Then replace motor.

(2) Gear N300 ②
 (a) Loosen 2 hex. screws (Ⓐ).
 (b) Pull down GEAR N300 ②.

(3) Ball bearing ④

(a) Loosen 2 hex. screws (Ⓐ).

(b) Remove 3 fixing screws of this assy.

(c) Detach Pulse Motor.

(d) Loosen 2 hex. screws (Ⓑ).

(e) Then pull out the SHAFT (P/N 717-0102) ⑤.

(f) Replace bearing.

(g) After replacement, confirm the height of table as mentioned at right.

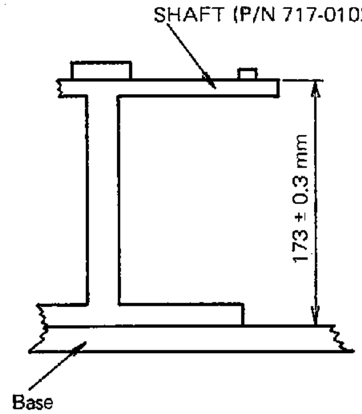


Fig. 8-5-1

717-0285 REACTION TABLE DRIVING ASSY

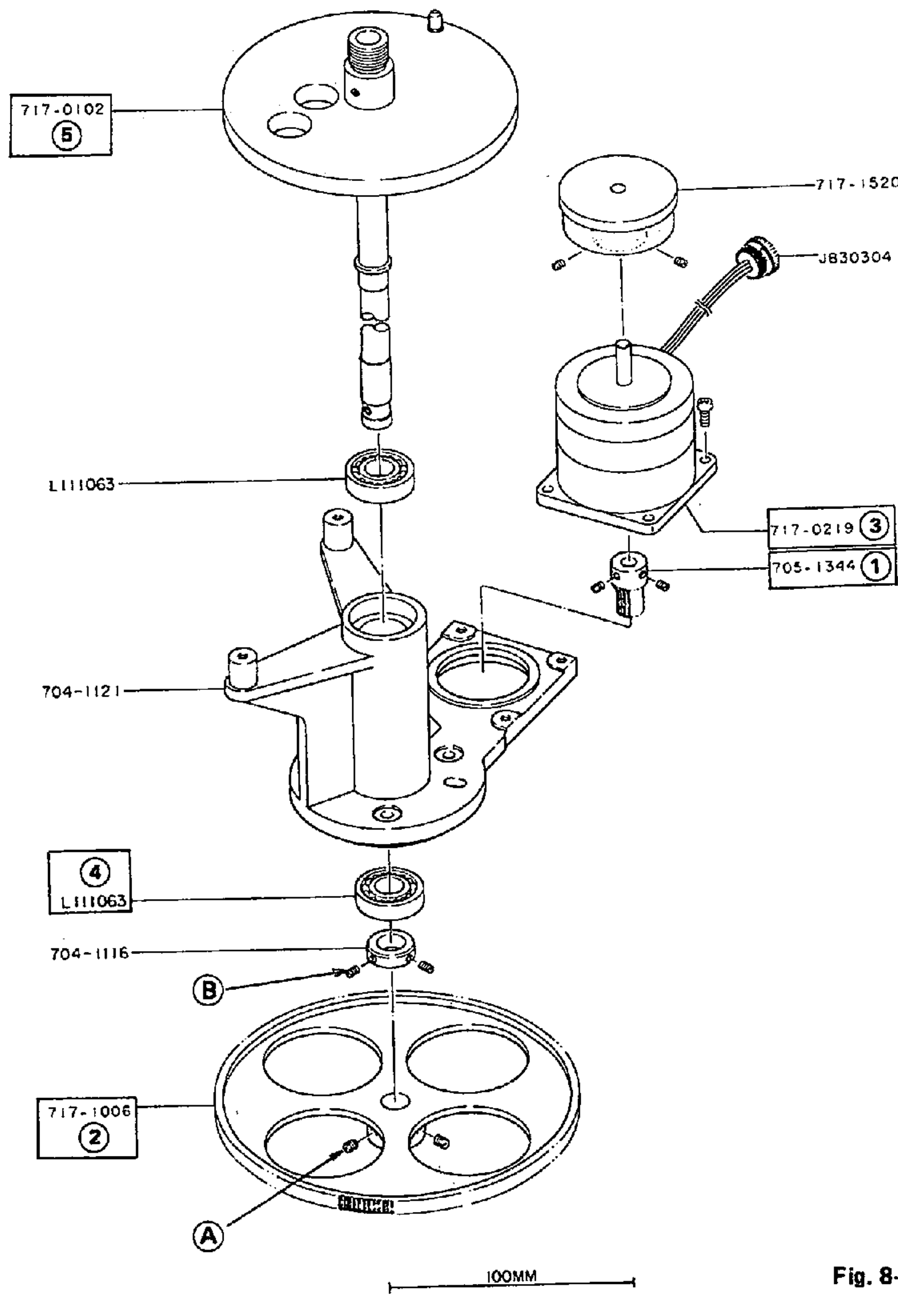


Fig. 8-5-2

8-6 Rinse Mechanism Assy

< Preparation >

(1) Remove TABLE COVER L (P/N 717-1425).

< Disassembly >

(1) Take out 2 fixing screws of this Mecha.

(2) Detach HEAD (P/N 704-1159).

(3) Detach RINSE ARM (P/N 717-0279).

(4) Disconnect connectors P428 and P215.

(5) Remove this assy.

< Lubrication >

(1) With grease BRB No. 1
   - (a) SHAFT (P/N 704-1145) ①
   - (b) SLIDER (P/N 717-1130) ②
   - (c) The face of SLIDER ASSY (P/N 717-0120) ③ touching GUIDE ASSY (P/N 704-0186) ④

< Adjustment >

The bearing of GUIDE ASSY (P/N 704-0186) must be adjusted so as to eliminate vibrations when the slider mechanism moves up and down.

(1) Loosen fixing screw Ⓐ. (Fig. 8-6-1)

(2) Make sure that the bearing mount is inserted in the groove, and tighten the fixing screw while pressing the bearing mount as guided by arrow in Fig. 8-6-1.

< Replacement >

(1) AC MOTOR ASSY (P/N 717-0219) ⑤
   - (a) Detach 2 SENSORS (P/N 704-5035).
   - (b) Loosen 2 hex. screws (Ⓐ) of CRANK ASSY (P/N 717-0121) ⑥.
   - (c) Pull out crank assy.
   - (d) Remove 4 fixing screws, and 2 screws of capacitor of motor.
   - (e) Replace assy.
   - (f) After replacement, adjust crank assy in order to be at center of photo-coupler.

Note: In case it's difficult to remove crank assy from motor's shaft, detach slider assy.

(2) BALL BEARING of SLIDER ASSY (P/N L116171) ⑦

(a) Remove snap-ring (Ⓑ) of shaft.

(b) Pull out shaft.

(c) Remove snap-ring fixing ball bearing.

(d) Replace bearing.

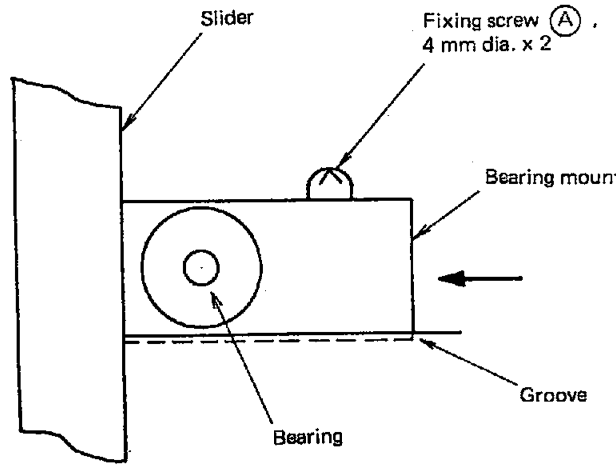


Fig. 8-6-1

717-0231 RINSE DRIVER ASSY

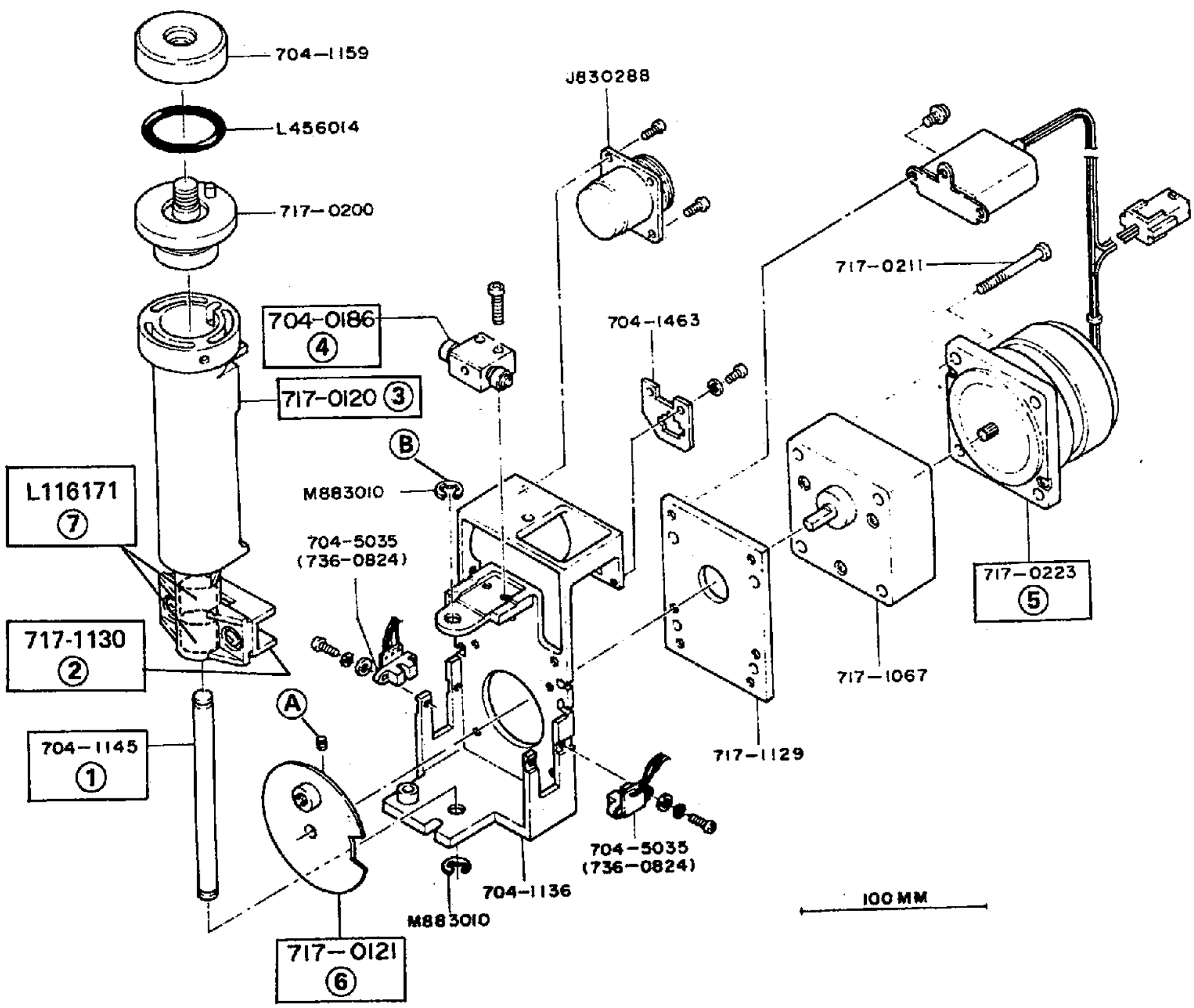


Fig. 8-6-2

8-7 Sampling Mechanism Assy S

< Preparation >

(1) Remove OPERATION PANEL (P/N 717-0218).

(2) Remove TABLE COVER L (P/N 717-1425).

(3) Remove jacket. S.

(4) Remove fixing screws of this assy (2 screws).

(5) Disconnect connector P421.

(6) Remove NIPPLE (P/N 717-1084) from serum pipetter.

< Lubrication Part >

(1) With grease BRB No. 1
   (a) SPRING GUIDE (P/N 704-1486) ①
   (b) SHAFT (P/N 704-1076) ②

(2) With tri-flon oil
   (a) GUIDE (P/N 704-0162) ③
   (b) CHANGE NUT (P/N 717-1247) ④

< Adjustment >

(1) The inserting distance of JUNFLON TUBE (P/N F274168) and (P/N F274152) should be 10 mm.

(2) Refer to adjustment of motor assy S. (item 8-12).

(3) For the adjustment of timing belt tension, fix rotation Pulse Motor by 4 fixing screws, so that Probe can move 3 mm manually while holding Motor Pulley.

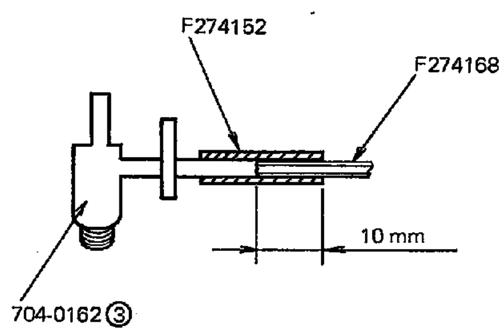


Fig. 8-7-1

< Replacement >

(1) Pulse motor
   (a) For up-down motor (P/N 717-0188) ⑤
      1) Remove 4 fixing screws.
      2) Loosen 2 hex. screws of coupling (Ⓐ).
      3) Replace motor.
   (b) For rotation motor (P/N 717-0245) ⑥
      1) Remove 4 fixing screws.
      2) Detach STOPPER (P/N 717-1184) ⑦ and photocoupler.
      3) Move Timing BELT (P/N 704-1097) ⑧ at PULLEY (P/N 704-1071) ⑨.
      4) Take out Motor ASSY S (P/N 717-0245).
      5) Loosen 2 hex. screws of pulley ⑨ in motor assy S.

6) Detach pulley ⑨ and stopper from motor's shaft.
7) Replace motor.
8) After replacement, adjustment of sampling nozzle's position and Timing Belt's tension is required.

(2) CHANGE NUT (P/N 717-1247) ④

1) Loosen 2 hex. screws of coupling (Ⓑ).
2) Detach Pulse MOTOR (P/N 717-0188) ⑤ with coupling.
3) Detach PULLEY (P/N 704-1071) ⑨, in order to remove COVER (P/N 704-1081) ⑩ .
4) Remove cover, and remove Ball Bearing ⑫ .
5) Remove 2 fixing screws of CAP (P/N 717-1248) ⑪ , (Ⓒ).
6) Replace nut. (Replacement of Ball Bearing ⑫ is done in the same way.)

(3) SHAFT ASSY (P/N 704-0547) ⑭

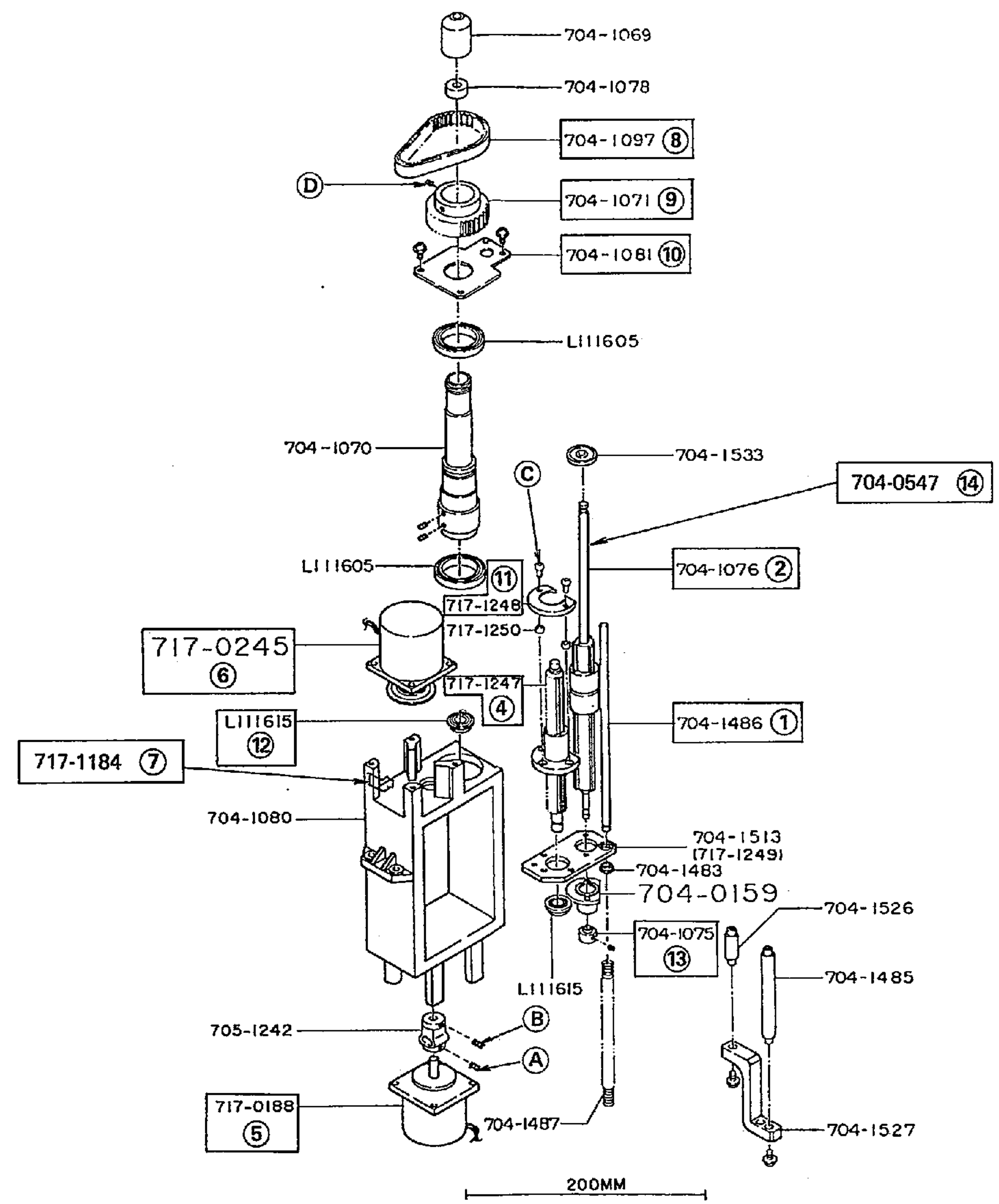
1) Detach ARM ASSY S (P/N 717-0251) by loosening 2 hex. screws.
2) After moving timing belt, remove PULLEY (P/N 704-1071) ⑨ by loosening 2 hex. screws (Ⓓ).
3) Remove COVER (P/N 704-1081) ⑩ .
4) Put wire binder on both ends of shaft, so that shaft can not be pulled out from ball-spline.
5) Remove STOPPER (P/N 704-1075) ⑬ at the end of shaft.
6) Replace SHAFT ASSY (P/N 704-0547).

Note: Pay attention not to pull out shaft from ball-spline.
SHAFT ASSY ⑭ consists of SHAFT (P/N 704-1076), SUPPORTING RING (P/N 704-1533), BEARING SUPPORT (P/N 704-1078), CAP (P/N 704-1069), and GUIDE (P/N 704-1070).

(4) TIMING BELT (P/N 704-1097) ⑧

1) Same procedure as (1)-(b), 1) to 4).
2) Detach arm assy S.
3) Replace belt.

717-0254 DRIVING MECHANISM ASSY S



8-8 Sampling Mechanism Assy R1 (and also for R2)

< Preparation >

(1) Remove COVER RU (P/N 717-0122).

(2) Remove TABLE COVER C (P/N 717-1423).

(3) Remove TABLE COVER R (P/N 717-1424).

(4) Remove fixing screws of this ASSY (2 screws).

(5) Disconnect connector P426.

(6) Remove NIPPLE (P/N 716-1084) from R1 pipetter.

< Lubrication Part >

(1) With grease BRB No. 1
- (a) SPRING GUIDE (P/N 704-1486) ①
- (b) SHAFT (P/N 704-1076) ②

(2) With tri-flon oil
- (a) GUIDE (P/N 704-0162) ③
- (b) CHANGE NUT (P/N 717-1247) ④

< Adjustment >

(1) Refer to adjustment of motor assy R1. (item 8-12).

(2) For the adjustment of timing belt's tension, fix rotation pulse motor by 4 fixing screws, so that Probe can move 3 mm manually while holding motor pulley.

< Replacement >

(1) Pulse motor
- (a) For up-down motor (P/N 717-0188) ⑤
  1) Remove 4 fixing screws.
  2) Loosen 2 hex. screws of coupling (Ⓐ).
  3) Replace motor.
- (b) For rotation motor (P/N 717-0246) ⑥ (For R2, P/N 717-0247)
  1) Remove 4 fixing screws.
  2) Detach STOPPER (P/N 717-1185) ⑦ and photocoupler.
  3) Move timing Belt ⑧ at pulley (P/N 704-1071).
  4) Take out motor assy R1 (P/N 717-0246).
  5) Loosen 2 hex. screws of pulley in motor assy R1.
  6) Detach Pulley and stopper from motor's shaft.
  7) Replace motor.
  8) After replacement, adjustment of reagent nozzle's position and timing belt's tension is required.

(2) CHANGE NUT (P/N 717-1247) ④
1) Loosen 2 hex. screws of coupling (Ⓑ).
2) Detach pulse Motor (P/N 717-0188) ⑤ with coupling.
3) Detach PULLEY (P/N 704-1071) in order to remove COVER (P/N 704-1081).
4) Remove cover, and remove ball bearing ⑫.
5) Remove 2 fixing screws of CAP (P/N 717-1248) ⑪, (Ⓒ).
6) Replace nut. (Replacement of ball bearing is done in same way.)

(3) SHAFT ASSY (P/N 704-0547) ⑭
1) Detach ARM ASSY R (P/N 717-0252) by loosening 2 hex. screws.
2) After moving timing belt, remove PULLEY (P/N 704-1071) ⑨ by loosening 2 hex. screws (Ⓓ).
3) Remove COVER (P/N 704-1081) ⑩.
4) Put wire binder on both ends of shaft, so that shaft can not be pulled out from ball-spline.
5) Remove STOPPER (P/N 704-1075) ⑬ at the end of shaft.
6) Replace shaft assy.

Note: Pay attention not to pull out shaft from special ball bearing.
Shaft assy ⑭ consists of SHAFT (P/N 704-1076), SUPPORTING RING (P/N 704-1533), BEARING SUPPORT (P/N 704-1078), CAP (P/N 704-1069) and GUIDE (P/N 704-1070).

(4) TIMING BELT (P/N 704-1097) ⑧
1) Same procedure as in (1)-(b), 1) to 4).
2) Detach ARM assy R.
3) Replace belt.

717-0256 DRIVING MECHANISM ASSY R1

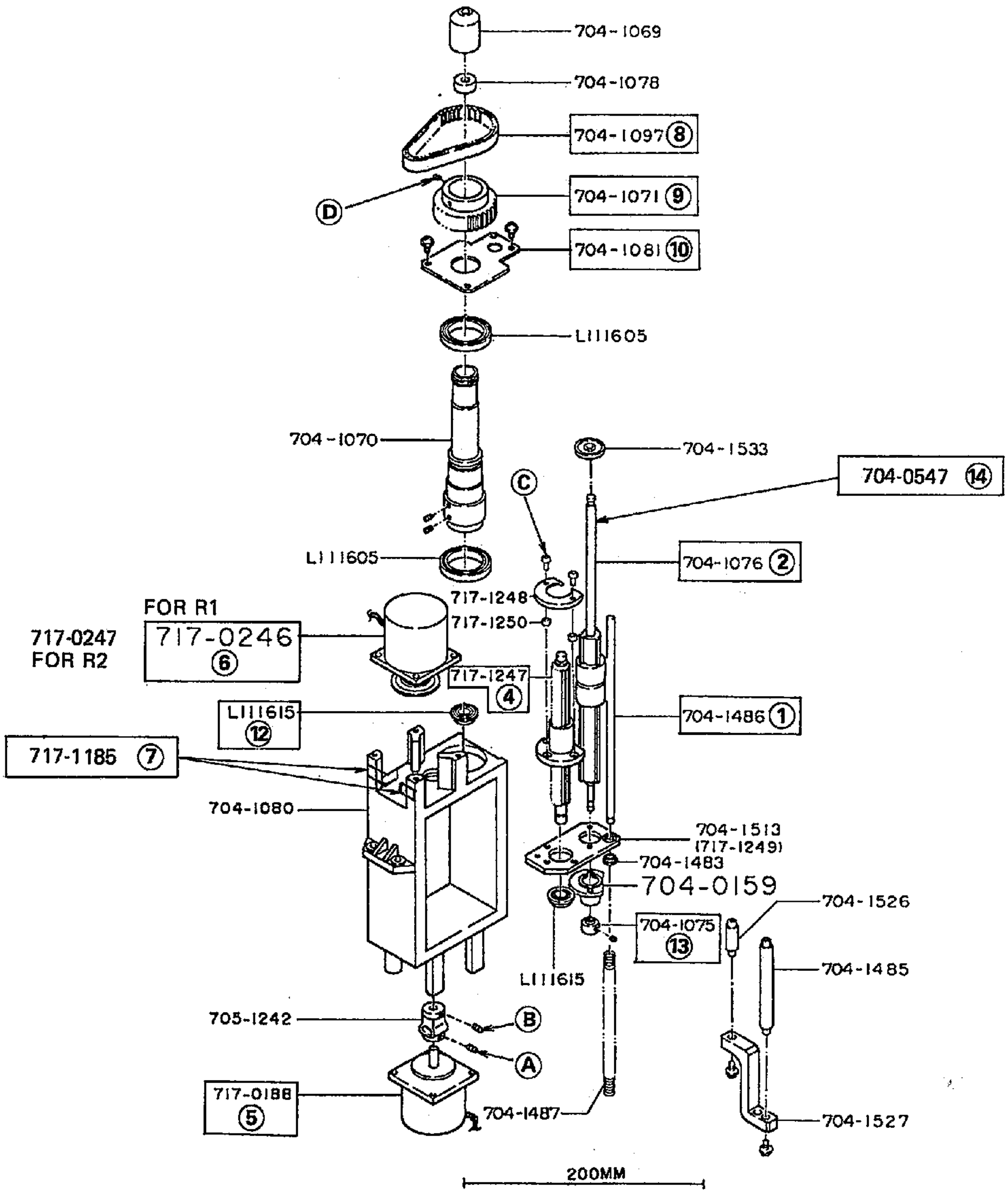


Fig. 8-8-1

8-9 Extran Pump Assy

< Preparation >

(1) Open the FRONT COVER (P/N 717-1416).

(2) Remove BOUNDARY PLATE (P/N 717-1448).

(3) Disconnect connectors P512 and P513.

(4) Take out 2 fixing screws for connector J513.

(5) Remove 2 NIPPLES (P/N 704-1242).

(6) Remove PUMP PLATE ASSY (P/N 717-0265).

< Lubrication >

(1) With grease BRB No. 1
   - (a) PUMP HEAD (P/N 704-0344) ①

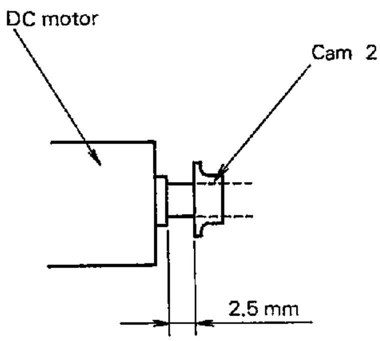
(2) With tri-flon oil
   - (a) CAM (P/N 704-1551) ②
   - (b) SUPPORT (P/N 704-0343) ③

< Adjustment >

(1) The gap between MOTOR (P/N 704-0346) ④ and cam ② should be 2.5 mm.

< Replacement >

(1) DC MOTOR (P/N 704-0346) ④
   - (a) Detach RING (P/N 704-1474) ⑤, support, and PUMP HEAD (P/N 704-0344) with 2 hex. screws and 4 fixing screws.
   - (b) Detach 3 fixing screws of motor.
   - (c) Replace motor.


DC motor
Cam 2
2.5 mm

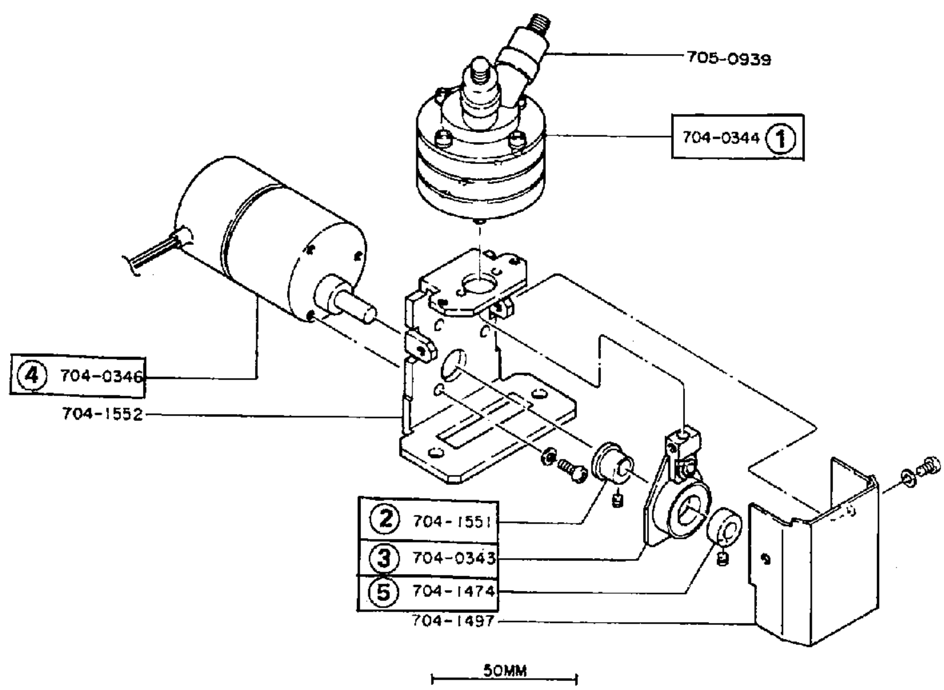

705-0939
704-0344 1
4 704-0346
704-1552
2 704-1551
3 704-0343
5 704-1474
704-1497
50MM

Fig. 8-9-1

8-10 Pipetter Assy

< Preparation >

(1) Open the FRONT COVER (P/N 717-1416).

(2) Detach 2 fixing screws.

(3) Detach 2 NIPPLES

(4) Disconnect connector P416.

(5) Take out this assy from main unit.

< Lubrication >

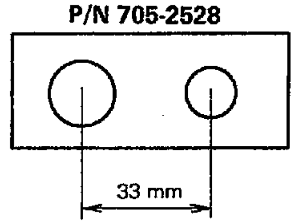
(1) With grease BRB No. 1
- (a) SLIDER (P/N 705-1317) ①
- (b) BASE (P/N 705-1039)

(2) With tri-flon oil
- (a) GEAR 180 (P/N 705-1311) ②
- (b) RACK (P/N 705-1869) ③

< Adjustment >

(1) The distance between center of shaft of PULSE MOTOR (P/N 705-0391) ④ and center of GEAR 180 (P/N 705-1311) should be 33 mm ± 0.0015.
For this adjustment, Syringe Gear ADJ. TOOL (P/N 705-2528) is available. Put this tool on pulse motor and gear 180, and adjust gap.

P/N 705-2528



< Replacement >

(1) PULSE MOTOR (P/N 705-0391) ④
- (a) Detach 2 fixing screws.
- (b) Replace pulse motor.

(2) GEAR 180 (P/N 705-1311) ②
- (a) Loosen 2 hex. screws for gear 180.
- (b) Detach 2 fixing screws.
- (c) Replace gear 180.

(3) SLIDER ASSY (P/N 736-0347) ⑦
- (a) Remove 4 fixing screws of MOTOR BASE (P/N 705-1318) ⑤, 2 screws of HOLDER (P/N 705-1312) ⑥.
- (b) Remove one of 2 snap-rings of SHAFT (P/N L159104) ⑧.
- (c) Pull out shaft from slider assy.
- (d) Replace slider assy.

736-0143 PIPETTER ASSY

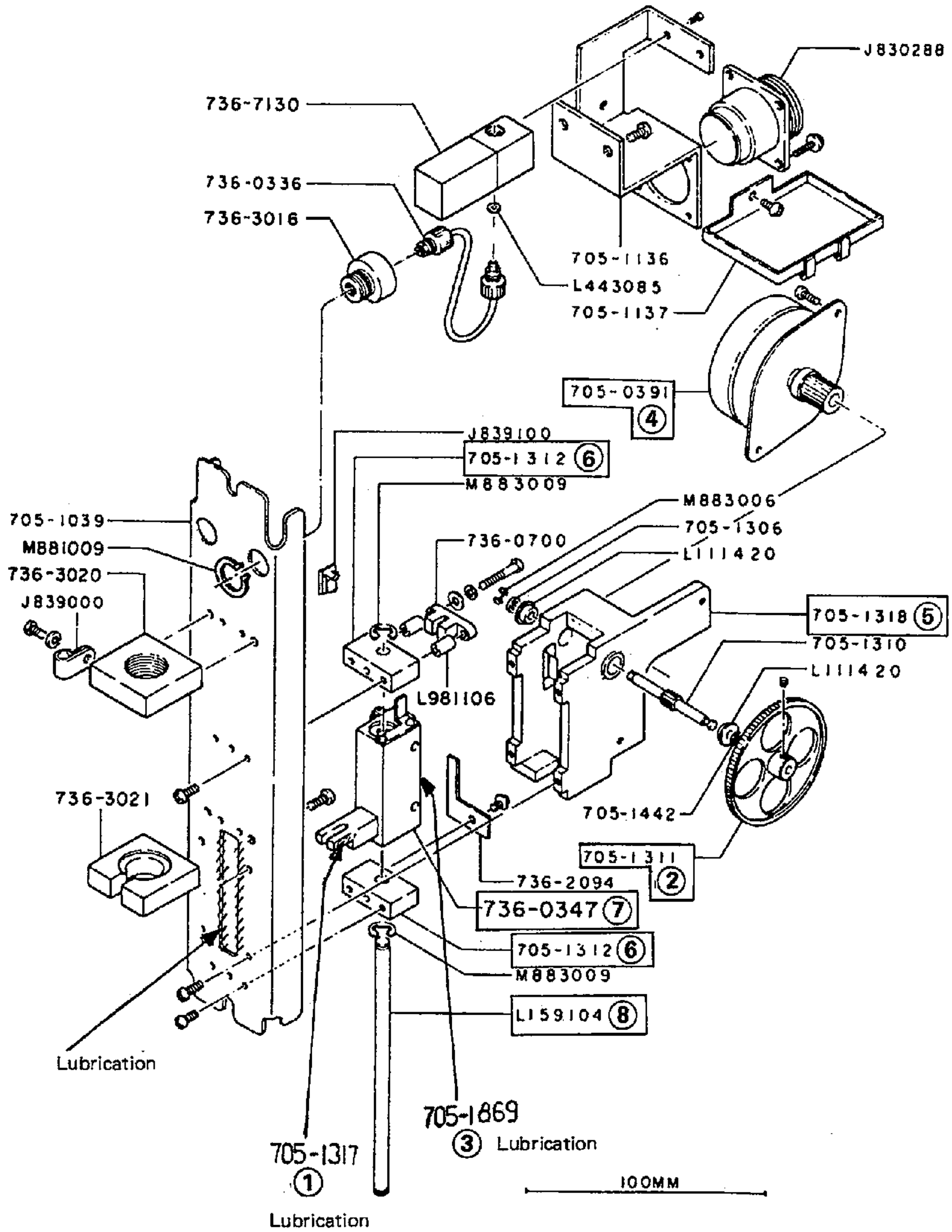


Fig. 8-10-1

8-11 Stirrer Assy (P/N 717-0288)

< Preparation >

(1) Remove jacket R1. (Refer to driving mecha. assy R1, Preparation (1) to (7).)

(2) Disconnect connectors P425 and P216.

(3) Loosen 2 fixing screws of this assy.

(4) Take out this assy.

Note: Pay attention not to bend stirring rods.

< Lubrication >

(1) With grease BRB No. 1
- (a) RACK (P/N 717-1073) ①
- (b) Outside of ball bearing of GUIDE ASSY (P/N 717-0229) ②
- (c) Outside of ball bearing of CRANK ASSY (P/N 717-0121) ③

(2) With tri-flon oil (After lubrication, wipe off oil.)
- (a) SHAFT (P/N 717-1066) ④

< Adjustment >

(1) The gap between end of stirring rod and bottom of cuvette should be 1.5 mm.

(2) CRANK (P/N 717-0110) should be at center of photocoupler.

< Replacement >

(1) SHIFT MOTOR (P/N 717-0225) ⑤
- (a) Remove 2 fixing screws Ⓐ of PEDESTAL (P/N 717-0112) ⑥.
- (b) Remove 2 fixing screws of pulse motor.
- (c) Replace motor.

(2) AC MOTOR (P/N 717-0224) ⑦
- (a) Loosen 2 hex. screws Ⓑ of crank assy.
- (b) Remove 2 Photocouplers.
- (c) Remove 4 fixing screws of AC motor and 2 screws of capacitor.
- (d) Pull out AC motor.
- (e) Replace motor.

(3) Ball bearing Ⓑ of slider assy

(a) Remove snap-ring Ⓒ from shaft ⑨.

(b) Pull out shaft.

(c) Remove snap-ring C in slider assy.

(d) Replace bearing.

(4) Stirring motor

(a) Remove two fixing screws of stirring rod and detach stirring rod.

(b) Loosen fixing screws of stirring motor base.

(c) Disconnect connector J425 and pull out the leadwire pin from connector.

(d) Detach the stirring motor leadwire from the protective spring.

(e) Replace motor.

Note: Be careful not to let the leadwires be pinched.

717-0288 STIRRER ASSY

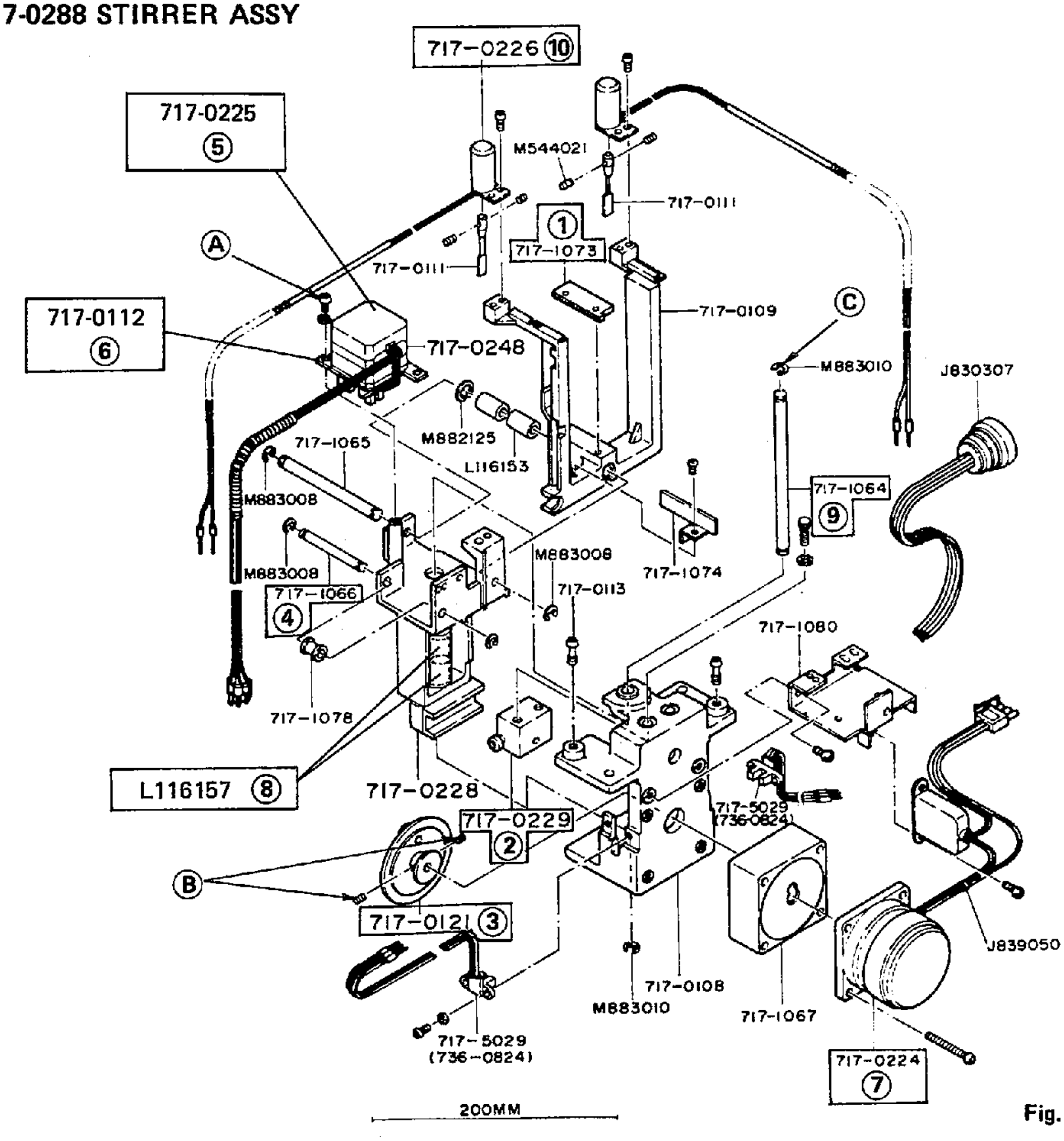


Fig. 8-11-1

8-12 Usage of Adjuster's Tool for Motor Assy S, Motor Assy R1, and Motor Assy R2

(1) Loosen 2 hex. screws of pulley ① and stopper ②.

(2) Insert pulley and stopper into adjuster tool as guided by arrow in Fig. 8-12-1.

(3) Adjust pulley and stopper so as to fix to a guide of adjuster tool.
Ⓐ is for stopper.
Ⓑ is for pulley.

Note: Corresponding angles between stopper and pulley are shown in Fig. 8-12-1 and 2.

ADJ. TOOL (P/N 717-0367) FOR MOTOR ASSY S

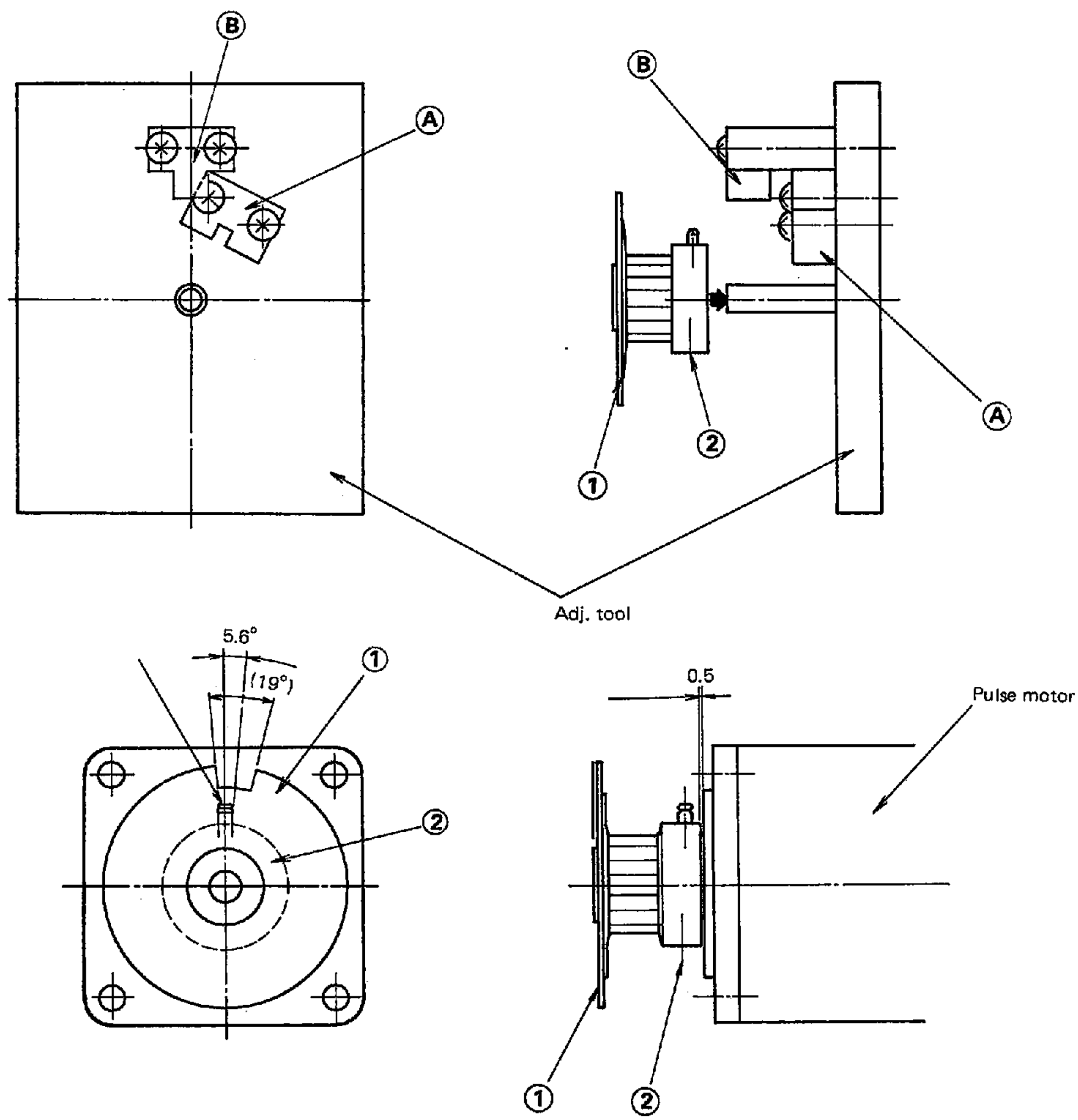


Fig. 8-12-1

ADJ. TOOL for MOTOR ASSY R1, R2 (P/N 717-0368)

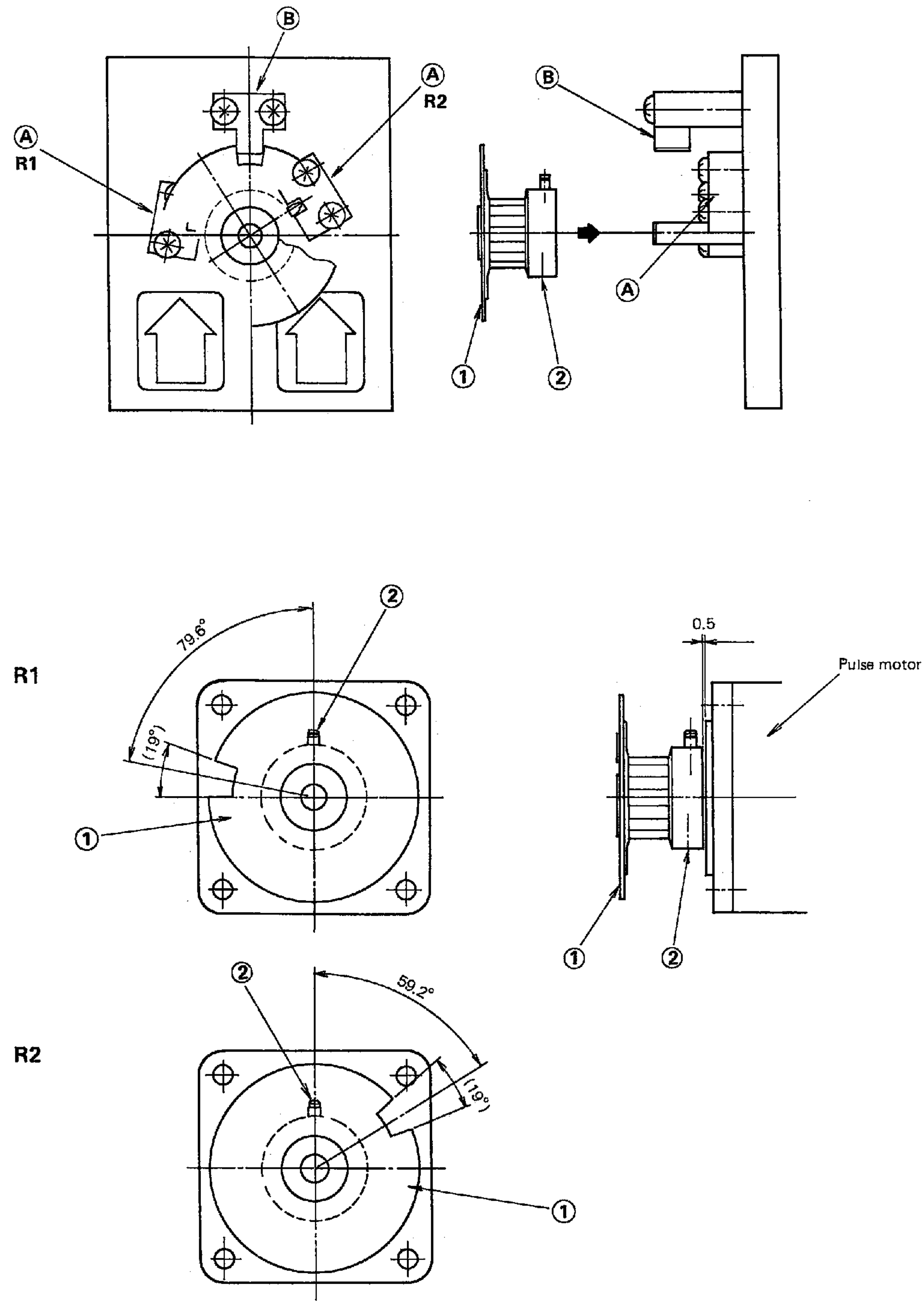


Fig. 8-12-2

8-13 Photometer Assy

< Disassembly >

(1) Remove top cover and intermediate covers Ⓐ to Ⓔ from the main unit.

(2) Remove the nozzle section of rinsing mechanism, reaction disk and reaction bath.
To empty out the reaction bath, open the drain plug (P/N717-1410) located at the incubation water circulating pump. Then, wipe off residual water in the reaction bath with a clean cloth.

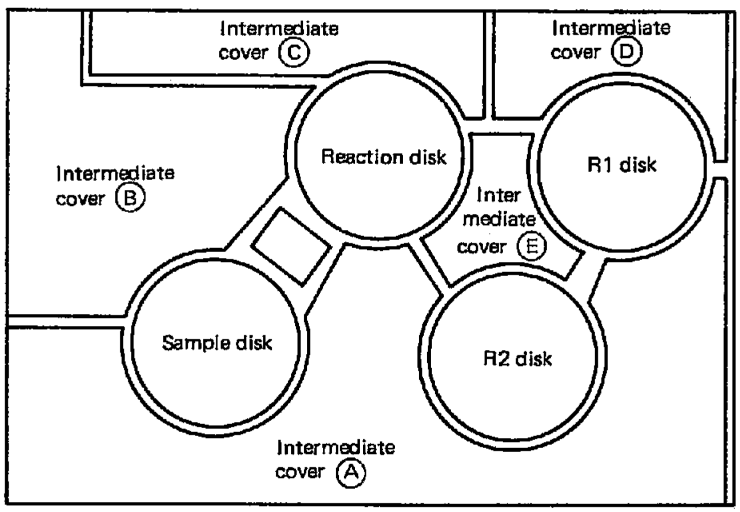


Fig. 8-13-1

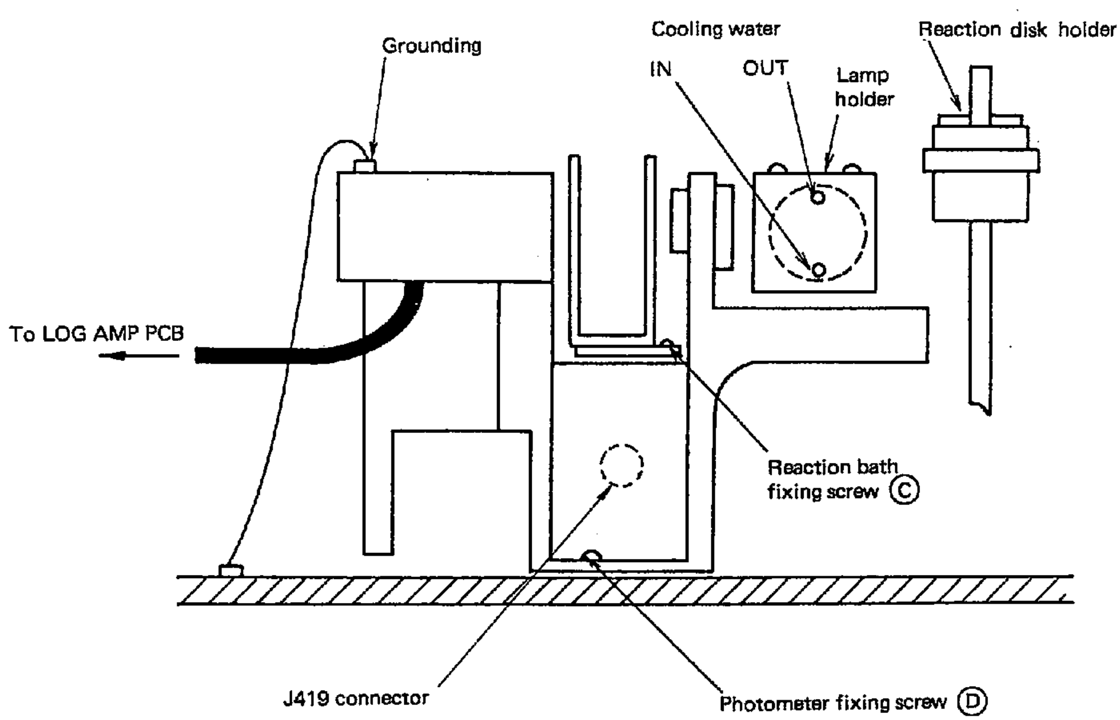


Fig. 8-13-2

(3) Disconnect the J419 connector.

(4) Separate the connector from the photometer AMP PC board.

(5) Disconnect the light source lamp cooling water tube.

(6) Remove the reaction disk holder.

(7) Remove photometer fixing screw Ⓓ and lift out the photometer.

(8) Make reassembly by reversing the above procedures.

8-14 Cold Water Tank

< Disassembly >

(1) Remove fixing screw Ⓐ .

(2) When it is necessary to take out the tank from the main unit, disconnect the connector and tubing.

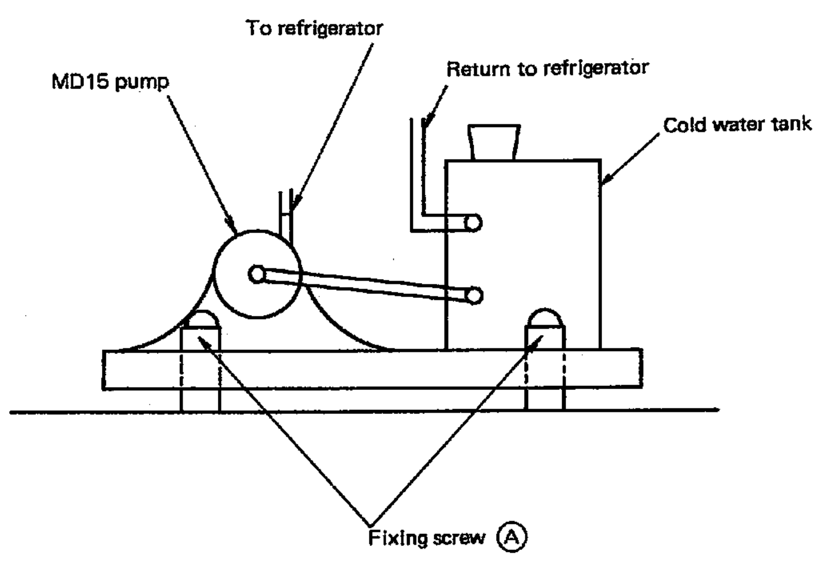


Fig. 8-14-1

8-15 Waste Liquid Cup Assy

< Disassembly >

(1) Remove fixing screw Ⓐ .

(2) Detach the J230, J231 and J233 connectors.

(3) Lift up the fixture, and pull it out toward the front.

(4) Loosen fixing screw Ⓑ , and remove the fastening band.

(5) Disconnect hose Ⓔ from solenoid valves (SV30, 31, 33).

(6) Loosen fixing screw Ⓒ to remove solenoid valves (SV30, 31, 33).

(7) Pull out the leadwire pins from connectors J230, J231 and J233.

(8) Reassemble the solenoid valves in reverse to the above procedures while preventing the lead-wire being caught by other components and protecting the glass bottle from damage.

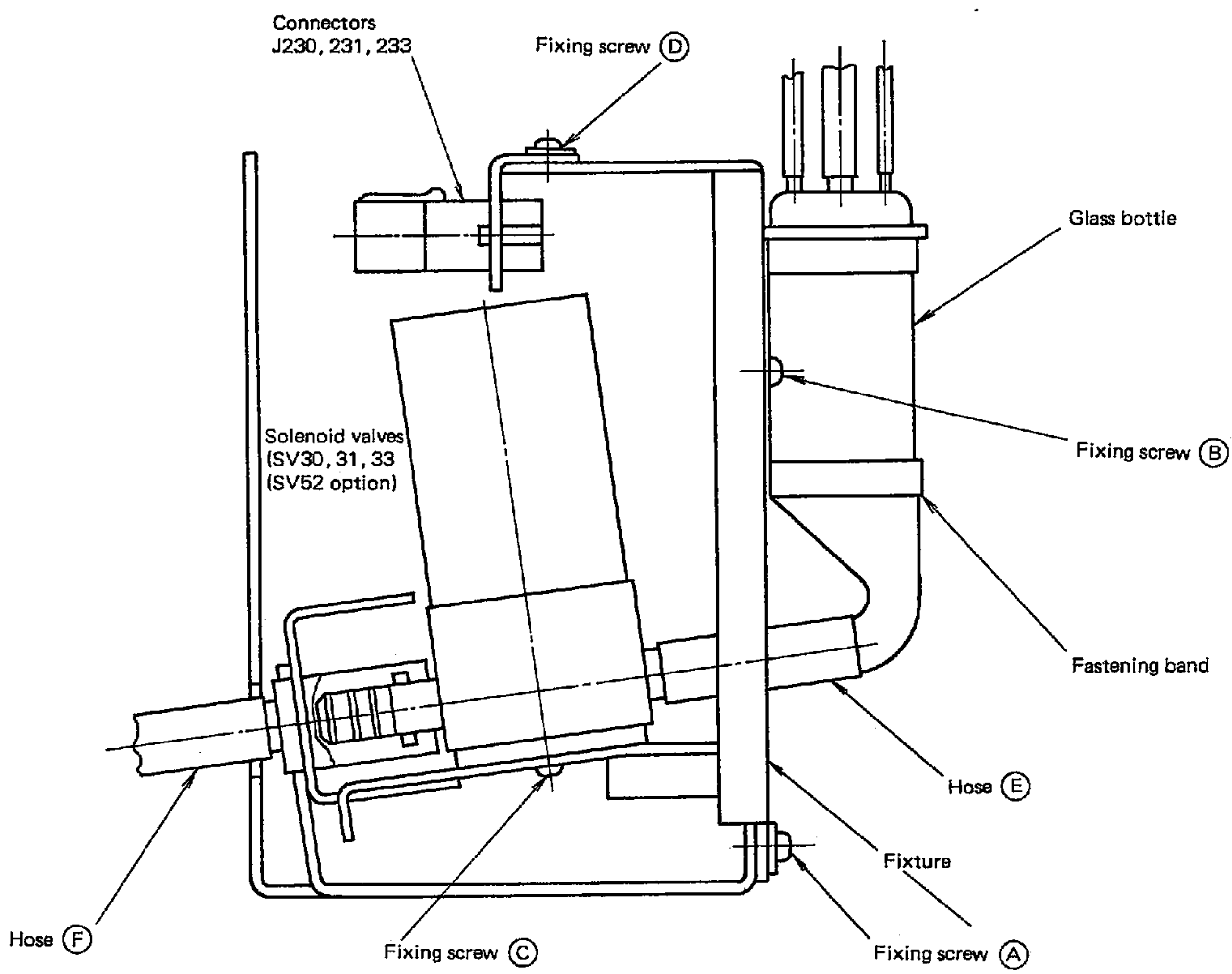


Fig. 8-15-1 Vacuum Bottle and Solenoid Valves for Drain System

8-16 Floppy Disk Drive

< **Disassembly** >

(1) Remove the front intermediate cover (with keyboard).

(2) Loosen fixing screws Ⓐ and draw out the floppy disk box.
Attention should be paid since the connector is provided at the back face of the box.

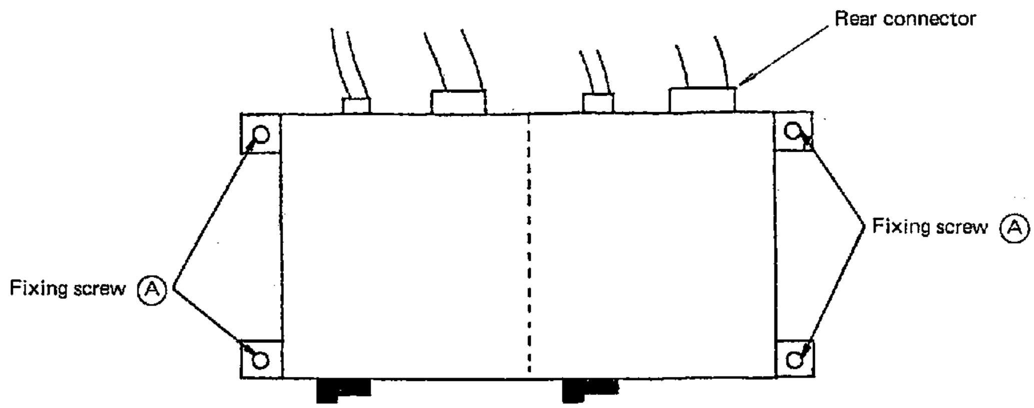


Fig. 8-16-1 Floppy Disk Drives

8-17 DC Power Supply Unit

< **Disassembly** >

(1) Open the right side cover of main unit, and remove the front cover of DC power supply unit.

(2) Open the front right cover of main unit, and remove the DIST PCB cover.

(3) Unplug the connector from the rear of DC power supply unit. Loosen fixing screw Ⓐ , and then pull out the DC power supply unit.

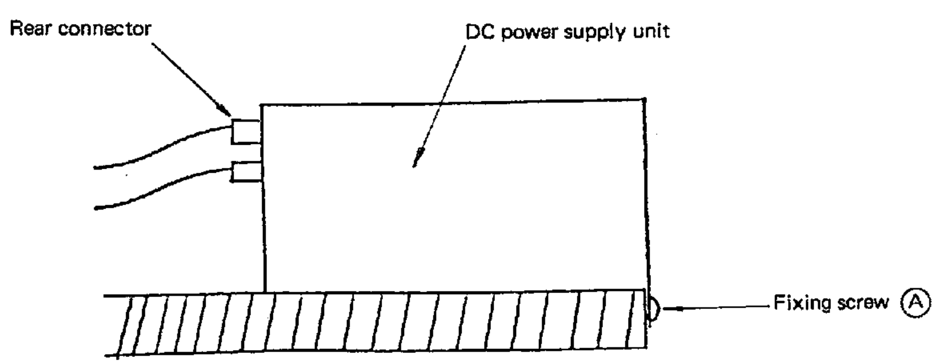


Fig. 8-17-1 DC Power Supply Unit

8-18 Vacuum Pump

(1) Vacuum Pump for Vacuum Tank

(a) Procedure for changing Valve sheet

1) Loosen fixing screws Ⓐ , and take out head.
2) Loosen fixing screws Ⓑ , and remove the valve sheet.
3) Make reassembly while paying attention to the direction of the valve sheet.

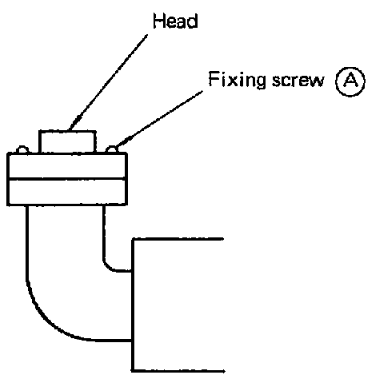


Fig. 8-18-1 Vacuum Pump for Vacuum Tank (1)

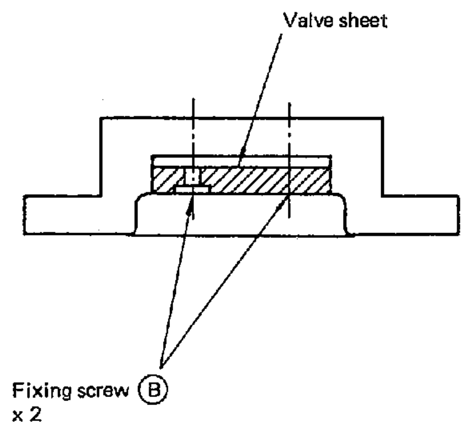


Fig. 8-18-2 Vacuum Pump for Vacuum Tank (2)

(b) Procedure for changing diaphragm

1) Loosen fixing screws Ⓒ on the sheet, then remove the sheet.
2) Change the diaphragm with a new one.

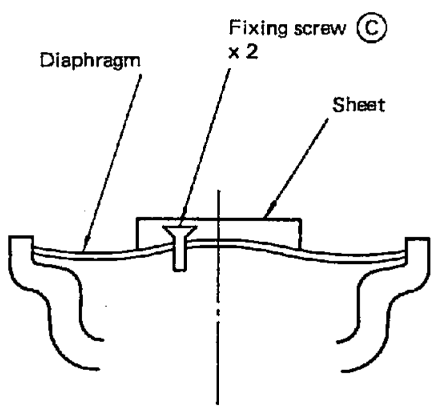


Fig. 8-18-3 Vacuum Pump for Vacuum Tank (3)

(2) Vacuum Pump for Degasser

(a) Procedure for changing valve sheet

1) Loosen fixing screws (A) with a Phillips screwdriver.

2) Take out the head, loosen fixing screws, then remove the valve sheet. (Refer to Fig. 8-18-2.)

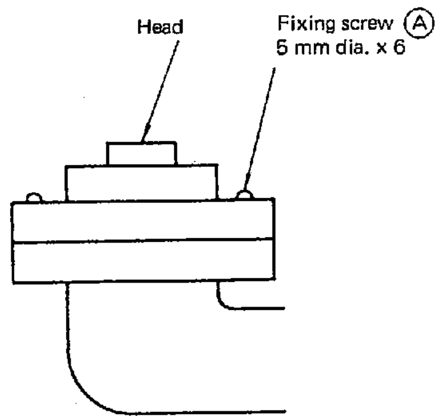


Fig. 8-18-4 Vacuum Pump for Degasser

(b) Procedure for changing diaphragm
Refer to Fig. 8-18-2 and Fig. 8-18-3.

8-19 Gear Pump Pressure Adjustment

Adjust the screw for pressure adjustment so that pressure meter indicates 1.5 kg/cm^2 during operation.

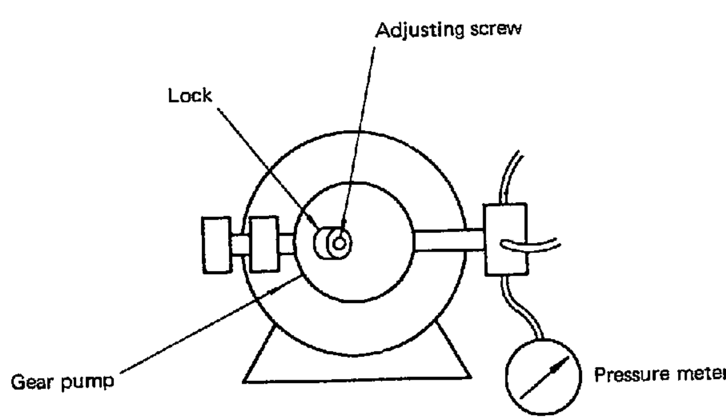


Fig. 8-19-1 Adjustment of Gear Pump Pressure

8-20 ISE Diluent Cup Assy

< **Preparation** >

(1) Remove intermediate cover.

(2) Disconnect P434.

(3) Disconnect tubings. (IS, DIL, SIP tubings, and water circulating tubings and overflow tubing)

(4) Remove 3 fixing screws of this assy.

< **Adjustment** >

(1) Detector plate (13) of vacuum nozzle assy should be in center of photocoupler.

(2) Fix SOLENOID VALVE (2) (P/N 717-0849) (1) (Fig. 8-20-2), so that vacuum nozzle can move smoothly up/down by hand.
(4 fixing screws B (Fig. 8-20-2) are concerned.)

(3) Sipper nozzle should not be touched to diluent cup.

< **Replacement** >

(1) Removal procedure of UPPER PLATE (P/N 717-2017) (7) (Fig. 8-20-1)
   - (a) Remove Nozzle (SIP) (10)., Nozzle (ISE) (11) . (Fig. 8-20-1)
     Be careful not to lose spacers.
   - (b) Remove vacuum nozzle assy (8) by unscrewing (F). (Fig. 8-20-1)
   - (c) Remove shutter (6) (Fig. 8-20-1) by unscrewing (E).
   - (d) Remove fixing screws and take out upper plate (7).

(2) SOLENOID VALVE (2) (P/N 717-0849) (1) (Fig. 8-20-2)
   - (a) Remove snap-ring ((A)) and remove pin. (Fig. 8-20-2)
   - (b) Remove 4 fixing screws ((B)). (Fig. 8-20-2)
   - (c) Replace valve.

(3) BALL-BEARING (P/N L116212) (2) (Fig. 8-20-2)
   - (a) Remove upper plate (7). (Fig. 8-20-1)
   - (b) Remove solenoid valve (2) (1). (Fig. 8-20-2)
   - (c) Remove 2 hex. screws ((C)). (Fig. 8-20-2)
   - (d) Pull down SHAFT (P/N 717-2006) (3). (Fig. 8-20-2)
     Be careful not to lose spring.
   - (e) Remove HOLDER (P/N 717-2007) (4) by unscrewing ((D)). (Fig. 8-20-2)
   - (f) Remove Snap-ring.
   - (g) Replace bearing.

(4) ROTARY SOLENOID (P/N 704-0369)⑤ (Fig. 8-20-2)

(a) Remove upper plate⑦. (Including shutter removal.)

(b) Remove 2 screws (Ⓖ). (Fig. 8-20-2)

(c) Pull down rotary solenoid⑤ with SUPPORT (P/N 717-2011)⑨. . (Fig. 8-20-2)

(d) Loosen hex. screws (Ⓗ). (Fig. 8-20-2)

(e) Replace solenoid.

(5) PINCH VALVE (P/N 717-0845) ⑫ (Fig. 8-20-1)

(a) Disconnect pinch tube.

(b) Remove fixing screws (ⓘ). (Fig. 8-20-1)

(c) Pull down pinch valve ⑫ .

(d) Replace valve.

717-0802 DILUENT CUP ASSY

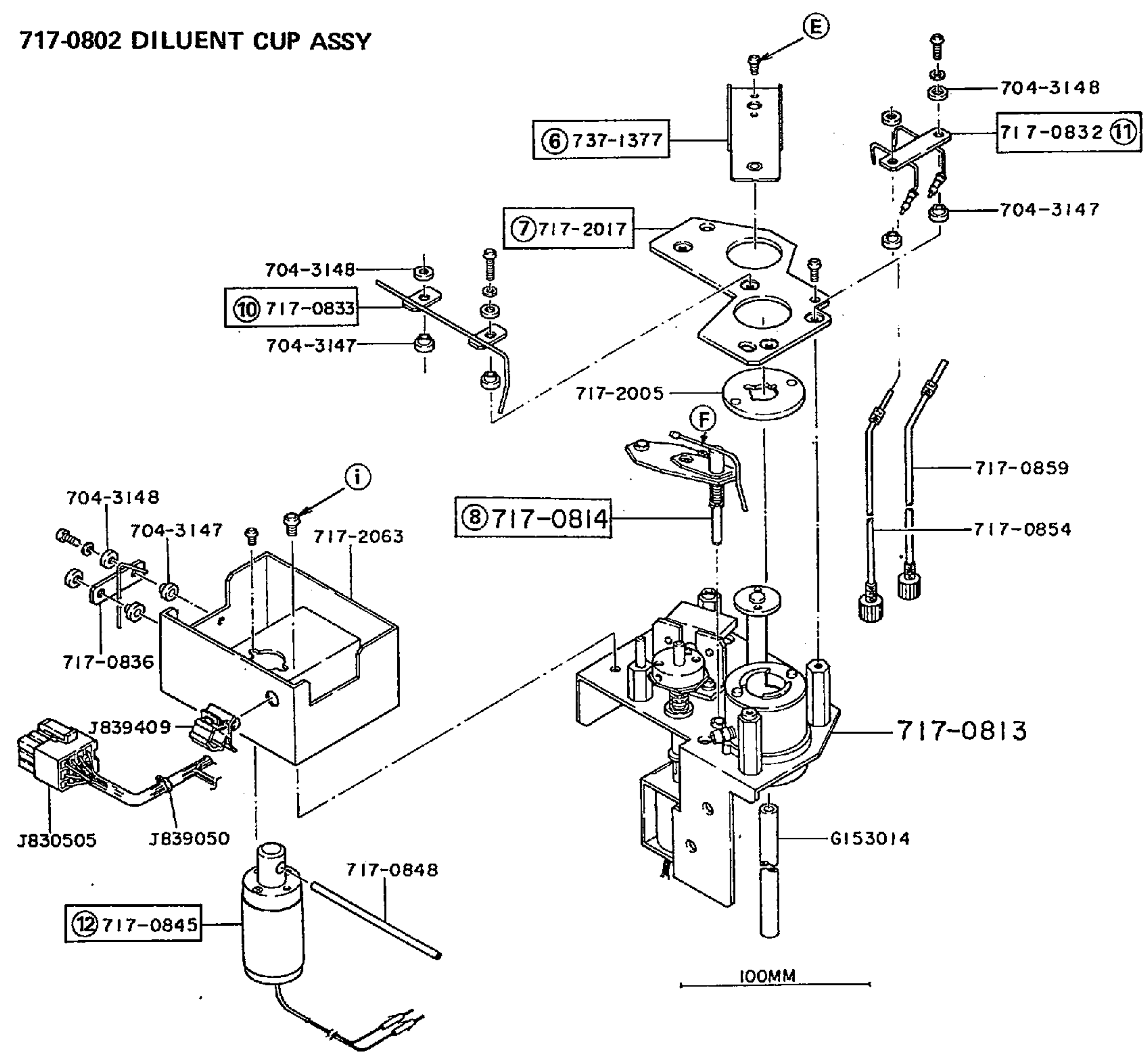


Fig. 8-20-1

717-0813 DILUENT CUP BASE ASSY

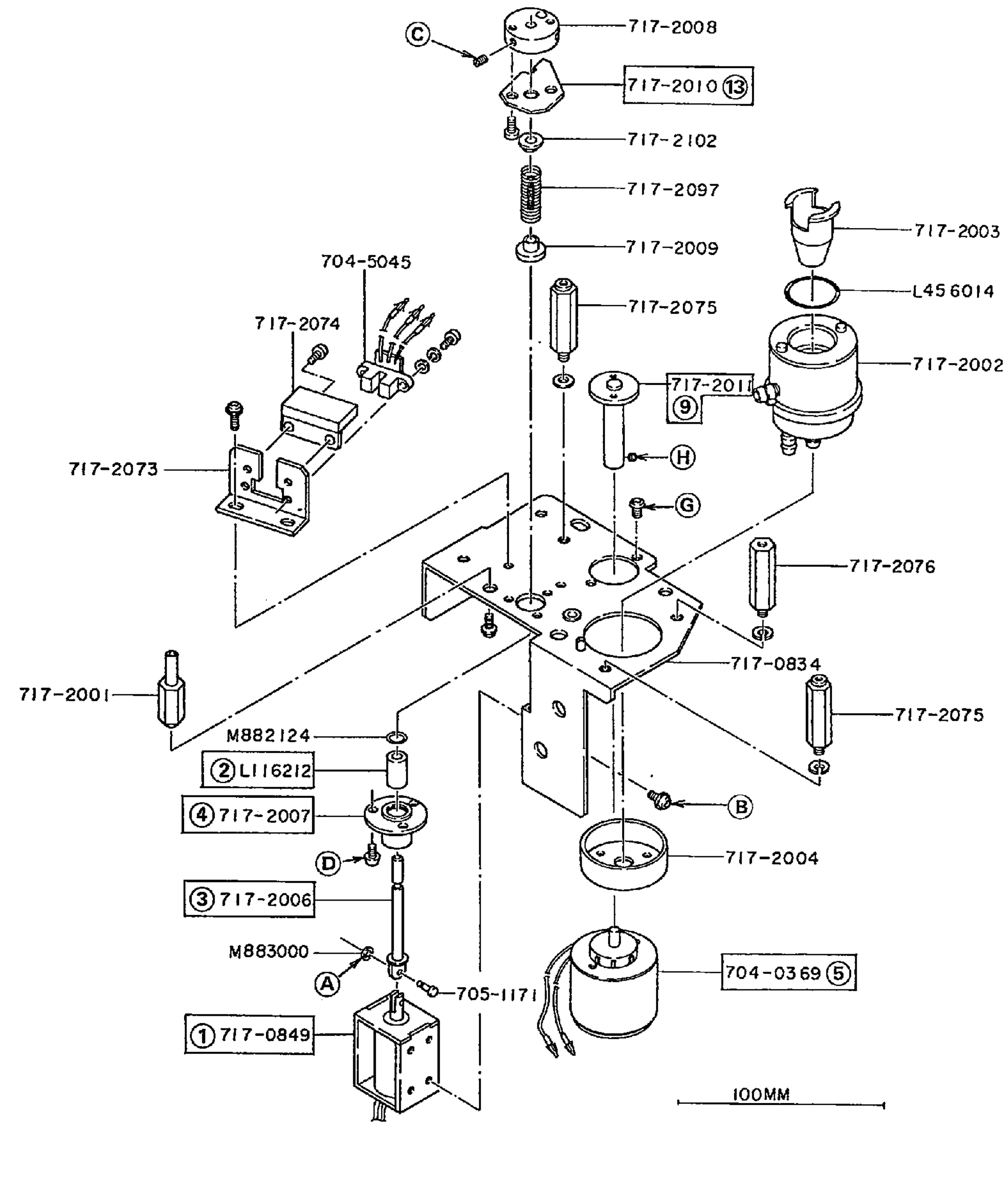


Fig. 8-20-2

8-21 Replacement and Adjustment of Electrical System

(1) DC Power Supply

- DC Power Supply Voltage and Current

Table 8-21-1 DC Power Supply Adjustment

Reference Voltage/ Current	Measurement Point	Adjustment Value	Measured Current	Measured Ripple	Load
+12 V, 3 A	Between +12 V CRT TEST POINT and SG	12.2 V ±0.05	1.7 A	60 mV	FDD CRT
+12 V, 3A	Between +12 V LAMP TEST POINT and SG	12.2 V ±0.05	1.7 A	50 mV	Light source lamp
+5 V, 16 A	Between +5 V TEST POINT and SG	5.3 V ±0.05	11.1 A	50 mV	Control unit 1 Control unit 2
+15 V, 0.5 A	Between +15 V TEST POINT and SG	15.1 V ±0.05 (Fixed)	0.14 A	50 mV	ADC, logarithmic amplifier, operational amplifier, etc.
−15 V, 0.5 A	Between −15 V TEST POINT and SG	−15.1 V ±0.05 (Fixed)	0.20 A	50 mV	ADC, logarithmic amplifier, operational amplifier, etc.
+24 V, 14 A	Between +24 V TEST POINT and SG	24.2 V ±0.1	6.9 A	150 mV	Stepping motor Solenoid valve Solenoid

Cautions:

1. The above adjustment values are effective when no load is applied.
2. When adjusting the power unit independently, the following is required for (+12 V (LAMP) power supply) which has remote sensing terminals +S and −S ; short-circuiting of J452 4 and 3 terminals and J452 2 and 1 terminals.
   If this is neglected, the output overvoltage protective circuit is activated to prevent output.
   Note that these terminals should be short-circuited on the power supply pack terminal board.
3. MODULEs +12 V (LAMP) power supply and +24 V power supply use ON/OFF remote control function. So when adjusting them independently, J454 21 and GND for +24 V power supply, and J454 22 and GND should be short-circuited for +12 V (LAMP) power supply.
   However, when adjusting the modules assembled in the instrument, remove the wire from the J454 21 (or J454 22) terminal, and short-circuit the J454 21 (J454 22) and GND terminals.
4. Use the variable resistor (VOLT/VADJ) of each DC power for adjusting the voltage.

(2) LOG AMP PC Board

(a) Adjustment Item

- Offset Current

  Each LOG element output must be 2 V upon removing the cuvette from the optical axis with the reaction bath filled with distilled water.

Note: Only adjust after changing lamp with new one, cleaning bath, cleaning lens and cleaning optical filter.

(b) Adjusting Procedure

1) Connection

   Connect ⊕ side of a digital voltmeter (capable of voltage measurement down to 10^{-3} V) to TP13 and ⊖ side to the GND test pin.

2) Offset Adjustment

   i) Assemble in the main unit, fill the reaction bath with water and remove the cuvette from the optical axis. In this status, measure distilled water.
   Note that the light source lamp cannot be ignited before completion of system initialization. This is because of the operation program of the system.

   ii) Connect a digital voltmeter as in (b) — 1).
   While changing over switch 1 sequentially from 0 to D, adjust output voltage by each corresponding variable resistor in reference to Table 8-21-2. Adjustment value must meet Table 8-21-2.

Table 8-21-2 LOG AMP Adjustment

MODULE No.	DIP Switch Setting No.	Offset Adjustment			
		VR No.	Check Point	V OUT	Remarks
MOD1	0	VR1	TP1	2 V ± 1.0 %	
MOD2	1	VR2	TP2	2 V ± 1.0 %	
MOD3	2	VR3	TP3	2 V ± 1.0 %	
MOD4	3	VR4	TP4	2 V ± 1.0 %	
MOD5	4	VR5	TP5	2 V ± 1.0 %	
MOD6	5	VR6	TP6	2 V ± 1.0 %	
MOD7	6	VR7	TP7	2 V ± 1.0 %	
MOD8	7	VR8	TP8	2 V ± 1.0 %	
MOD9	8	VR9	TP9	2 V ± 1.0 %	
MOD10	9	VR10	TP10	2 V ± 1.0 %	
MOD11	A	VR11	TP11	2 V ± 1.0 %	
MOD12	B	VR12	TP12	2 V ± 1.0 %	
	C	VR20	TP20	2 V ± 0.1 %	
	D	VR21	TP21	6 V ± 0.1 %	

Note: When measuring the voltage only across test pins 13 and 14, the DIP switch is used to change over the multiplexer.

The same effect is obtainable by measuring the test pins listed in the above table one by one.

Before adjustment using switch 1, don't forget to change SW3 to CHK side. And after that, return it.

(3) Adjustment of ADC Start Timing Signal

(a) Measuring Instrument
2-CHANNEL synchroscope

(b) Wiring

(c) Synchroscope Settings

1)	Input range	Channel 1: 5 V/div. in DC input mode Channel 2: 2 V/div. in DC input mode
2)	Time width	20 msec/div.
3)	Mode	Chopping mode
4)	Trigger mode	Trigger source: Channel 1 Trigger edge : Rising edge

(d) Method of Adjustment

1) Fill the reaction bath and all reaction cuvettes with distilled water, and run the relevant program in the maintenance job. (DISK)
2) Adjust the trigger level of the synchroscope so that a waveform as shown in Fig. 8-21-2 appears on the synchroscope when the reaction disk starts rotation.
3) Adjust the VR1 on the TRI ADC PC board so as to locate the rising edge of ADC start request signal (waveform at TP15 on TRI ADC PC board) in channel 2 at the center of the high absorbance region due to cuvette wall which corresponds to the LOG AMP output signal (waveform at TP3 on TRI ADC 717 PC board) with reference to Fig. 8-21-2.

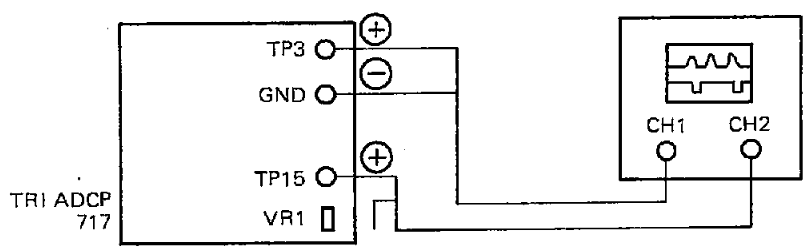


Fig. 8-21-1 Wiring Diagram

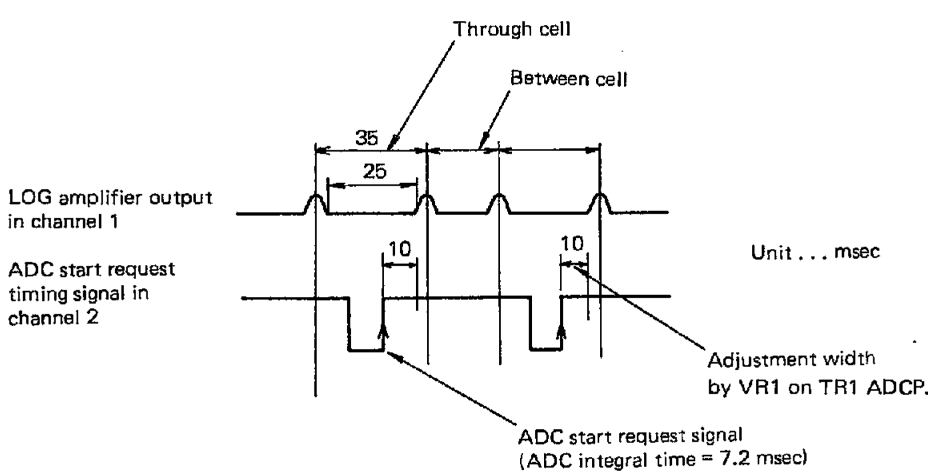


Fig. 8-21-2 Output Waveform

(4) Incubation Bath Temperature Control PC Board

(a) Adjustment Item

Control temperature of incubation bath temperature control section

Note: Set temperature is 37°C usually. Although 30 or 25°C setting requires changing the rotary switch position, description contains adjustment for these settings.

(b) Adjusting Procedure

1) Set the rotary switch located at the front side of the instrument for temperature control.
2) Energize the instrument.
   After completion of initialization, remove the nozzle section of the cuvette rinsing mechanism and the reaction disk, and introduce a water thermometer into the incubation bath in order to measure water temperature.
3) After incubation bath water reaches a required temperature, adjust the VR16 on the amplifier PC board for temperature control so as to match CRT display with 37°C.
4) Manipulate the adjusting VR4, so that incubation bath water reaches a required temperature, while watching the thermometer.

Table 8-21-3 Incubation Bath Temperature Adjustment

Set Temperature	Rotary Switch Setting	Adjusting Variable Resistor
25°C	Position of 25°C	VR14
30°C	Position of 30°C	VR15
37°C	Position of 37°C	VR16

(5) Replacement of Battery for CMOS and Real Timer Backup

(a) Replacement Item

Battery PC board

(b) Replacement Frequency

5 years in specified environment

(c) Replacing Procedure

1) Energize the instrument so that 5 V power can be fed to the battery PC board.
2) Replace only the battery PC board on the temperature control amplifier PC board with no connectors disconnected from the temperature control amplifier PC board as shown in Fig. 8-21-3.
3) After replacement, check if data in the real timer such as date and time are retained. If not retained, such data should be set again.

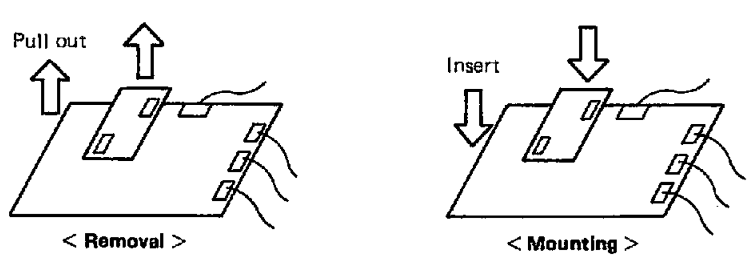


Fig. 8-21-3 Battery Replacement

(6) ISE AMP. PCB

(a) Adjustment of A-D Converter Reference Voltage (ZERO, SPAN)

Remove the floppy disk from the drive, and then turn ON the power switch of the instrument (so that data select signal will not be selected via the CPU).

Measure the voltage level at the check terminals as instructed below. Be sure to use a digital voltmeter capable of indicating a voltage level with a maximum of 4 digits when measuring the voltage.

1) Connect the digital voltmeter to TP1 and TP3 (GND).
2) Set SW1 to 9.
3) Turn VR3 until the digital voltmeter reads 2.00 ± 0.01 V. (Adjustment of E2)
4) Set SW1 to A.
5) Turn VR2 until the digital voltmeter reads 8.00 ± 0.01 V. (Adjustment of E8)

(b) Performance Check of Na/K/Cl/REF AMP

1) Connect the Na electrode cable to check pin A, and REF electrode cable to check pin B. Check that the digital voltmeter reads 4.37 to 5.37 V when SW1 is set to 0.
2) Connect the K electrode cable to check pin A with the REF electrode cable connected to check pin B. Check that the digital voltmeter reads 4.37 to 5.37 V when SW1 is set to 1.
3) Connect the Cl electrode cable to check pin A with the REF electrode cable connected to check B. Check that the digital voltmeter reads 4.37 to 5.37 V when SW1 is set to 2.
4) Set SW1 to 3 under the same condition as described in step 3) above, and check that the digital voltmeter reads 3.56 to 4.08 V.
5) After the above confirmation, set SW1 to 0.

Note: Before this adjustment, remove operation panel and disconnect connector for keyboard (P470).

8-22 Major Components

Table 8-22-1 (1/4)

No.	Part Name	Type	Part No.	Key in Drawing	Rating	Manufacturer
MOTOR						
1	SERUM PROBE UP-DOWN	A2652-9212	717-0188		DC	ORIENTAL
2	SERUM PROBE TURN	PH265M-31	704-0151		DC	ORIENTAL
3	REAGENT PROBE 1, 2 UP-DOWN	A2652-9212	717-0188		DC	ORIENTAL
4	REAGENT PROBE 1, 2 TURN	PH265M-31	704-0151		DC	ORIENTAL
5	SAMPLE DISK TURN	PH265M-31	717-0219		DC	ORIENTAL
6	REAGENT DISK 1, 2 TURN	PH265M-31	717-0219		DC	ORIENTAL
7	REACTION DISK TURN	PH265M-31	717-0219		DC	ORIENTAL
8	RINSE MECHA UP-DOWN	C0545-424	717-0223		AC	ORIENTAL
9	STIRRING MECHA UP-DOWN	2RX3GX-A	717-0224		AC	ORIENTAL
10	STIRRING MECHA TURN	PXC43-03AC8	717-0225		DC	ORIENTAL
11	STIRRING ROD TURN	LSI6-IC	717-0191		DC	COPAL
12	SERUM PIPETTER	SM55-4802	705-0391		DC	FUJI
13	REAGENT 1, 2 PIPETTER	SM55-4802	705-0391		DC	FUJI
COOLING FAN						
14	ON THE RIGHT SIDE	MU1225M-11N	717-4145		AC	ORIENTAL MOTOR ORIX
15	ON THE REAR SIDE	MU1225M-11N	717-4145		AC	ORIENTAL MOTOR ORIX
16	ON THE COOLING UNIT	MU1225M-11N	717-0235		AC	
PUMP						
17	MAGNET PUMP. CIRCULATING DISTILLED WATER	MD-20RZ	717-0238	MP 1	AC	IWAKI
18	MAGNET PUMP, CIRCULATING INCUBATION BATH WATER	MD-15RG	717-0241	MP 2	AC	IWAKI
19	MAGNET PUMP. CIRCULATING COOLING UNIT WATER	MD-15RG	717-0234		AC	IWAKI

Table 8-22-1 (2/4)

No.	Part Name	Type	Part No.	Key in Drawing	Rating	Manufacturer
20	VACUUM PUMP FOR RINSE	AP115SHIDG	717-0239	VP 1	AC	IWAKI
21	VACUUM PUMP FOR DEGASSER	AP412NLG	717-1300	VP 2	AC	IWAKI
22	DEAERATING GEARED PUMP	MDG-H2TA100NG	717-0240	GP 1	AC	IWAKI

OEM

23	DEGASSER	DEG717	717-1308		AC	HITACHI, NL
24	FLOPPY DISK DRIVE (5 inch)	JU585	704-4074		DC	MATSUSHITA
25	PRINTER	M3349H	717-1500		AC	FUJITSU
26	CRT		717-5100		DC	HITACHI
27	COOLING UNIT				AC	SHOUKETSU
28	DC POWER SUPPLY		717-4019			HITACHI LIGHTING LTD.

E.M. VALVE

29	FOR SERUM SYRINGE	UDV2-M6-C	717-0192	SV 1	AC	TAKASAGO
30	FOR REAGENT 1 SYRINGE	UDV2-M6-C	717-0192	SV 2	AC	TAKASAGO
31	FOR REAGENT 2 SYRINGE	UDV2-M6-C	717-0192	SV 3	AC	TAKASAGO
32	NOZZLE RINSING	UDV2-M6-C	717-0192	SV 4	AC	TAKASAGO
33	NOZZLE RINSING	UDV2-M6-C	717-0192	SV 5	DC	TAKASAGO
34	STIRRING ROD RINSING	UDV2-M6-C	717-0192	SV 6	DC	TAKASAGO
35	RINSING WATER SUPPLY	AG4X	717-0186	SV 7	AC	CKD
36	DISTILLED WATER SUPPLY	AB4X	717-0184	SV 8	AC	CKD
37	INCUBATION BATH WATER SUPPLY	AB4X	717-0185	SV 9	AC	CKD
38	ADDITIONAL WATER TO INCUBATION BATH WATER	UDV2-M6-C	717-0192	SV 10	DC	TAKASAGO
39	TIP RINSING WATER SUPPLY	UDV2-M6-C	717-0192	SV 11	DC	TAKASAGO

Table 8-22-1 (3/4)

No.	Part Name	Type	Part No.	Key in Drawing	Rating	Manufacturer
40	CELL BLANK WATER SUPPLY	UDV2-M6-C	717-0192	SV 15	DC	TAKASAGO
41	BYPASS	AB4X3431	717-0190	SV 16	AC	CKD
42	OVERFLOW SUCTION	NTV-2-HN	704-0306	SV 20	AC	TAKASAGO
43	WASTE SOLUTION SUCTION	NTV-2-HN	704-0306	SV 21	AC	TAKASAGO
44	DILUTED WASTE SOLUTION DISCHARGE	NTV-2-HN	704-0306	SV 30	AC	TAKASAGO
45	CONCENTRATED WASTE SOLUTION DISCHARGE	NTV-2-HN	704-0306	SV 31	AC	TAKASAGO
46	WASTE SOLUTION WATER DISCHARGE	AB4X	717-0184	SV 32	AC	CKD
47	OVERFLOW DISCHARGE	NTV-2-HN	704-0306	SV 33	AC	TAKASAGO

E.M. VALVE FOR ISE (OPTION)

48	FOR I.S. SYRINGE	MTV-2-SM6D	705-0839	SV 41	DC	TAKASAGO
49	FOR CHANGING I.S. FLOW PATH	MTV-3-M6	704-0366	SV 42	DC	TAKASAGO
52	DIL. SUPPLY	MTV-2-SM6D	705-0365	SV 45	DC	TAKASAGO
53	REF. SUPPLY	MTV-2-SM6D	705-0365	SV 46	DC	TAKASAGO
54	FOR SIP. SYRINGE	MTV-2-SM6D	705-0839	SV 51	DC	TAKASAGO
55	DILUTED WASTE SOLUTION DISCHARGE	MTV-2-HN	704-0306	SV 52	AC	TAKASAGO
56	CONCENTRATED WASTE SOLUTION DISCHARGE	MTV-2-SM6D	705-0365	SV 53	DC	TAKASAGO
57	WASTE SOLUTION SUCTION	MTV-3-M6	704-0366	SV 55	DC	TAKASAGO

SOLENOID FOR ISE (OPTION)

58	SOLENOID	SD-08	717-0849	S 1	DC	AKUTO GIKEN
59	SOLENOID	ROTARY SOLENOID 35 TYPE	704-0369	S 2	DC	USHIO DENKI
60	PINCH VALVE	AP-2062-13H	717-0845	SV 60	DC	ADVANCE DENKI KOGYO

Table 8-22-1 (4/4)

ID (OPTION)

No.	Part Name	Type	Part No.	Key in Drawing	Rating	Manufacturer
61	ID SCANNER	BA521	736-3703		AC	MEKANOSPPOTRON K.K.
62	ID DECODER	BD-1500X	737-4112		AC	MEKANOSPPOTRON K.K.

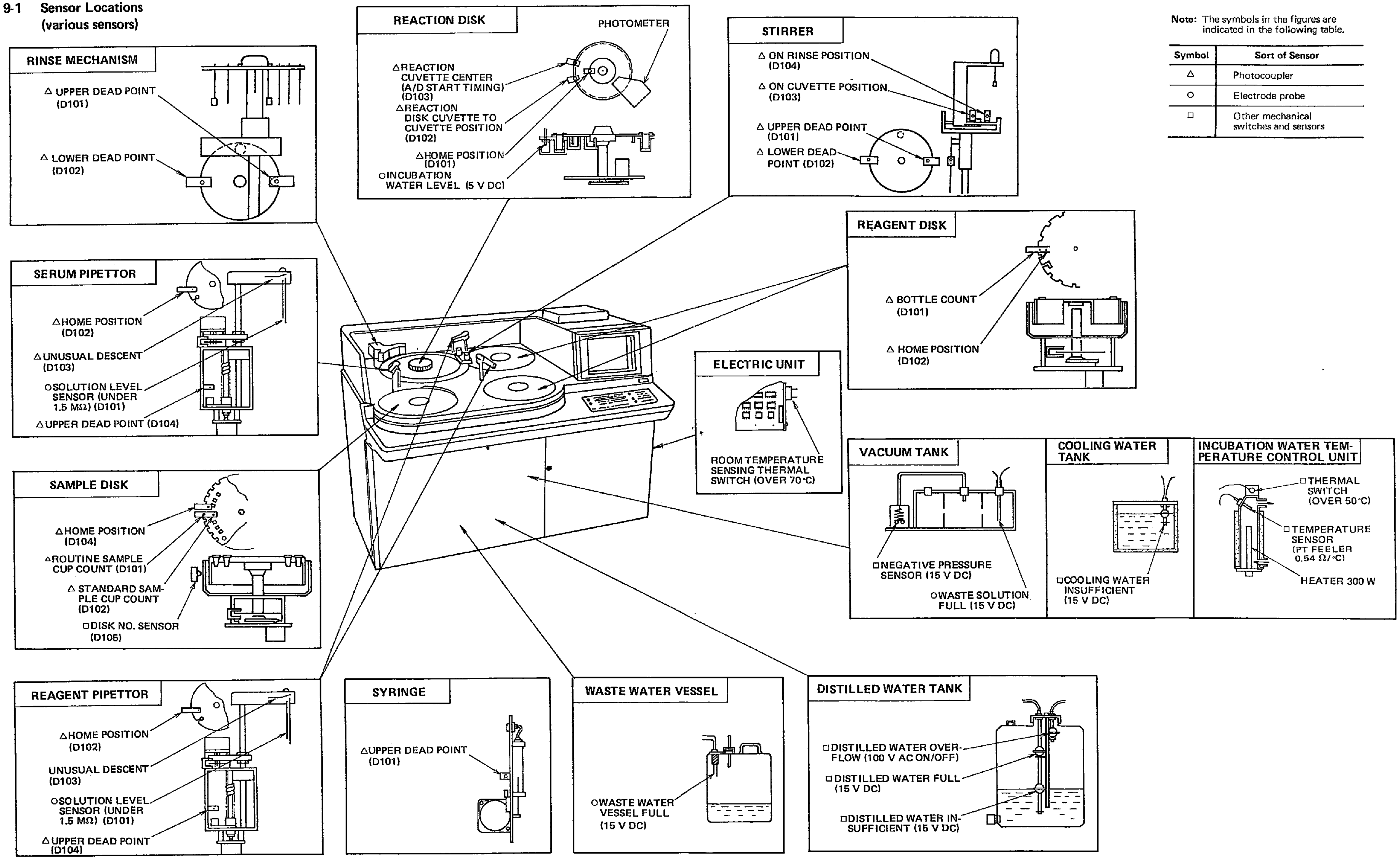
9. SENSOR LOCATIONS AND WIRE CROSS REFERENCE LIST

9. SENSOR LOCATIONS AND WIRE CROSS REFERENCE LIST

9-1 Sensor Locations (various sensors)

Note: The symbols in the figures are indicated in the following table.

Symbol	Sort of Sensor
△	Photocoupler
○	Electrode probe
□	Other mechanical switches and sensors



9-2 Wire Cross Reference List

Table 9-2-1 (1/10)

⟨Symbol⟩ TRI: TRI ADCP 717 P.C.B. S.I/F: S.I/F. APU 2 P.C.B. MCN1: M.CONT 1 P.C.B. MCN2: M.CONT 2 P.C.B. ISEC: ISE CONT P.C.B.
MOTH: MOTHER 717 P.C.B. DIST: DIST 717 P.C.B. PM1: PM.DRIVER 1 P.C.B. PM2: PM.DRIVER 2 P.C.B. LOG: LOG AMP P.C.B.
PFD: PFD 5 P.C.B. REY: RELAY 2 P.C.B. TEMP: TEMP AMP P.C.B. ACM: ACMCNT P.C.B.

	Parts	Connector No./Pin	To
Sample Disk	D101 (Outer count)	P420–1 (GND)	J321-2B:DIST
		P420–2 (+5V)	J321-2A:DIST
		P420–3 (Sig)	J321-3B:DIST→J300-5A:DIST→J115-5A:MOTH→J122-22A:MOTH→P122-22A:MCN1→Pin No. 23 of ICJ9:MCN1
	D102 (Inner count)	P420–4 (GND)	J321-3A:DIST
		P420–5 (+5V)	J321-4B:DIST
		P420–6 (Sig)	J321-4A:DIST→J300-5B:DIST→J115-5B:MOTH→J122-22B:MOTH→P122-22B:MCN1→Pin No. 24 of ICJ9:MCN1
	D103 (Not used)	P420–7 (GND)	J321-5B:DIST
		P420–8 (+5V)	J321-5A:DIST
		P420–9 (Sig)	–
	D104 (Home position)	P420–10 (GND)	J321-6A:DIST
		P420–11 (+5V)	J321-7B:DIST
		P420–12 (Sig)	J321-7A:DIST→J300-4B:DIST→J115-4B:MOTH→J122-21B:MOTH→P122-21B:MCN1→Pin No. 22 of ICJ9:MCN1
	D105 (Disk ID)	J519–1 (GND)	P420-20→J321-9B:DIST
		J519–2 (+24V)	P420-21→J321-9A:DIST
		J519–3 (Sig)	P420-22→J321-10B:DIST→J300-27A:MOTH→J115-27A:MOTH→J121-17A:MCN2→Pin No. 6 of MOD6:MCN2
	Sample Disk Rotation Stepping Motor	P420–23 (+24V)	J134-2A:PM1
		P420–24 (+24V)	J134-3A:PM1
		P420–25 (φ1)	J134-4A:PM1→J130-19B:PM1→J81-19A:MCN1→Pin No. 34 ICJ9:MCN1
		P420–26 (φ2)	J134-5A:PM1→J130-20B:PM1→J81-20A:MCN1→Pin No. 33 ICJ9:MCN1
		P420–27 (φ3)	J134-6A:PM1→J130-21B:PM1→J81-21A:MCN1→Pin No. 32 ICJ9:MCN1
		P420–28 (φ4)	J134-7A:PM1→J130-22B:PM1→J81-22A:MCN1→Pin No. 31 ICJ9:MCN1
Reaction Disk	D101 (Home position)	J419–8 (GND)	J320-2B:DIST
		J419–9 (+5V)	J320-2A:DIST
		J419–10 (Sig)	J320-3B:DIST→J300-3B:DIST→J115-3B:MOTH→J122-19B:MOTH→P122-19B:MCN1→Pin No. 22 of ICJ11:MCN1
	D102 (Cell count)	J419–11 (GND)	J320-3A:DIST
		J419–12 (+5V)	J320-4B:DIST
		J419–13 (Sig)	J320-4A:DIST→J300-4A:DIST→J115-4A:MOTH→J122-20A:MOTH→P122-20A:MCN1→Pin No. 23 of ICJ11:MCN1
	D103 (ADC Start)	J419–14 (GND)	J320-5B:DIST
		J419–15 (+5V)	J320-5A:DIST
		J419–16 (Sig)	J320-6B:DIST→J300-1A:DIST→J115-1A:MOTH→J106-25A:MOTH→P106-25A:TRI

Table 9-2-1 (2/10)

	Parts	Connector No./Pin	To
Reaction Disk	Power Supply of LAMP	J419—1 (+S)	P452-1→DC POWER SUPPLY
		J419—2 (+12V)	P452-2→DC POWER SUPPLY
		J419—3 (0V)	P452-3→DC POWER SUPPLY
		J419—4 (—S)	P452-4→DC POWER SUPPLY
	Reaction Disk Rotation Stepping Motor	P427—2 (+24V)	J133-2A:PM1
		P427—3 (+24V)	J133-3A:PM1
		P427—4 (ϕ1)	J133-4A:PM1→Pin No. 5 MOD3:PM1→J81-14A:MCN1→Pin No. 34 of ICJ11:MCN1
		P427—5 (ϕ2)	J133-5A:PM1→Pin No. 9 MOD3:PM1→J81-15A:MCN1→Pin No. 33 of ICJ11:MCN1
		P427—6 (ϕ3)	J133-6A:PM1→Pin No. 7 MOD3:PM1→J81-16A:MCN1→Pin No. 32 of ICJ11:MCN1
		P427—7 (ϕ4)	J133-7A:PM1→Pin No. 11 MOD3:PM1→J81-17A:MCN1→Pin No. 31 of ICJ11:MCN1
Reagent 1 Disk	D101 (R1 count)	P424—9 (GND)	J323-2B:DIST
		P424—10 (+5V)	J323-2A:DIST
		P424—11 (Sig)	J323-3B:DIST→J300-6B:DIST→J115-6B:MOTH→J122-24A:MOTH→P122-24A:MCN1→Pin No. 23 of ICJ6:MCN1
	D102 (Home position)	P424—12 (GND)	J323-3A:DIST
		P424—13 (+5V)	J323-4B:DIST
		P424—14 (Sig)	J323-4A:DIST→J300-6A:DIST→J115-6A:MOTH→J122-23A:MOTH→P122-23A:MCN1→Pin No. 21 of ICJ6:MCN1
	Reagent 1 Disk Rotation Stepping Motor	P424—2 (+24V)	J135-2A:PM1
		P424—3 (+24V)	J135-3A:PM1
		P424—4 (ϕ1)	J135-4A:PM1→Pin No. 5 of MOD5:PM1→J81-24A:MCN1→Pin No. 34 of ICJ6:MCN1
		P424—5 (ϕ2)	J135-5A:PM1→Pin No. 9 of MOD5:PM1→J81-25A:MCN1→Pin No. 33 of ICJ6:MCN1
		P424—6 (ϕ3)	J135-6A:PM1→Pin No. 7 of MOD5:PM1→J81-26A:MCN1→Pin No. 32 of ICJ6:MCN1
		P424—7 (ϕ4)	J135-7A:PM1→Pin No. 11 of MOD5:PM1→J81-27A:MCN1→Pin No. 31 of ICJ6:MCN1
Reagent 2 Disk	D101 (R2 count)	P423—9 (GND)	J325-2B:DIST
		P423—10 (+5V)	J325-2A:DIST
		P423—11 (Sig)	J325-3B:DIST→J300-10B:DIST→J115-10B:MOTH→J122-24A:MOTH→P122-24A:MCN2→Pin No. 23 of ICJ6:MCN2
	D102 (Home position)	P423—12 (GND)	J325-3A:DIST
		P423—13 (+5V)	J325-4B:DIST
		P423—14 (Sig)	J325-4A:DIST→J300-10A:DIST→J115-10A:MOTH→J122-23A:MOTH→P122-23A:MCN2→Pin No. 21 of ICJ6:MCN2
	Reagent 2 Disk Rotation Stepping Motor	P423—2 (+24V)	J135-2A:PM2
		P423—3 (+24V)	J135-3A:PM2
		P423—4 (ϕ1)	J135-4A:PM2→Pin No. 5 of MOD5:PM2→J81-24A:MCN2→Pin No. 34 of ICJ6:MCN2
		P423—5 (ϕ2)	J135-5A:PM2→Pin No. 9 of MOD5:PM2→J81-25A:MCN2→Pin No. 33 of ICJ6:MCN2
		P423—6 (ϕ3)	J135-6A:PM2→Pin No. 7 of MOD5:PM2→J81-26A:MCN2→Pin No. 32 of ICJ6:MCN2
		P423—7 (ϕ4)	J135-7A:PM2→Pin No. 11 of MOD5:PM2→J81-27A:MCN2→Pin No. 31 of ICJ6:MCN2

Table 9-2-1 (3/10)

	Parts	Connector No./Pin	To
Serum Sampling Arm	D101 (Liquid level detect)	1→3: S.PRO (−Sig)	P421-17→J322-7B:DIST
		2→4: S.PRO (+Sig)	P421-18→J322-7A:DIST→J300-2B:DIST→J115-2B:MOTH→J122-15B:MOTH→P122-15B:MCN1→Pin No. 22 of ICJ14:MCN1
	D102 (Rotation Home)	P421−10 (GND)	J322-5B:DIST
		P421−11 (+5V)	J322-5A:DIST
		P421−12 (Sig)	J322-6B:DIST→J300-3A:DIST→J115-3A:MOTH→J122-18A:MOTH→P122-18A:MCN1→Pin No. 23 of ICJ12:MCN1
	D103 (Abnormal detect)	P421−4 (GND)	J322-2B:DIST
		P421−5 (+5V)	J322-2A:DIST
		P421−6 (Sig)	J322-3B:DIST→J300-12B:DIST→J115-12B:MOTH→J122-27A:MOTH→P122-27A:MCN1→Pin No. 35 of ICJ7:MCN1
	D104 (Upper Dead Point)	P421−7 (GND)	J322-3A:DIST
		P421−8 (+5V)	J322-4B:DIST
		P421−9 (Sig)	J322-4A:DIST→J300-2A:DIST→J115-2A:MOTH→J122-15A:MOTH→P122-15A:MCN1→Pin No. 21 of ICJ14:MCN1
	Serum Sampling Up/Down Stepping Motor	P421−23 (+24V)	J131-2A:PM1
		P421−24 (+24V)	J131-3A:PM1
		P421−25 (ϕ1)	J131-4A:PM1→J130-4B:PM1→J81-4A:MCN1→Pin No. 34 of ICJ14:MCN1
		P421−26 (ϕ2)	J131-5A:PM1→J130-5B:PM1→J81-5A:MCN1→Pin No. 33 of ICJ14:MCN1
		P421−27 (ϕ3)	J131-6A:PM1→J130-6B:PM1→J81-6A:MCN1→Pin No. 32 of ICJ14:MCN1
		P421−28 (ϕ4)	J131-7A:PM1→J130-7B:PM1→J81-7A:MCN1→Pin No. 31 of ICJ14:MCN1
	Serum Sampling Rotation Stepping Motor	P421−31 (+24V)	J132-2A:PM1
		P421−32 (+24V)	J132-3A:PM1
		P421−33 (ϕ1)	J132-4A:PM1→J130-9B:PM1→J81-9A:MCN1→Pin No. 34 of ICJ12:MCN1
		P421−34 (ϕ2)	J132-5A:PM1→J130-10B:PM1→J81-10A:MCN1→Pin No. 33 of ICJ12:MCN1
		P421−35 (ϕ3)	J132-6A:PM1→J130-11B:PM1→J81-11A:MCN1→Pin No. 32 of ICJ12:MCN1
		P421−36 (ϕ4)	J132-7A:PM1→J130-12B:PM1→J81-12A:MCN1→Pin No. 31 of ICJ12:MCN1
Reagent 1 Sampling Arm	D101 (Liquid level detect)	1→3: S. PRO (−Sig)	P426-17→J324-7B:DIST
		2→4: S. PRO (+Sig)	P426-18→J324-7A:DIST→J300-7B:DIST→J115-7B:MOTH→J122-15B:MOTH→P122-15B:MCN2→Pin No. 22 of ICJ14:MCN2
	D102 (Rotation Home)	P426−10 (GND)	J324-5B:DIST
		P426−11 (+5V)	J324-5A:DIST
		P426−12 (Sig)	J324-6B:DIST→J300-8A:DIST→J115-8A:MOTH→J122-18A:MOTH→P122-18A:MCN2→Pin No. 23 of ICJ12:MCN2
	D103 (Abnormal detect)	P426−4 (GND)	J324-2B:DIST
		P426−5 (+5V)	J324-2A:DIST
		P426−6 (Sig)	J324-3B:DIST→J300-14A:DIST→J155-14A:MOTH→J122-27A:MOTH→P122-27A:MCN2→Pin No. 35 of ICJ7:MCN2
	D104 (Upper Dead Point)	P426−7 (GND)	J324-3A:DIST
		P426−8 (+5V)	J324-4B:DIST
		P426−9 (Sig)	J324-4A:DIST→J300-7A:DIST→J115-7A:MOTH→J122-15A:MOTH→P122-15A:MCN2→Pin No. 21 of ICJ14:MCN2

Table 9-2-1 (4/10)

	Parts	Connector No./Pin	To
Reagent 1 Sampling Arm	Reagent 1 Sampling Up/Down Stepping Motor	P426–23 (+24V)	J131-2A:PM2
		P426–24 (+24V)	J131-3A:PM2
		P426–25 (ϕ1)	J131-4A:PM2→J130-4B:PM2→J81-4A:MCN2→Pin No. 34 of ICJ14:MCN2
		P426–26 (ϕ2)	J131-5A:PM2→J130-5B:PM2→J81-5A:MCN2→Pin No. 33 of ICJ14:MCN2
		P426–27 (ϕ3)	J131-6A:PM2→J130-6B:PM2→J81-6A:MCN2→Pin No. 32 of ICJ14:MCN2
		P426–28 (ϕ4)	J131-7A:PM2→J130-7B:PM2→J81-7A:MCN2→Pin No. 31 of ICJ14:MCN2
	Reagent 1 Sampling Rotation Stepping Motor	P426–31 (+24V)	J132-2A:PM2
		P426–32 (+24V)	J132-3A:PM2
		P426–33 (ϕ1)	J132-4A:PM2→Pin No. 5 of MOD2:PM2 →J81-9A:MCN2→Pin No. 34 of ICJ12:MCN2
		P426–34 (ϕ2)	J132-5A:PM2→Pin No. 9 of MOD2:PM2 →J81-10A:MCN2→Pin No. 33 of ICJ12:MCN2
		P426–35 (ϕ3)	J132-6A:PM2→Pin No. 7 of MOD2:PM2 →J81-11A:MCN2→Pin No. 32 of ICJ12:MCN2
		P426–36 (ϕ4)	J132-7A:PM2→Pin No. 11 of MOD2:PM2→J81-12A:MCN2→Pin No. 31 of ICJ12:MCN2
Reagent 2 Sampling Arm	D101 (Liquid level detect)	1→3: S.PRO (–Sig)	P422-17→J326-7B:DIST
		2→4: S.PRO (+Sig)	P422-18→J326-7A:DIST→J300-9A:DIST→J115-9A:MOTH→J122-19B:MOTH→P122-19B:MCN2→Pin No. 22 of ICJ11:MCN2
	D102 (Rotation Home)	P422–10 (GND)	J326-5B:DIST
		P422–11 (+5V)	J326-5A:DIST
		P422–12 (Sig)	J326-6B:DIST→J300-9B:DIST→J115-9B:MOTH→J122-22A:MOTH→P122-22A:MCN2→Pin No. 23 of ICJ9:MCN2
	D103 (Abnormal detect)	P422–4 (GND)	J326-2B:DIST
		P422–5 (+5V)	J326-2A:DIST
		P422–6 (Sig)	J326-3B:DIST→J300-14B:DIST→J115-14B:MOTH→J122-27B:MOTH→P122-27B:MCN2→Pin No. 36 of ICJ7:MCN2
	D104 (Upper Dead Point)	P422–7 (GND)	J326-3A:DIST
		P422–8 (+5V)	J326-4B:DIST
		P422–9 (Sig)	J326-4A:DIST→J300-8B:DIST→J115-8B:MOTH→J122-19A:MOTH→P122-19A:MCN2→Pin No. 21 of ICJ11:MCN2
	Reagent 2 Sampling Up/Down Stepping Motor	P422–23 (+24V)	J133-2A:PM2
		P422–24 (+24V)	J133-3A:PM2
		P422–25 (ϕ1)	J133-4A:PM2→Pin No. 5 of MOD3:PM2 →J81-14A:MCN2→Pin No. 34 of ICJ11:MCN2
		P422–26 (ϕ2)	J133-5A:PM2→Pin No. 9 of MOD3:PM2 →J81-15A:MCN2→Pin No. 33 of ICJ11:MCN2
		P422–27 (ϕ3)	J133-6A:PM2→Pin No. 7 of MOD3:PM2 →J81-16A:MCN2→Pin No. 32 of ICJ11:MCN2
		P422–28 (ϕ4)	J133-7A:PM2→Pin No. 11 of MOD3:PM2 →J81-17A:MCN2→Pin No. 31 of ICJ11:MCN2
	Reagent 2 Sampling Rotation Stepping Motor	P422–31 (+24V)	J134-2A:PM2
		P422–32 (+24V)	J134-3A:PM2
		P422–33 (ϕ1)	J134-4A:PM2→Pin No. 5 of MOD4:PM2 →J81-19A:MCN2→Pin No. 34 of ICJ9:MCN2
		P422–34 (ϕ2)	J134-5A:PM2→Pin No. 9 of MOD4:PM2 →J81-20A:MCN2→Pin No. 33 of ICJ9:MCN2
		P422–35 (ϕ3)	J134-6A:PM2→Pin No. 7 of MOD4:PM2 →J81-21A:MCN2→Pin No. 32 of ICJ9:MCN2
		P422–36 (ϕ4)	J134-7A:PM2→Pin No. 11 of MOD4:PM2 →J81-22A:MCN2→Pin No. 31 of ICJ9:MCN2

Table 9-2-1 (5/10)

	Parts	Connector No./Pin	To
Rinse	D101 (Upper Dead Point)	P428–5 (GND)	J328-2B:DIST
		P428–6 (+5V)	J328-2A:DIST
		P428–7 (Sig)	J328-3B:DIST→J300-15A:DIST→J115-15A:MOTH→J121-9A:MOTH→P121-9A:MCN1→Pin No. 21 of ICJ3:MCN1
	D102 (Lower Dead Point)	P428–8 (GND)	J328-3A:DIST
		P428–9 (+5V)	J328-4B:DIST
		P428–10 (Sig)	J328-4A:DIST→J300-15B:DIST→J115-15B:MOTH→J121-9B:MOTH→P121-9B:MCN1→Pin No. 22 of ICJ3:MCN1
	Rinse Up/Down AC Motor	J215–4 (AC100V)	J316-2B:ACM→J315-3B:ACM→J313-2B:REY→TBI-7
		J215–3 (COMMON)	J316-2A:ACM→J315-3A:ACM→J313-2B:REY→J311-7A:REY→J334-7A:DIST:MCN1 ⟨ J300-17B:DIST→J115-13B:MOTH→*1 J300-17A:DIST→J115-13A:MOTH→*2
	Rinse Break	(AC100V)	
		J215–1	J316-3A:ACM→J315-4A:ACM→J313-4A:REY→J311-8B:REY→J334-8B:DIST→J301-20B:DIST
Stirrer	D101 (Upper Dead Point)	P425–1 (GND)	J329-2B:DIST
		P425–2 (+5V)	J329-2A:DIST
		P425–3 (Sig)	J329-3B:DIST→J300-16A:DIST→J115-16A:MOTH→J121-10A:MOTH→P121-10A:MCN1→Pin No. 23 of ICJ3:MCN1
	D102 (Lower Dead Point)	P425–4 (GND)	J329-3A:DIST
		P425–5 (+5V)	J329-4B:DIST
		P425–6 (Sig)	J329-4A:DIST→J300-16B:DIST→J115-16B:MOTH→J121-10B:MOTH→P121-10B:MCN1→Pin No. 24 of ICJ3:MCN1
	D103 (Cell Side)	P425–7 (GND)	J329-5B:DIST
		P425–8 (+5V)	J329-5A:DIST
		P425–9 (Sig)	J329-6B:DIST→J300-11A:DIST→J115-11A:MOTH→J122-25B:MOTH→P122-25B:MCN1→Pin No. 22 of ICJ7:MCN1
	D104 (Home: Rinsing Side)	P425–10 (GND)	J329-6A:DIST
		P425–11 (+5V)	J329-7B:DIST
		P425–12 (Sig)	J329-7A:DIST→J300-12A:DIST→J115-12A:MOTH→J122-26B:MOTH→P122-26B:MCN1→Pin No. 24 of ICJ7:MCN1
	R1 Stirrer-Rod DC Motor	P425–13 (+V)	J329-9B:DIST
		P425–14 (Sig)	J329-9A:DIST→J300-18A:DIST→J115-18A:MOTH→J121-14A:MOTH→P121-21A:MCN2→Pin No. 2 of ICH6:MCN2
	R2 Stirrer-Rod DC Motor	P425–15 (+V)	J329-10B:DIST
		P425–16 (Sig)	J329-10A:DIST→J300-18B:DIST→J115-18B:MOTH→J121-14B:MOTH→P121-21B:MCN2→Pin No. 5 of ICH6:MCN2
	Stirrer Movement Stepping Motor	P425–23 (+24V)	J329-12B:DIST
		P425–24 (+24V)	J329-12A:DIST
		P425–25 (ϕ1)	J329-13B:DIST→J301-3A:DIST→J116-3A:MOTH→J121-3A:MOTH→P121-3A:MCN1→Pin No. 31 of ICJ7:MCN1
		P425–26 (ϕ2)	J329-13A:DIST→J301-3B:DIST→J116-3B:MOTH→J121-3B:MOTH→P121-3B:MCN1→Pin No. 32 of ICJ7:MCN1
		P425–27 (ϕ3)	J329-14B:DIST→J301-4A:DIST→J116-4A:MOTH→J121-4A:MOTH→P121-4A:MCN1→Pin No. 33 of ICJ7:MCN1
		P425–28 (ϕ4)	J329-14A:DIST→J301-4B:DIST→J116-4B:MOTH→J121-4B:MOTH→P121-4B:MCN1→Pin No. 34 of ICJ7:MCN1
	Stirrer Up/Down AC Motor	J216–4 (AC100V)	J316-6B:ACM→J315-7B:ACM→J313-7B:REY→J311-8A:REY→J334-8A:DIST→J300-18A:DIST→J115-18A:MOTH →J121-1-14A:MOTH→Pin No. 29 of J3:MCN1
		J216–3 (COMMON)	J316-6A:ACM→J315-7A:ACM

*1: J121-1-13B:MOTH→Pin No. 28 of ICJ3:MCN1 *2: J121-1-13A:MOTH→Pin No. 27 of ICJ3:MCN1

Table 9-2-1 (6/10)

	Parts	Connector No./Pin	To
Stirrer	Stirrer Break		
		J216–1	J316-7A:ACM→J315-8A:ACM→J313-8A:REY→J311-9B:REY→J334-9B:DIST→J301-20B:DIST→J116-20B:DIST →J121-2-26B:MOTH→Pin No. 19 of ICH3:MCN2
Serum Syringe	SV1	J414–1 (+24V)	J327-1A:DIST
		J414–2 (Sig)	J327-2B:DIST→J301-9A:DIST→J116-9A:MOTH→J121-21A:MOTH→P121-21A:MCN1→Pin No. 2 of ICH6:MCN1
	D101 (Upper Dead Point)	J414–11 (GND)	J327-6B:DIST
		J414–12 (+5V)	J327-6A:DIST
		J414–13 (Sig)	J327-7B:DIST→J300-11B:DIST→J115-11B:DIST→J122-26A:MOTH→P122-26A:MCN1→Pin No. 23 of ICJ7:MCN1
	Syringe Up/Down Stepping Motor	J414–3 (+24V)	J327-2A:DIST
		J414–4 (+24V)	J327-3B:DIST
		J414–5 (ϕ4)	J327-3A:DIST→J301-2B:DIST→J116-2B:MOTH→J121-2B:MOTH→P121-2B:MCN1→Pin No. 30 of ICJ7:MCN1
		J414–6 (ϕ3)	J327-4B:DIST→J301-2A:DIST→J116-2A:MOTH→J121-2A:MOTH→P121-2A:MCN1→Pin No. 29 of ICJ7:MCN1
		J414–7 (ϕ2)	J327-4A:DIST→J301-1B:DIST→J116-1B:MOTH→J121-1B:MOTH→P121-1B:MCN1→Pin No. 28 of ICJ7:MCN1
		J414–8 (ϕ1)	J327-5B:DIST→J301-1A:DIST→J116-1A:MOTH→J121-1A:MOTH→P121-1A:MCN1→Pin No. 27 of ICJ7:MCN1
Reagent 1 Syringe	SV2	J415–1 (+24V)	J327-8B:DIST
		J415–2 (Sig)	J327-8A:DIST→J301-9B:DIST→J116-21B:MOTH→J121-21B:MOTH→P121-21B:MCN1→Pin No. 5 of ICH6:MCN1
	D101 (Upper Dead Point)	J415–11 (GND)	J327-12A:DIST
		J415–12 (+5V)	J327-13B:DIST
		J415–13 (Sig)	J327-13A:DIST→J300-13A:DIST→J115-13A:MOTH→J122-26A:MOTH→P122-26A:MCN2→Pin No. 23 of ICJ7:MCN2
	Syringe Up/Down Stepping Motor	J415–3 (+24V)	J327-9B:DIST
		J415–4 (+24V)	J327-9A:DIST
		J415–5 (ϕ4)	J327-10B:DIST→J301-6B:DIST→J116-6B:MOTH→J121-2B:MOTH→P121-2A:MCN2→Pin No. 30 of ICJ7:MCN2
		J415–6 (ϕ3)	J327-10A:DIST→J301-6A:DIST→J116-6A:MOTH→J121-2A:MOTH→P121-2A:MCN2→Pin No. 29 of ICJ7:MCN2
		J415–7 (ϕ2)	J327-11B:DIST→J301-5B:DIST→J116-5B:MOTH→J121-1B:MOTH→P121-1B:MCN2→Pin No. 28 of ICJ7:MCN2
		J415–8 (ϕ1)	J327-11A:DIST→J301-5A:DIST→J116-5A:MOTH→J121-1A:MOTH→P121-1A:MCN2→Pin No. 27 of ICJ7:MCN2
Reagent 2 Syringe	SV3	J416–1 (+24V)	J327-14A:DIST
		J416–2 (Sig)	J327-15B:DIST→J301-10A:DIST→J116-10A:MOTH→J121-22A:MOTH→P121-22A:MCN1→Pin No. 6 of ICH6:MCN1
	D101 (Upper Dead Point)	J416–11 (GND)	J327-19B:DIST
		J416–12 (+5V)	J327-19A:DIST
		J416–13 (Sig)	J327-20B:DIST→J300-13B:DIST→J115-13B:MOTH→J122-26B:DIST→P122-26B:MCN2→Pin No. 24 of ICJ7:MCN2
	Syringe Up/Down Stepping Motor	J416–3 (+24V)	J327-15A:DIST
		J416–4 (+24V)	J327-16B:DIST
		J416–5 (ϕ4)	J327-16A:DIST→J301-8B:DIST→J116-8B:MOTH→J121-4B:DIST→P121-4B:MCN2→Pin No. 34 of ICJ7:MCN2
		J416–6 (ϕ3)	J327-17B:DIST→J301-8A:DIST→J116-8A:MOTH→J121-4A:DIST→P121-4A:MCN2→Pin No. 33 of ICJ7:MCN2
		J416–7 (ϕ2)	J327-17A:DIST→J301-7B:DIST→J116-7B:MOTH→J121-3B:DIST→P121-3B:MCN2→Pin No. 32 of ICJ7:MCN2
		J416–8 (ϕ1)	J327-18B:DIST→J301-7A:DIST→J116-7A:MOTH→J121-3A:DIST→P121-3A:MCN2→Pin No. 31 of ICJ7:MCN2

Table 9-2-1 (7/10)

	Parts	Connector No./Pin	To
DC Solenoid Valve	SV4 (Serum Sampling Nozzle Rinsing)	P510—1 (+24V)	J82-2B:MCN1
		P510—2 (Sig)	J82-2A:MCN1→Pin No. 12 of ICH6:MCN1
	SV5 (R1/R2 Nozzle Rinsing)	P510—3 (+24V)	J82-3B:MCN1→Pin No. 15 of ICH6:MCN1
		P510—4 (Sig)	J82-3A:MCN1
	SV6 (Stirrer Rod Rinsing)	P510—5 (+24V)	J82-4B:MCN1→Pin No. 16 of ICH6:MCN1
		P510—6 (Sig)	J82-4A:MCN1
	SV10 (Add Incubation Bath Water)	P510—7 (+24V)	J82-5B:MCN1
		P510—8 (Sig)	J82-5A:MCN1→Pin No. 19 of ICH6:MCN1
	SV11 (Rinse Tip Rinsing)	P510—9 (+24V)	J82-6B:MCN1
		P510—10 (Sig)	J82-6A:MCN1→Pin No. 2 of ICH3:MCN1
	SV15 (Discharging Blank Water)	P509—1 (+24V)	J82-4B:MCN2
		P509—2 (Sig)	J82-4A:MCN2→Pin No. 16 of ICH6:MCN2
AC Solenoid Valve	SV7 (Rinse Water Supply)	P219—1 (AC100V)	J312-4B:REY
		P219—3 (Sig)	J312-5B:REY→J311-2B:REY→J334-2B:DIST→J301-12A:DIST→J116-12A:MOTH→J121-24A:MOTH→P121-24A:MCN1 →Pin No. 6 of ICH3:MCN1
	SV8 (Water Supply)	P235—1 (AC100V)	J312-5A:REY
		P235—6 (Sig)	J312-6A:REY→J311-6B:REY→J334-6B:DIST→J301-12B:DIST→J116-12B:MOTH→J121-24B:MOTH→P121-24B:MCN1 →Pin No. 9 of ICH3:MCN1
	SV9 (Incubation Bath Water Supply)	P219—7 AC100V)	J312-7B:REY
		P219—9 (Sig)	J312-8B:REY→J311-6A:REY→J334-6A:DIST→J301-18A:DIST→J116-18A:MOTH→J121-24A:MOTH→P121-25A:MCN1 →Pin No. 12 of ICH3:MCN1
	SV16 (Incubation Bath Control For 37°C)	J234—1 (AC100V)	J312-16B:REY
		J234—3 (Sig)	J312-17B:REY→J311-4A:REY→J334-4A:DIST→J336-2A:DIST
	SV20 (Overflow)	J228—1 (AC100V)	J312-8A:REY
		J228—2 (Sig)	J312-9A:REY→J311-3A:REY→J334-3A:DIST→J301-13B:DIST→J116-13B:MOTH→J121-25B:MOTH→P121-25B:MCN1 →Pin No. 15 of ICH3:MCN1
	SV21 (Waste Sipper Sipper)	J228—3 (AC100V)	J312-10B:REY
		J228—4 (Sig)	J312-11B:REY→J311-7B:REY→J334-7B:DIST→J301-14A:DIST→J116-14A:MOTH→J121-26A:MOTH→P121-26A:MCN1 →Pin No. 16 of ICH3:MCN1
	SV30, 31, 33 (Waste Solution)	J230~ J232—1 (AC100V)	J312-11A:REY
		J230~ J232—3 (Sig)	J312-12A:REY→J311-3B:REY→J334-3B:DIST→J301-17A:DIST→J116-17A:MOTH→J121-23A:MOTH→P121-23A:MCN2 →Pin No. 2 of ICH3:MCN2
	SV32 (Incubation Bath Waste)	P229—1 (AC100V)	J312-14A:REY
		P229—3 (Sig)	J312-15A:REY→J311-5B:REY→J334-5B:DIST→J301-11A:DIST→J116-11A:MOTH→J121-24A:MOTH→P121-24A:MCN2 →Pin No. 6 of ICH3:MCN2

Table 9-2-1 (8/10)

	Parts	Connector No./Pin	To
Pump	MP-1 (Water Supply Pump)	J213–1 (AC100V)	J316-8B:ACM→J315-9B:ACM→J313-9B:REY
		J213–3 (Sig)	J316-9B:ACM→J315-10B:ACM→J313-10B:REY→J311-9A:REY→J334-9A:DIST→J300-21A:DIST→J115-21A:MOTH →J121-14A:MCN2→Pin No. 29 of ICJ3:MCN2
	MP-2 (Incubation Water Circulation Pump)	J212–1 (AC100V)	J312-2B:REY
		J212–3 (Sig)	J312-3B:REY→J311-4B:REY→J334-4B:DIST→J300-20A:DIST→J115-20A:MOTH→J121-13A:MOTH→P121-13A:MCN2 →Pin No. 27 of ICJ3:MCN2
	MP-3 (Coolant Circulation Pump)	J225–5 (AC100V)	J227-5→F100 Fuse→Pin No. 8 of TB101:POWER TRANSFORMER
		J225–6 (Sig)	J227-6→(AC DIST)→Pin No. 7 of TB101:POWER TRANSFORMER
	G.P. (Gear Pump)	J214–1 (AC100V)	J316-9B:ACM→J315-10A:ACM→J313-10A:REY
		J214–3 (Sig)	J316-10B:ACM→J315-11A:ACM→J313-11A:REY→J311-10B:REY→J334-10B:DIST→J300-21B:DIST→J115-21B:MOTH →J121-14B:MOTH→P121-14B:MCN2→Pin No. 30 of ICJ3:MCN2
	VP-1 (Vacuum Pump)	J211–1 (AC100V)	J316-11B:ACM→J315-12B:ACM→J313-12B:REY
		J211–3 (Sig)	J316-12B:ACM→J315-13B:ACM→J313-13B:REY→J311-10A:REY→J334-10A:DIST→J300-22A:DIST→J115-22A:MOTH →J121-15A:MOTH→P121-15A:MCN2→Pin No. 31 of ICJ3:MCN2
	VP-2 (Vacuum Pump For Degasser)	J222–1 (AC100V)	P221-3:Power Supply For Degasser→J221-6(0V)→J243-9→TB102-4→TB101-6
		J222–3 (Sig)	P221-5:Power Supply For Degasser→J221-7(100V)→J243-11→TB102-9→F102→TB101-5
	Extran Pump (DC Motor)	J513–2 (+12V)	J514-2→J82-2B(24V):MCN2
		J513–1 (Sig)	J514-1→J82-2A:MCN2
Other Sensors	Abnormal Degasser Detection	J515–1 (+)	J332-1A:DIST→J300-27B:DIST→J115-27B:MOTH→J121-17B:MOTH→P121-17B:MCN2→Pin No. 4 of ICG4:MCN2
		J515–3 (–)	J332-2B:DIST
		J515–4 (+) Vacuum pressure down	J332-2A:DIST→J300-27B:DIST→J115-27B:MOTH→J121-17B:MOTH→P121-17B:MCN2→Pin No. 4 of ICG4:MCN2
		J515–6 (–) Vacuum pressure down	J332-3B:DIST
	Cold water tank Level Detection	P502–1 (+)	J332-4B:DIST→J300-26A:DIST→J115-26A:MOTH→J121-20A:MOTH→P121-20A:MCN2→Pin No. 15 of ICG4:MCN2!
		P502–2 (–)	J332-4A:DIST
	Incubation Bath Water Level Detect	P503–1 (+)	J332-5A:DIST→J300-23A:DIST→J115-23A:MOTH→J121-17A:MOTH→P121-17A:MCN1→Pin No. 2 of ICG4:MCN1
		P503–2 (–)	J332-6B:DIST
	Vacuum pressure Detection	P506–1 (NC)	J332-7B:DIST→J300-24B:DIST→J115-24B:MOTH→J121-18B:MOTH→P121-18B:MCN1→Pin No. 8 of ICG4:MCN1
		P506–2 (COMMON)	J322-7A:DIST
		P506–3 (NO)	J322-8B:DIST
	Vacuum tank waste Solution Detect	P507–1 (+)	J332-9B:DIST→J300-24A:DIST→J115-24A:MOTH→J121-18A:MOTH→P121-18A:MCN1→Pin No. 6 of ICG4:MCN1
		P507–2 (–)	J332-9A:DIST
	Distilled water tank Low level	P504–1 (+)	J332-10A:DIST→J300-25A:DIST→J115-25A:MOTH→J121-19A:MOTH→P121-19A:MCN1→Pin No. 11 of ICG4:MCN1
		P504–2 (–)	J332-11B:DIST
	Distilled water tank High level	P504–3 (+)	J332-11A:DIST→J300-25B:DIST→J115-25B:MOTH→J121-19B:MOTH→P121-19B:MCN1→Pin No. 13 of ICG4:MCN1
		P504–4 (–)	J332-12B:DIST

Table 9-2-1 (9/10)

	Parts	Connector No./Pin	To
Other Sensors	Waste Sollution tank level	P505—1 (+)	J332-12A:DIST→J300-23B:DIST→J115-23B:MOTH→J121-17B:MOTH→P121-17B:MCN1→Pin No. 4 of ICG4:MCN1
		P505—2 (—)	J332-13B:DIST
	SV51	J437—1 (+24V)	J330-1A:DIST
		J437—2 (Sig)	J330-2B:DIST→J302-14B:DIST→J117-14B:MOTH→J121-3-21B:MOTH→Pin No. 4 of Q1→ISEC
	SIP Syringe Stepping Motor	J437—3 (+24V)	J330-2A:DIST
		J437—4 (+24V)	J330-3B:DIST
		J437—5 (ϕ4)	J330-3A:DIST→J302-5B:DIST→J117-5B:MOTH→J121-3-2B:MOTH→Pin No. 11 of Q4→ISEC
		J437—6 (ϕ3)	J330-4B:DIST→J302-5A:DIST→J117-5A:MOTH→J121-3-2A:MOTH→Pin No. 9 of Q4→ISEC
		J437—7 (ϕ2)	J330-4A:DIST→J302-4B:DIST→J117-4B:MOTH→J121-3-1B:MOTH→Pin No. 4 of Q4→ISEC
		J437—8 (ϕ1)	J330-5B:DIST→J302-4A:DIST→J117-4A:MOTH→J121-3-1A:MOTH→Pin No. 2 of Q4→ISEC
	SIP Syringe Upper Dead Point	J437—11 (GND)	J330-6B:DIST
		J437—12 (+5V)	J330-6A:DIST
		J437—13 (Sig)	J330-7B:DIST→J302-1A:DIST→J117-1A:MOTH→J122-3-26A:MOTH→Pin No. 12 of MOD3→ISEC
	SV43	J438—1 (+24V)	J330-8B:DIST
		J438—2 (Sig)	J330-8A:DIST→J302-14A:DIST→J117-14A:MOTH→J121-3-21A:MOTH→Pin No. 2 of Q5→ISEC
	DIL Syringe Stepping Motor	J438—3 (+24V)	J330-9B:DIST
		J438—4 (+24V)	J330-9A:DIST
		J438—5 (ϕ4)	J330-10B:DIST→J302-7B:DIST→J117-7B:MOTH→J121-3-4B:MOTH→Pin No. 11 of Q5→ISEC
		J438—6 (ϕ3)	J330-10A:DIST→J302-7A:DIST→J117-7A:MOTH→J121-3-4A:MOTH→Pin No. 9 of Q5→ISEC
		J438—7 (ϕ2)	J330-11B:DIST→J302-6B:DIST→J117-6B:MOTH→J121-3-3B:MOTH→Pin No. 4 of Q5→ISEC
		J438—8 (ϕ1)	J330-11A:DIST→J302-6A:DIST→J117-6A:MOTH→J121-3-3A:MOTH→Pin No. 2 of Q5→ISEC
	DIL Syringe Upper Dead Point	J438—11 (GND)	J330-12A:DIST
		J438—12 (+5V)	J330-13B:DIST
		J438—13 (Sig)	J330-13A:DIST→J302-1B:DIST→J117-1B:MOTH→J122-3-26B:MOTH→Pin No. 13 of MOD3→ISEC
	SV41	J439—1 (+24V)	J330-14A:DIST
		J439—2 (Sig)	J330-15B:DIST→J302-10A:DIST→J117-10A:MOTH→J122-2-21A:MOTH→Pin No. 10 of MOD2→MCN2
	IS Syringe Stepping Motor	J439—3 (+24V)	J330-15A:DIST
		J439—4 (+24V)	J330-16B:DIST
		J439—5 (ϕ4)	J330-16A:DIST→J302-9B:DIST→J117-9B:MOTH→J122-2-6B:MOTH→Pin No. 11 of Q6:MCN2→Pin No. 30 of ICJ5:MCN2
		J439—6 (ϕ3)	J330-17B:DIST→J302-9A:DIST→J117-9A:MOTH→J122-2-6A:MOTH→Pin No. 9 of Q6:MCN2→Pin No. 29 of ICJ5:MCN2
		J439—7 (ϕ2)	J330-17A:DIST→J302-8B:DIST→J117-8B:MOTH→J122-2-5B:MOTH→Pin No. 4 of Q6:MCN2→Pin No. 28 of ICJ5:MCN2
		J439—8 (ϕ1)	J330-18B:DIST→J302-8A:DIST→J117-8A:MOTH→J122-2-5A:MOTH→Pin No. 2 of Q6:MCN2→Pin No. 27 of ICJ5:MCN2
	IS Syringe Upper Dead Point	J439—11 (GND)	J330-19B:DIST
		J439—12 (+5V)	J330-19A:DIST
		J439—13 (Sig)	J330-20B:DIST→J302-2B:DIST→J117-2B:MOTH→J122-2-29A:MOTH→Pin No. 10 of MOD4→MCN2

Table 9-2-1 (10/10)

	Parts	Connector No./Pin	To
ISE	SV42	J435–1 (+24V)	J82-2B:ISEC
		J435–2 (Sig)	J82-2A:ISEC→Pin No. 12 of ICH6:ISEC
	SV44	J435–3 (+24V)	J82-3B:ISEC
		J435–4 (Sig)	J82-3A:ISEC→Pin No. 15 of ICH6:ISEC
	SV45	J436–1 (+24V)	J82-6B:ISEC
		J436–2 (Sig)	J82-6A:ISEC→Pin No. 2 of ICH3:ISEC
	SV46	J436–3 (+24V)	J82-7B:ISEC
		J436–4 (Sig)	J82-7A:ISEC→Pin No. 5 of ICH3:ISEC
	SV52	J233–1 (AC100V)	J312-13B:REY
		J233–3 (Sig)	J312-14B:REY→J311-5A:REY→J334-5A:DIST→J302-16A:DIST→J117-16A:DIST→J121-25A:ISEC→P121-25A:ISEC →Pin No. 12 of ICH3:ISEC
	SV53	J436–5 (+24V)	J82-8B:ISEC
		J436–6 (Sig)	J82-8A:ISEC→Pin No. 6 of ICH3:ISEC
	SV55	J435–5 (+24V)	J82-4B:ISEC
		J435–6 (Sig)	J82-4A:ISEC→Pin No. 16 of ICH6 on ISEC
	PCP for ISE Door Open	J433–1 (GND)	J331-1A:DIST
		J433–2 (+5V)	J331-2B:DIST
		J433–3 (Sig)	J331-2A:DIST→J302-12A:DIST→J117-12A:DIST→J121-17A:ISEC→P121-17A:ISEC→Pin No. 2 of ICG4:ISEC
	PCP for Vacuum Nozzle down Detection	J434–1 (GND)	J331-3A:DIST
		J434–2 (+5V)	J331-4B:DIST
		J434–3 (Sig)	J331-4A:DIST→J302-12B:DIST→J117-12B:DIST→J121-17B:ISEC→P121-17B:ISEC→Pin No. 4 of ICG4:ISEC
	Solenoid for Vacuum Nozzle Up/Down	J434–4 (+24V)	J331-6B:DIST
		J434–5 (Sig)	J331-6A:DIST→J302-11B:DIST→J117-11B:DIST→J121-22B:MCN2→P121-22B:MCN2→Pin No. 9 of ICH6:MCN2
	Solenoid for Shutter	J434–6 (+24V)	J331-7B:DIST
		J434–7 (Sig)	J331-7A:DIST→J302-15B:DIST→J117-15B:DIST→J121-22B:ISEC→P121-22B:ISEC→Pin No. 9 of ICH6:ISEC
	Pinch Valve	J434–8 (+24V)	J331-8B:DIST
		J434–9 (Sig)	J331-8A:DIST→J302-15A:DIST→J117-15A:DIST→J121-22A:ISEC→P121-22A:ISEC→Pin No. 6 of ICH6:ISEC

10. CIRCUIT BOARD EXPLANATIONS

10-2 CIRCUIT EXPLANATIONS

10-2-1 Printed Circuit Board Explanations

(1) Outline of Electrical System

Fig.10-2-1 shows a block diagram of the electrical system of the 717 automatic analyzer. The electrical system consists roughly of the components shown below, and its layout is illustrated in Fig. 10-2-2.

- CPU UNIT .... Controls all interfaces, processes data, and communicates with host computer
- CONTROL UNIT .... Controls all mechanisms of 717
- AC SOLID STATE RELAY .... Drives AC motors and solenoid valves
- TEMPERATURE CONTROLLER ...... Controls reaction bath temperature
- LOG AMPLIFIER .... Log conversion and amplification of photometer signal
- POWER FAIL DETECTOR .... Detects AC line voltage down or blackout
- I/O DEVICES .... Printer
Floppy disk drives
Operation panel
CRT display
- DC POWER UNIT

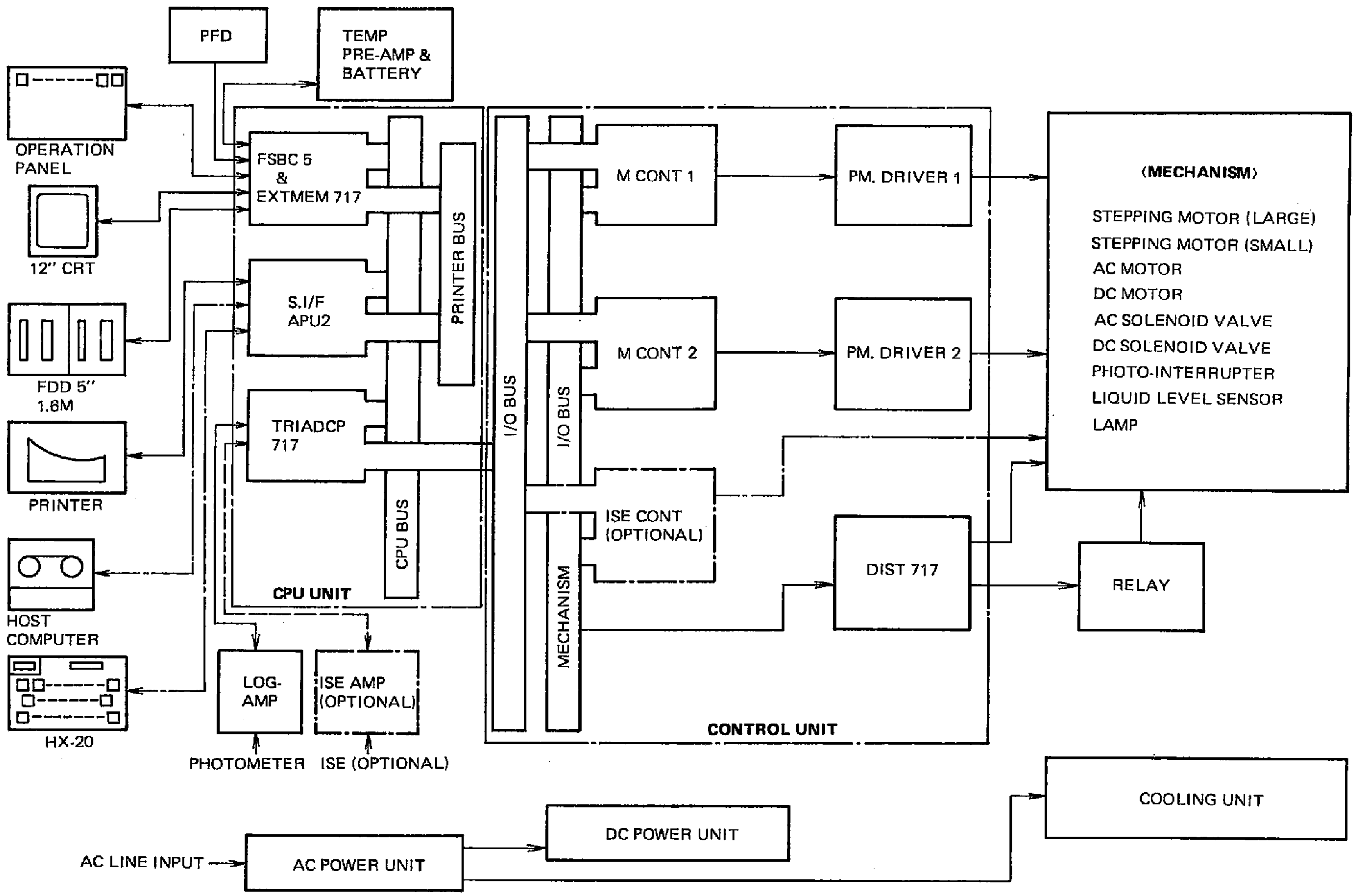


Fig. 10-2-1 Block Diagram of 717 Automatic Analyzer

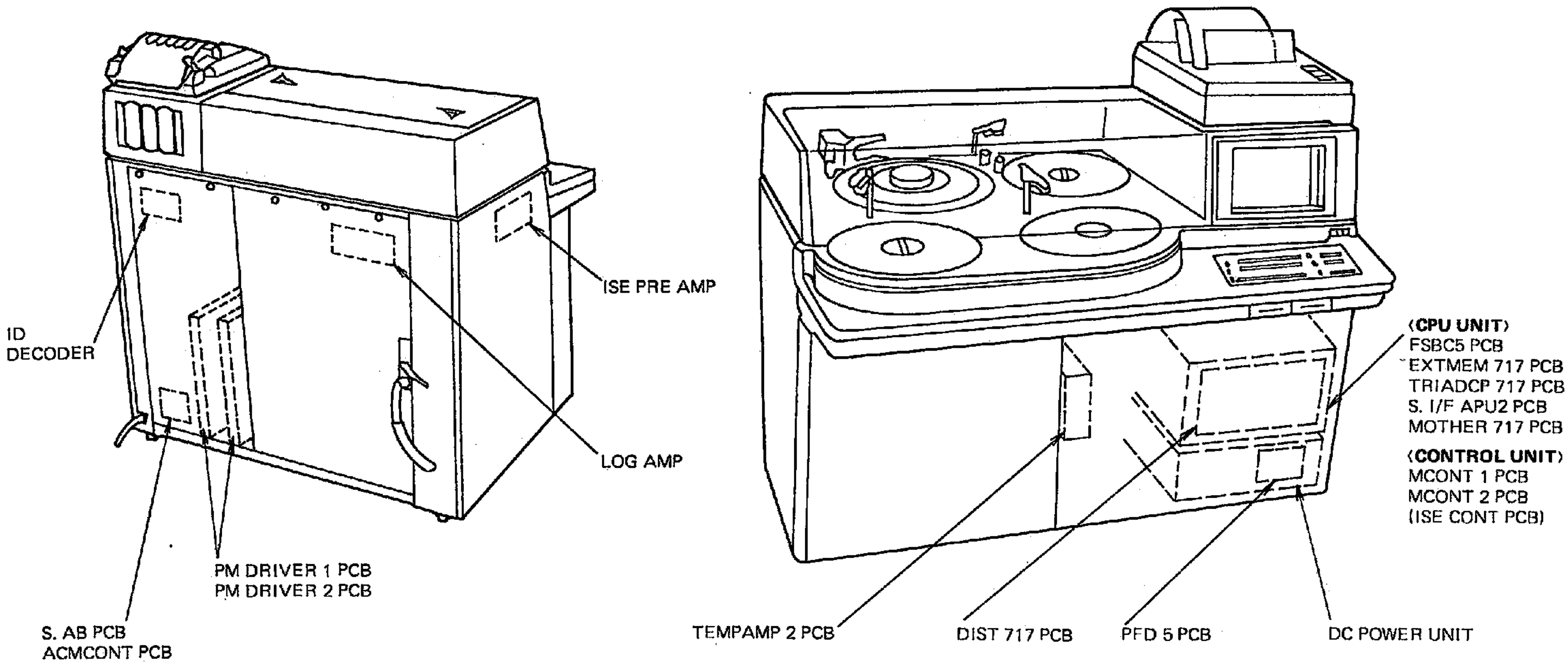


Fig. 10-2-2 Printed Circuit Board Layout

10-2-2 CPU Unit

(1) Outline

This unit consists of a CPU serving as the center of control, various interfaces and A/D converters. It controls the entire 717 analyzer, processes data and communicates with host computer.
The CPU unit is made up of the following printed circuit boards which are arranged in a rack.

- FSBC 717
- EXTMEM 717 (for FSBC)
- S.I/F APU2
- TRIADCP 717
- MOTHER 717

The function of each circuit board is described in the following section.

(2) FSBC 717 Printed Circuit Board
(Single board computer with floppy disk controller)

This board is the main CPU board of 717, and has some interfaces.

- CPU .... 68A09 : Clock 1 MHz
- ROM ... 8 k bytes : (2764 X 1) (for IPL)
- RAM ... 256 k bytes : (50464 X 8) (for 717 program and data)
- Other Functions
  - · CRT controller
  - · Floppy disk controller
  - · Real time clock (battery back-up)
  - · Keyboard I/F controller
  - · PIA (parallel I/F)
  - · Printer controller (single chip CPU)
  - · Programmable timer
  - · A/D converter (1 ch, for incubation bath temperature monitor)

Fig. 10-2-3 shows the block diagram of FSBC, and details of functions and location of ICs are described in Fig. 10-2-4.

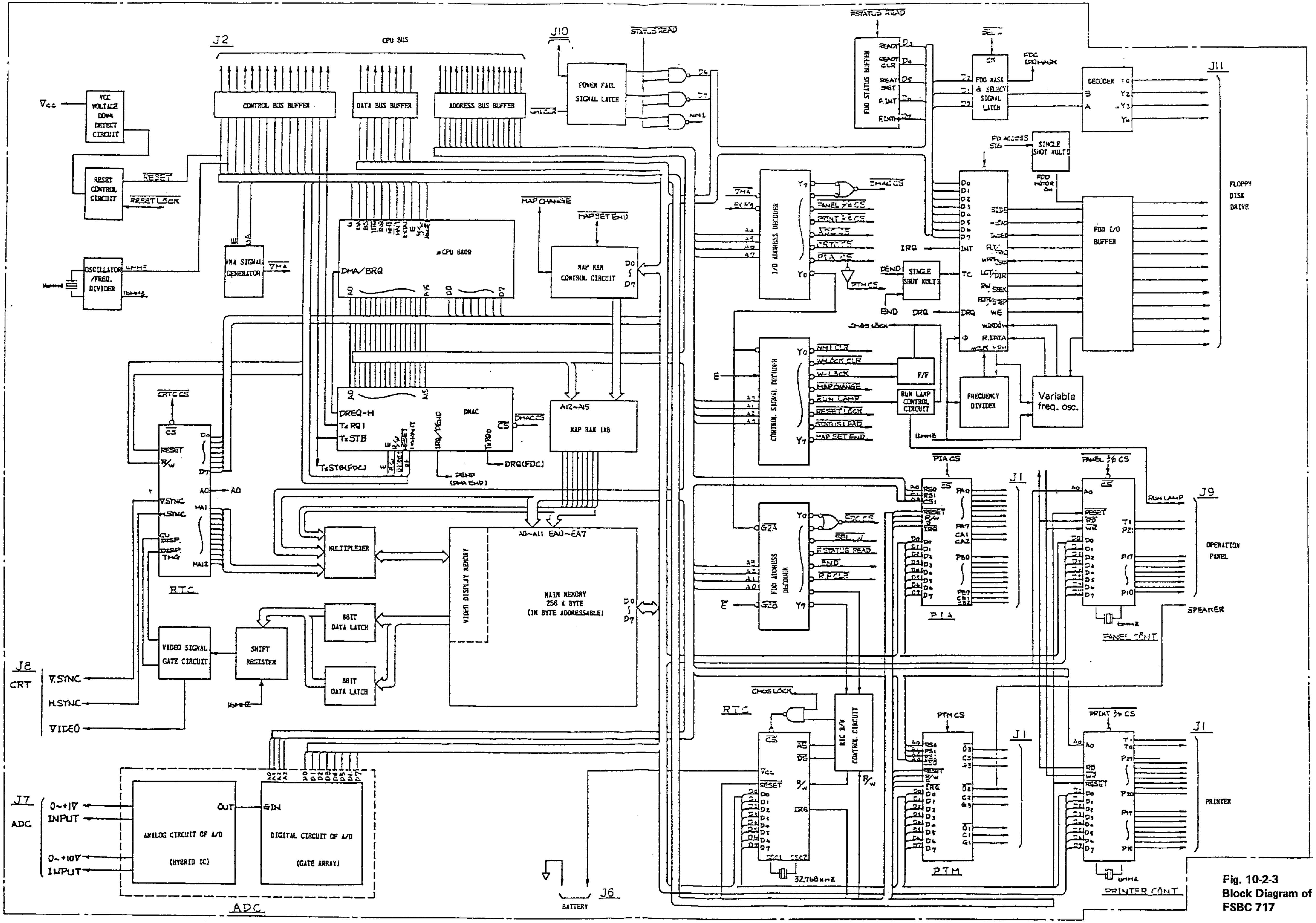


Fig. 10-2-3
Block Diagram of FSBC 717

VFO circuit:

This circuit is used for separating the data and the clock signal from the raw FD read signal.

Floppy disk drive interface:

This circuit controls reading of data from a floppy disk and writing of data on it.
Data are transferred between floppy disk and memory by DMA (Direct Memory Access) method.
This circuit consists of following ICs.
FDD motor on/off timing control (ICK11)
FDD channel select signal latch and decoder (ICN6, N7)
FDD read/write control and head load control (ICM6 FDC)
Signal buffers (ICP4, P5, P7, N9, N10)
Direct memory access control (ICE3 DMAC)

Battery voltage monitor circuit:

This circuit detects voltage level drop of the battery under 3.0 ± 0.2 V.
Normal voltage of the battery is 3.6 ± 0.2 V.

Dynamic RAM address multiplexer:

This circuit switches the address signals from CPU and CRTC, and transfers the address signals to dynamic RAMs.

A/D converter:

This circuit converts analog input signal to digital signal.
This is a dual slope integration A/D converter and consists of a hybrid IC and an exclusive gate-array digital IC.
The number of conversion bits is 12 to 20 and it is software selectable.

Real time clock:

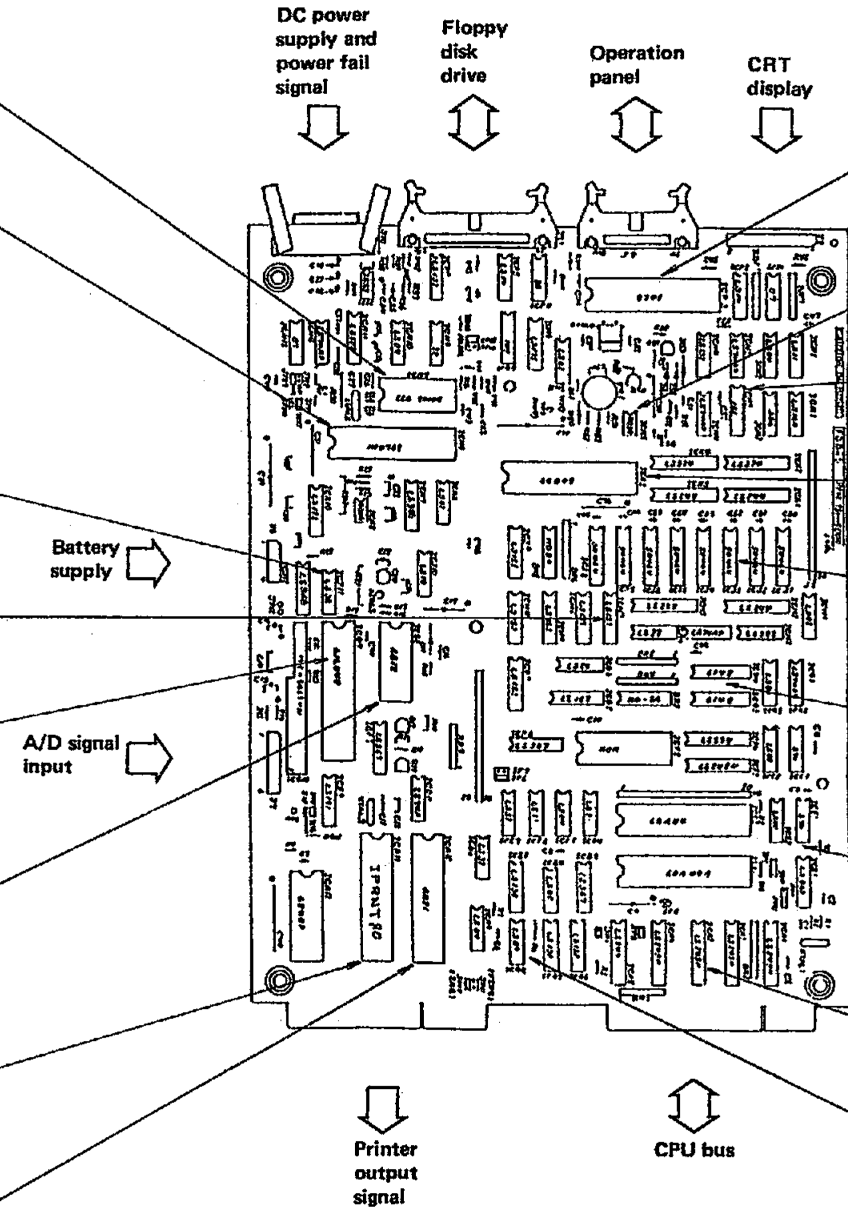
This circuit consists of RTC (ICE8).
It is battery backed-up and works by battery when power is off.

Printer controller:

This circuit controls the data transfer to the printer, and consists of an 8741 single chip micro-computer.
The interface signals of this circuit are compatible with the Centronics interface.

Parallel interface:

This circuit has 16 data lines and 4 control lines, and consists of a 6821 PIA.



Keyboard interface (operation panel interface):

This circuit controls data communication with keyboard (operation panel).
This interface consists of 8741 single chip micro-computer.

Vcc (+5 V) voltage monitor circuit:

This circuit monitors the voltage level of Vcc, and if Vcc goes down under 4.6 V this circuit outputs the reset signal to the CPU.
Adjustment: Set the Vcc to 4.6 V (voltage across the C3), then set the VR1 to the point where the signal between TP2 and TP3 (GND) goes high to low, or low to high.

Dynamic memory refresh signal and CRTC clock signal generator:

This circuit makes the dynamic memory refresh signals and CRTC clock signals from 16 MHz main clock.

CRT display data and timing control circuit:

This circuit controls CRT display data and timing signals.
CRTC (ICK5) also works as a dynamic RAM refresh controller.

Dynamic RAMs:

256 k bytes (CPU) main memories.
Some of these memories are used for CRT display memories.

Memory address extension circuit:

This circuit consists of MAP RAM (ICG3, G4) and MAP change register (ICF4).

Clock signal generator:

This circuit consists of a 16 MHz oscillator (ICB1) and frequency divider (ICC1, D1).
16, 8 and 4 MHz clock signals are supplied from ICB1-pin 5, ICC1-pin 5 and ICD1-pin 5 respectively.

CPU external bus buffer circuit:

This circuit consists of a data buffer (ICA1), address buffers (ICA2, A3) and control signal buffers (ICA4, A5).

I/O address decoder (for peripherals in FSBC):

This circuit consists of LSI device select decoder (ICA6), control signal decoder (ICB5) and FDD I/F address decoder (ICA7).

Fig. 10-2-4 Configuration of FSBC 5

The 6809 CPU has originally a main memory of up to 64 k bytes. However, FSBC is capable of accessing up to 1 M bytes due to use of a memory changeover system.
Fig. 10-2-5 shows this memory extension system. Four lines A12 through A15 of the CPU address are expanded to 8 lines EA12 through EA20 via the conversion memory as shown in Fig. 10-2-5.
According to control signal from CPU, the conversion memory is switched over via the memory selection latch so as to enable accessing up to 1 M bytes.

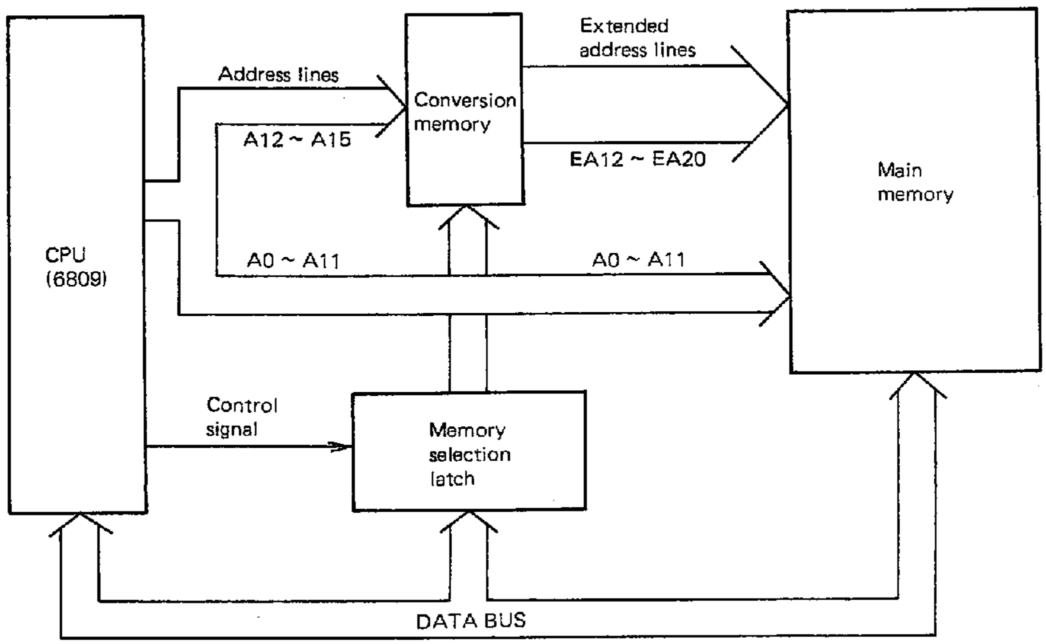


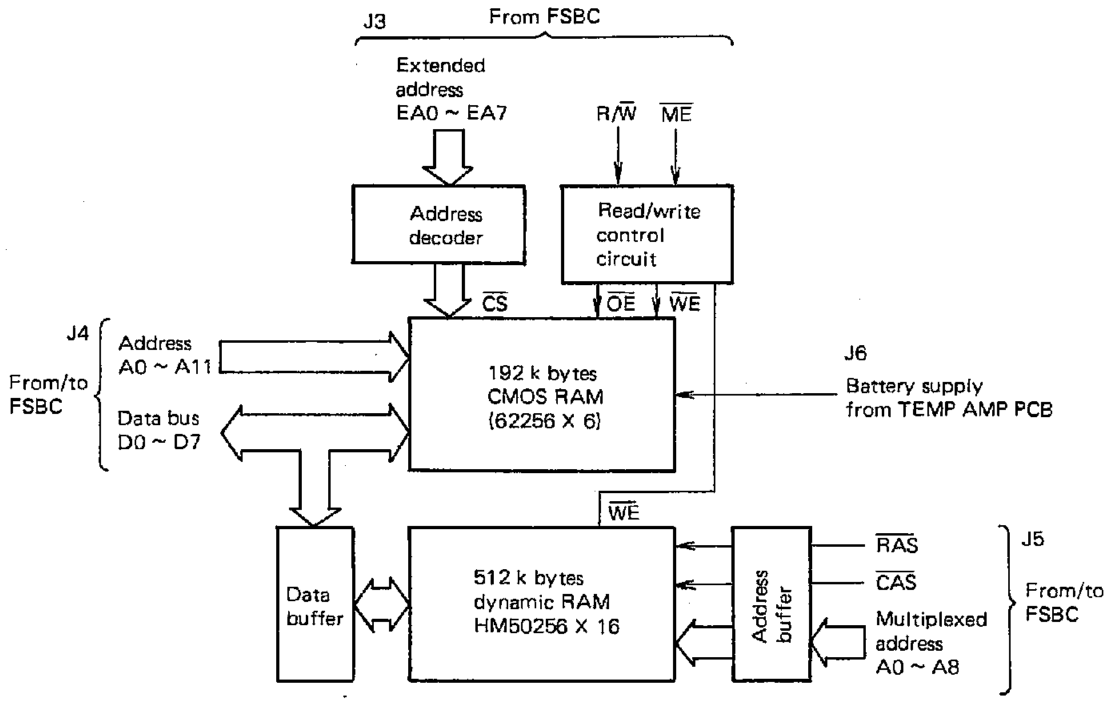
Fig. 10-2-5 Address Extension System in FSBC 717

(3) EXTMEM 717 Printed Circuit Board (extension memory for FSBC)

This board is an extension memory for FSBC, and is mounted on FSBC.

RAM ... Dynamic RAM 512 k bytes (50256 × 16)
CMOS RAM 192 k bytes (62256 × 6, battery backed up)

Fig. 10-2-6 shows the block diagram of this board, and Fig. 10-2-7 shows the IC location of this board.

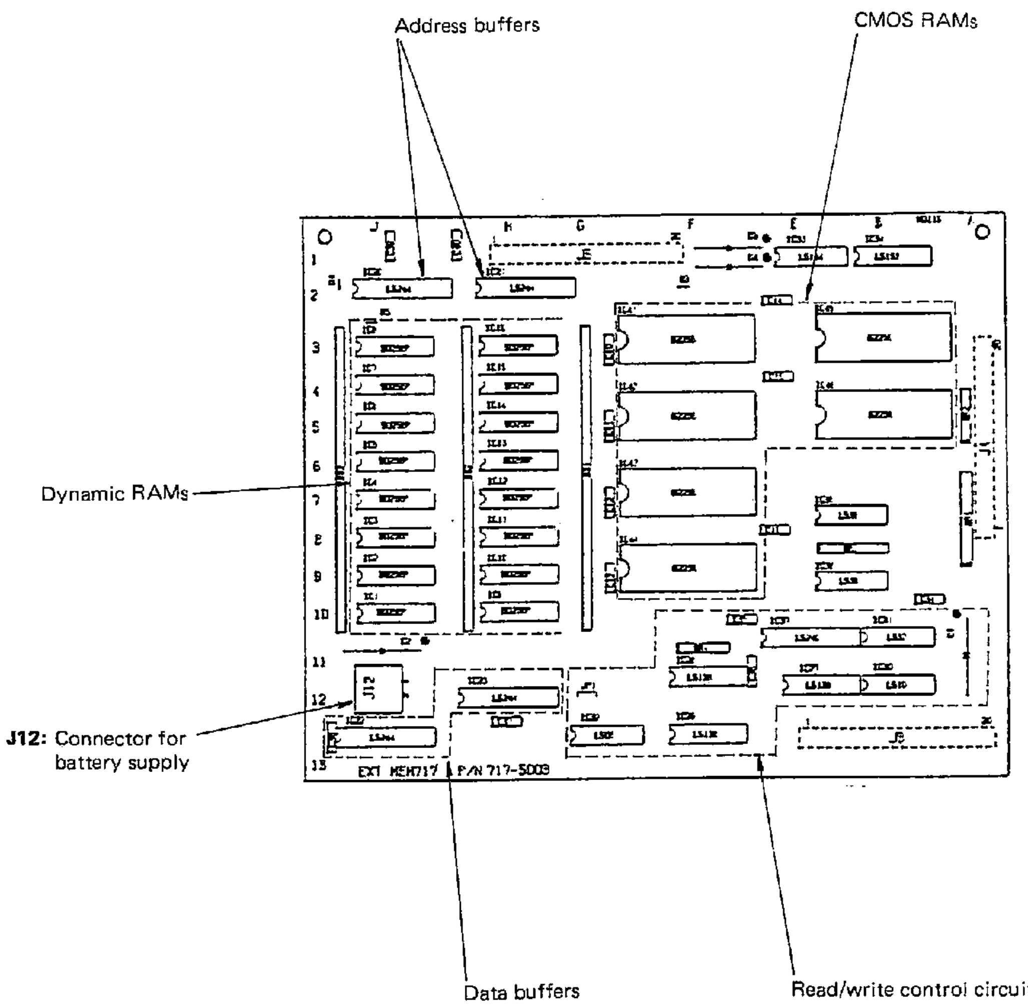


MAP

Block	1 ~ 3F	FSBC DRAM
	40 ~ BF	EXT MEM D RAM
	CO ~ EF	EXT MEM C RAM
	FO ~ FF	FSBC ROM

MAP RAM E400 ~ E7FF MAP Reg.

Fig. 10-2-6 Block Diagram of EXTMEM 717



	704	717
Dynamic RAM	512 k bytes	512 k bytes
CMOS RAM	64 k bytes	192 k bytes

Fig. 10-2-7 Configuration of EXTMEM 717

(4) S.I/F APU Printed Circuit Board

This board has 2 ch S.I/F. (No Data Buffers), 1 ch S.I/F (With Data Buffer), APU, DC Power Fail Detector and Printer Buffer.

(a) 2 ch S.I/F (No Data Buffers)
   1) HX-20
   2) Bar-Code-Reader

(b) 1 ch S.I/F (With Data Buffer)
   This is used for host communication.
   It has 512 K bytes FIFO X 2 and controlled by single chip CPU.

(c) APU
   This is Arithmetic Processing Unit.
   (For floating point calculation)

(d) DC Power Fail Detector
   This is a detector for DC + 12 V (LAMP), +12 V (CRT, FD), + 24 V and ±15 V power fail.

(e) Printer Buffer

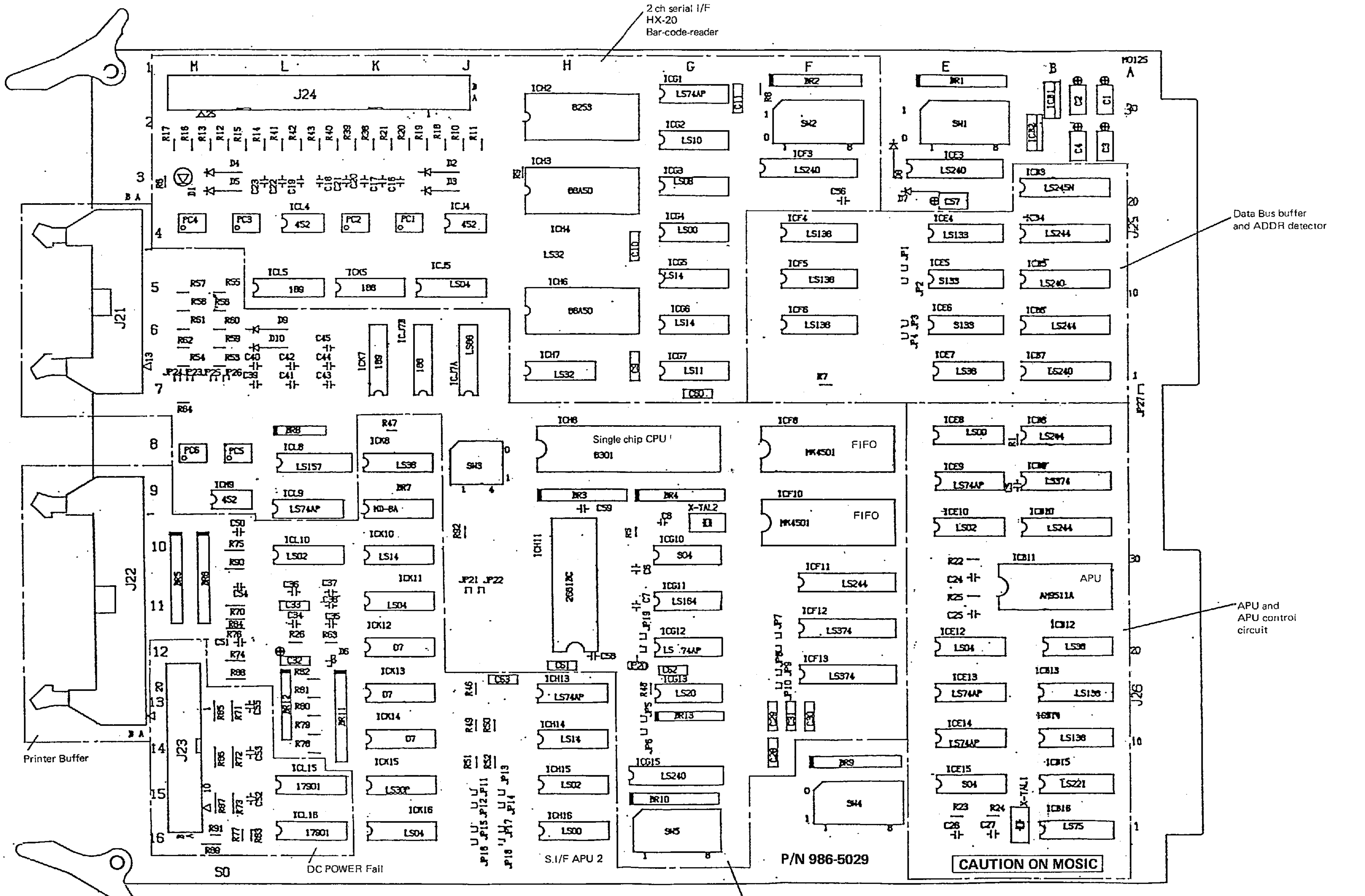


Fig. 10-2-8 Configuration of S.I/F APU 2

(5) TRIADCP 717 Printed Circuit Board

This board contains 3 ch A/D converter, I/O bus I/F circuit for mechanism control, and 20 bit mode selecting switches.

(a) 3 ch A/D Converter

This is a dual slope type A/D converter consisting of a hybrid IC and a gate-array digital IC. The number of conversion bits is 16. It is expandable up to 24 bits.
The Model 717 uses 2 ch of A/D converter for the photometer. Conversion bits are 15 bits and 1 bit is used for overflow.

(b) I/O Bus I/F (low speed bus interface for mechanism control)

This is an exclusive interface circuit for mechanism control. It has input and output lines consisting of 8 bit data/address lines and 8 bit control lines.
These lines are connected to the control printed circuit board in order to interface control signals from CPU.

Fig. 10-2-9 shows the block diagram of this board, and Fig. 10-2-10 shows the configuration of this board.

(6) MOTHER 717

This board is installed in the CPU rack and connects FSBC 5, S.I/F APU 2, TRIADCP 717, MCONT 1, MCONT 2 and ISECONT printed circuit boards with each other.

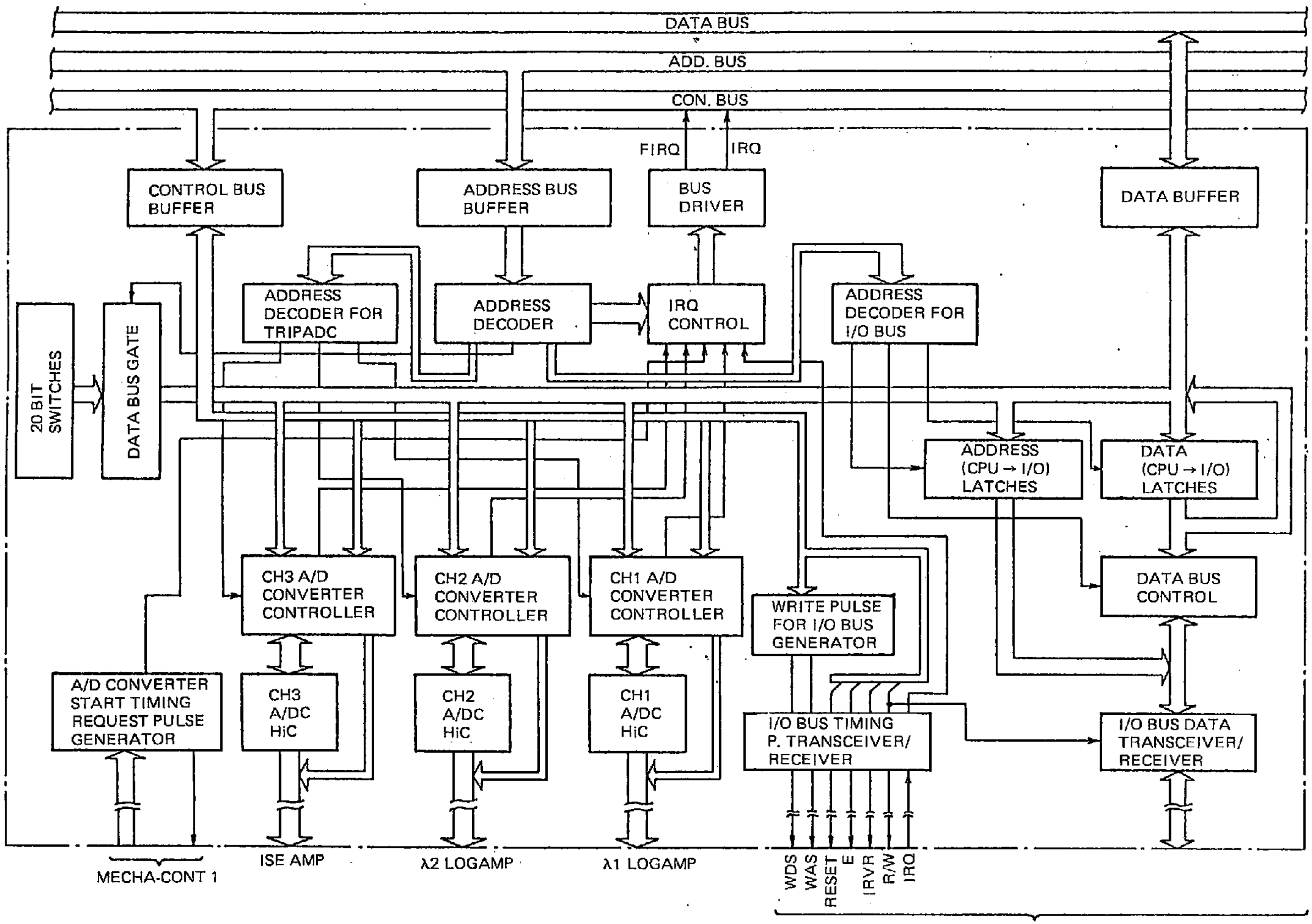


Fig. 10-2-9 Block Diagram of TRIADCP 717

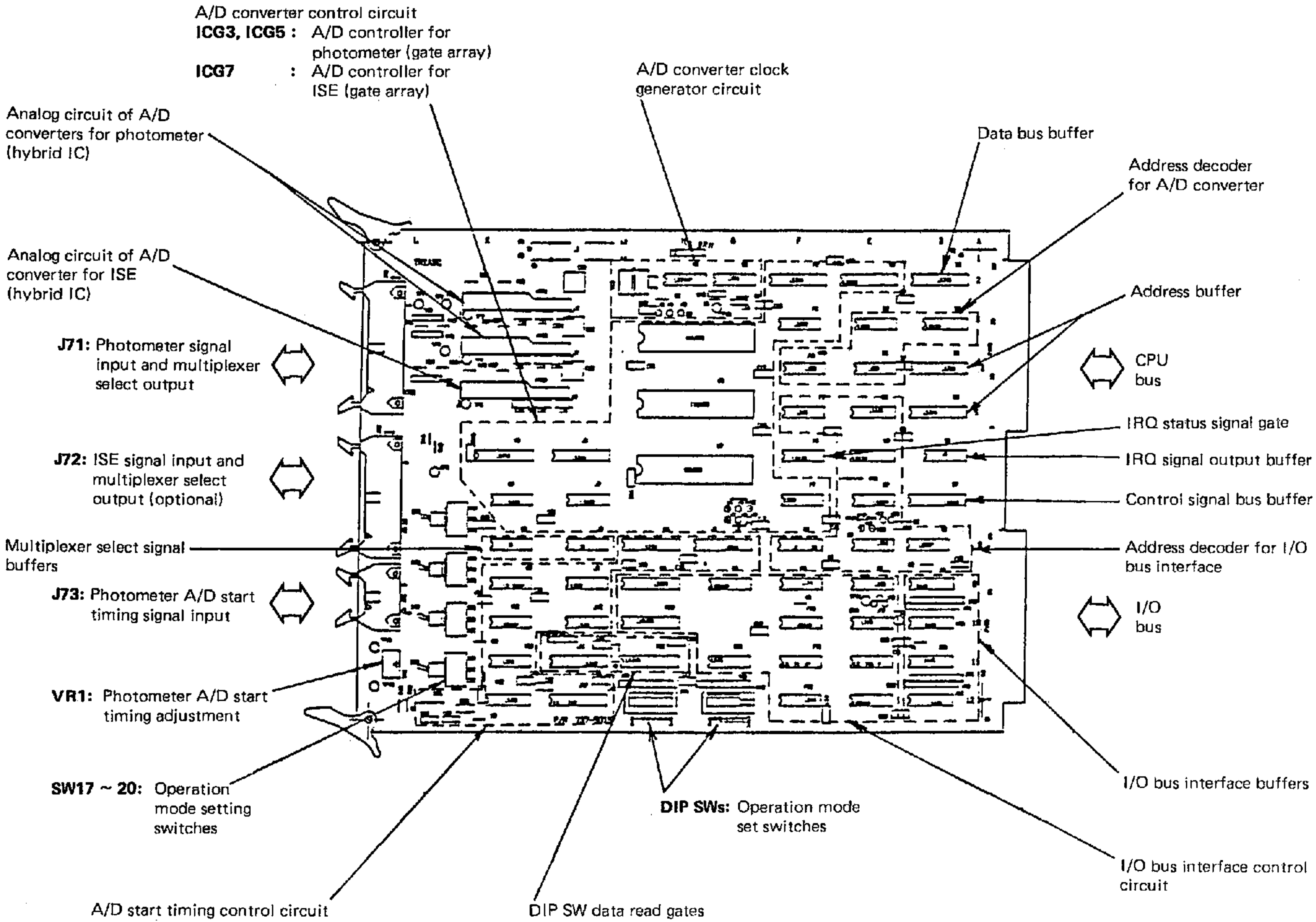


Fig. 10-2-10 Configuration of TRIADCP 717

10-2-3 Control Unit

(1) Outline

This unit controls various mechanisms according to the instructions from the CPU and comprises the following printed circuit boards. These boards are arranged in a PCB rack and PMD rack.

- MCONT 1
- MCONT 2
- ISECONT

— MOTHER 717

- PM DRIVER 1
- PM DRIVER 2

— PM rack

The function of each printed circuit board is described below.

(2) MCONT 1, MCONT 2 Printed Circuit Board

This board controls various I/Os, and consists of 8 single chip micro-computers, D/I, D/O circuits and I/O bus interface. MCONT 1 and MCONT 2 are compatible.

- Single Chip CPUs

  These single chip micro-computers are used for stepping motor controllers and motor controller. Functions of these CPUs depend on internal program. In 717, 3 types of single chip CPUs are used.

(a) APCNT (Advanced Stepping Motor Controller)
APCNT is a high performance stepping motor controller which has slow up/down capability.
This controller can count the sensor input signals and stop the stepping motor by the number of input pulses.

(b) SMCNT (Dual & Constant Speed Stepping Motor Controller)
This is a stepping motor controller which has 2 stepping motor drive outputs. Only constant speed is allowed.
And this controller has 6 input lines which can be used for stepping motor stop signal input.

(c) MTCNT (Motor Controller)
This controller has 8 interruption input lines and the same number of outputs. They can be used as independent inputs and outputs or as stop interruption signals corresponding to each output.

- D/O Circuit

  This circuit is TTL level ON/OFF output circuit, and is composed of latches and buffers.

- D/I Circuit

  This circuit is TTL level status input circuit, and is composed of tri-stage gates.

Inputs and outputs of the MCONT 1 and MCONT 2 printed circuit boards correspond to various mechanisms as listed below.
Fig. 10-2-11 is the block diagram of this board, and Fig. 10-2-12 shows its configuration.

Table 10-2-1

	Control I/O	Use
MCNT 1	APCNT 1-1 (ICJ14)	Up/down movement of serum sampling
	APCNT 1-2 (ICJ12)	Rotation of serum sampling
	APCNT 1-3 (ICJ11)	Rotation of reaction disk
	APCNT 1-4 (ICJ9)	Rotation of sample disk
	APCNT 1-5 (ICJ6)	Rotation of reagent 1 disk
	SMCNT 1-1 (ICJ7)	Serum syringe
		Back and forth movement of stirrer
	SMCNT 1-2 (ICJ5)	(Not used)
	MTCNT 1-1 (ICJ3)	Up/down movement of rinse
MCNT 2	APCNT 2-1 (ICJ14)	Up/down movement of reagent 1 sampling
	APCNT 2-2 (ICJ12)	Rotation of reagent 1 sampling
	APCNT 2-3 (ICJ11)	Up/down movement of reagent 2 sampling
	APCNT 2-4 (ICJ9)	Rotation of reagent 2 sampling
	APCNT 2-5 (ICJ6)	Rotation of reagent 2 disk
	SMCNT 2-1 (ICJ7)	Reagent 1 syringe
		Reagent 2 syringe
	SMCNT 2-2 (ICJ5)	(IS syringe)
	MTCNT 2-1 (ICJ3)	Various pumps
MCNT 1 MCNT 2	D/Os (ICH3, ICH6)	Various solenoid valves
		Rotation of R1 and R2 stirrer rods
		Reaction bath temperature signal MPX select
	D/Is (ICG4)	Various level detections (Reaction bath water, Waste tank liquid, Vacuum tank water, Distilled water, Cold water)
		Abnormal temperature detection (PCB rack, PMD1 radiator, PMD2 radiator)
		Breaker ON detection
		Fuse alarm detection

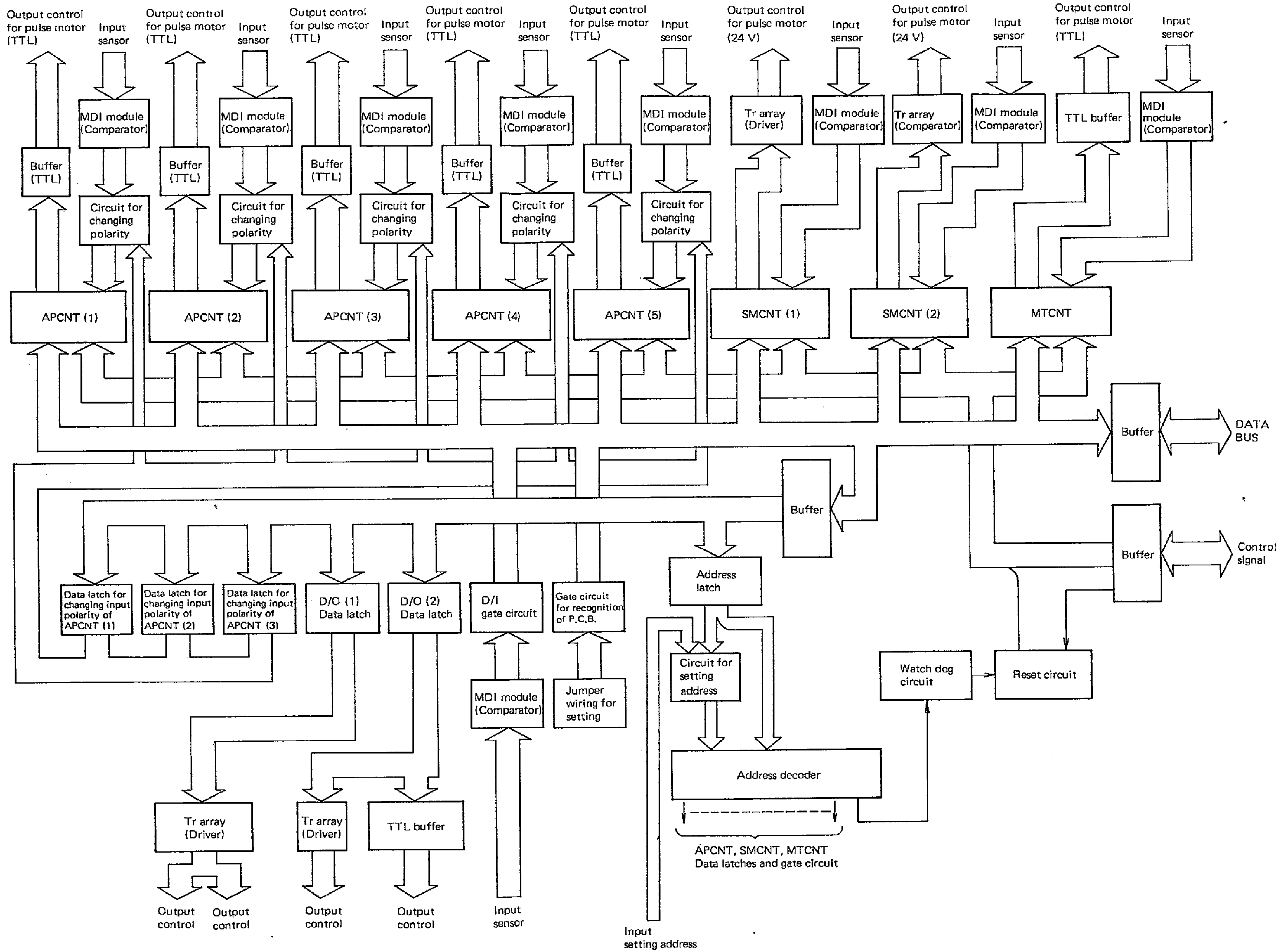


Fig. 10-2-11 Block Diagram of MCONT.

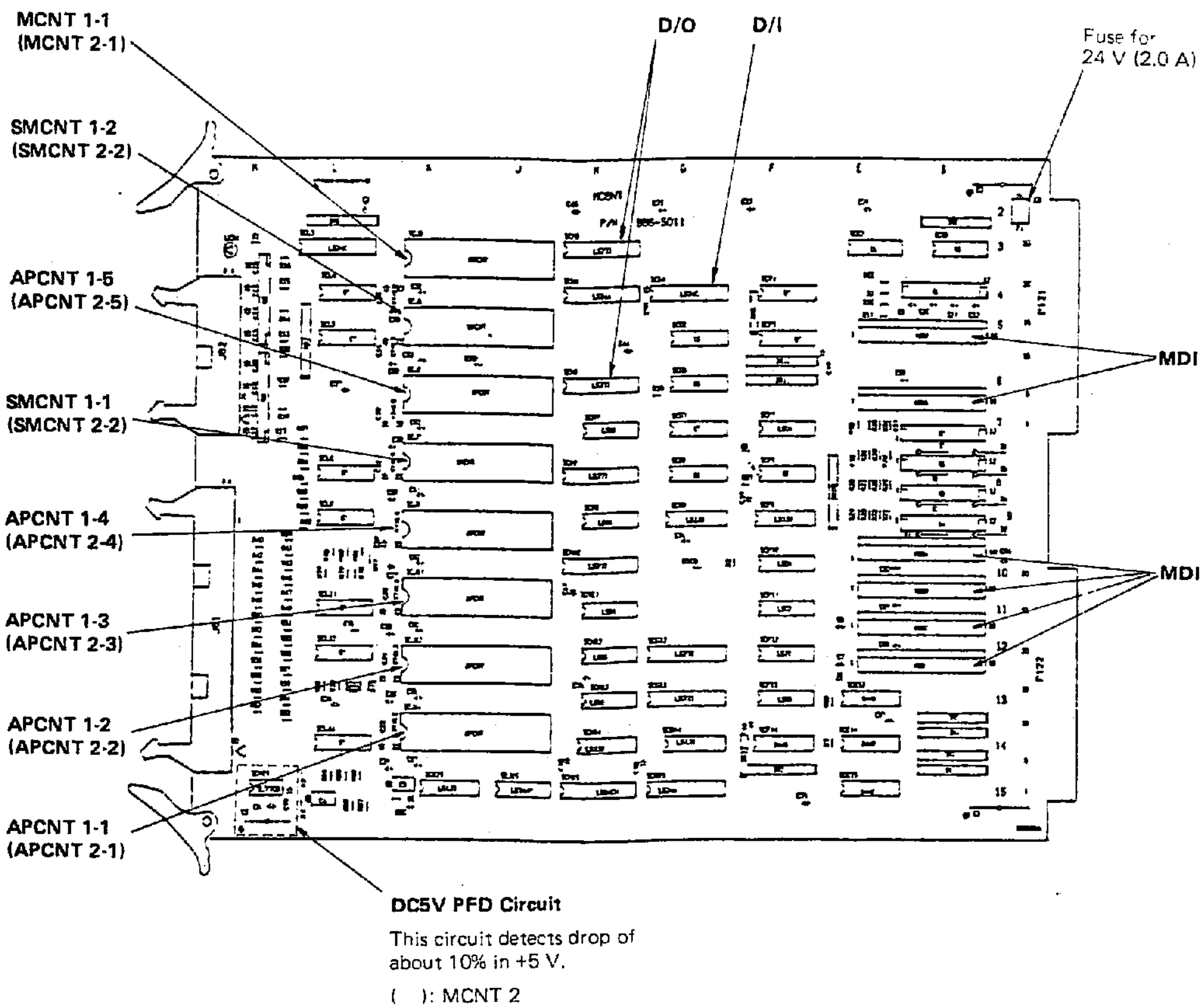


Fig. 10-2-12 Configuration of MCNT 1 (MCNT 2)

MDI (Waveform Shaping Comparator Module)

This module shapes the waveform of input signal from photointerrupters or other sensors. Each module comprises 8 waveform shaping circuits in Fig. 10-2-13.

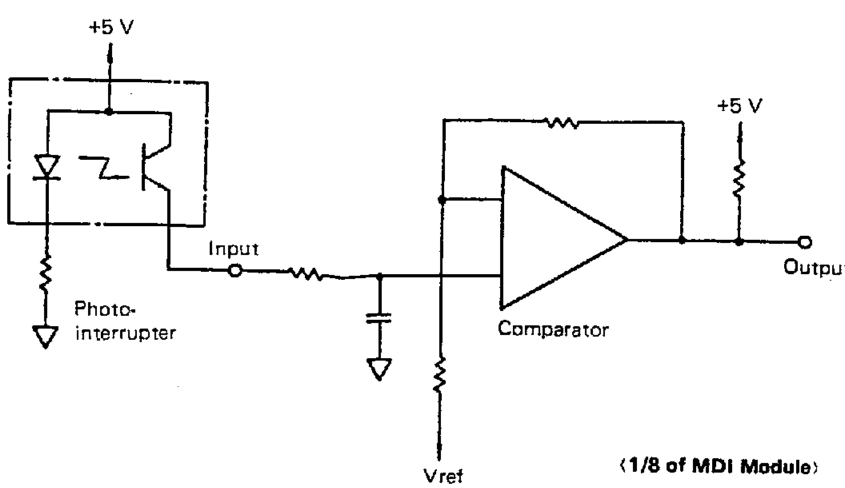


Fig. 10-2-13 MDI Module Circuit

(3) PM DRIVER 1 Printed circuit board

This board has five drive circuits which drive the stepping motors according to the signals from MCONT 1 printed circuit board.
Fig. 10-2-15 shows its configuration.
One 2.0 A fuse is set in +24 V input line for driving module of stepping motor on each module.
In case of burnt FUSE, LED is off for an indication.
Listed below are driving circuits and stepping motors driven by these circuits. Details of each driving circuit are described next to the list.

Table 10-2-2

Stepping Motor Driving Module No.	Use
MOD 1–1	Up/down movement of serum sampling
MOD 1–2	Rotation of serum sampling
MOD 1–3	Rotation of reaction disk
MOD 1–4	Rotation of sample disk
MOD 1–5	Rotation of reagent 1 disk

- PM DRIVER

This circuit is a stepping motor driver of constant current.

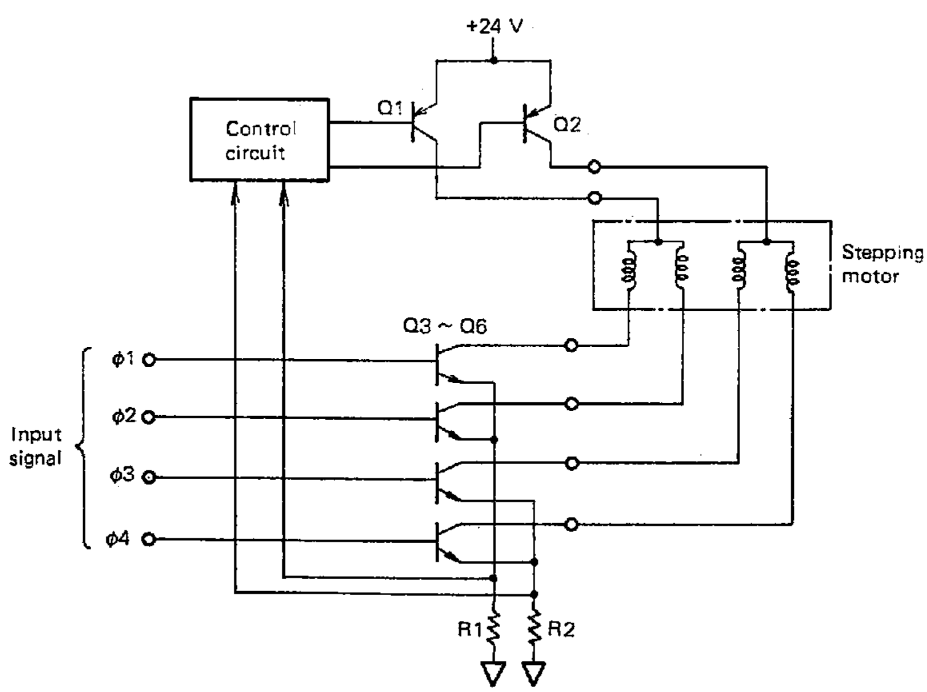
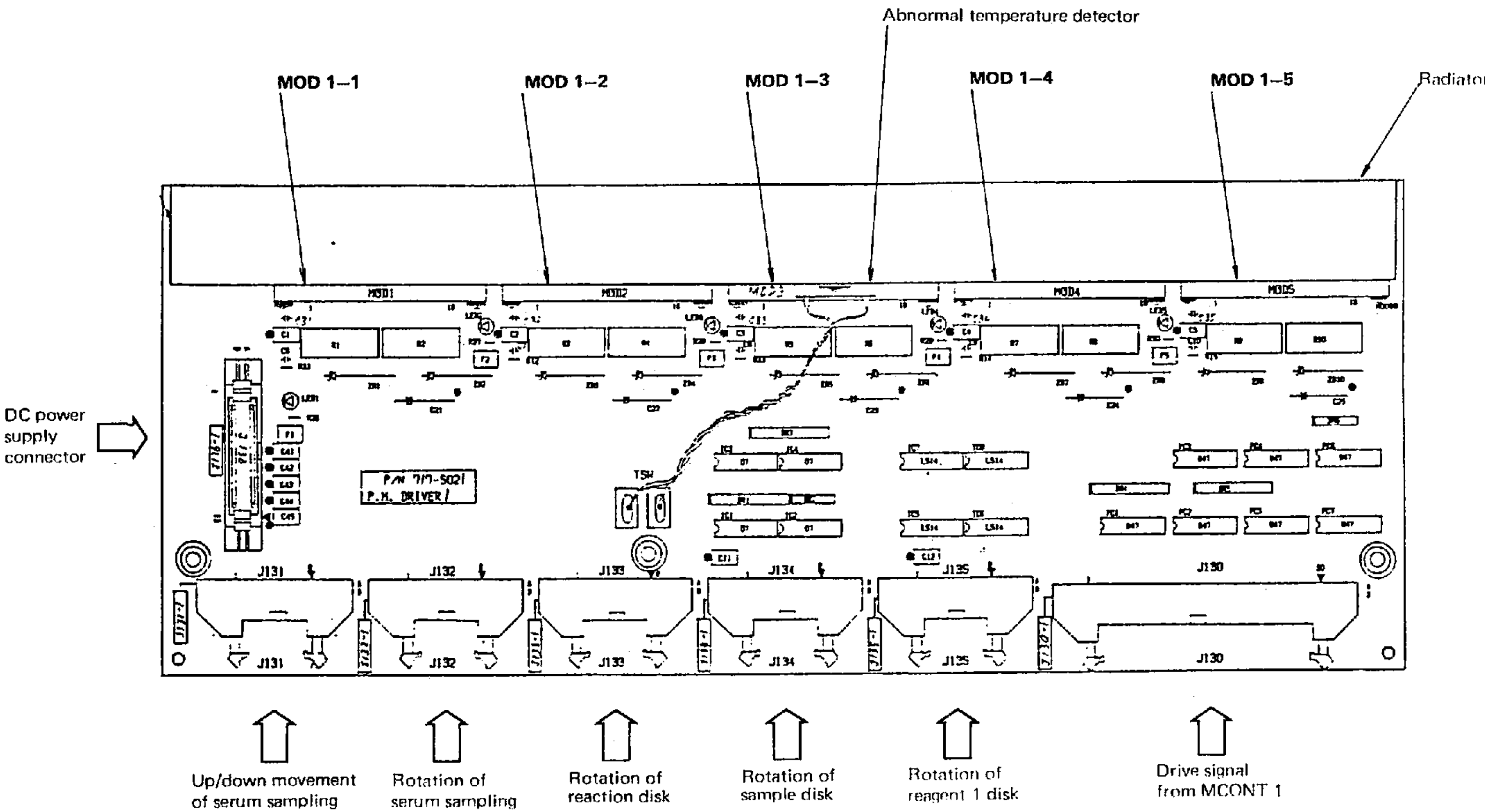


Fig. 10-2-14 PM Driver Circuit

The pulse motor driving circuit is chopped at Q1 and Q2 at a frequency of 25 kHz.
ON period of the transistors Q1 and Q2 is controlled according to feedback signal from R1 and R2 to maintain average current constant.
The PM driver is used in the DIST 717 for the following purposes; rotation of reaction disk, sample disk and sampling arm, and up/down movement of sampling arm.



R11 ~ R15: Output current of each MOD setting VR

Fig. 10-2-15 Configuration of PM DRIVER 1

(4) PM DRIVER 2 Printed circuit board

This PCB has five stepping motor driving circuits, same as PM DRIVER 1.
This PCB drives stepping motor by the signal from MCONT 2.
Fig. 10-2-16 shows its configuration.
The list below shows correspondence between module and stepping motor.

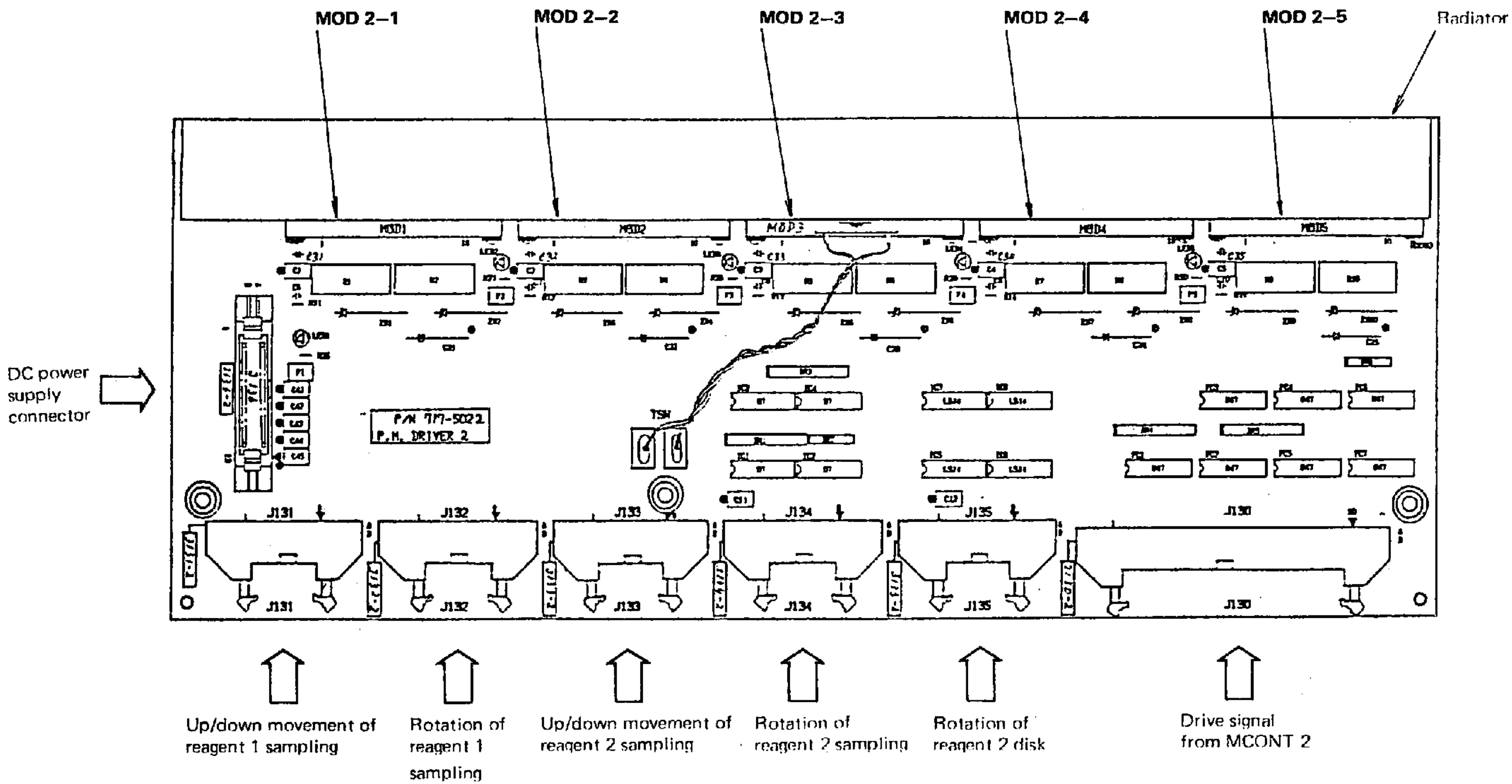
Table 10-2-3

Stepping Motor Driving Module No.	Use
MOD 2–1	Up/down movement of reagent 1 sampling
MOD 2–2	Rotation of reagent 1 sampling
MOD 2–3	Up/down movement of reagent 2 sampling
MOD 2–4	Rotation of reagent 2 sampling
MOD 2–5	Rotation of reagent 2 disk

Output current of PM DRIVER 2 for stepping motor is different from PM DRIVER 1.
Therefore, PM DRIVER 1 and PM DRIVER 2 are not exchangeable.

Table 10-2-4 PM Driver Output Current

MOD No.	PM DRIVER 1	PM DRIVER 2
1	1.0 [A/ϕ]	1.0 [A/ϕ]
2	0.54 [A/ϕ]	0.54 [A/ϕ]
3	0.54 [A/ϕ]	1.0 [A/ϕ]
4	0.77 [A/ϕ]	0.54 [A/ϕ]
5	0.77 [A/ϕ]	0.77 [A/ϕ]



R11 ~ R15: Output current of each MOD setting VR

Fig. 10-2-16 Configuration of PM DRIVER 2

10-2-4 RELAY 2 Printed Circuit Board

This board is composed of 18 AC solid-state relays, and controls AC motors, AC solenoid valves and pumps.
These mechanisms are listed below.

Table 10-2-5

SSR No.	Use
Ry 1	Incubation bath heater
Ry 2	Rinse mechanism up/down
Ry 3	Rinse mechanism break
Ry 4	Stirrer mechanism up/down
Ry 5	Stirrer mechanism break
Ry 6	Water supply pump
Ry 7	Gear pump
Ry 8	Solenoid valve 7
Ry 9	Vacuum pump
Ry 10	Solenoid valve 8
Ry 11	Solenoid valve 30, 31, 33
Ry 12	Solenoid valve 9
Ry 13	Solenoid valve 20
Ry 14	Solenoid valve 21
Ry 15	Solenoid valve 52
Ry 16	Solenoid valve 32
Ry 17	Solenoid valve 16
Ry 18	Incubation water

Only Ry 1 is a 20 A SSR, and others are 3 A SSRs.
Configuration of this board is illustrated in Fig. 10-2-17.

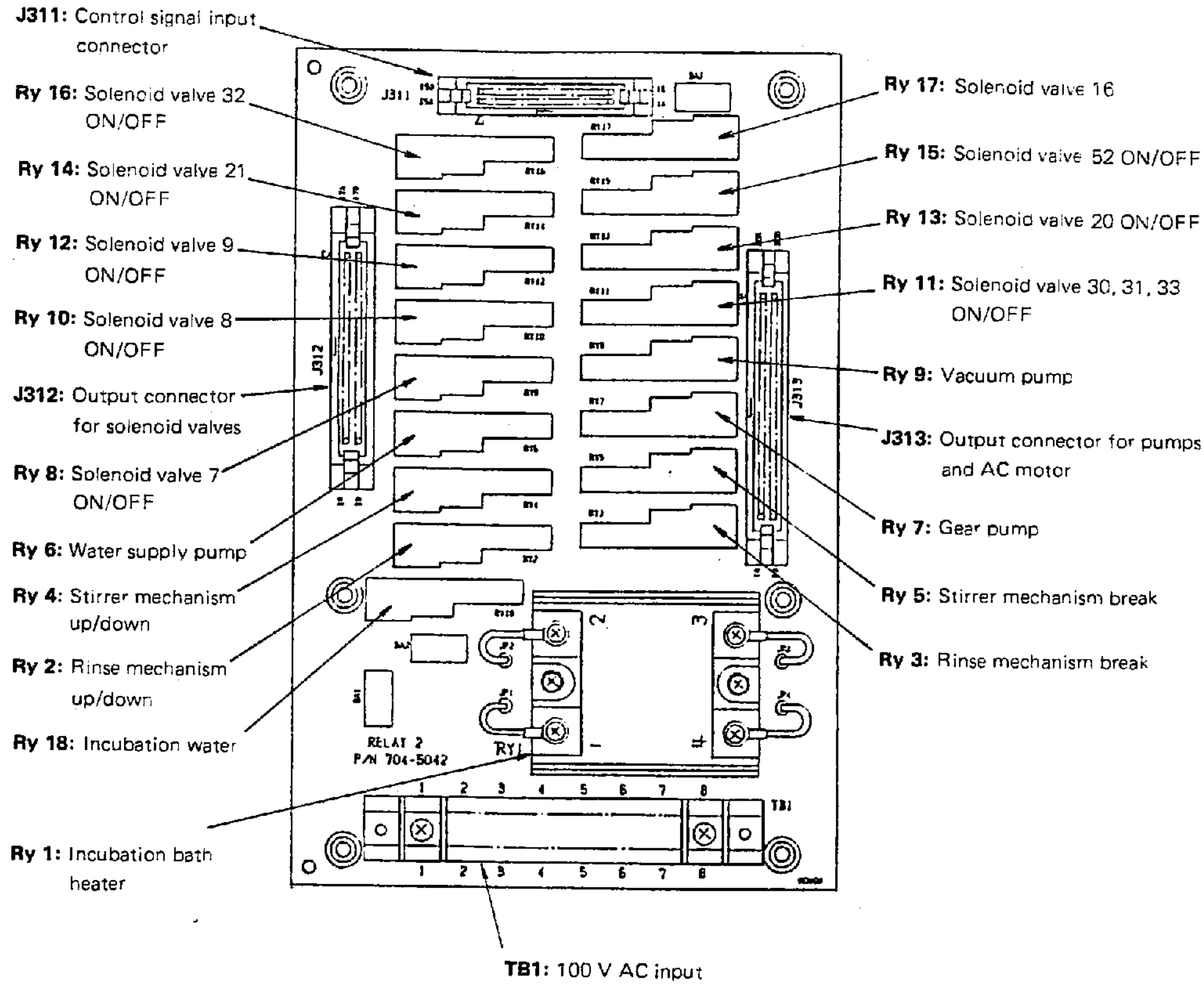


Fig. 10-2-17 Configuration of RELAY 2

10-2-5 TEMP AMP Printed Circuit Board

This board consists of 2 ch of preamplifier and constant current circuit, reference voltage for A/D calibration, reference voltage for 37, 30, 25° C control, comparator, multiplexer and buffer amplifier. This board also has 5 V power fail detector and battery for CMOS RAMs and real time clock.

One of temperature sensor inputs is for incubation bath temperature sensor, and the other is for ISE unit temperature sensor.

Temperature sensor signals detected by Pt sensors are amplified in this board and A/D converted in FSBC. From these signals, this board controls the heater on/off so as to keep incubation bath temperature constant.

Temperature signal output 0 V of this board corresponds to 0° C, and 10 V to 40° C.

Fig. 10-2-18 is the block diagram of this board, and Fig. 10-2-19 shows its configuration.

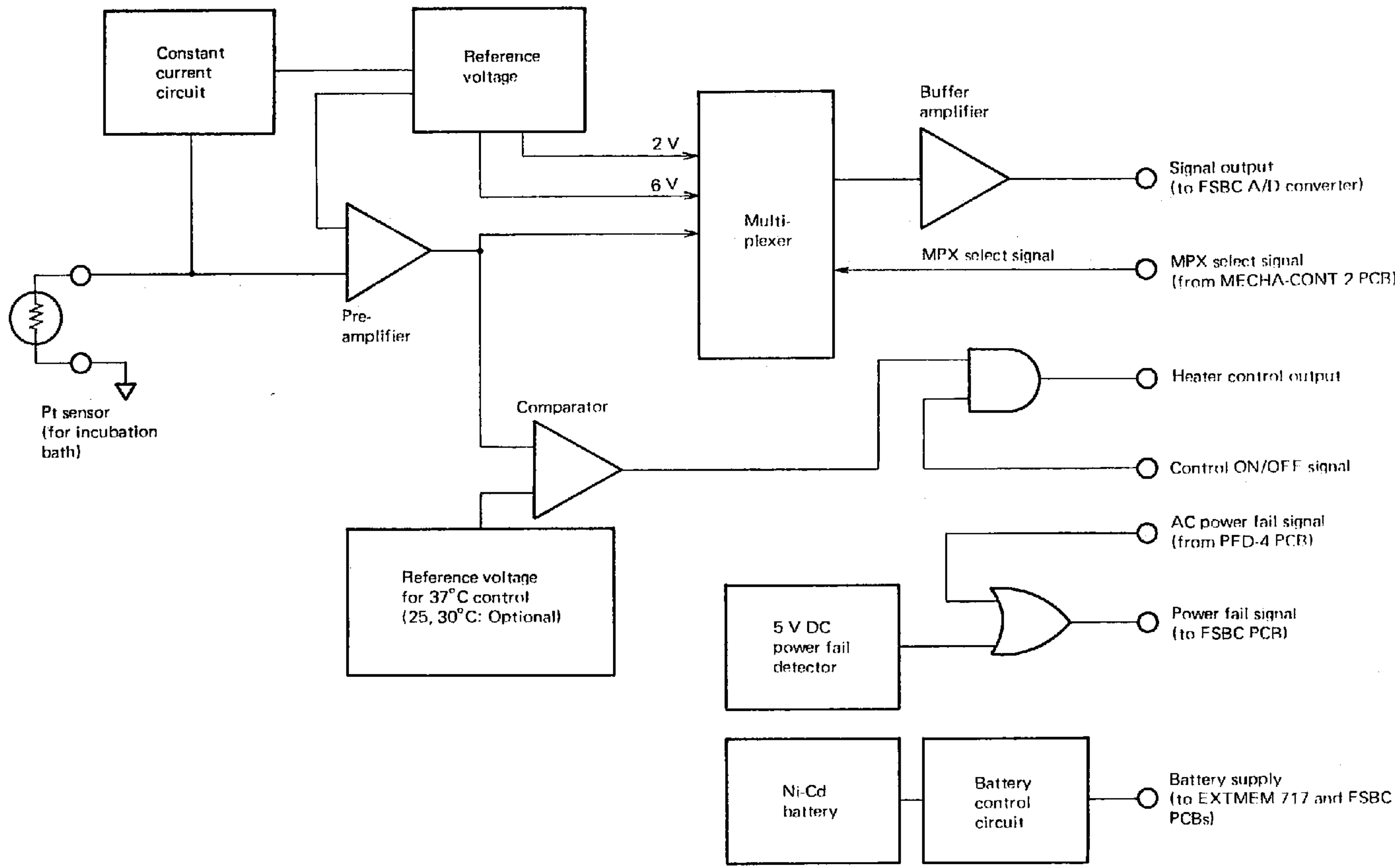
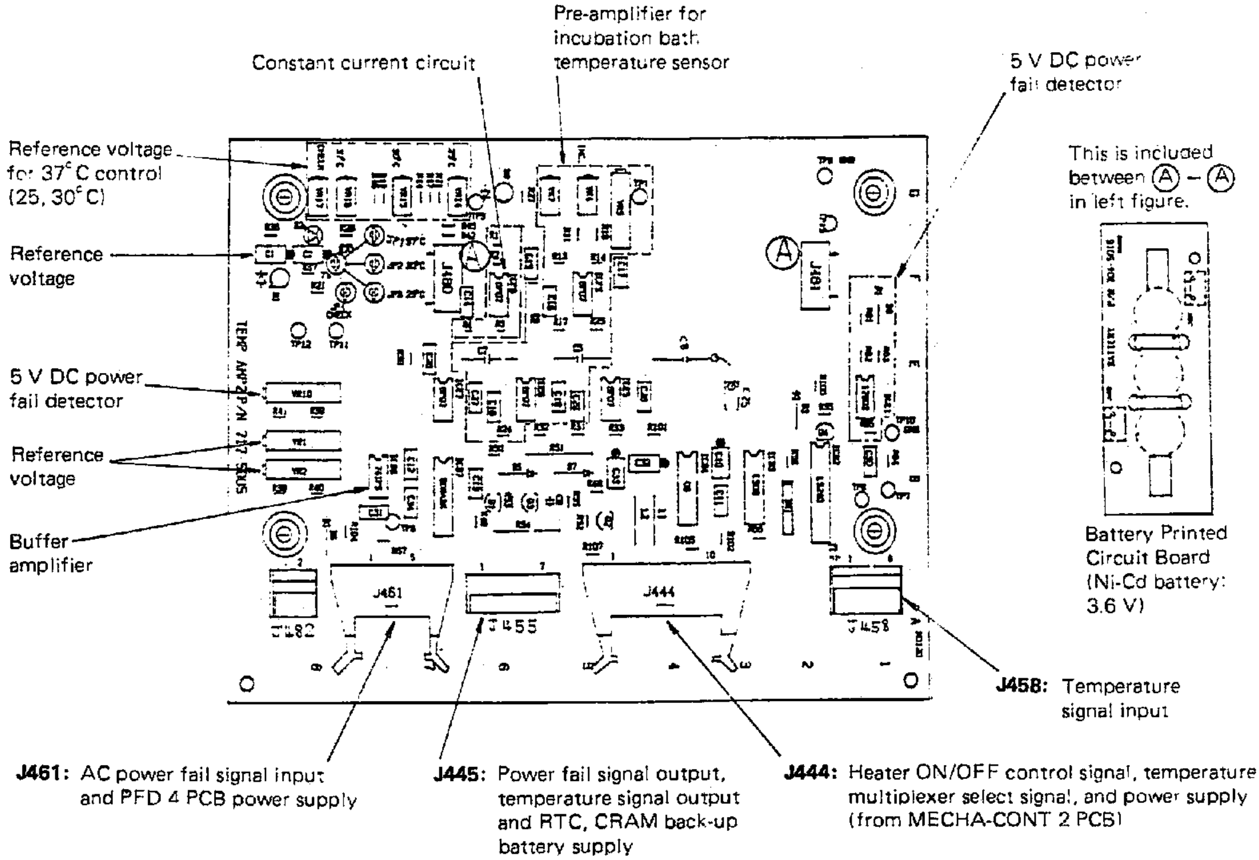


Fig. 10-2-18 Block Diagram of TEMP AMP



VR No.	Function
VR1	Reference voltage for A/D calibration (2 V) adjustment
VR2	Reference voltage for A/D calibration (6 V) adjustment
VR3	Incubation bath temperature pre-amp offset adjustment (coarse)
VR4	Incubation bath temperature pre-amp offset adjustment (fine)
VR5	
VR6	
VR7	Incubation bath temperature pre-amp gain adjustment
VR8	
VR10	5 V DC power fail detect level adjustment
VR11	
VR12	
VR13	
VR14	Incubation bath temperature adjustment (25°C)
VR15	Incubation bath temperature adjustment (30°C)
VR16	Incubation bath temperature adjustment (37°C)
VR17	Check

Fig. 10-2-19 Configuration of TEMP AMP

10-2-6 LOG AMP 717 Printed Circuit Board

The LOGAMP 717 circuit board is configured as shown in Fig. 10-2-20 and Fig. 10-2-21. It consists of 12 log amplifiers corresponding to respective wavelengths, 2 multiplexers and 2/6 V reference voltages for A/D converter calibration.

A simultaneous dual wavelength photometry is enabled by use of two multiplexers on this board and two A/D converters on the TRIADCP 717 circuit board.

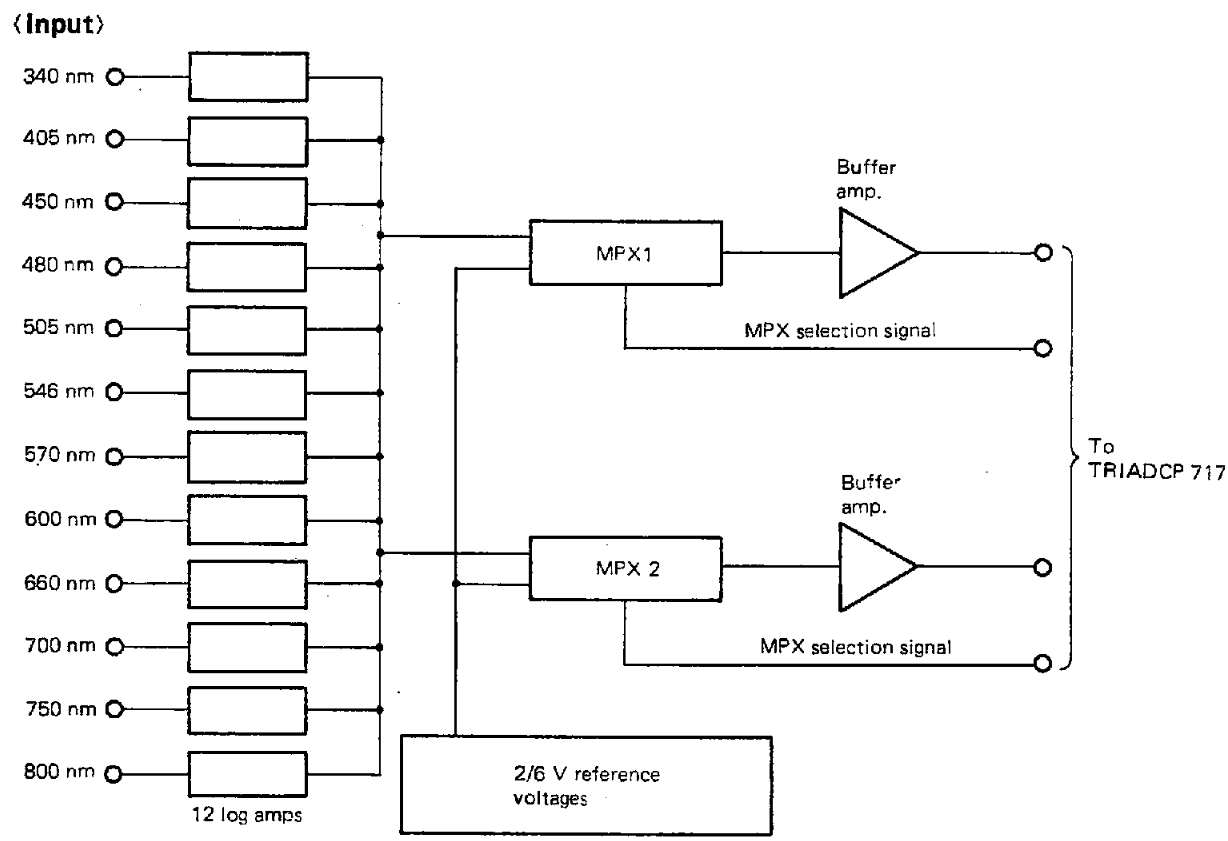


Fig. 10-2-20 Block Diagram of LOGAMP 717

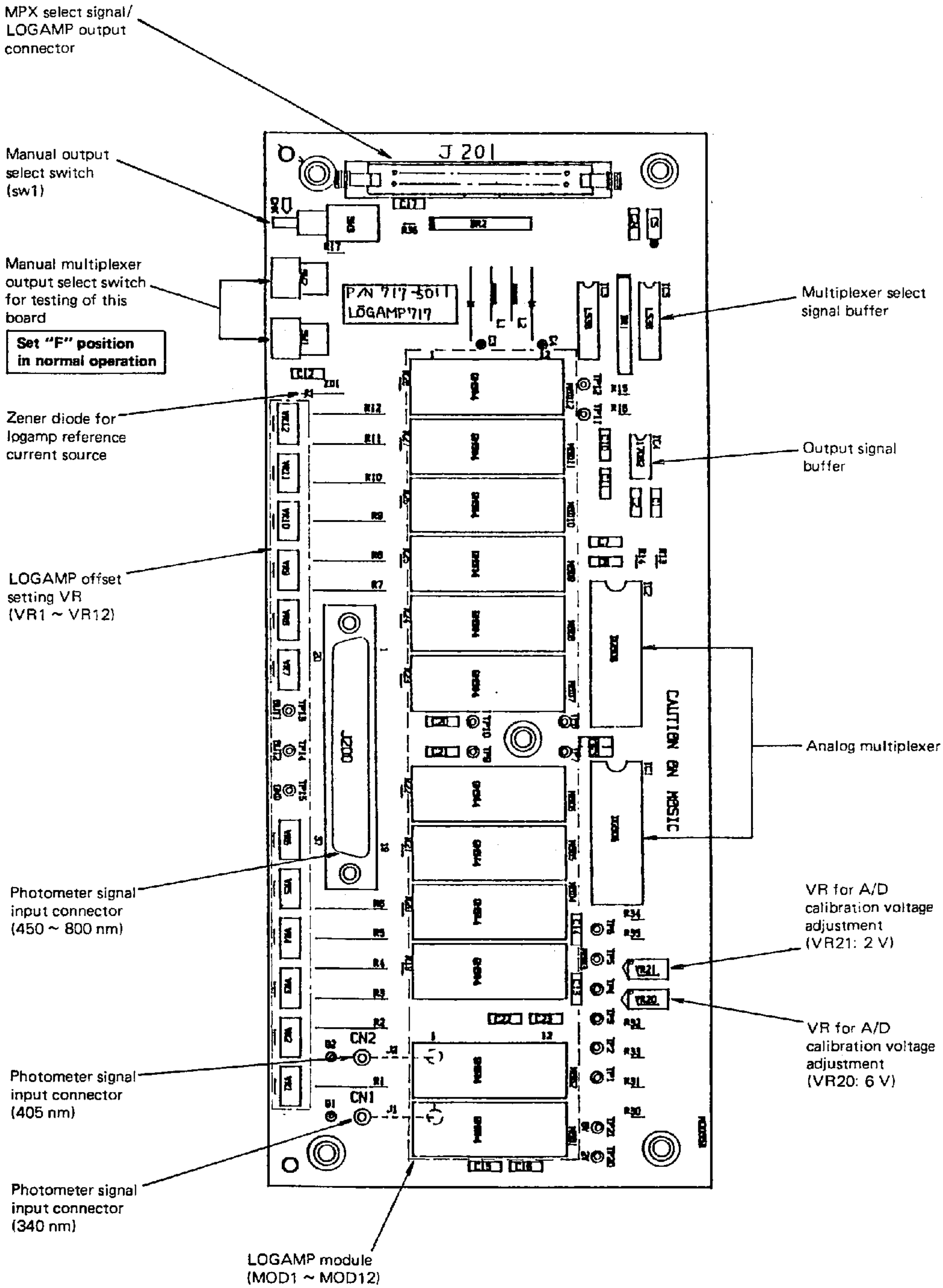


Fig. 10-2-21 Configuration of LOGAMP 717

10-2-7 PFD 5 Printed Circuit Board

This board detects about a 15 % AC line voltage drop or more than 18 msec of blackout, and sends the power fail signal to the CPU.
This board consists of rectifier, comparator, photo-coupler for isolation and single-shot multivibrator.
Fig. 10-2-22 is the block diagram of this board and Fig. 10-2-23 shows its configuration.

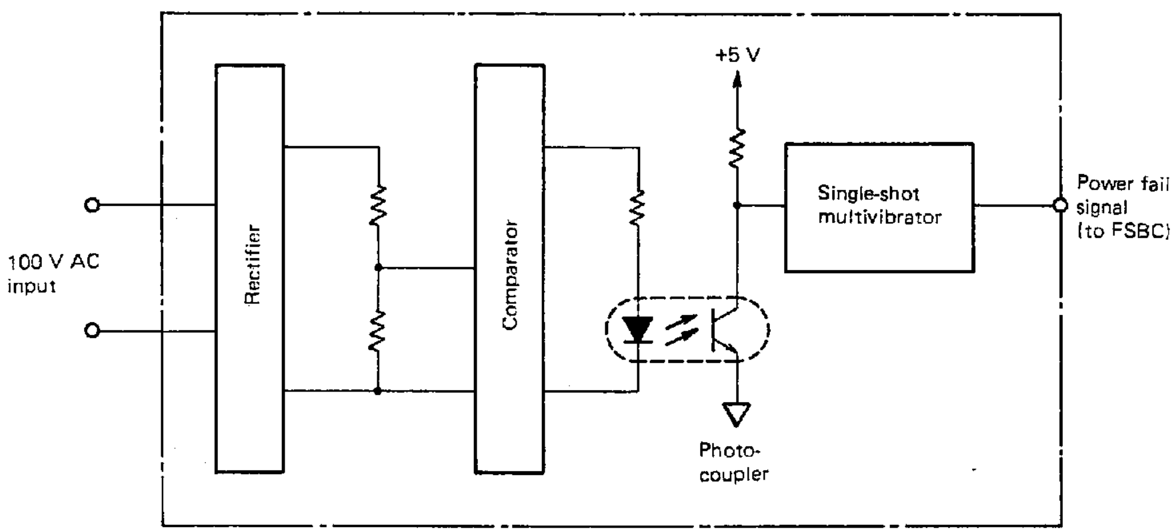


Fig. 10-2-22 Block Diagram of PFD 5

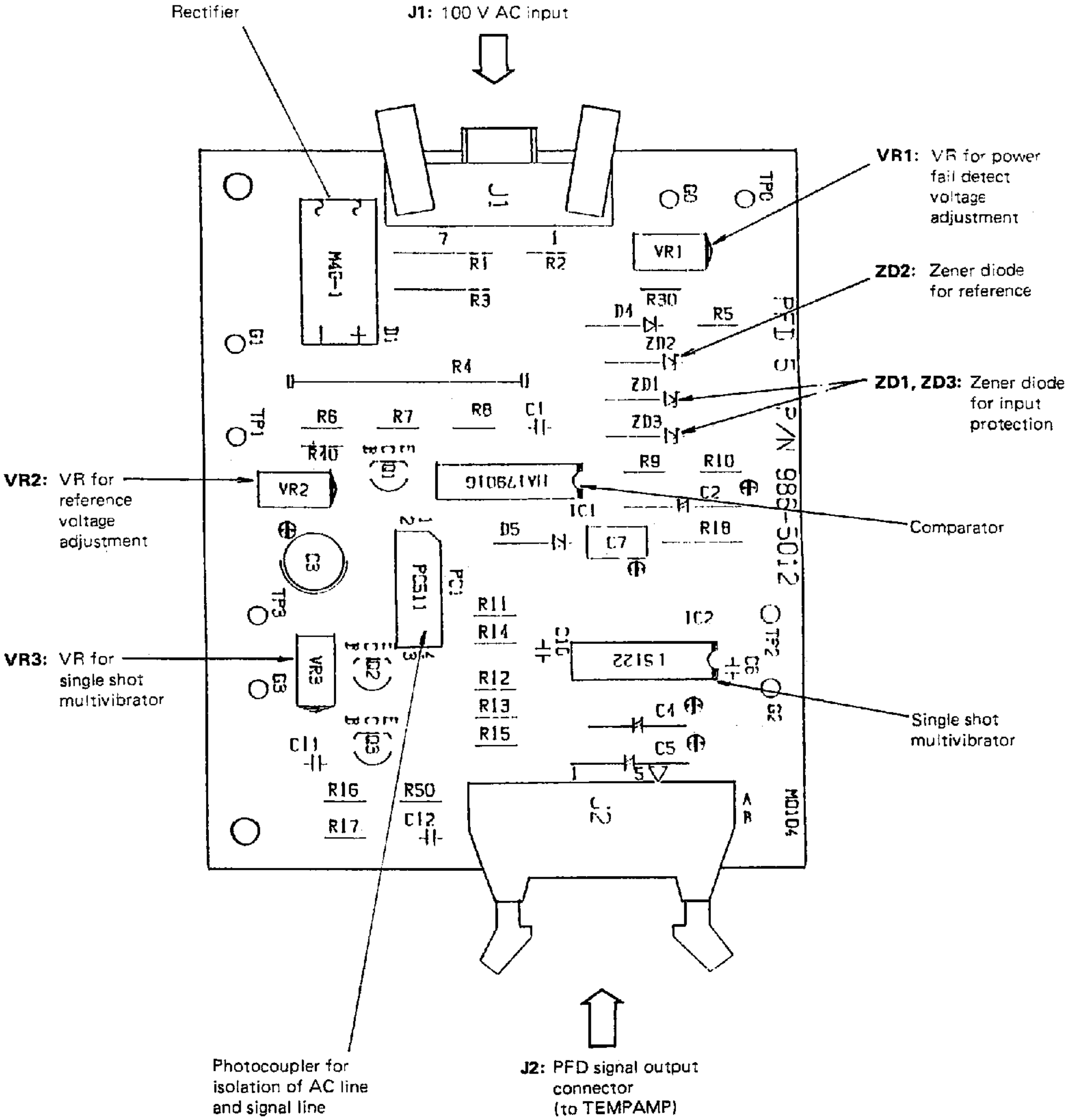


Fig. 10-2-23 Configuration of PFD5

10-2-8 DIST 717 Printed Circuit Board

This PCB has the following functions;

Drive circuit: To drive mechanism by control signal coming from MCONT PCB.
Detect circuit for liquid level sensor.
Distribution of signals.

For details of connectors, refer to the list below.
Fig. 10-2-24 shows its configuration.

Table 10-2-6

Connector No.	Use
J300	Input/output of control signal
J301	Input/output of control signal
J302	Output for ISE
J303	DC power supply
J320	Various detection for reaction disk
J321	Various detection for sample disk
J322	Various detection for serum sampling
J323	Various detection for reagent 1 disk
J324	Various detection for reagent 1 sampling
J325	Various detection for reagent 2 disk
J326	Various detection for reagent 2 sampling
J327	Input signal of syringe (serum, reagent 1, reagent 2)
J328	Various detection for rinse mechanism
J329	Detection of stirrer
J330	Output for ISE syringe (sipper, dilution and I.S)
J331	Various detection for ISE
J332	Various detection for liquid level, degasser and vacuum pressure
J333	Input signal for various detection
J334	Output for rinse and stirrer mechanism
J335	DC power for tempamp
J336	Output for barcode reader
J340	(Optional)

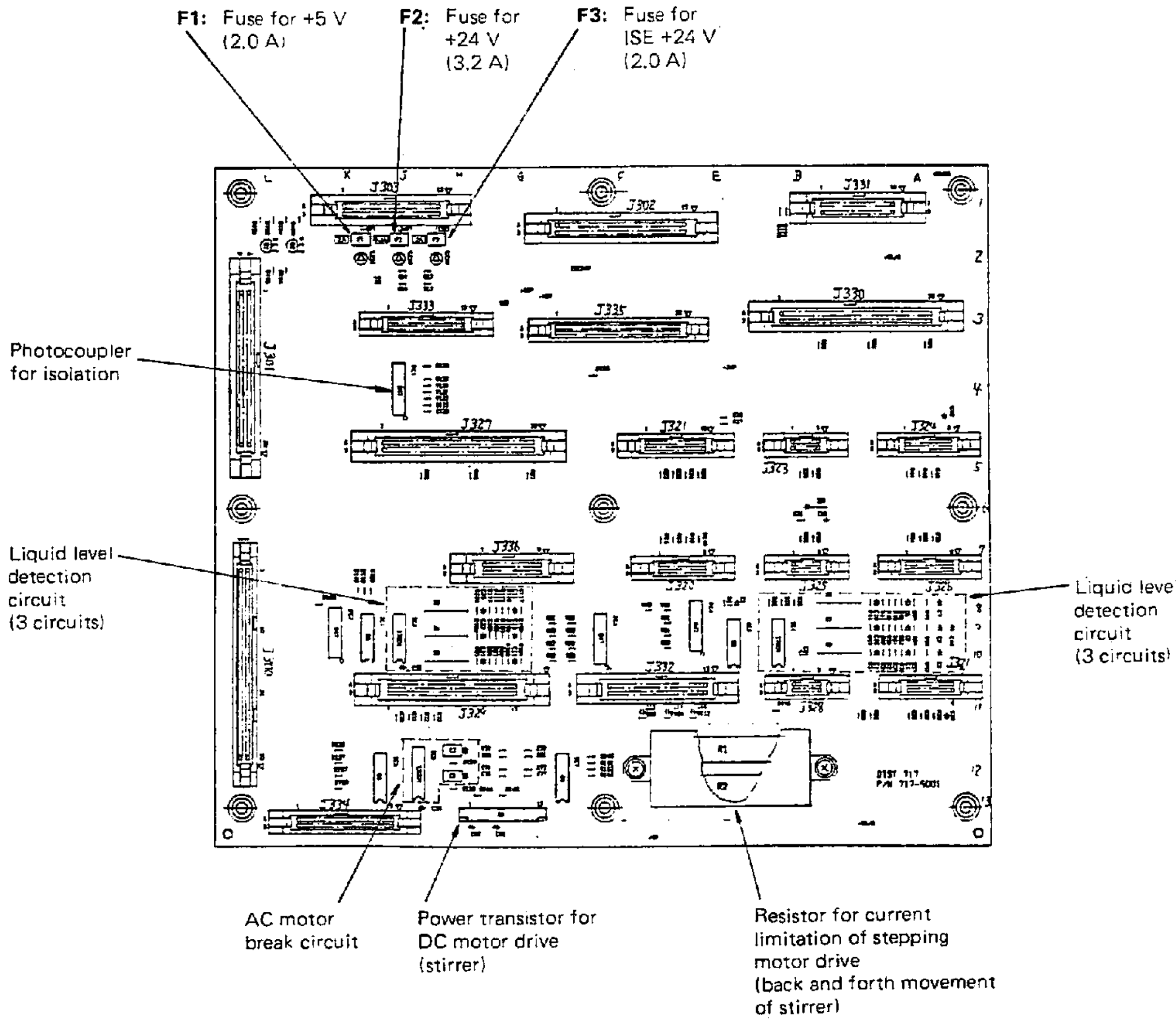


Fig. 10-2-24 Configuration of DIST 717

- Liquid Level Detection Circuit

  The liquid level detection circuit is shown in Fig. 10-2-25. This circuit utilizes a fluid resistance. Input lines for serum pipettor and sample pipettor are protected from static electricity via the SPRO 3 printed circuit board.

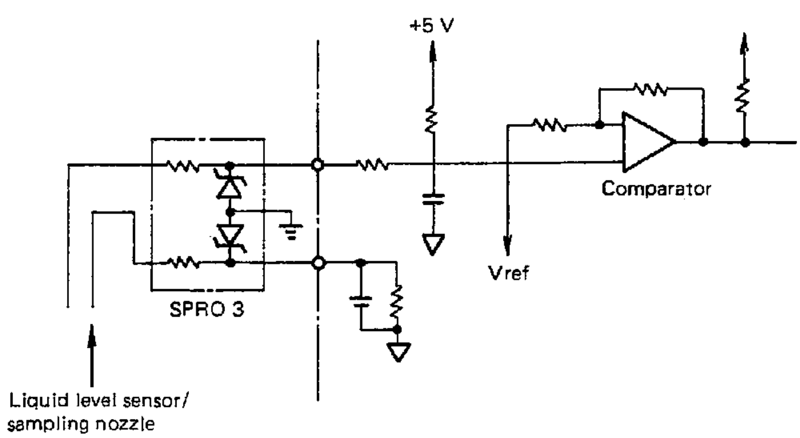


Fig. 10-2-25 Liquid Level Detection Circuit

10-2-9 ACMCNT Printed Circuit Board

This PCB is a brake circuit for AC motor of rinse and stirrer ASSY.
This PCB makes a half-wave rectification on a reverse current for rotation from RELAY 2 PCB, and applies the brake to AC motor by sending that current.
The time of braking is set by both C2 and R128 or both C1 and R125 in AC motor brake circuit on DIST 717 PCB.
The parts used are shown below.

Table 10-2-7

Parts of DIST 717	Parts of RELAY 2	Parts of ACMCNT	Use
C1: 10 μF	Ry 3	R1: 47 kΩ	AC motor for rinse
R126: 56 kΩ	Ry 3	D1, D2: U05G	
C2: 10 μF	Ry 5	R2: 47 kΩ	AC motor for stirrer
R128: 56 kΩ	Ry 5	D3, D4: U05G	

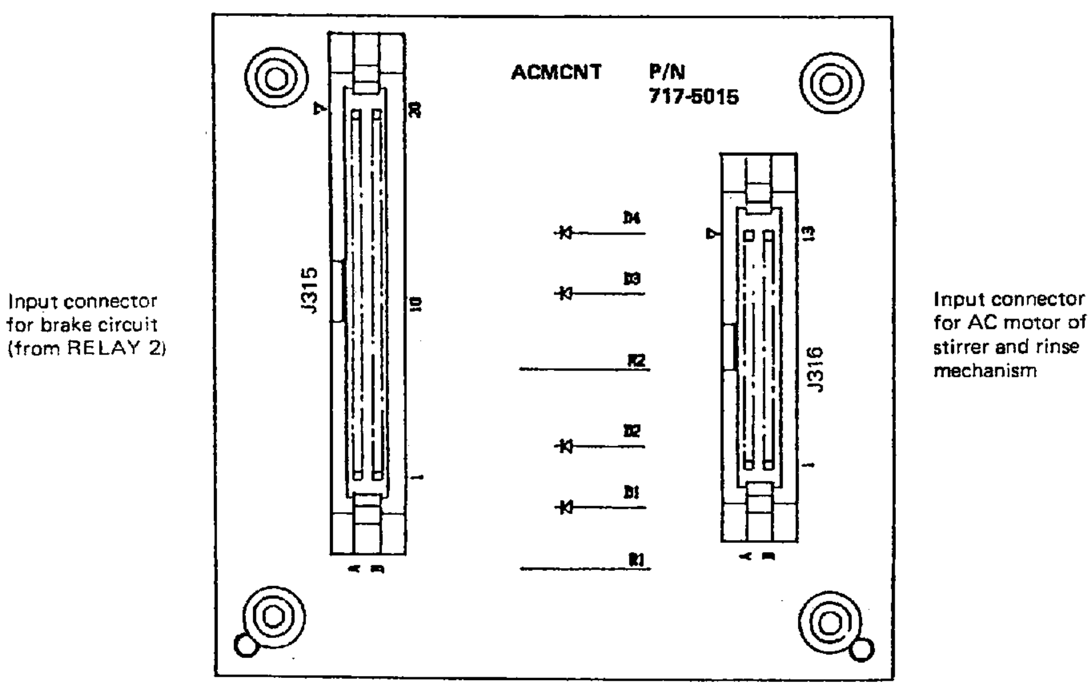


Fig. 10-2-26 Configuration of ACMCNT

10-2-10 S.AB Printed Circuit Board

The purpose of this PCB is to reduce impulse noise incoming from AC 100 V. Fig. 10-2-27 shows the configuration of S.AB.

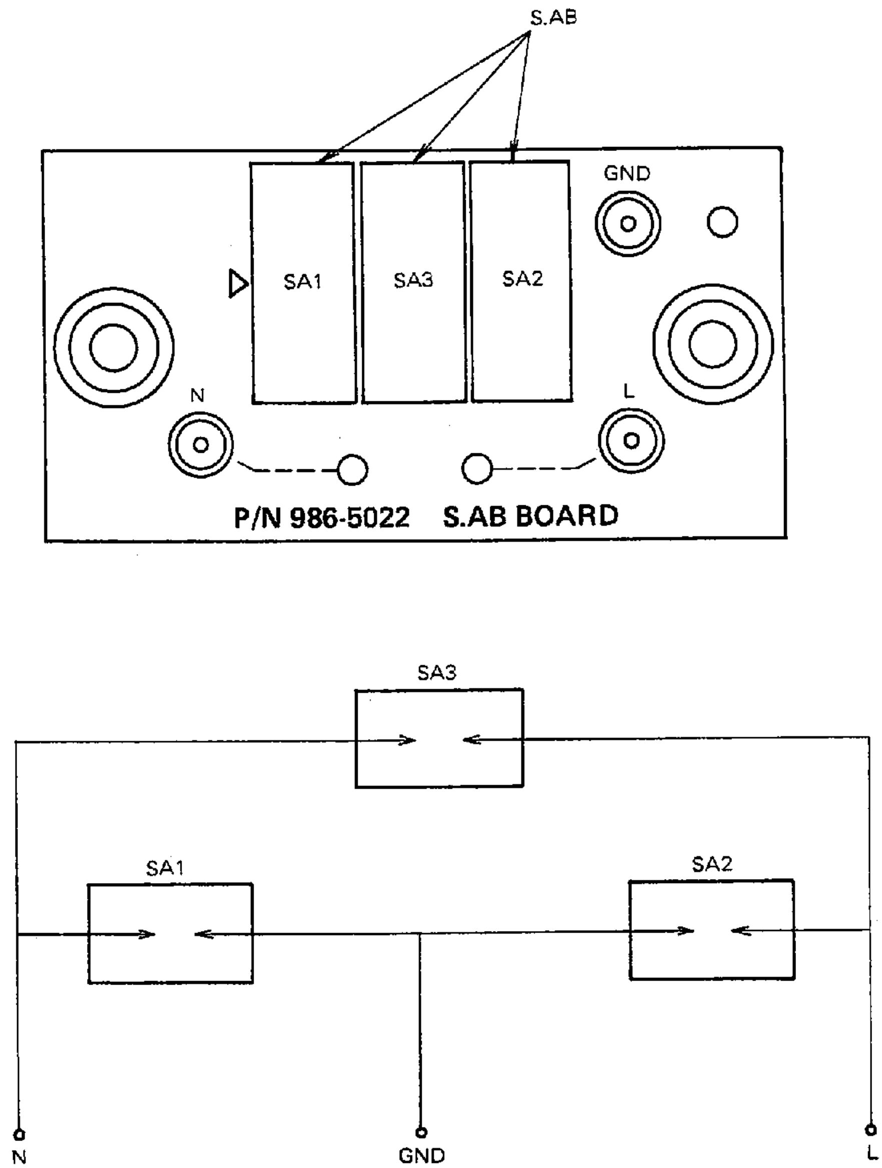


Fig. 10-2-27 Configuration of S.AB

10-3 I/O Address Table

Following tables show the I/O addresses for mechanism controllers in MCONT 1 and MCONT 2 printed circuit board.

(NEG: falling edge of signal, POS: rising edge of signal, (DD): detect by dark, (DB): detect by bright)

Table 10-3-1 (1/12)

IC No.	Address	Pin No.	Symbol	IN/OUT	Application	I/O Logic	Delay	Remarks
APCNT 1-1	\$80	21	LF	IN	Upper dead point	POS	4 pulse	Limiter for CW direction (DD)
MCONT 1	81	22	LR	IN	Liquid level sensor	NEG	4 pulse	Limiter for CCW direction
ICJ 14		23	L1	IN				
		24	L2	IN				
		35						
		36						
		37						
		39						
		27	POUT	OUT				
		28	DIR	OUT				
		29	HOLD	OUT	Power down signal	NEG		
		30						
		31	ϕ4	OUT	ϕ4	NEG		
		32	ϕ3	OUT	ϕ3 Serum sampling up/down stepping	NEG		1-2 Phase Excitation
		33	ϕ2	OUT	ϕ2 motor	NEG		
		34	ϕ1	OUT	ϕ1	NEG		
APCNT 1-2	\$82	21	LF	IN				Limiter for CW direction
MCONT 1	83	22	LR	IN				Limiter for CCW direction
ICJ 12		23	L1	IN	Home position	NEG	6 pulse	(DB)
		24	L2	IN				
		35						
		36						
		37						
		39						
		27	POUT	OUT				
		28	DIR	OUT				
		29	HOLD	OUT	Power down signal	NEG		
		30						
		31	ϕ4	OUT	ϕ4	NEG		
		32	ϕ3	OUT	ϕ3 Serum sampling rotation stepping	NEG		1-2 Phase excitation
		33	ϕ2	OUT	ϕ2 motor	NEG		
		34	ϕ1	OUT	ϕ1	NEG		

Table 10-3-1 (2/12)

IC No.	Address	Pin No.	Symbol	IN/OUT	Application	I/O Logic	Delay	Remarks
APCNT 1-3 MCONT1 ICJ 11	$84	21	LF	IN				Limiter for CW direction
	85	22	LR	IN	Home position	NEG	39 pulse	Limiter for CCW direction (DB)
		23	L1	IN	Cell count	NEG	21 pulse	(DB)
		24	L2	IN				
		35						
		36						
		37						
		39						
		27	POUT	OUT				
		28	DIR	OUT				
		29	HOLD	OUT	Power down signal	NEG		
		30						
		31	$\phi 4$	OUT	$\phi 4$	NEG		
		32	$\phi 3$	OUT	$\phi 3$ Reaction disk rotation stepping	NEG		1-2 Phase excitation
		33	$\phi 2$	OUT	$\phi 2$ motor	NEG		
		34	$\phi 1$	OUT	$\phi 1$	NEG		
APCNT 1-4 MCONT 1 ICJ 9	$86	21	LF	IN				Limiter for CW direction
	87	22	LR	IN	Home position	NEG	32 pulse	Limiter for CCW direction (DB)
		23	L1	IN	Outside count	NEG	30 pulse	(DB)
		24	L2	IN	Inside count	NEG	34 pulse	(DB)
		35						
		36						
		37						
		39						
		27	POUT	OUT				
		28	DIR	OUT				
		29	HOLD	OUT	Power down signal			
		30						
		31	$\phi 4$	OUT	$\phi 4$	NEG		
		32	$\phi 3$	OUT	$\phi 3$ Sample disk rotation stepping	NEG		1-2 Phase excitation
		33	$\phi 2$	OUT	$\phi 2$ motor	NEG		
		34	$\phi 1$	OUT	$\phi 1$	NEG		

Table 10-3-1 (3/12)

IC No.	Address	Pin No.	Symbol	IN/OUT	Application	I/O Logic	Delay	Remarks
APCNT 1-5 MCONT 1 ICJ 6	$88	21	LF	IN	Home position	NEG	32 pulse	Limiter for CW direction
	89	22	LR	IN				Limiter for CCW direction
		23	L1	IN	Count	NEG	30 pulse	
		24	L2	IN				
		35						
		36						
		37						
		39						
		27	POUT	OUT				
		28	DIR	OUT				
		29	HOLD	OUT	Power down signal	NEG		
		30						
		31	ϕ 4	OUT	ϕ 4 Reagent 1 disk rotation stepping motor	NEG		1-2 Phase excitation
		32	ϕ 3	OUT	ϕ 3	NEG		
		33	ϕ 2	OUT	ϕ 2	NEG		
		34	ϕ 1	OUT	ϕ 1	NEG		
SMCNT 1-1 MCONT 1 ICJ 7	$8A	21	IREQ 0	IN				
	8B	22	IREQ 1	IN	Stirrer cell side	NEG	40 msec	(DB)
		23	IREQ 2	IN	S. Syringe upper dead point	POS	60 msec	(DD)
		24	IREQ 3	IN	Stirrer back/forth home	NEG	40 msec	(DB)
		35	IREQ 4	IN	S. Pipettor abnormal down	NEG	5 msec	(DB)
		36	IREQ 5	IN				
		37						
		39						
		27	ϕ 1-0	OUT	ϕ 1 Serum syringe up/down stepping motor			1-2 Phase excitation
		28	ϕ 2-0	OUT	ϕ 2			
		29	ϕ 3-0	OUT	ϕ 3			
		30	ϕ 4-0	OUT	ϕ 4			
		31	ϕ 1-1	OUT	ϕ 1 Stirrer back/forth stepping motor	NEG		1-2 Phase excitation
		32	ϕ 2-1	OUT	ϕ 2	NEG		
		33	ϕ 3-1	OUT	ϕ 3	NEG		
		34	ϕ 4-1	OUT	ϕ 4	NEG		

Table 10-3-1 (4/12)

IC No.	Address	Pin No.	Symbol	IN/OUT	Application	I/O Logic	Delay	Remarks
SMCNT 1-2 MCONT 1 ICJ 5	$8C	21	IREQ 0	IN				
	8D	22	IREQ 1	IN				
		23	IREQ 2	IN				
		24	IREQ 3	IN				
		35	IREQ 4	IN				
		36	IREQ 5	IN				
		37						
		39						
		27	ϕ 1	OUT				
		28	ϕ 2	OUT				
		29	ϕ 3	OUT				
		30	ϕ 4	OUT				
		31	ϕ 1	OUT				
		32	ϕ 2	OUT				
		33	ϕ 3	OUT				
		34	ϕ 4	OUT				
MTCNT 1-1 MCONT 1 ICJ 3	$8E	21	IREQ 0	IN	Rinse upper dead point	NEG	10 msec	(DB)
	8F	22	IREQ 1	IN	Rinse lower dead point	NEG	10 msec	(DB)
		23	IREQ 2	IN	Stirrer upper dead point	NEG	10 msec	(DB)
		24	IREQ 3	IN	Stirrer lower dead point	NEG	10 msec	(DB)
		35	IREQ 4	IN				
		36	IREQ 5	IN				
		37	IREQ 6	IN				
		39	IREQ 7	IN				
		27	OUT 0	OUT		NEG		
		28	OUT 1	OUT		NEG		
		29	OUT 2	OUT		NEG		
		30	OUT 3	OUT		NEG		
		31	OUT 4	OUT		NEG		
		32	OUT 5	OUT		NEG		
		33	OUT 6	OUT	+24 V ON	NEG		
		34	OUT 7	OUT	+12 V (LAMP) ON	NEG		

Table 10-3-1 (5/12)

IC No.	Address	Pin No.	Symbol	IN/OUT	Application	I/O Logic	Delay	Remarks
APCNT 2-1	$A0	21	LF	IN	Upper dead point	POS	4 pulse	Limiter for CW direction (DD)
MCONT 2 ICJ 14	A1	22	LR	IN	Liquid level sensor	NEG	4 pulse	Limiter for CCW direction
		23	L1	IN				
		24	L2	IN				
		35						
		36						
		37						
		39						
		27	POUT	OUT				
		28	DIR	OUT				
		29	HOLD	OUT	Power down signal	NEG		
		30						
		31	ϕ 4	OUT	ϕ 4	NEG		
		32	ϕ 3	OUT	ϕ 3 Reagent 1 sampling up/down stepping	NEG		1-2 Phase excitation
		33	ϕ 2	OUT	ϕ 2 motor	NEG		
		34	ϕ 1	OUT	ϕ 1	NEG		
APCNT 2-2	$A2	21	LF	IN				Limiter for CW direction
MCONT 2 ICJ 12	A3	22	LR	IN				Limiter for CCW direction
		23	L1	IN	Home position	NEG	6 pulse	
		24	L2	IN				
		35						
		36						
		37						
		39						
		27	POUT	OUT				
		28	DIR	OUT				
		29	HOLD	OUT	Power down signal			
		30						
		31	ϕ 4	OUT	ϕ 4	NEG		
		32	ϕ 3	OUT	ϕ 3 Reagent 1 sampling rotation stepping	NEG		1-2 Phase excitation
		33	ϕ 2	OUT	ϕ 2 motor	NEG		
		34	ϕ 1	OUT	ϕ 1	NEG		

Table 10-3-1 (6/12)

IC No.	Address	Pin No.	Symbol	IN/OUT	Application	I/O Logic	Delay	Remarks
APCNT 2-3 MCONT 2 ICJ 11	$A4	21	LF	IN	Upper dead point	POS	4 pulse	Limiter for CW direction (DD)
	A5	22	LR	IN	Liquid level sensor	NEG	4 pulse	Limiter for CCW direction
		23	L1	IN				
		24	L2	IN				
		35						
		36						
		37						
		39						
		27	POUT	OUT				
		28	DIR	OUT				
		29	HOLD	OUT	Power down signal	NEG		
		30						
		31	ϕ 4	OUT	ϕ 4 Reagent 2 sampling up/down stepping motor	NEG		1-2 Phase excitation
		32	ϕ 3	OUT	ϕ 3	NEG		
		33	ϕ 2	OUT	ϕ 2	NEG		
		34	ϕ 1	OUT	ϕ 1	NEG		
APCNT 2-4 MCONT 2 ICJ 9	$A6	21	LF	IN				Limiter for CW direction
	A7	22	LR	IN				Limiter for CCW direction
		23	L1	IN	Home position	NEG	6 pulse	
		24	L2	IN				
		35						
		36						
		37						
		39						
		27	POUT	OUT				
		28	DIR	OUT				
		29	HOLD	OUT	Power down signal			
		30						
		31	ϕ 4	OUT	ϕ 4 Reagent 2 sampling rotation stepping motor	NEG		1-2 Phase excitation
		32	ϕ 3	OUT	ϕ 3	NEG		
		33	ϕ 2	OUT	ϕ 2	NEG		
		34	ϕ 1	OUT	ϕ 1	NEG		

Table 10-3-1 (7/12)

IC No.	Address	Pin No.	Symbol	IN/OUT	Application	I/O Logic	Delay	Remarks
APCNT 2-5 MCONT 2 ICJ 6	$A8	21	LF	IN	Home position	NEG	32 pulse	Limiter for CW direction
	A9	22	LR	IN				Limiter for CCW direction
		23	L1	IN	Count	NEG	30 pulse	
		24	L2	IN				
		35						
		36						
		37						
		39						
		27	POUT	OUT				
		28	DIR	OUT				
		29	HOLD	OUT	Power down signal	NEG		
		30						
		31	ϕ 4	OUT	ϕ 4 Reagent 2 disk rotation stepping motor	NEG		1-2 Phase excitation
		32	ϕ 3	OUT	ϕ 3	NEG		
		33	ϕ 2	OUT	ϕ 2	NEG		
		34	ϕ 1	OUT	ϕ 1	NEG		
SMCNT 2-1 MCONT 2 ICJ 7	$AA	21	IREQ 0	IN				
	AB	22	IREQ 1	IN				
		23	IREQ 2	IN	R1 Syringe upper dead point	POS	25 msec	(DD)
		24	IREQ 3	IN	R2 Syringe upper dead point	POS	25 msec	(DD)
		35	IREQ 4	IN	R1 Pipettor abnormal down	NEG	5 msec	(DB)
		36	IREQ 5	IN	R2 Pipettor abnormal down	NEG	5 msec	(DB)
		37						
		39						
		27	ϕ 1-0	OUT	ϕ 1 R1 syringe up/down stepping motor	NEG		1-2 Phase excitation
		28	ϕ 2-0	OUT	ϕ 2	NEG		
		29	ϕ 3-0	OUT	ϕ 3	NEG		
		30	ϕ 4-0	OUT	ϕ 4	NEG		
		31	ϕ 1-1	OUT	ϕ 1 R2 syringe up/down stepping motor	NEG		1-2 Phase excitation
		32	ϕ 2-1	OUT	ϕ 2	NEG		
		33	ϕ 3-1	OUT	ϕ 3	NEG		
		34	ϕ 4-1	OUT	ϕ 4	NEG		

Table 10-3-1 (8/12)

IC No.	Address	Pin No.	Symbol	IN/OUT	Application	I/O Logic	Delay	Remarks
SMCNT 2-2 MCONT 2 ICJ 5	$AC	21	IREQ 0	IN				
	AD	22	IREQ 1	IN				
		23	IREQ 2	IN	IS Syringe upper dead P. (ISE)	POS	30 msec	(DD)
		24	IREQ 3	IN				
		35	IREQ 4	IN				
		36	IREQ 5	IN				
		37						
		39						
		27	ϕ 1	OUT	ϕ 1 } IS (ISE Opt.) Syringe pulse motor			
		28	ϕ 2	OUT	ϕ 2			
		29	ϕ 3	OUT	ϕ 3			
		30	ϕ 4	OUT	ϕ 4			
		31	ϕ 1	OUT				
		32	ϕ 2	OUT				
		33	ϕ 3	OUT				
		34	ϕ 4	OUT				
MTCNT 2-1 MCONT 2 ICJ 3	$AE	21	IREQ 0	IN				
	AF	22	IREQ 1	IN				
		23	IREQ 2	IN				
		24	IREQ 3	IN				
		35	IREQ 4	IN				
		36	IREQ 5	IN				
		37	IREQ 6	IN				
		39	IREQ 7	IN				
		27	OUT 0	OUT	Inc. water circulatory pump	NEG		
		28	OUT 1	OUT		NEG		
		29	OUT 2	OUT	Water supply pump	NEG		
		30	OUT 3	OUT	Gear pump	NEG		
		31	OUT 4	OUT	Vacuum pump	NEG		
		32	OUT 5	OUT		NEG		
		33	OUT 6	OUT		NEG		
		34	OUT 7	OUT		NEG		

Table 10-3-1 (9/12)

IC No.	Address	Pin No.	Symbol	IN/OUT	Application	I/O Logic	Delay	Remarks
D/O 1 H6 (MCONT 1)	$90	2	D/O 1-0	OUT	SV 1			S. syringe
		5	D/O 1-1	OUT	SV 2			R1 syringe
		6	D/O 1-2	OUT	SV 3			R2 syringe
		9	D/O 1-3	OUT				
		12	D/O 1-4	OUT	SV 4			S. nozzle outside rinsing
		15	D/O 1-5	OUT	SV 5			R1, R2 nozzle outside rinsing
		16	D/O 1-6	OUT	SV 6			Stirrer rod rinsing
		19	D/O 1-7	OUT	SV 10			Incubation bath add water
D/O 2 H3 (MCONT 1)	$91	2	D/O 2-0	OUT	SV 11			Rinse tip rinsing
		5	D/O 2-1	OUT				
		6	D/O 2-2	OUT	SV 7			Cell rinse water supply
		9	D/O 2-3	OUT	SV 8			Distilled water supply
		12	D/O 2-4	OUT	SV 9			Incubation water supply
		15	D/O 2-5	OUT	SV 20			Overflow water aspiration
		16	D/O 2-6	OUT	SV 21			Cell rinse water aspiration
		19	D/O 2-7	OUT	SV 23			Vacuum pressure
D/O 3 H6 (MCONT 2)	$B0	2	D/O 3-0	OUT	DC motor			R1 stirrer rod rotation DC motor
		5	D/O 3-1	OUT	DC motor			R2 stirrer rod rotation DC motor
		6	D/O 3-2	OUT				
		9	D/O 3-3	OUT				
		12	D/O 3-4	OUT	SV 13			Extran supply
		15	D/O 3-5	OUT				
		16	D/O 3-6	OUT				
		19	D/O 3-7	OUT	SV 22			Vacuum pressure off
D/O 4 H3 (MCONT 2)	$B1	2	D/O 4-0	OUT	SV 30, 31, 33			Overflow water drain
		5	D/O 4-1	OUT				Waste solution drain
		6	D/O 4-2	OUT	SV 32			Incubation water drain
		9	D/O 4-3	OUT				
		12	D/O 4-4	OUT	A0			
		15	D/O 4-5	OUT	A1			MPX select signal for tempamp
		16	D/O 4-6	OUT	A2			
		19	D/O 4-7	OUT	Inc. water temp control ON			

Table 10-3-1 (10/12)

IC No.	Address	Pin No.	Symbol	IN/OUT	Application	I/O Logic	Delay	Remarks
D/I 1 G4 (MCONT 1)	$90	2	D/I 1-0	IN	Detect inc. water level			1: OK
		4	D/I 1-1	IN	Waste solution tank full			1: Full
		6	D/I 1-2	IN	Vacuum tank water full			1: OK
		8	D/I 1-3	IN	Detect vacuum pressure			1: OK
		11	D/I 1-4	IN	Distilled water tank empty			0: Empty
		13	D/I 1-5	IN	Distilled water tank full			1: Full
		15	D/I 1-6	IN	Cold water tank level			1: OK
		17	D/I 1-7	IN	Abnormal temp. in PMDRIVER 1			1: Normal
D/I 2 G4 (MCONT 2)	$B0	2	D/I 2-0	IN	Sample disk ID			1: ID = 1
		4	D/I 2-1	IN	Abnormal degasser			1: Abnormal
		6	D/I 2-2	IN				
		8	D/I 2-3	IN				
		11	D/I 2-4	IN	Detect breaker ON/OFF			1: Breaker ON
		13	D/I 2-5	IN	Detect fuse OFF			1: Fuse Off
		15	D/I 2-6	IN	Abnormal temp.			1: Normal
		17	D/I 2-7	IN	Abnormal temp. in PMDRIVER 2			1: Normal

Table 10-3-1 (11/12)

IC No.	Address	Pin No.	Symbol	IN/OUT	Application	I/O Logic	Delay	Remarks
D/O 5 (ISE) H6 (ISECONT)	$D0	2	D/O 5-0	OUT	SV 43 (24 V DIL.SYR. SV)			
		5	D/O 5-1	OUT	SV 51 (24 V SIP.SYR. SV)			
		6	D/O 5-2	OUT	Sipper pinch valve (24 V)			
		9	D/O 5-3	OUT	Rotary solenoid for shutter			
		12	D/O 5-4	OUT	SV 42 (24 V SV for IS.SYR. changing)			
		15	D/O 5-5	OUT	SV 44 (24 V SV for DIL.SYR. changing)			
		16	D/O 5-6	OUT	SV 55 (24 V SV for sucking waste solution)			
		19	D/O 5-7	OUT				
D/O 6 H3 (ISECONT)	$D1	2	D/O 6-0	OUT	SV 45 (24 V SV for supplying DIL. solution)			
		5	D/O 6-1	OUT	SV 46 (24 V SV for supplying IS. solution)			
		6	D/O 6-2	OUT	SV 53 (24 V SV for draining conc. waste liquid)			
		9	D/O 6-3	OUT				
		12	D/O 6-4	OUT	SV 52 (AC 100 V SV for draining waste liquid)			
		15	D/O 6-5	OUT				
		16	D/O 6-6	OUT				
		19	D/O 6-7	OUT				
D/I 3 G4 (ISECONT)	$D0	2	D/I 3-0	IN	Detection for ISE door open	POS		(DD)
		4	D/I 3-1	IN	Detection for vacuum nozzle	NEG		(DB) Bright: Descent of vacuum nozzle
		6	D/I 3-2					
		8	D/I 3-3					
		11	D/I 3-4					
		13	D/I 3-5					
		15	D/I 3-6					
		17	D/I 3-7					

Table 10-3-1 (12/12)

IC No.	Address	Pin No.	Symbol	IN/OUT	Application	I/O Logic	Delay	Remarks
SMCNT 5 ISECONT	$CA	21	IREQ 0	IN				
	CB	22	IREQ 1	IN				
		23	IREQ 2	IN	SIP. Syringe upper dead point	POS	30 msec	(DD)
		24	IREQ 3	IN	DIL. Syringe upper dead point	POS	30 msec	(DD)
		35	IREQ 4	IN				
		36	IREQ 5	IN				
		37						
		39						
		27	ϕ 1	OUT	Sipper syringe P. motor ϕ 1	NEG		
		28	ϕ 2	OUT	Sipper syringe P. motor ϕ 2	NEG		
		29	ϕ 3	OUT	Sipper syringe P. motor ϕ 3	NEG		
		30	ϕ 4	OUT	Sipper syringe P. motor ϕ 4	NEG		
		31	ϕ 1	OUT	Dil syringe P. motor ϕ 1	NEG		
		32	ϕ 2	OUT	Dil syringe P. motor ϕ 2	NEG		
		33	ϕ 3	OUT	Dil syringe P. motor ϕ 3	NEG		
		34	ϕ 4	OUT	Dil syringe P. motor ϕ 4	NEG		
SMCNT 6 ISE CONT	$CC	21	IREQ 0	IN				
	CD	22	IREQ 1	IN				
		23	IREQ 2	IN				
		24	IREQ 3	IN				
		35	IREQ 4	IN				
		36	IREQ 5	IN				
		37						
		39						
		27	ϕ 1	OUT				
		28	ϕ 2	OUT				
		29	ϕ 3	OUT				
		30	ϕ 4	OUT				
		31	ϕ 1	OUT				
		32	ϕ 2	OUT				
		33	ϕ 3	OUT				
		34	ϕ 4	OUT				

10-4 Switch Setting

The system interface, etc. of this analyzer are set by switches located on TRIADCP717 printed circuit board (P/N 717-5002) and S. I/F APU printed circuit board (P/N 986-5029).
Their functions and setting are described below.

(1) Functions and Standard Setting

(a) TRIADCP717 PCB (P/N 717-5002)

Table 10-4-1

		OFF	ON	Standard Setting
DIP SW1	SW0	Not used (turn off)		OFF
	SW1	Without ISE	With ISE	OFF
	SW2	Without ID	With ID	OFF
	SW3	For sample cup	For vacutainer	OFF
	SW4	QC $\bar{X}$–R	QC X–R	OFF
	SW5	With QC range plot	Without QC range plot	OFF
	SW6	With concentration function.	Without concentration function.	OFF
	SW7	With LIN 8 check	Without LIN 8 check	OFF
DIP SW2	SW8	Not used (turn off)	————	OFF
	SW9	S. NO $\leq$ 1000	S. NO $>$ 1000	OFF
	SW10	Not used (turn off)	Not used (turn off)	OFF
	SW11			OFF
	SW12			OFF
	SW13			OFF
	SW14			OFF
	SW15	————	Alarm release	OFF
Toggle switch	SW17	Communication trace off	Communication trace on	OFF
	SW18	Without system I/F	With system I/F	OFF
	SW19	With rerun test inquiry	Without rerun test inquiry	OFF
	SW20	With routine and rerun test inquiry	Without routine and rerun test inquiry	OFF

(b) S. I/F APU PCB (P/N 986-5029)

1) SW3: System interface setting 1

Table 10-4-2

	OFF	ON	Standard Setting
SW3-1	RS-232C	Current loop	ON
SW3-2	Current loop CTS logic (fixed at on)		ON
SW3-3	Current loop RTS logic (fixed at on)		ON
SW3-4	Current loop Rx, Tx logic (fixed at on)		ON

2) SW5: System interface setting 2

Table 10-4-3

SW5-6	SW5-7	SW5-8	Baud Rate
ON	OFF	OFF	4800 bps
OFF	ON	OFF	2400 bps

SW5-1 to SW5-5 are set to off (fixed).
Standard setting is 2400 bps.

(2) Setting when Adding Accessories

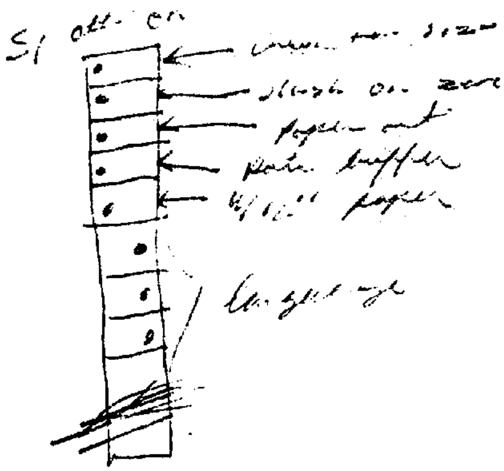
(a) System Interface (standard provided)

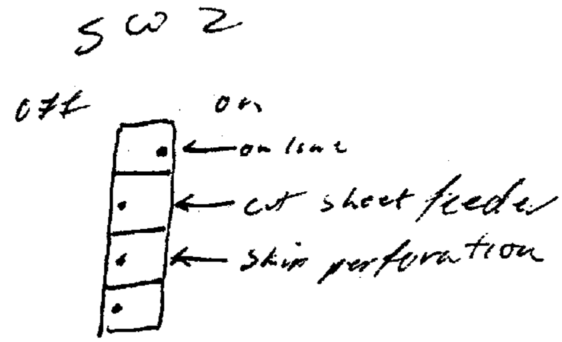
- When using a system interface, turn on SW18 of TRIADCP717 PCB.
- Set SW17, SW19 and SW20 according to the method of use referring to (1).
  For details of functions, refer to the section on system interface.
- When using RS-232C, turn off SW3-1 of S. I/F APU PCB.
  When setting the baud rate to 4800 bps, set SW5 on S. I/F APU PCB referring to (1).

(b) ISE Accessory
When using ISE accessory, turn on SW1 of DIP SW1.

(c) Sample ID Accessory
When using a sample ID accessory, turn on SW2 and SW3 of DIP SW1 on TRIADCP717 PCB.

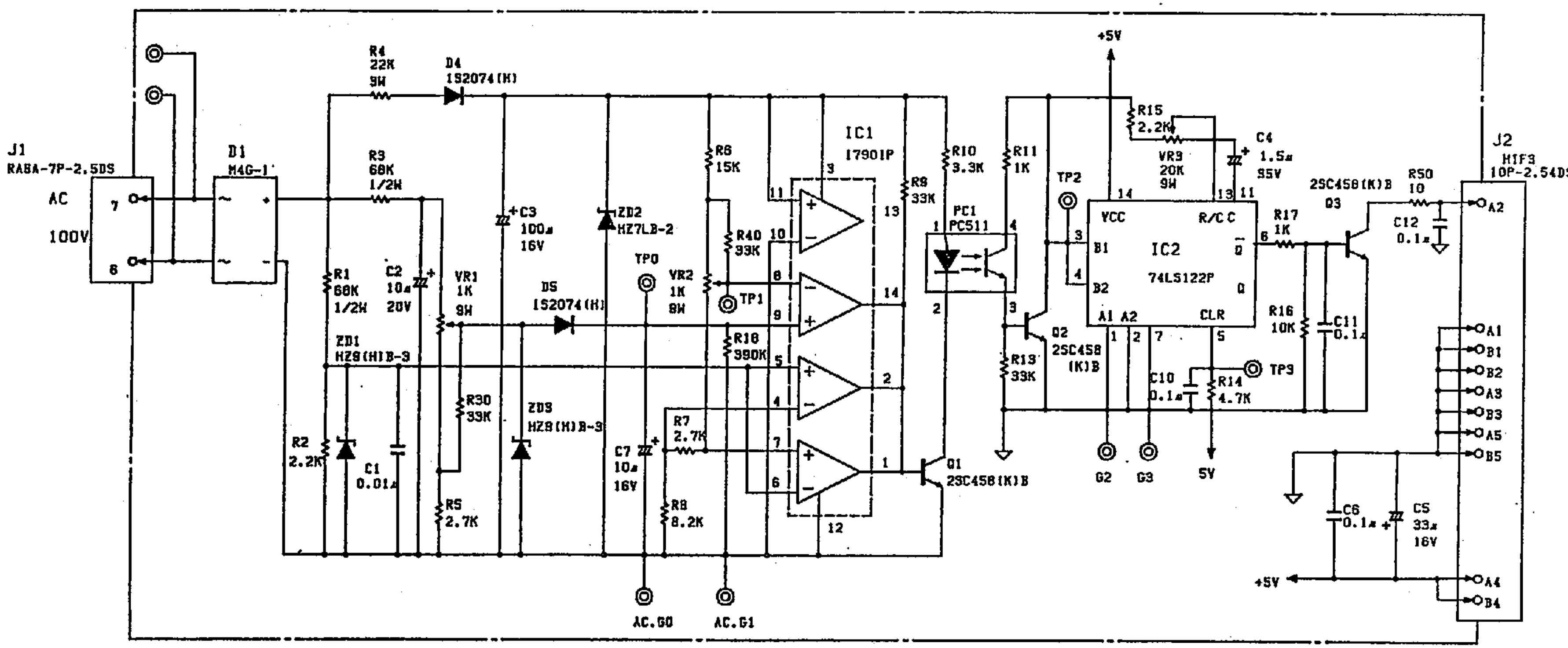
Printer switches





S3 on f side
for ROM

11. CIRCUIT DIAGRAMS



Specifications:

1. Undefined unit of resistors is Ω.
   Unspecified rated-power of resistors is 1/4 W.
2. Undefined unit of capacitors is F.
   Unspecified withstand-voltage of capacitors is 50 V.

Fig. 11-10 PFD-5 Circuit Diagram

Specifications:

1. RY2 ~ 17 : D2W103F
2. RY1 : D2W215E18
3. SA1 ~ 3 : SURGE ABSORBER

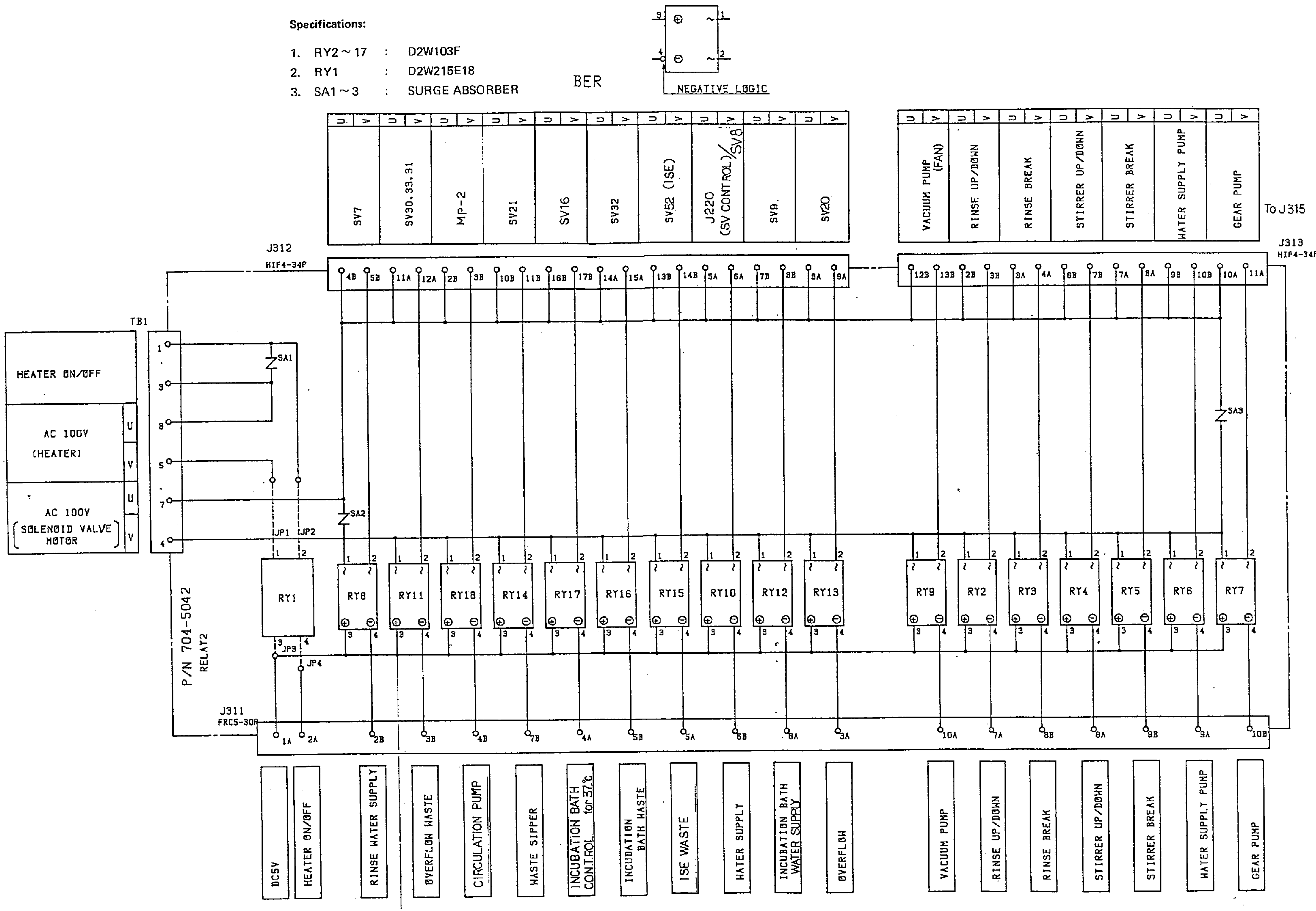


Fig. 11-11 RELAY2 Circuit Diagram

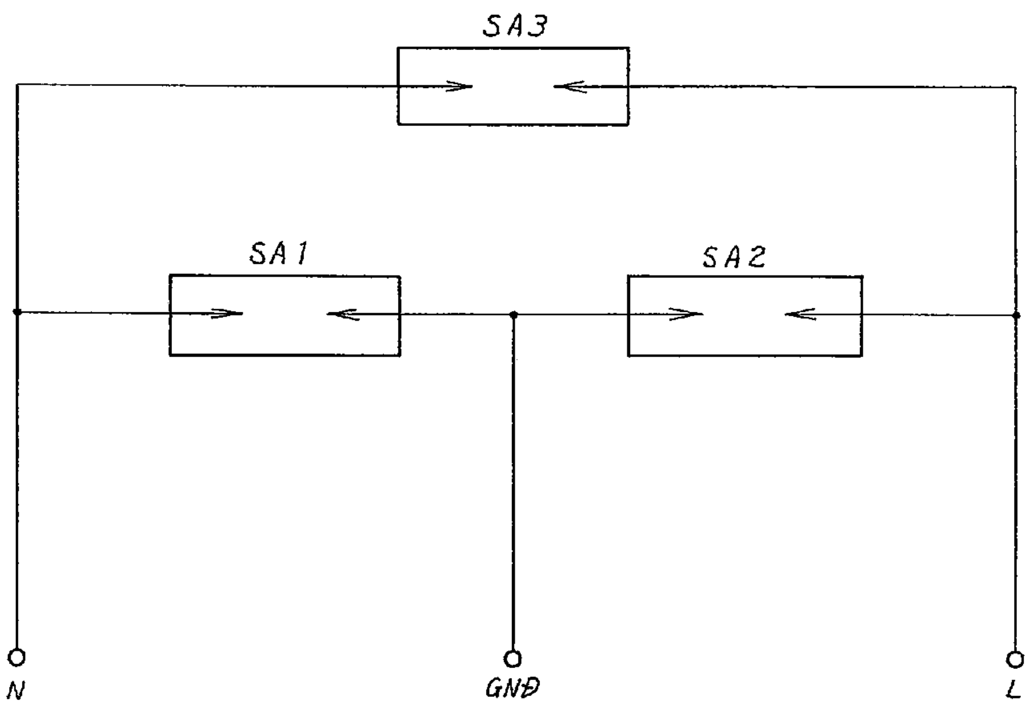
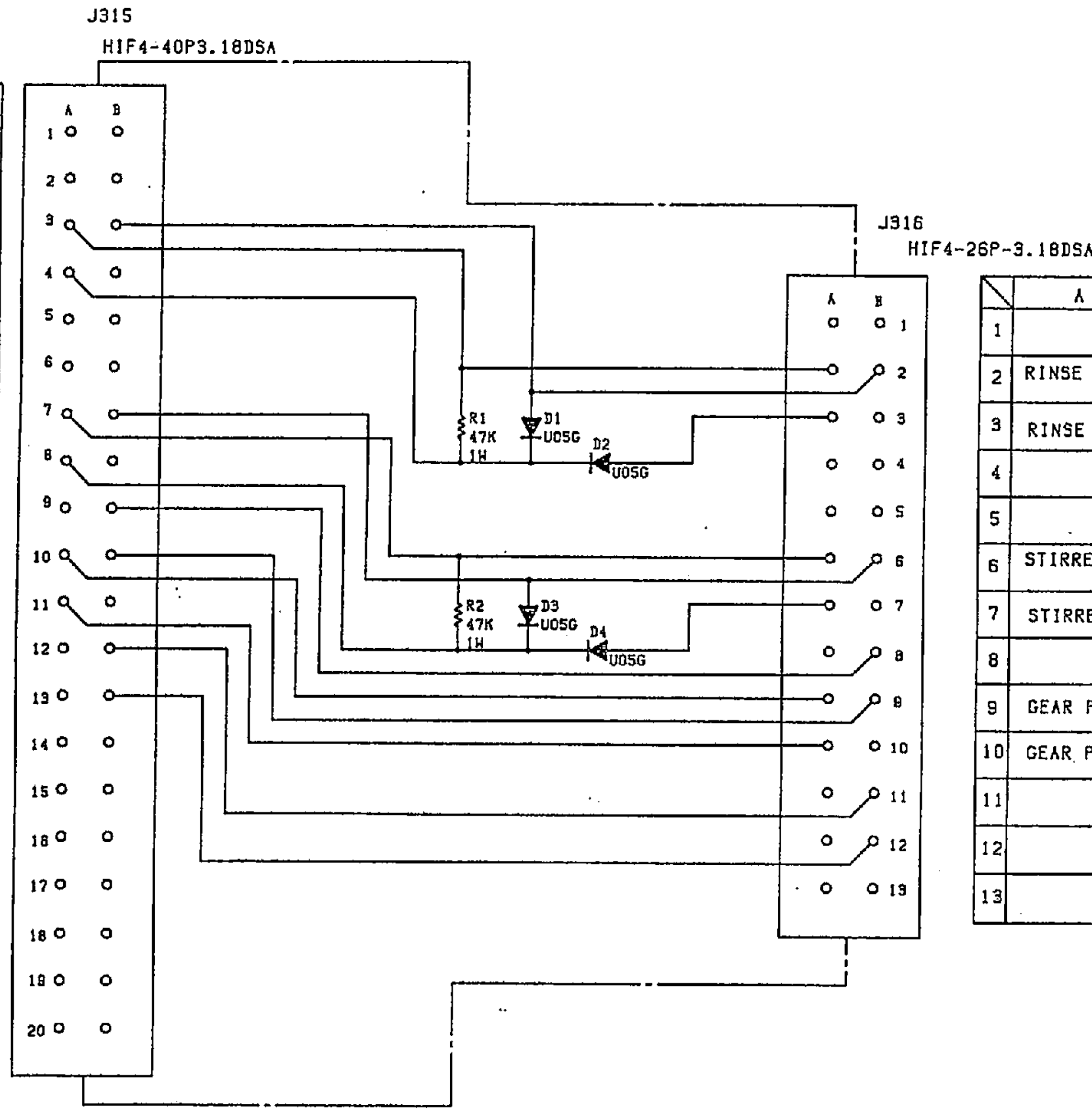


Fig. 11-13 S. AB Circuit Diagram

	A	B
1		
2		
3	RINSE UP/DOWN (COMMON)	RINSE UP/DOWN
4	RINSE BREAK	
5		
6		
7	STIRRER UP/DOWN (COMMON)	STIRRER UP/DOWN
8	STIRRER BREAK	
9		WATER SUPPLY PUMP
10	GEAR PUMP	WATER SUPPLY PUMP
11	GEAR PUMP	
12		VACUUM PUMP
13		VACUUM PUMP
14		
15		
16		
17		
18		
19		
20		



	A	B
1		
2	RINSE UP/DOWN (COMMON)	RINSE UP/DOWN
3	RINSE BREAK	
4		
5		
6	STIRRER UP/DOWN (COMMON)	STIRRER UP/DOWN
7	STIRRER BREAK	
8		WATER SUPPLY PUMP
9	GEAR PUMP	WATER SUPPLY PUMP
10	GEAR PUMP	
11		VACUUM PUMP
12		VACUUM PUMP
13		

Fig. 11-14 ACMCNT Circuit Diagram

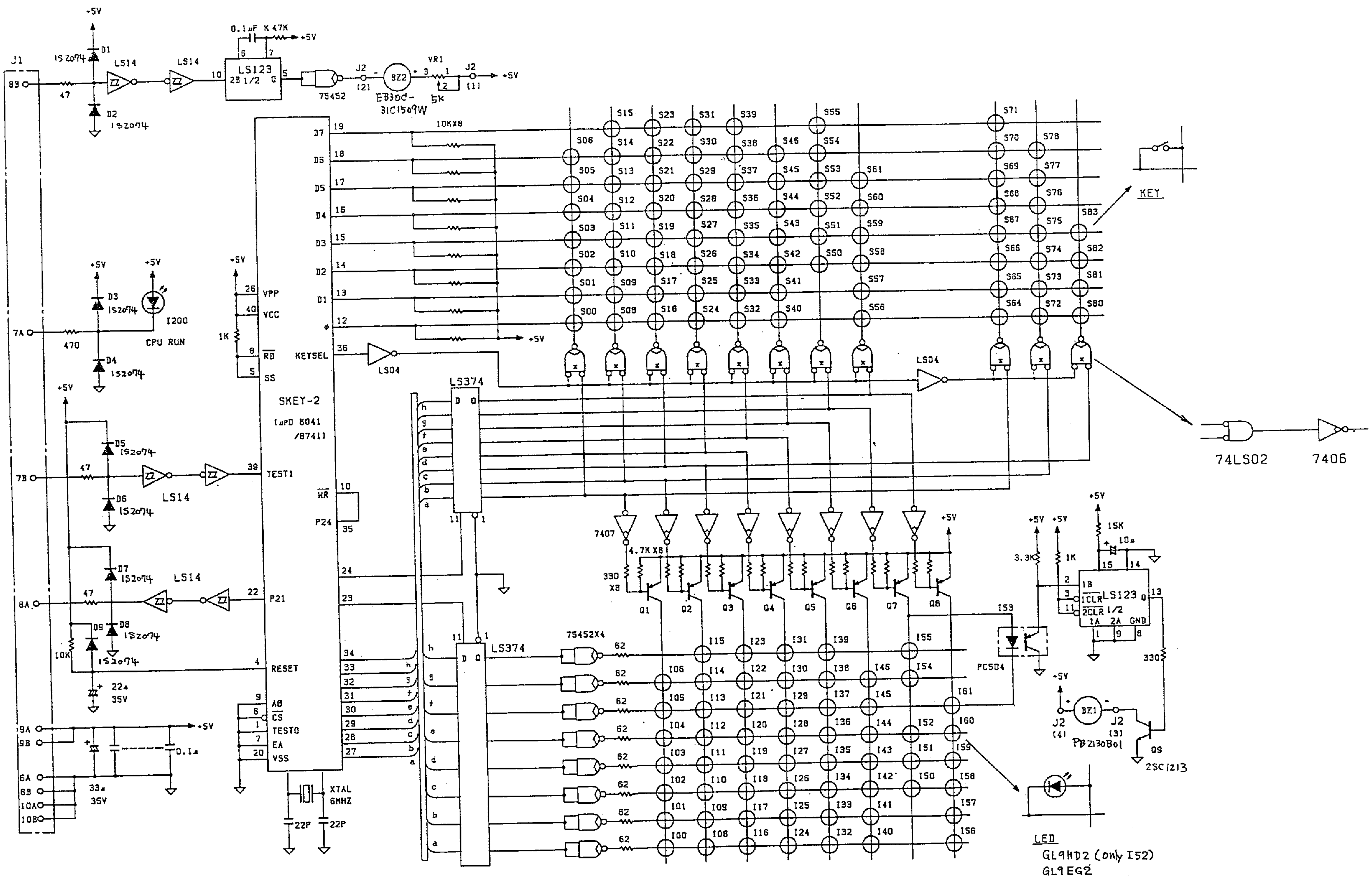


Fig. 11-15 KEYBOARD Circuit Diagram

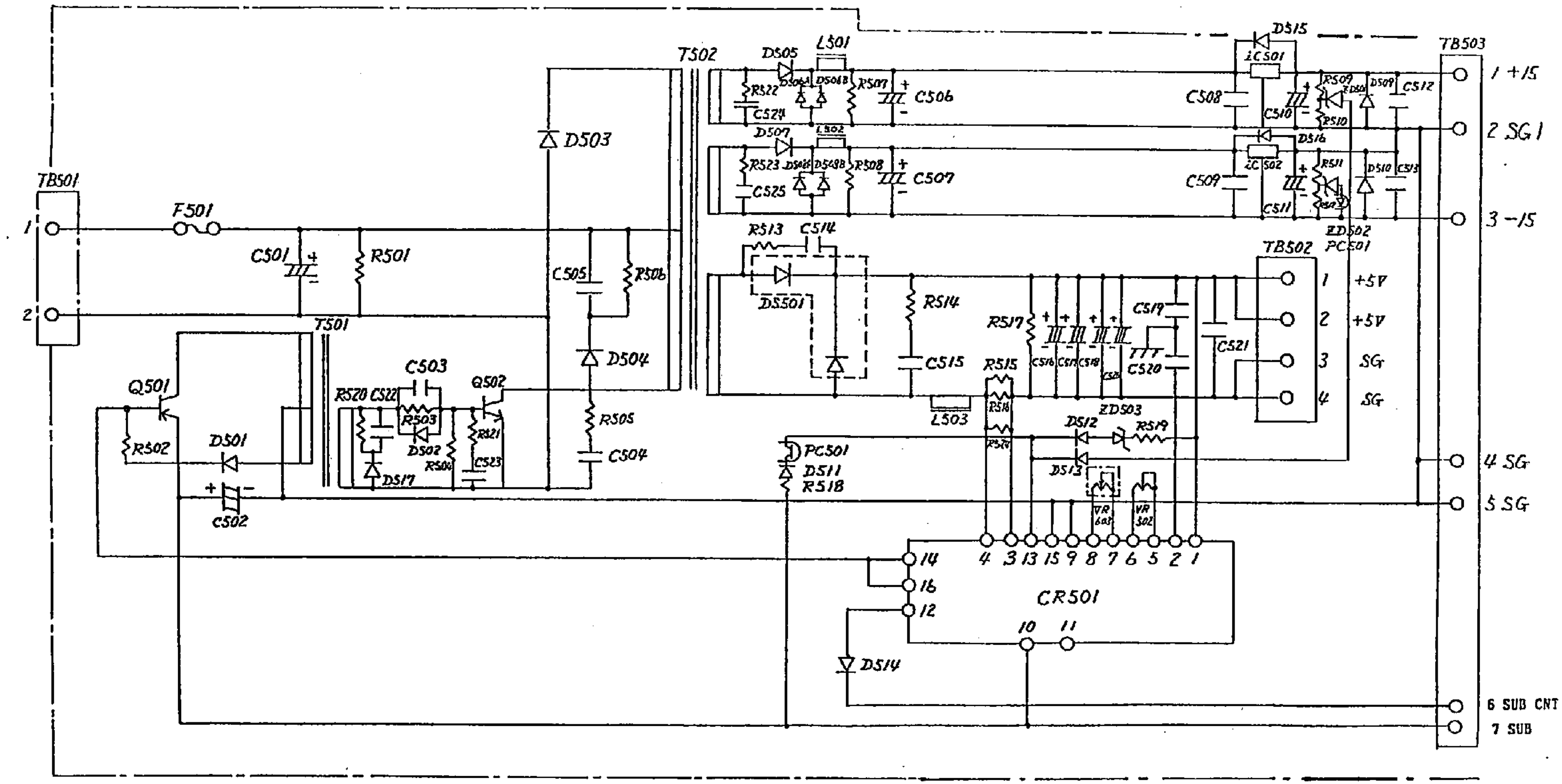


Fig. 11-16-2 +5 V, ±15 V Circuit Diagram

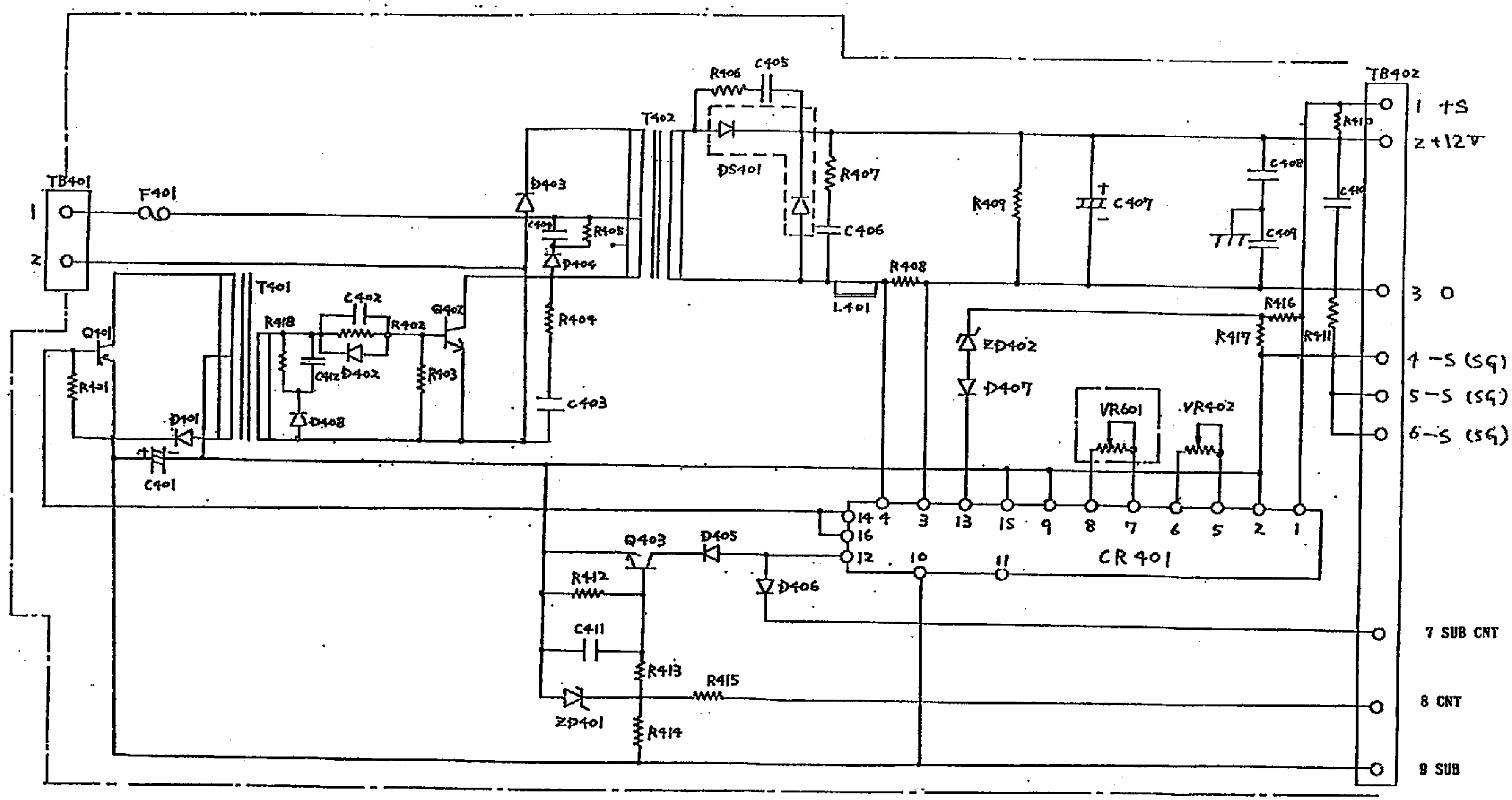


Fig. 11-16-3 +12 V Circuit (A) Diagram

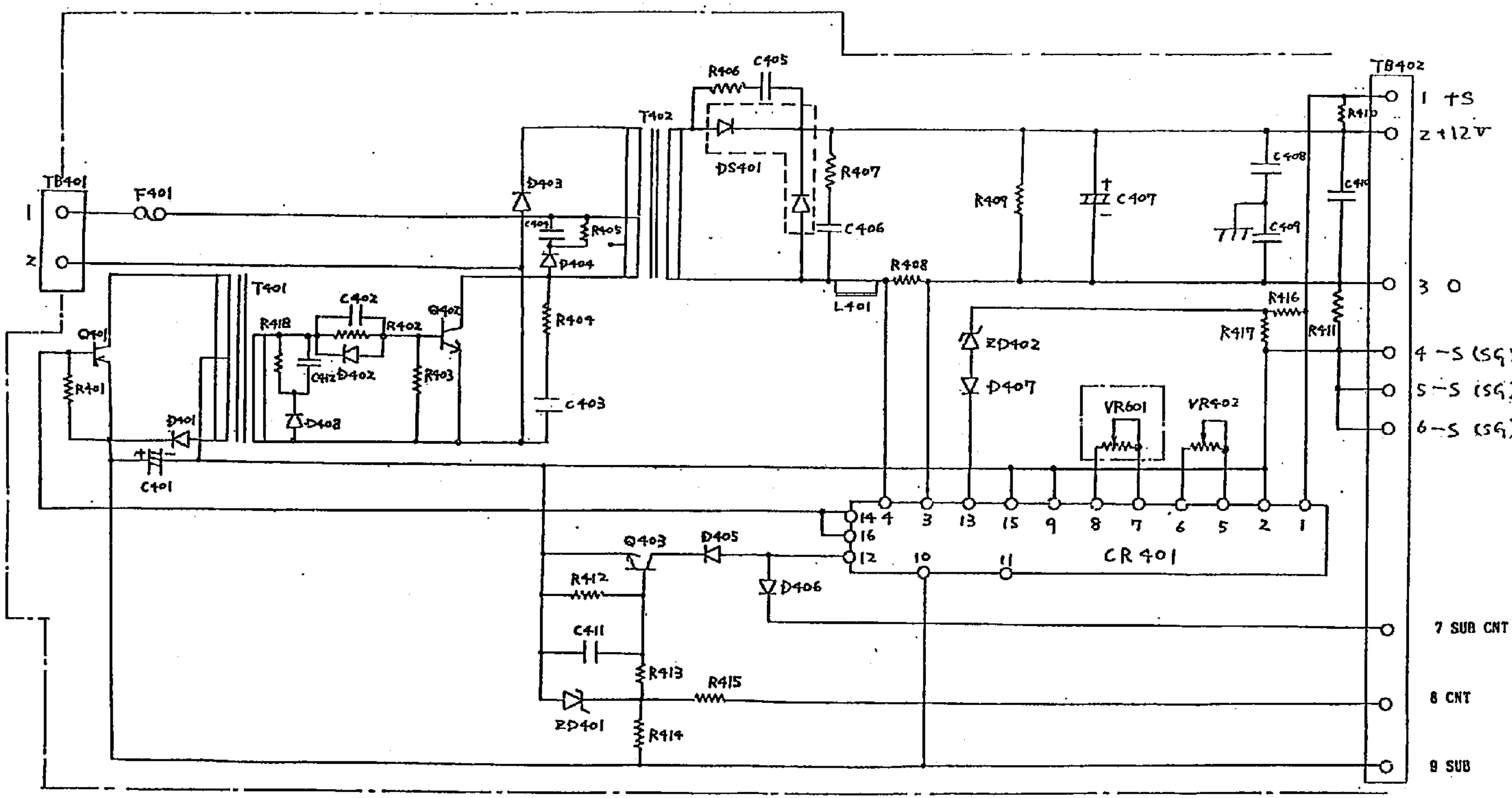


Fig. 11-16-4 +12 V Circuit (B) Diagram

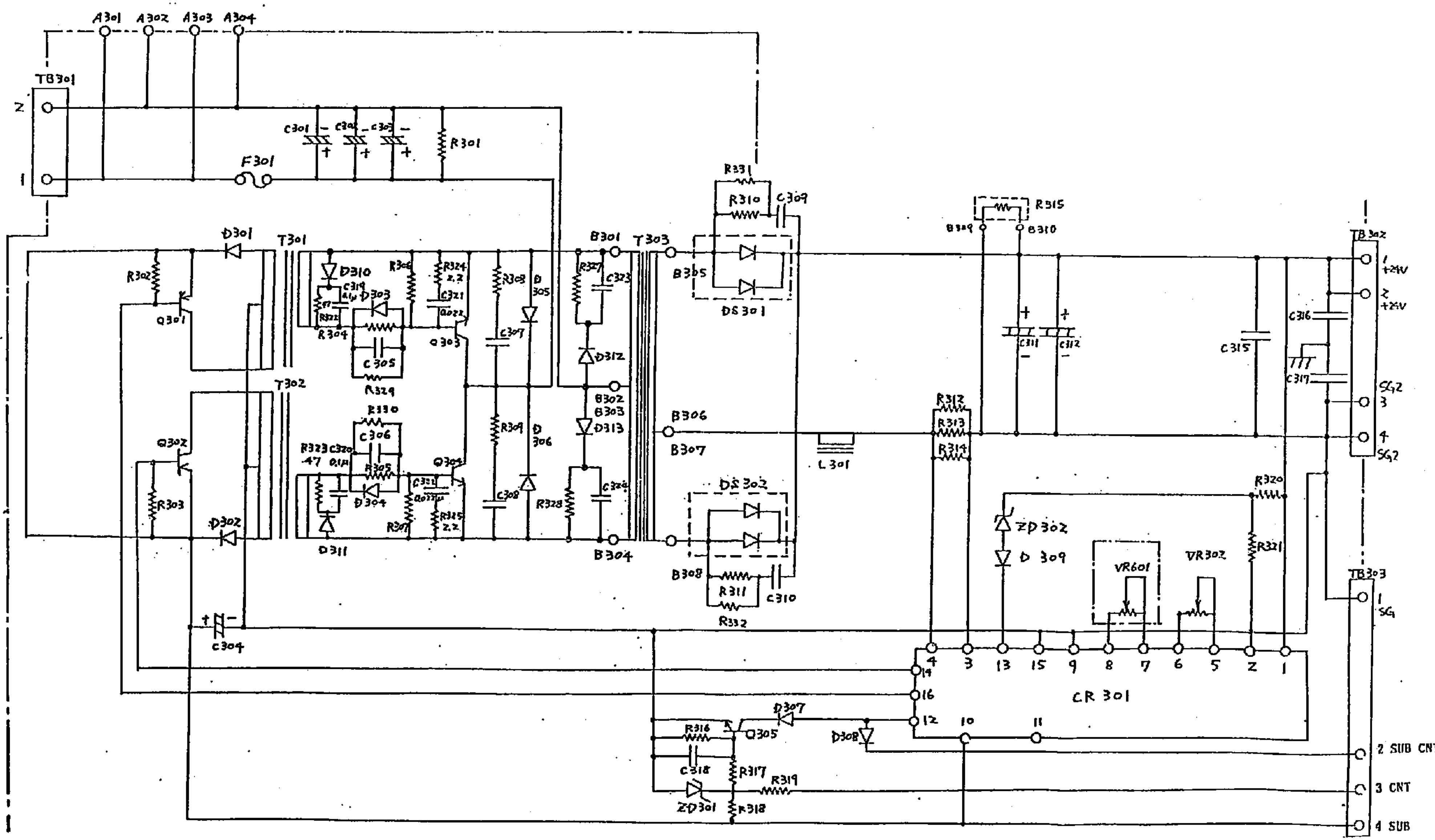
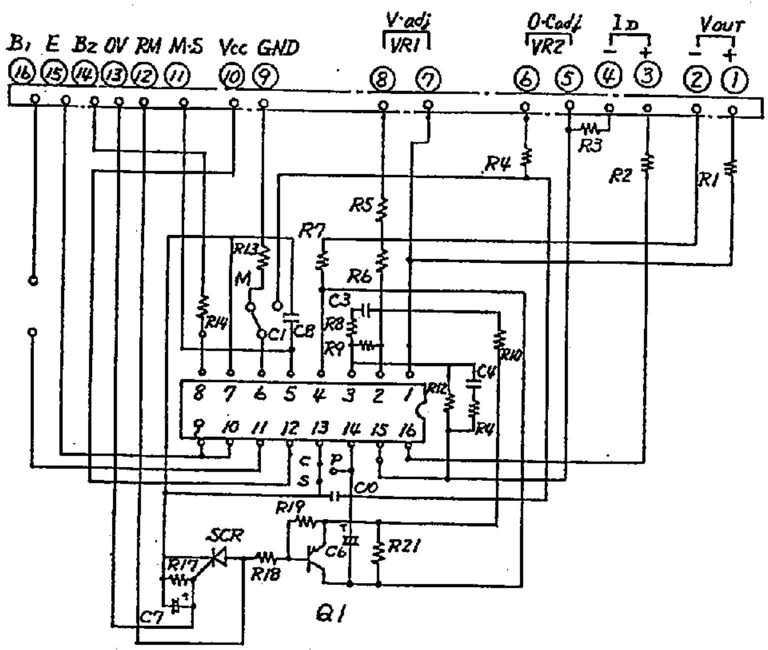
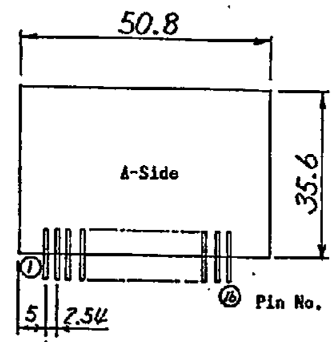


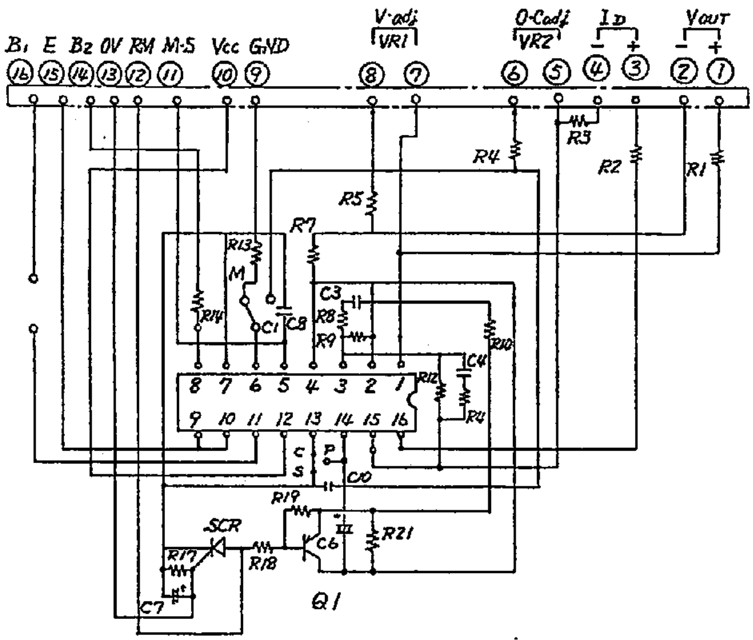
Fig. 11-16-5 +24 V Circuit Diagram

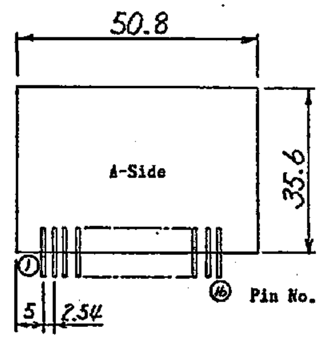




iC	MB3759 M-6	R12	1/8W 100K	SCR	03P2M
R1	1/4W 910	R13	〃 24K	Q1	2SA1020-0
R2	〃 56	R14	1/2W 680	C1	
R3	〃 56	R15		C2	
R4	〃 10K	R16	1/2W	C3	50V 0.1μ
R5	〃 470	R17	1/8W 2.2K	C4	〃 0.01μ
R6	1/8W 2.2K	R18	〃 470	C5	
R7	1/8W 24K	R19	〃 1K	C6	16V 33μ
R8	〃 10K	R20	〃 Short	C7	50V 1μ
R9	〃 100K	R21	〃 47K	C8	〃 0.001μ
R10	〃 2.2K			C9	
R11	〃 10K			C10	50V 0.01μ

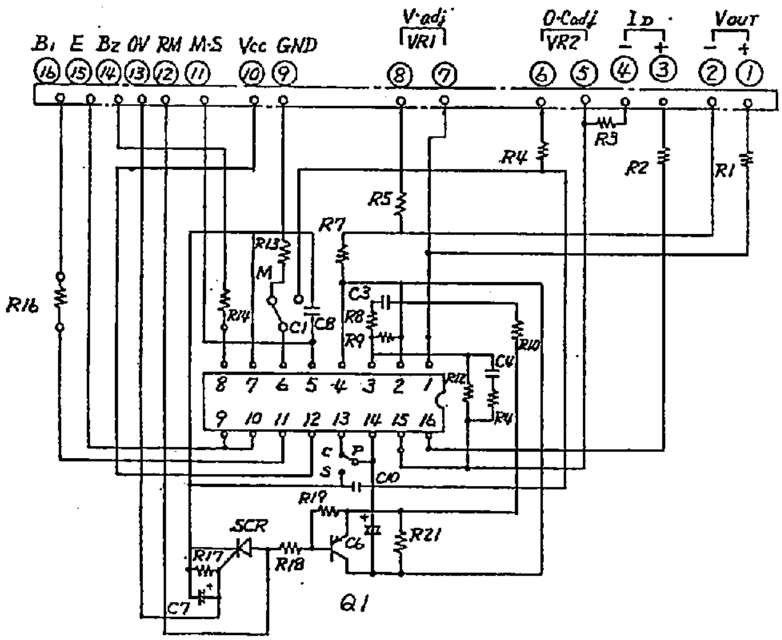
Fig. 11-16-6 +5 V, ±15 V Control Circuit Diagram

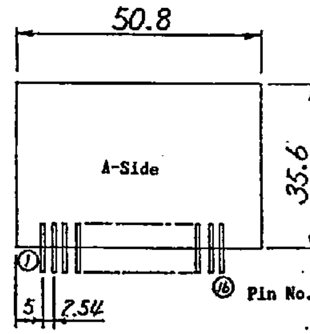




IC	MB3759 M-S	R12	1/8W 100K	SCR	03P2M
R1	1/4W 1.8K	R13	〃 24K	Q1	2SA1020θ
R2	〃 47	R14	1/2W 1K	C1	
R3	〃 47	R15		C2	
R4	〃 10K	R16	1/2W	C3	50V 0.1μ
R5	〃 910	R17	1/8W 2.2K	C4	〃 0.01μ
R6	1/8W	R18	〃 470	C5	
R7	1/8W 24K	R19	〃 1K	C6	16V 33μ
R8	〃 10K	R20		C7	50V 1μ
R9	〃 100K	R21	〃 47K	C8	〃 0.001μ
R10	〃 2.2K			C9	
R11	〃 10K			C10	50V 0.01μ

Fig. 11-16-7 +12 V Control Circuit Diagram





IC	HB3759 K-6	R12	1/8W 100K	SCR	03P2M
R1	1/4W 7.5K	R13	〃 18K	Q1	2SA1020-0
R2	〃 47	R14	1/2W 470	C1	
R3	〃 47	R15		C2	
R4	〃 10K	R16	1/2W 470	C3	50V 0.1μ
R5	〃 1.5K	R17	1/8W 2.2K	C4	〃 0.01μ
R6	〃	R18	〃 470	C5	
R7	1/8W 9.1K	R19	〃 1K	C6	16V 33μ
R8	〃 10K	R20	〃 Short	C7	50V 1μ
R9	〃 100K	R21	〃 47K	C8	〃 0.001μ
R10	〃 2.2K			C9	
R11	〃 10K			C10	50V 0.01μ

Fig. 11-16-8 +24 V Control Circuit Diagram

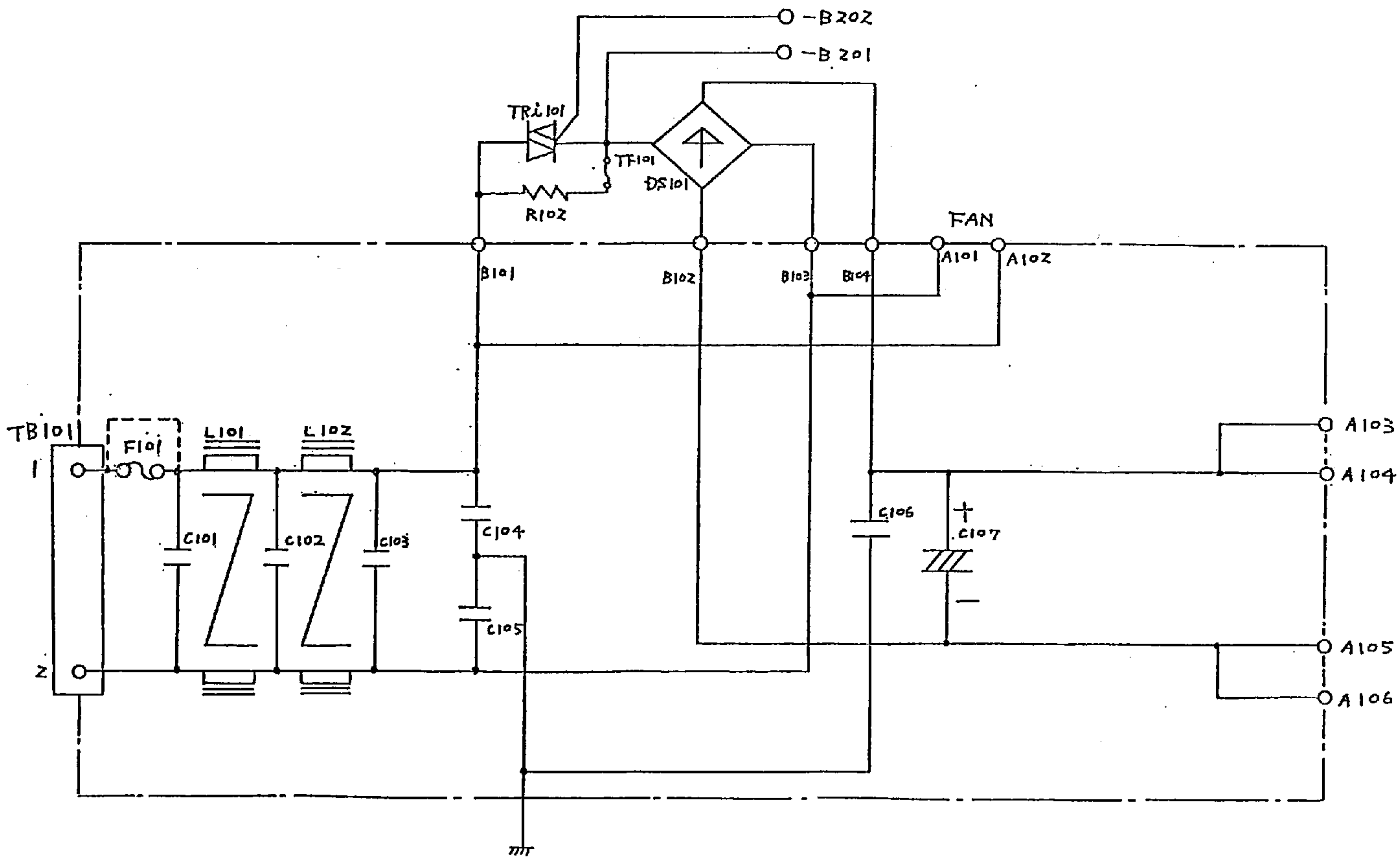


Fig. 11-16-9 Input Circuit Diagram

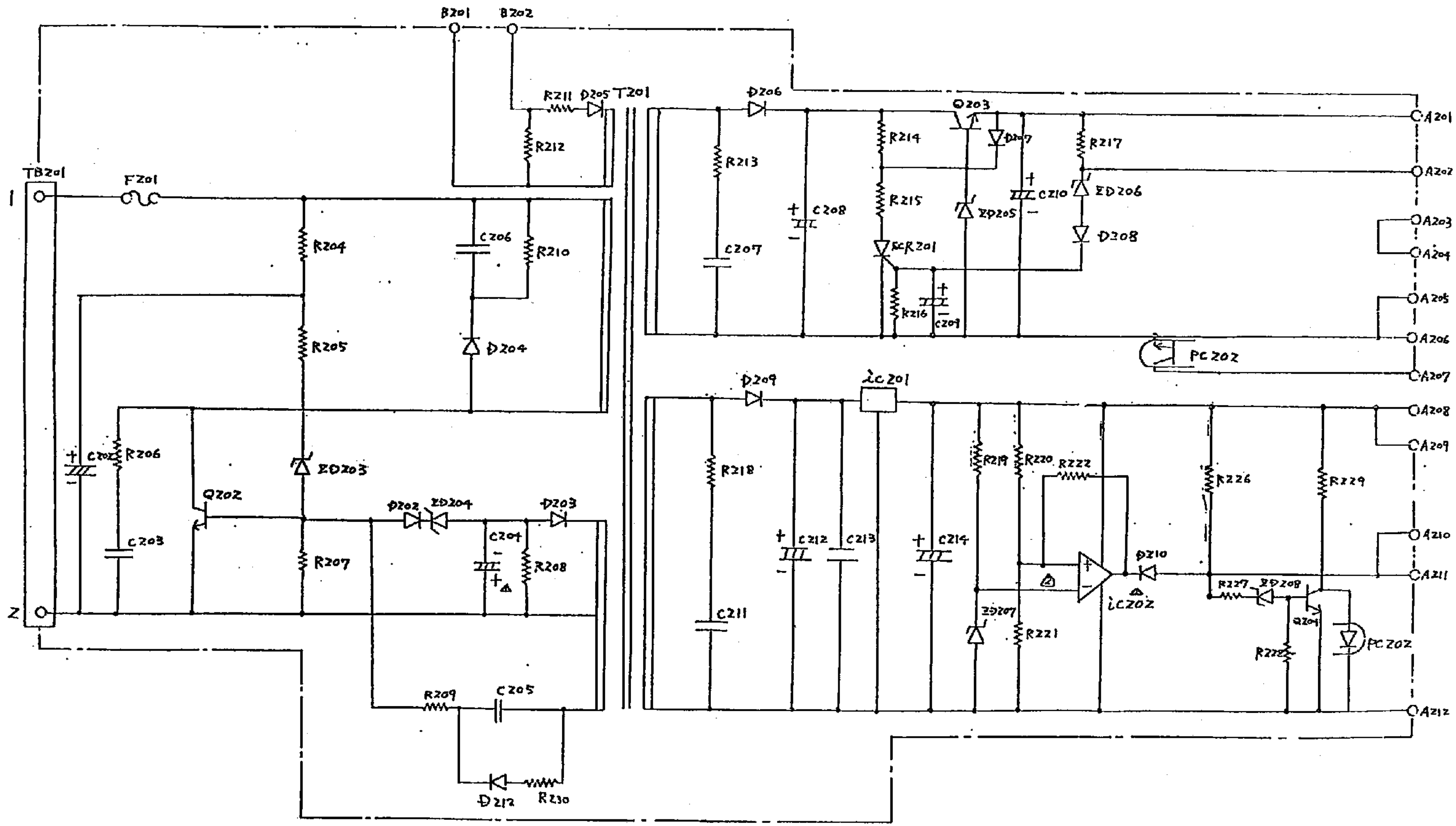


Fig. 11-16-10 Sub Power Supply Diagram

12. WIRING DIAGRAMS

12-1 AC Line Circuit Diagram

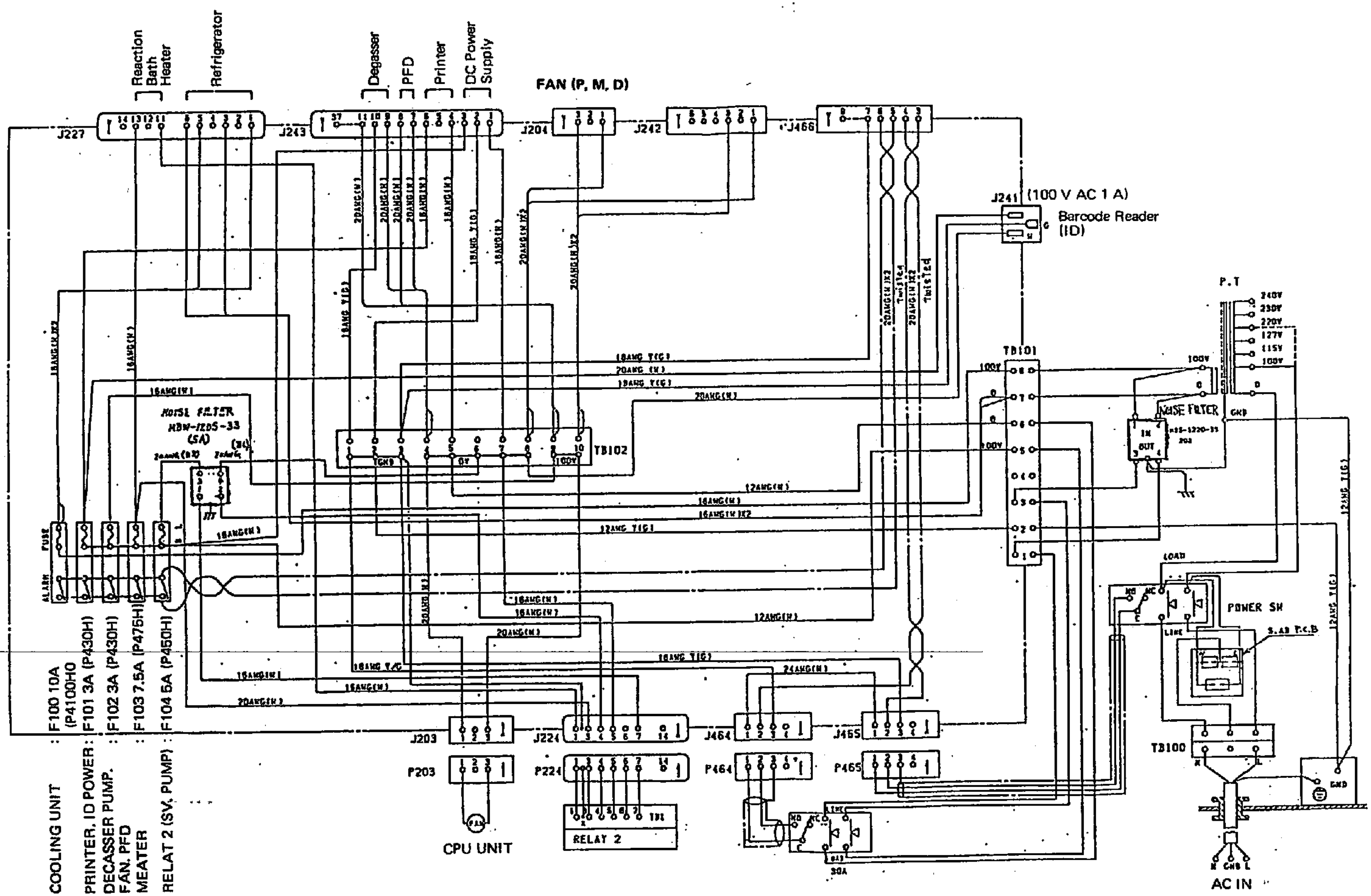
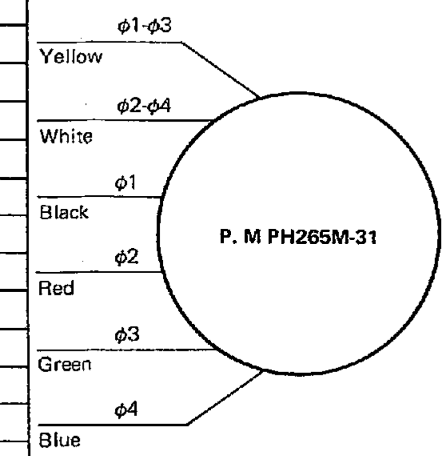


Fig. 12-1-1

1. Sample Disk Mecha.

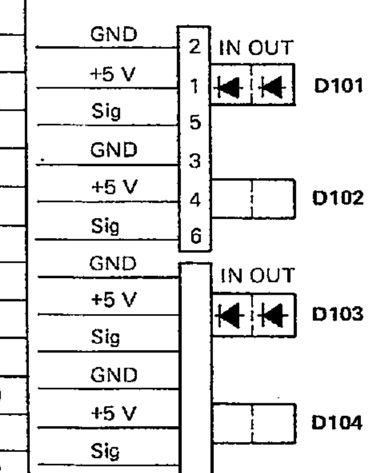
P134

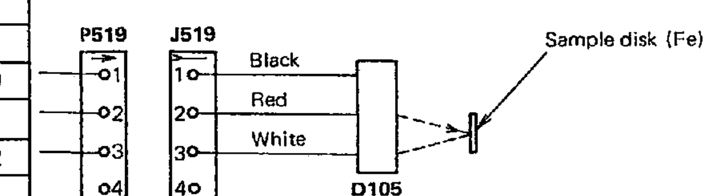
Pin No.		Symbol	In/Out	I/O Logic	Application	Remarks	Connector No./Pin No.	Control IC
1	B							
	A							
2	B							
	A	+24					J420 – 23	P420 – 23
3	B							
	A	+24					J420 – 24	P420 – 24
4	B							
	A	ϕ1			Sample disk rotation		J420 – 25	P420 – 25
5	B				Stepping motor			
	A	ϕ2					J420 – 26	P420 – 26
6	B							
	A	ϕ3					J420 – 27	P420 – 27
7	B							
	A	ϕ4					J420 – 28	P420 – 28
8	B							
	A							
9	B							
	A							
10	B							
	A							



P321

Pin No.		Symbol	In/Out	I/O Logic	Application	Remarks	Connector No./Pin No.	Control IC
1	B							
	A							
2	B	G			GND		J420 – 1	P420 – 1
	A	+5			+5 Sample disk outer count	Detect by bright	J420 – 2	P420 – 2
3	B	O count			Sig		J420 – 3	P420 – 3
	A	G			GND		J420 – 4	P420 – 4
4	B	+5			+5 Sample disk inner count	Detect by bright	J420 – 5	P420 – 5
	A	I count			Sig		J420 – 6	P420 – 6
5	B	G					J420 – 7	P420 – 7
	A	+5					J420 – 8	P420 – 8
6	B	–			Sample disk home	Detect by bright	J420 – 9	P420 – 9
	A	G			GND		J420 – 10	P420 – 10
7	B	+5			+5		J420 – 11	P420 – 11
	A	S home			Sig		J420 – 12	P420 – 12
8	B							
	A							
9	B	GND			GND		J420 – 20	P420 – 20
	A	+24			+24 Sample disk ID		J420 – 21	P420 – 21
10	B	SDID			Sig		J420 – 22	P420 – 22
	A							

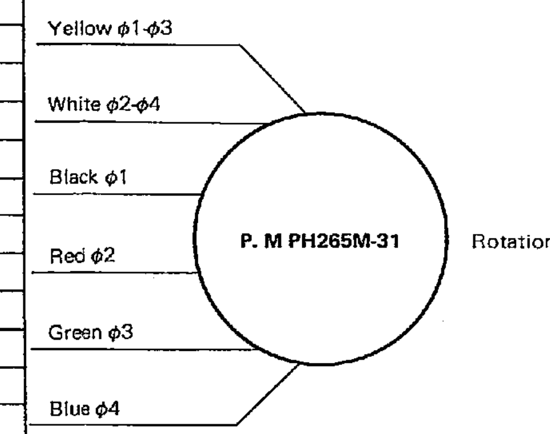




2. R1 Disk Mecha.

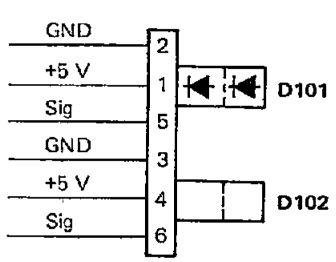
P135-1

Pin No.		Symbol	In/Out	I/O Logic	Application	Remarks	Connector No./Pin No.	Control IC
1	B							
	A							
2	B							
	A	+24					J424 – 2	P424 – 2
3	B							
	A	+24					J424 – 3	P424 – 3
4	B							
	A	$\phi 1$					J424 – 4	P424 – 4
5	B				R1 disk rotation stepping motor			
	A	$\phi 2$					J424 – 5	P424 – 5
6	B							
	A	$\phi 3$					J424 – 6	P424 – 6
7	B							
	A	$\phi 4$					J424 – 7	P424 – 7
8	B							
	A							
9	B							
	A							
10	B							
	A							



P323

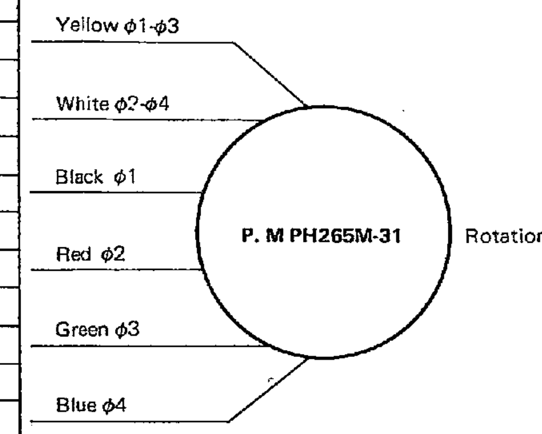
Pin No.		Symbol	In/Out	I/O Logic	Application	Remarks	Connector No./Pin No.	Control IC
1	B							
	A							
2	B	GND			GND		J424 – 9	P424 – 9
	A	+5			+5 PCP for R1 count	Detect by bright	J424 – 10	P424 – 10
3	B	R2 count			Sig		J424 – 11	P424 – 11
	A	GND			GND		J424 – 12	P424 – 12
4	B	+5			+5 PCP for R1 home	Detect by bright	J424 – 13	P424 – 13
	A	R2 home			Sig		J424 – 14	P424 – 14
5	B							
	A							
6	B							
	A							
7	B							
	A							
8	B							
	A							
9	B							
	A							
10	B							
	A							



3. R2 Disk Mecha.

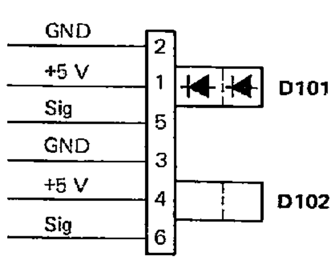
P135-2

Pin No.		Symbol	In/Out	I/O Logic	Application	Remarks	Connector No./Pin No.	Control IC
1	B							
	A							
2	B							
	A	+24					J423 – 2	P423 – 2
3	B							
	A	+24					J423 – 3	P423 – 3
4	B							
	A	ϕ1					J423 – 4	P423 – 4
5	B				R2 disk rotation stepping motor			
	A	ϕ2					J423 – 5	P423 – 5
6	B							
	A	ϕ3					J423 – 6	P423 – 6
7	B							
	A	ϕ4					J423 – 7	P423 – 7
8	B							
	A							
9	B							
	A							
10	B							
	A							



P325

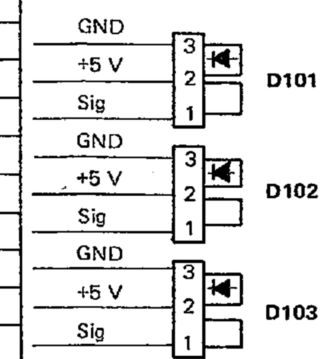
Pin No.		Symbol	In/Out	I/O Logic	Application	Remarks	Connector No./Pin No.	Control IC
1	B							
	A							
2	B	GND			GND		J423 – 9	P423 – 9
	A	+5			+5 PCP for R2 count	Detect by bright	J423 – 10	P423 – 10
3	B	R2 count			Sig		J423 – 11	P423 – 11
	A	GND			GND		J423 – 12	P423 – 12
4	B	+5			+5 PCP for R2 home	Detect by bright	J423 – 13	P423 – 13
	A	R2 home			Sig		J423 – 14	P423 – 14
5	B							
	A							
6	B							
	A							
7	B							
	A							
8	B							
	A							
9	B							
	A							
10	B							
	A							



4. Reaction Disk Mecha.

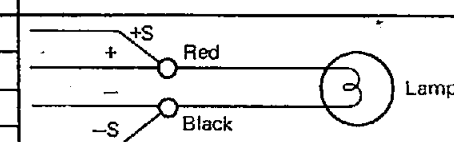
P320

Pin No.		Symbol	In/Out	I/O Logic	Application	Remarks	Connector No./Pin No.	Control IC
1	B							
	A							
2	B	GND			GND		P419 – 8	J419 – 8
	A	+5			+5 Reaction disk home	Detect by bright	P419 – 9	J419 – 9
3	B	RD home			Sig		P419 – 10	J419 – 10
	A	GND			GND		P419 – 11	J419 – 11
4	B	+5			+5 Reaction disk cell count	Detect by bright	P419 – 12	J419 – 12
	A	C count			Sig		P419 – 13	J419 – 13
5	B	GND			GND		P419 – 14	J419 – 14
	A	+5			+5 Reaction disk ADC start	Detect by bright	P419 – 15	J419 – 15
6	B	ADC			Sig		P419 – 16	J419 – 16
	A							
7	B							
	A							
8	B							
	A							



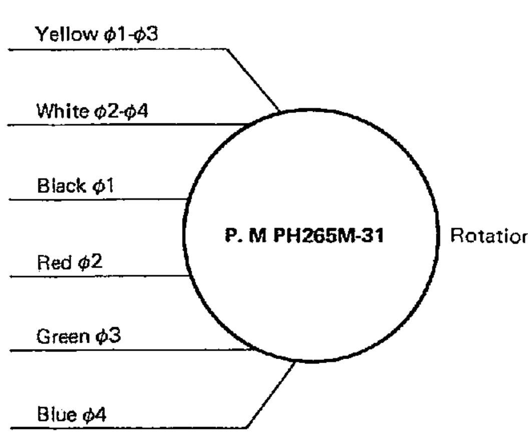
P452

Pin No.		Symbol	In/Out	I/O Logic	Application	Remarks	Connector No./Pin No.	Control IC
1		(+S)					P419 – 1	J419 – 1
2		+12					P419 – 2	J419 – 2
3		0					P419 – 3	J419 – 3
4		(–S)					P419 – 4	J419 – 4



P133-1

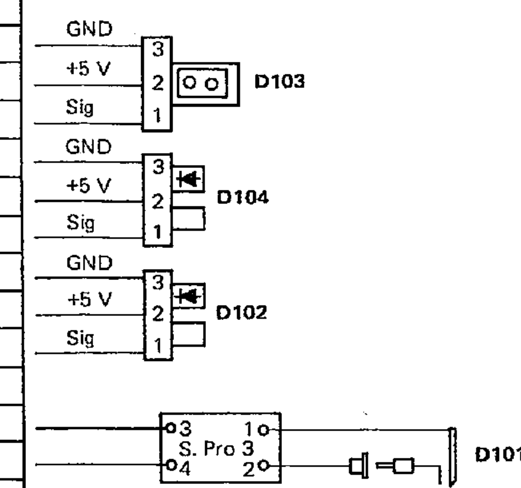
Pin No.		Symbol	In/Out	I/O Logic	Application	Remarks	Connector No./Pin No.	Control IC
1	B							
	A							
2	B							
	A	+24					J427 – 2	P427 – 2
3	B							
	A	+24					J427 – 3	P427 – 3
4	B							
	A	$\phi 1$					J427 – 4	P427 – 4
5	B				Reaction disk rotation			
	A	$\phi 2$					J427 – 5	P427 – 5
6	B							
	A	$\phi 3$					J427 – 6	P427 – 6
7	B							
	A	$\phi 4$					J427 – 7	P427 – 7
8	B							
	A							



5. Serum Sampling Mecha. (1/2)

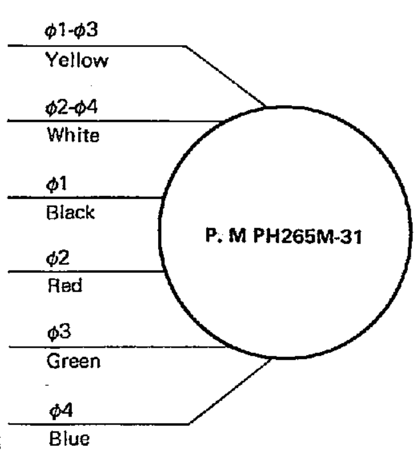
P322

Pin No.		Symbol	In/Out	I/O Logic	Application	Remarks	Connector No./Pin No.	Control IC
1	B							
	A							
2	B	GND			GND		J421 – 4	P421 – 4
	A	+5			+5 Serum probe abnormal down	Detect by bright	J421 – 5	P421 – 5
3	B	E stop			Sig		J421 – 6	P421 – 6
	A	GND			GND		J421 – 7	P421 – 7
4	B	+5			+5 Serum probe upper dead point	Detect by dark	J421 – 8	P421 – 8
	A	UL			Sig		J421 – 9	P421 – 9
5	B	GND			GND		J421 – 10	P421 – 10
	A	+5			+5 Serum probe rotation home	Detect by bright	J421 – 11	P421 – 11
6	B	Home			Sig		J421 – 12	P421 – 12
	A							
7	B	LS –			– Liquid level sensor	Nozzle (–)	J421 – 17	P421 – 17
	A	LS +			+	Liquid level sensor (+)	J421 – 18	P421 – 18
8	B							
	A							
9	B							
	A							
10	B							
	A							



P131-1

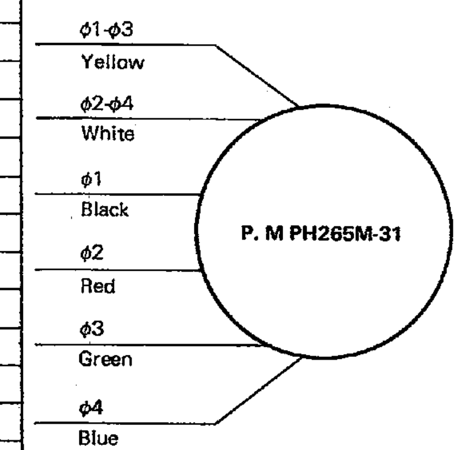
Pin No.		Symbol	In/Out	I/O Logic	Application	Remarks	Connector No./Pin No.	Control IC
1	B							
	A							
2	B							
	A	+24					J421 – 23	P421 – 23
3	B							
	A	+24					J421 – 24	P421 – 24
4	B							
	A	$\phi1$					J421 – 25	P421 – 25
5	B				Serum probe up/down stepping motor			
	A	$\phi2$					J421 – 26	P421 – 26
6	B							
	A	$\phi3$					J421 – 27	P421 – 27
7	B							
	A	$\phi4$					J421 – 28	P421 – 28
8	B							
	A							
9	B							
	A							
10	B							
	A							



5. Serum Sampling Mecha. (2/2)

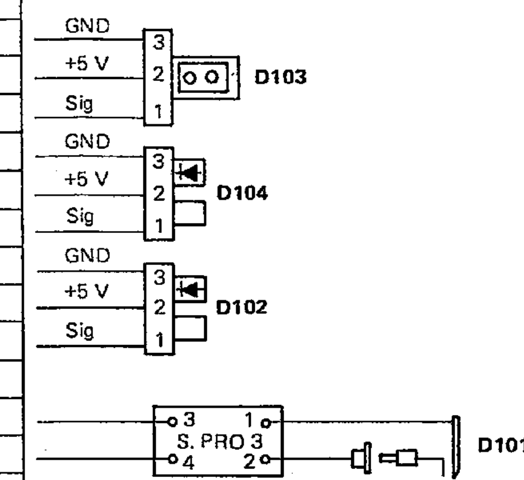
P132-1

Pin No.		Symbol	In/Out	I/O Logic	Application	Remarks	Connector No./Pin No.	Control IC
1	B							
	A							
2	B							
	A	+24					J421 – 31	P421 – 31
3	B							
	A	+24					J421 – 32	P421 – 32
4	B							
	A	$\phi1$					J421 – 33	P421 – 33
5	B				Serum probe rotation Stepping motor			
	A	$\phi2$					J421 – 34	P421 – 34
6	B							
	A	$\phi3$					J421 – 35	P421 – 35
7	B							
	A	$\phi4$					J421 – 36	P421 – 36
8	B							
	A							
9	B							
	A							
10	B							
	A							



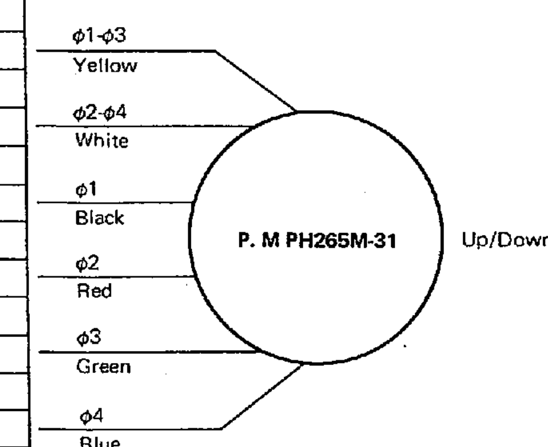
6. R1 Sampling Mecha. (1/2)

Pin No.		Symbol	In/Out	I/O Logic	Application	Remarks	Connector No./Pin No.	Control IC
1	B							
	A							
2	B	GND			GND		J426 – 4	P426 – 4
	A	+5			+5 R1 probe abnormal down	Detect by bright	J426 – 5	P426 – 5
3	B	E stop			Sig		J426 – 6	P426 – 6
	A	GND			GND		J426 – 7	P426 – 7
4	B	+5			+5 R1 probe upper dead point	Detect by dark	J426 – 8	P426 – 8
	A	UL			Sig		J426 – 9	P426 – 9
5	B	GND			GND		J426 – 10	P426 – 10
	A	+5			+5 R1 probe rotation home	Detect by bright	J426 – 11	P426 – 11
6	B	Home			Sig		J426 – 12	P426 – 12
	A							
7	B	LS –			– Liquid level sensor	Nozzle (–)	J426 – 17	P426 – 17
	A	LS +			+	Liquid level sensor (+)	J426 – 18	P426 – 18
8	B							
	A							
9	B							
	A							
10	B							
	A							



P131-2

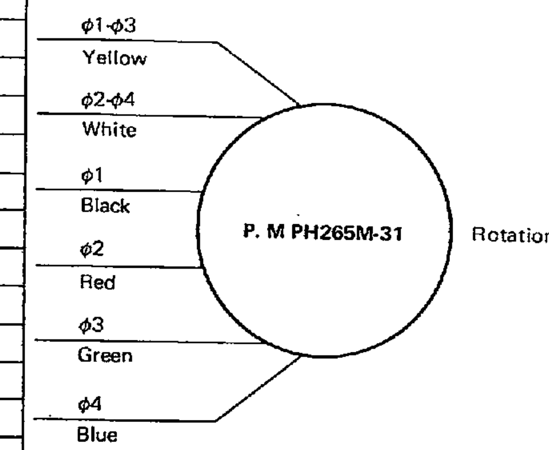
Pin No.		Symbol	In/Out	I/O Logic	Application	Remarks	Connector No./Pin No.	Control IC
1	B							
	A							
2	B							
	A	+24					J426 – 23	P426 – 23
3	B							
	A	+24					J426 – 24	P426 – 24
4	B							
	A	$\phi 1$					J426 – 25	P426 – 25
5	B				R1 probe up/down stepping motor			
	A	$\phi 2$					J426 – 26	P426 – 26
6	B							
	A	$\phi 3$					J426 – 27	P426 – 27
7	B							
	A	$\phi 4$					J426 – 28	P426 – 28
8	B							
	A							
9	B							
	A							
10	B							
	A							



6. R1 Sampling Mecha. (2/2)

P132-2

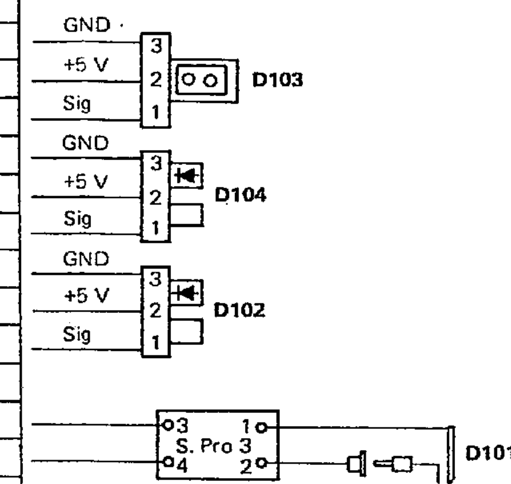
Pin No.		Symbol	In/Out	I/O Logic	Application	Remarks	Connector No./Pin No.	Control IC
1	B							
	A							
2	B							
	A	+24			R1 probe rotation stepping motor		J426 – 31	P426 – 31
3	B							
	A	+24					J426 – 32	P426 – 32
4	B							
	A	$\phi 1$					J426 – 33	P426 – 33
5	B							
	A	$\phi 2$					J426 – 34	P426 – 34
6	B							
	A	$\phi 3$					J426 – 35	P426 – 35
7	B							
	A	$\phi 4$					J426 – 36	P426 – 36
8	B							
	A							
9	B							
	A							
10	B							
	A							



7. R2 Sampling Mecha. (1/2)

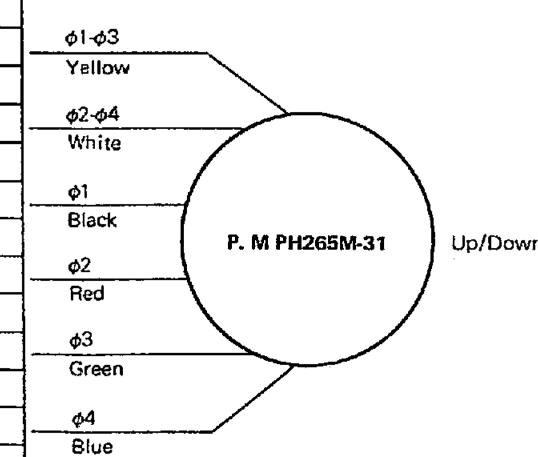
P326

Pin No.		Symbol	In/Out	I/O Logic	Application	Remarks	Connector No./Pin No.	Control IC
1	B							
	A							
2	B	GND			GND		J422 – 4	P422 – 4
	A	+5			+5 R2 probe abnormal down	Detect by bright	J422 – 5	P422 – 5
3	B	E stop			Sig		J422 – 6	P422 – 6
	A	GND			GND		J422 – 7	P422 – 7
4	B	+5			+5 R2 probe upper dead point	Detect by dark	J422 – 8	P422 – 8
	A	UL			Sig		J422 – 9	P422 – 9
5	B	GND			GND		J422 – 10	P422 – 10
	A	+5			+5 R2 probe rotation home	Detect by bright	J422 – 11	P422 – 11
6	B	Home			Sig		J422 – 12	P422 – 12
	A							
7	B	LS –			– Liquid level sensor	Nozzle (–)	J422 – 17	P422 – 17
	A	LS +			–	Liquid level sensor (+)	J422 – 18	P422 – 18
8	B							
	A							
9	B							
	A							
10	B							
	A							



P133-2

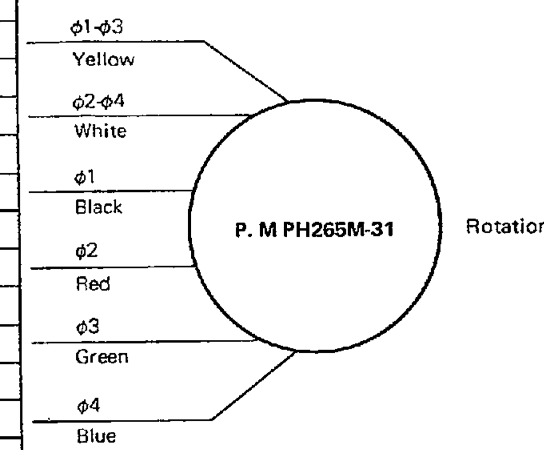
Pin No.		Symbol	In/Out	I/O Logic	Application	Remarks	Connector No./Pin No.	Control IC
1	B							
	A							
2	B							
	A	+24					J422 – 23	P422 – 23
3	B							
	A	+24					J422 – 24	P422 – 24
4	B							
	A	$\phi1$					J422 – 25	P422 – 25
5	B				R2 probe rotation stepping motor			
	A	$\phi2$					J422 – 26	P422 – 26
6	B							
	A	$\phi3$					J422 – 27	P422 – 27
7	B							
	A	$\phi4$					J422 – 28	P422 – 28
8	B							
	A							
9	B							
	A							
10	B							
	A							



7. R2 Sampling Mecha. (2/2)

P134-2

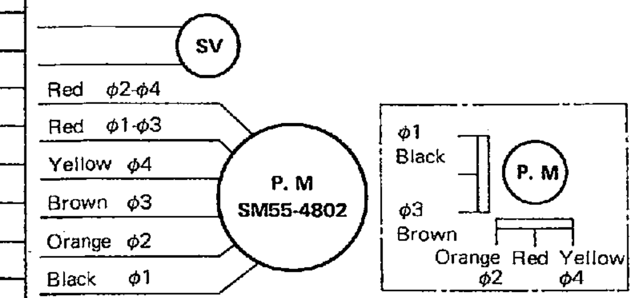
Pin No.		Symbol	In/Out	I/O Logic	Application	Remarks	Connector No./Pin No.	Control IC
1	B							
	A							
2	B							
	A	+24					J422 – 31	P422 – 31
3	B							
	A	+24					J422 – 32	P422 – 32
4	B							
	A	$\phi1$					J422 – 33	P422 – 33
5	B				R2 probe up/down stepping motor			
	A	$\phi2$					J422 – 34	P422 – 34
6	B							
	A	$\phi3$					J422 – 35	P422 – 35
7	B							
	A	$\phi4$					J422 – 36	P422 – 36
8	B							
	A							
9	B							
	A							
10	B							
	A							

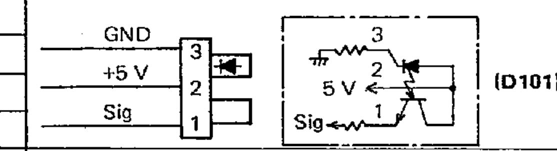


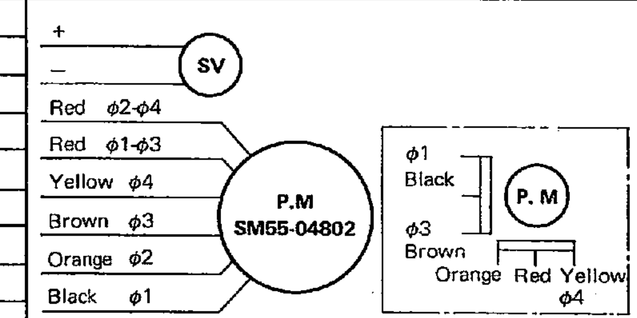
8. Syringe Mecha.

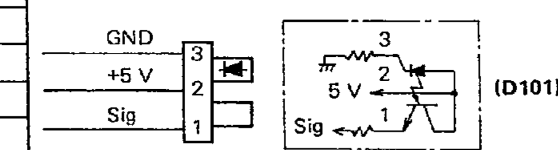
P327 To DIST PCB

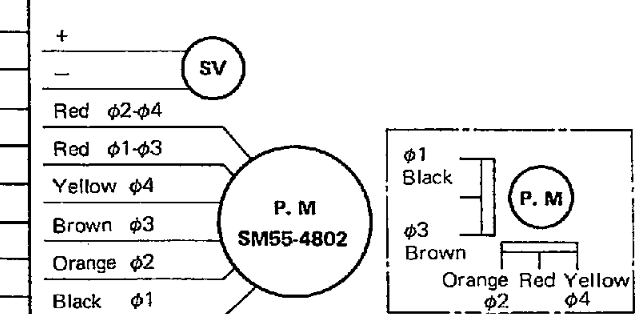
Pin No.		Symbol	In/Out	I/O Logic	Application	Remarks	Connector No./Pin No.	Control IC
1	B							
	A	24 V			+24 V — SV 1		P414 – 1	J414 – 1
2	B	SV 1			Sig		P414 – 2	J414 – 2
	A	+24 V			24 V — Serum syringe stepping motor		P414 – 3	J414 – 3
3	B	24 V			24 V		P414 – 4	J414 – 4
	A	$\phi4$			$\phi4$		P414 – 5	J414 – 5
4	B	$\phi3$			$\phi3$		P414 – 6	J414 – 6
	A	$\phi2$			$\phi2$		P414 – 7	J414 – 7
5	B	$\phi1$			$\phi1$		P414 – 8	J414 – 8
	A							
6	B	GND			GND — Serum syringe upper dead point	Detect by black	P414 – 11	J414 – 11
	A	+5			+5		P414 – 12	J414 – 12
7	B	UL			Sig		P414 – 13	J414 – 13
	A							
8	B	24 V			24 V — SV 2		P415 – 1	J415 – 1
	A	SV 2			Sig		P415 – 2	J415 – 2
9	B	24 V			24 V — R1 syringe stepping motor		P415 – 3	J415 – 3
	A	24 V			24 V		P415 – 4	J415 – 4
10	B	$\phi4$			$\phi4$		P415 – 5	J415 – 5
	A	$\phi3$			$\phi3$		P415 – 6	J415 – 6
11	B	$\phi2$			$\phi2$		P415 – 7	J415 – 7
	A	$\phi1$			$\phi1$		P415 – 8	J415 – 8
12	B							
	A	GND			GND — R1 syringe upper dead point	Detect by black	P415 – 11	J415 – 11
13	B	+5			+5		P415 – 12	J415 – 12
	A	UL			Sig		P415 – 13	J415 – 13
14	B							
	A	24 V			24 V — SV 3		P416 – 1	J416 – 1
15	B	SV 2			Sig		P416 – 2	J416 – 2
	A	24 V			24 V — R2 syringe stepping motor		P416 – 3	J416 – 3
16	B	24 V			24 V		P416 – 4	J416 – 4
	A	$\phi4$			$\phi4$		P416 – 5	J416 – 5
17	B	$\phi2$			$\phi3$		P416 – 6	J416 – 6
	A	$\phi3$			$\phi2$		P416 – 7	J416 – 7
18	B	$\phi1$			$\phi1$		P416 – 8	J416 – 8
	A							
19	B	GND			GND — R2 syringe upper dead point	Detect by black	P416 – 11	J416 – 11
	A	+5			+5		P416 – 12	J416 – 12
20	B	UL			Sig		P416 – 13	J416 – 13
	A							

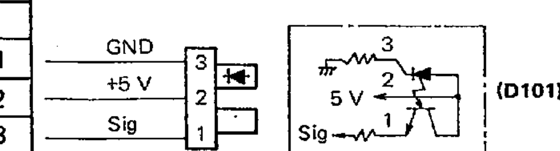








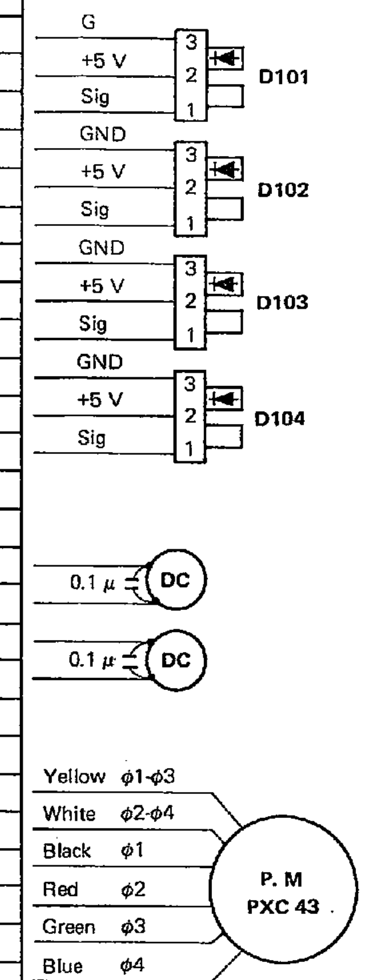




9. Stirrer Mecha.

P329-J425

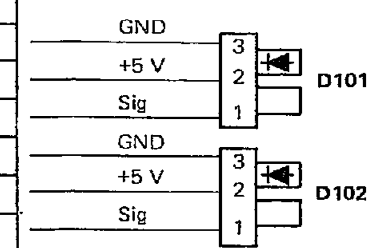
Pin No.		Symbol	In/Out	I/O Logic	Application		Remarks	Connector No./Pin No.	Control IC
1	B								
	A								
2	B	GND			GND	Stirrer upper dead point	Detect by bright	J425 – 1	P425 – 1
	A				+5			J425 – 2	P425 – 2
3	B	UL			Sig			J425 – 3	P425 – 3
	A	GND			GND	Stirrer lower dead point	Detect by bright	J425 – 4	P425 – 4
4	B	+5			+5			J425 – 5	P425 – 5
	A	LL			Sig			J425 – 6	P425 – 6
5	B	GND			GND	Stirrer cell side	Detect by bright	J425 – 7	P425 – 7
	A	+5			+5			J425 – 8	P425 – 8
6	B	CELL			Sig			J425 – 9	P425 – 9
	A	GND			GND	Stirrer home (rinsing side)	Detect by bright	J425 – 10	P425 – 10
7	B	+5			+5			J425 – 11	P425 – 11
	A	HOME			Sig			J425 – 12	P425 – 12
8	B								
	A								
9	B	R1 +			+	R1 stirrer rod rotation DC motor		J425 – 13	P425 – 13
	A	R1 –			–			J425 – 14	P425 – 14
10	B	R2 +			+	R2 stirrer rod rotation DC motor		J425 – 15	P425 – 15
	A	R2 –			–			J425 – 16	P425 – 16
11	B								
	A								
12	B	ϕ1-3			ϕ1-3	Stirrer back/forth stepping motor		J425 – 23	P425 – 23
	A	ϕ2-4			ϕ2-4			J425 – 24	P425 – 24
13	B	ϕ1			ϕ1			J425 – 25	P425 – 25
	A	ϕ2			ϕ2			J425 – 26	P425 – 26
14	B	ϕ3			ϕ3			J425 – 27	P425 – 27
	A	ϕ4			ϕ4			J425 – 28	P425 – 28
15	B								
	A								
16	B								
	A								
17	B								
	A								
18	B								
	A								
19	B								
	A								
20	B								
	A								



10. Rinse Mecha.

P328 on Dist PCB

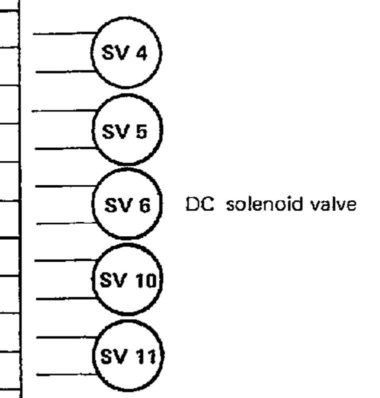
Pin No.		Symbol	In/Out	I/O Logic	Application	Remarks	Connector No./Pin No.	Control IC
1	B							
	A							
2	B	GND			GND		P428 – 5	J428 – 5
	A	+5			+5 Upper dead point detect	Detect by bright	P428 – 6	J428 – 6
3	B	UL			Sig		P428 – 7	J428 – 7
	A	GND			GND		P428 – 8	J428 – 8
4	B	+5			+5 Lower dead point detect	Detect by bright	P428 – 9	J428 – 9
	A	LL			Sig		P428 – 10	J428 – 10
5	B							
	A							
6	B							
	A							
7	B							
	A							
8	B							
	A							
9	B							
	A							
10	B							
	A							



11. DC Solenoid Valve and DC Motor

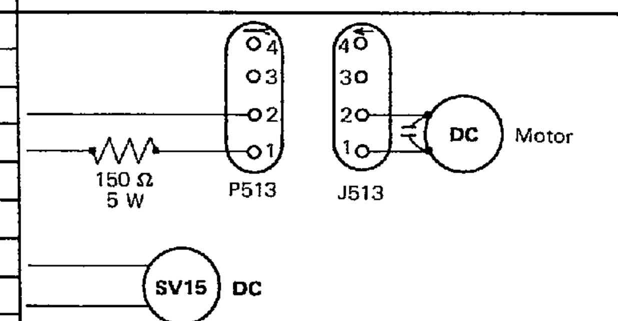
P82-1

Pin No.		Symbol	In/Out	I/O Logic	Application	Remarks	Connector No./Pin No.	Control IC
1	B							
	A							
2	B	24 V			+24 V } SV 4 (D/O 1 – 4)	} Serum sampling nozzle rinsing (Outside)	J510 – 1	
	A		OUT		Sig		J510 – 2	
3	B	24 V			+24 V } SV 5 (D/O 1 – 5)	} R1, R2 sampling nozzle rinsing (Outside)	J510 – 3	
	A		OUT		Sig		J510 – 4	
4	B	24 V			+24 V } SV 6 (D/O 1 – 6)	} Stirrer rod rinsing	J510 – 5	
	A		OUT		Sig		J510 – 6	
5	B	24 V			+24 V } SV 10 (D/O 1 – 7	} Add incubation bath water	J510 – 7	
	A		OUT		Sig		J510 – 8	
6	B	24 V			+24 V } SV 11 (D/O 2 – 0)	} Rinse tip rinsing	J510 – 9	
	A		OUT		Sig		J510 – 10	
7	B	24 V			} Spare			
	A		OUT					
8	B	24 V			} No use (use for 100 V sig)			
	A		OUT					
9	B	24 V						
	A		OUT					
10	B							
	A							



P82-2

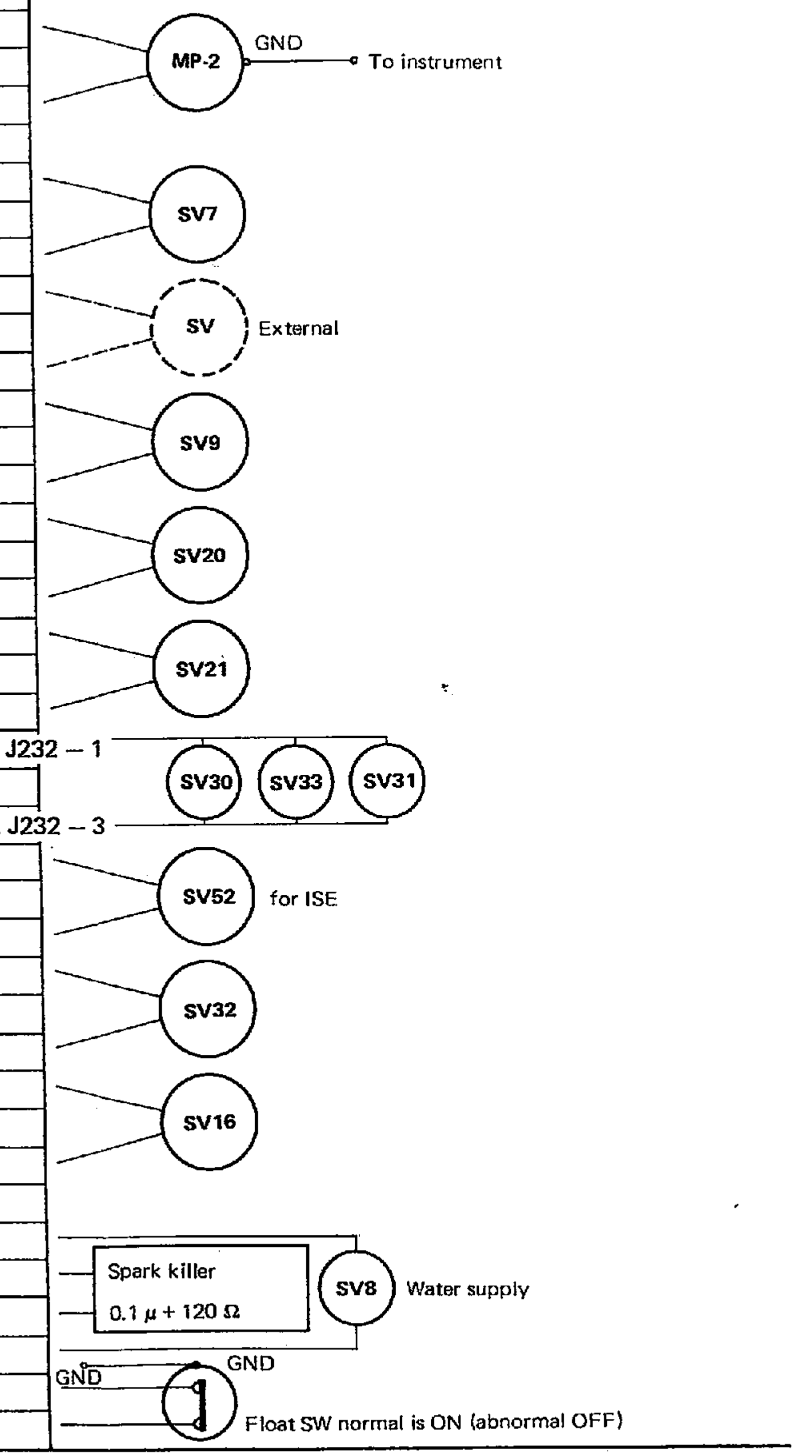
Pin No.		Symbol	In/Out	I/O Logic	Application	Remarks	Connector No./Pin No.	Control IC
1	B							
	A							
2	B	24 V			+24 V } DC motor (D/O 3 – 4)	} Extran	P514 – 2	J514 – 2
	A				Sig		P514 – 1	J514 – 1
3	B	24 V			+24 V } Spare (D/O 3 – 5)			
	A				Sig			
4	B	24 V			+24 V } SV 15 (D/O 3 – 6)	} Rinse (cell blank	P509 – 1	J509 – 1
	A				Sig		P509 – 2	J509 – 2
5	B	24 V			+24 V } Spare (D/O 3 – 7)	} DC SV		
	A				Sig			
6	B	24 V			} No use (use for AC 100 V SV)			
	A							
7	B	24 V						
	A							
8	B	24 V						
	A							
9	B	24 V						
	A							
10	B							
	A							



12. AC Motor and Solenoid Valve (1/2)

P312

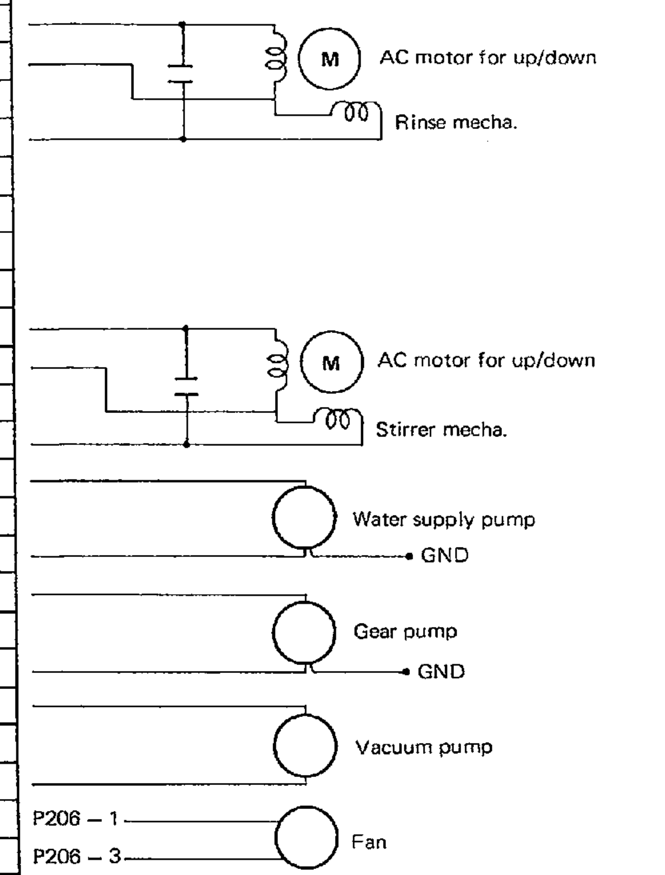
Pin No.		Symbol	In/Out	I/O Logic	Application	Remarks	Connector No./Pin No.	Control IC
1	B							
	A							
2	B				U		P212 – 1	J212 – 1
	A				MP-2 (Incubation water circulation pump)			
3	B				V		P212 – 3	J212 – 3
	A							
4	B				U		J219 – 1	P219 – 1
	A				SV7 Rinse water supply			
5	B				V		J219 – 3	P219 – 3
	A				U		P220 – 1	P220 – 1
6	B				SV8 Water supply			
	A				V		P220 – 5	P220 – 5
7	B				U		J219 – 7	P219 – 7
	A				SV9 Incubation bath water supply			
8	B				V		J219 – 9	P219 – 9
	A				U		P228 – 1	P228 – 1
9	B				SV20 Overflow aspiration			
	A				V		P228 – 2	J228 – 2
10	B				U		P228 – 3	J228 – 3
	A				SV21 Waste sipper			
11	B				V		P228 – 4	J228 – 4
	A				U		P230, P231, P232 – 1	J230, J231, J232 – 1
12	B				SV30, SV33 Draining overflow water (Parallel) SV31 Draining high concentration water solution			
	A				V		P230, P231, P232 – 3	J230, J231, J232 – 3
13	B				U		P233 – 1	J233 – 1
	A				SV52 (ISE) Waste solution aspiration			
14	B				V		P233 – 3	J233 – 3
	A				U		J229 – 1	P229 – 1
15	B				SV32 Incubation bath waste			
	A				V		J229 – 3	P229 – 3
16	B				U		P234 – 1	J234 – 1
	A				SV16 Changeover of incubation bath temperature			
17	B				V		P234 – 3	J234 – 3
	A							
18	B						J235 – 1	P235 – 1
	A						J235 – 3	P235 – 3
19	B						J235 – 5	P235 – 5
	A						J235 – 6	P235 – 6
20	B						J223 – 1	P223 – 1
	A						J223 – 3	P223 – 3



12. AC Motor and Solenoid Valve (2/2)

P316

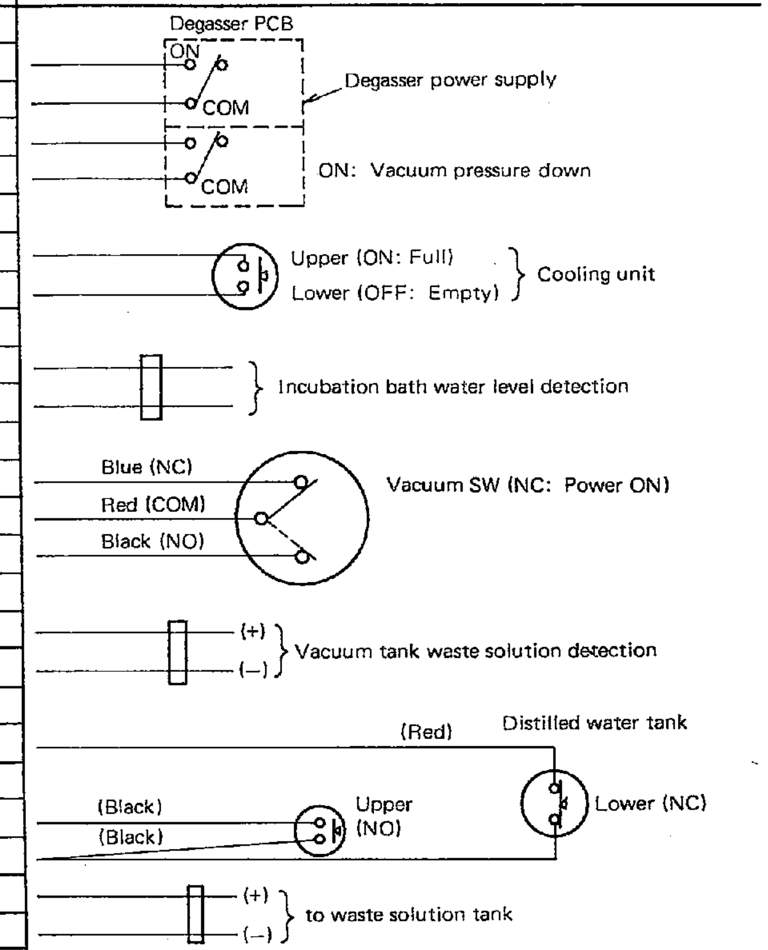
Pin No.		Symbol	In/Out	I/O Logic	Application	Remarks	Connector No./Pin No.	Control IC
1	B							
	A							
2	B				V (Rotation)		P215 – 4	J215 – 4
	A				U (Common)		P215 – 3	J215 – 3
3	B				Up/down rinse mecha.			
	A				V (Stop)		P215 – 1	J215 – 1
4	B							
	A							
5	B							
	A							
6	B				V (Rotation)		J216 – 4	P216 – 4
	A				U (Common)		J216 – 3	P216 – 3
7	B				Up/down stirrer mecha.			
	A				V (Stop)		J216 – 1	P216 – 1
8	B				U		P213 – 1	J213 – 1
	A				Water supply pump			
9	B				V		P213 – 3	J213 – 3
	A				U		P214 – 1	J214 – 1
10	B				Gear pump			
	A				V		P214 – 3	J214 – 3
11	B				U		P211 – 1	J211 – 1
	A				Vacuum pump			
12	B				V		P211 – 3	J211 – 3
	A						P211 – 4	J206 – 1
13	B						P211 – 5	J206 – 3
	A							
14	B							
	A							
15	B							
	A							
16	B							
	A							
17	B							
	A							
18	B							
	A							
19	B							
	A							
20	B							
	A							



13. Other Sensors

P332

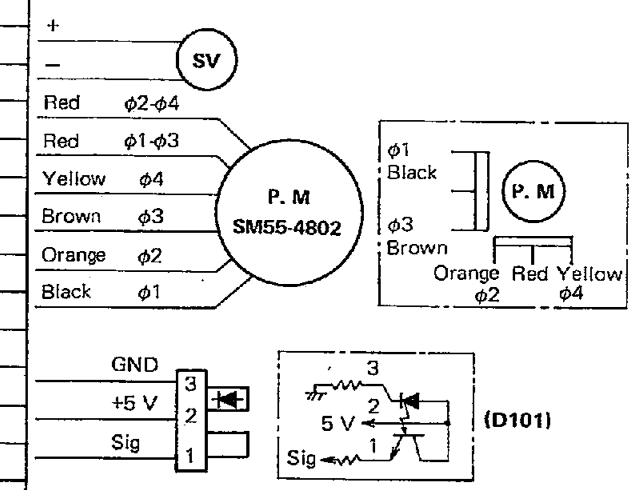
Pin No.		Symbol	In/Out	I/O Logic	Application	Remarks	Connector No./Pin No.	Control IC
1	B							
	A	DG +1			1 Abnormal degasser detection	On: Abnormal	P515 – 1	J515 – 1
2	B	DG –1			1		P515 – 3	J515 – 3
	A	DG +2			2		P515 – 4	J515 – 4
3	B	DG –2			2		P515 – 6	J515 – 6
	A							
4	B	CW +			+ Cold water tank level detection	Float sensor (On: Full)	J502 – 1	P502 – 1
	A	CW –			–		J502 – 2	P502 – 2
5	B							
	A	RBWL +			+ Incubation water level detection	Liquid level sensor	J503 – 1	P503 – 1
6	B	RBWL –			–		J503 – 2	P503 – 2
	A							
7	B	V.SW NC			NC Vacuum pressure detection	(Vacuum)	P506 – 1	J506 – 1
	A	V.SW COM			COM	Vacuum SW	P506 – 2	J506 – 2
8	B	V.SW NO			NO	(Atmosphere)	P506 – 3	J506 – 3
	A							
9	B	V. T +				Liquid level sensor	P507 – 1	J507 – 1
	A	VT –					P507 – 2	J507 – 2
10	B							
	A	DWL +			+ Distilled water tank empty	(On: Empty)	J504 – 1	P504 – 1
11	B	DWL –			–		J504 – 2	P504 – 2
	A	DWH +			+ Distilled water tank full	(On: Full)	J504 – 3	P504 – 3
12	B	DWH –			–		J504 – 4	P504 – 4
	A	WS +			+ Waste solution tank full	Liquid level sensor	J505 – 1	P505 – 1
13	B	WS –			–		J505 – 2	P505 – 2
	A							
14	B							
	A							
15	B							
	A							
16	B							
	A							
17	B							
	A							
18	B							
	A							
19	B							
	A							
20	B							
	A							

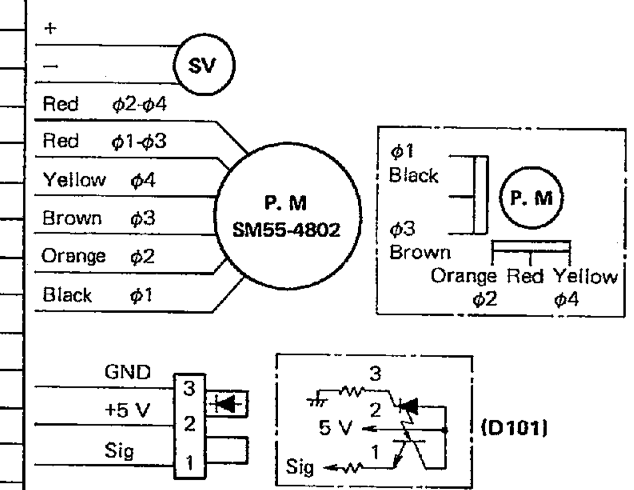


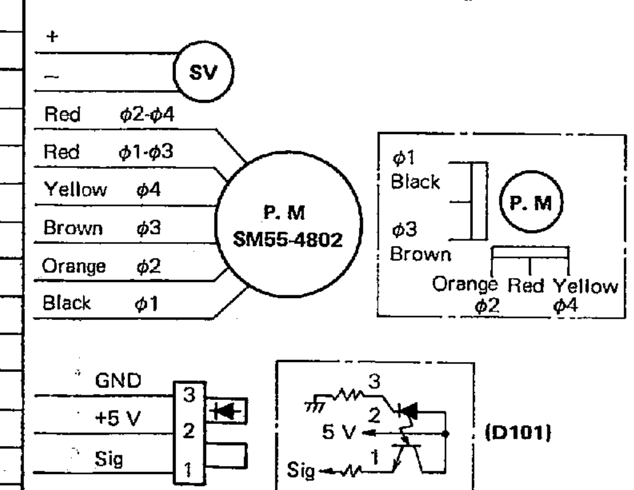
14. ISE Syringe Mecha.

P330 To DIST PCB

Pin No.		Symbol	In/Out	I/O Logic	Application		Remarks	Connector No./Pin No.	Control IC
1	B								
	A	24 V			24 V	ISE SV1		P437 – 1	J437 – 1
2	B	ISESV1			Sig			P437 – 2	J437 – 2
	A	24 V			24 V	Stepping motor for ISE SIP syringe		P437 – 3	J437 – 3
3	B	24 V			24 V			P437 – 4	J437 – 4
	A	φ4			φ4			P437 – 5	J437 – 5
4	B	φ3			φ3			P437 – 6	J437 – 6
	A	φ2			φ2			P437 – 7	J437 – 7
5	B	φ1			φ1			P437 – 8	J437 – 8
	A								
6	B	GND			GND	ISE SIP syringe upper dead point	Detect by dark	P437 – 11	J437 – 11
	A	+5			+5			P437 – 12	J437 – 12
7	B	Sig			Sig			P437 – 13	J437 – 13
	A								
8	B	24 V			24 V	ISE SV2		P438 – 1	J438 – 1
	A	ISESV2			Sig			P438 – 2	J438 – 2
9	B	24 V			24 V	Stepping motor for ISE syringe		P438 – 3	J438 – 3
	A	24 V			24 V			P438 – 4	J438 – 4
10	B	φ4			φ4			P438 – 5	J438 – 5
	A	φ3			φ3			P438 – 6	J438 – 6
11	B	φ2			φ2			P438 – 7	J438 – 7
	A	φ1			φ1			P438 – 8	J438 – 8
12	B								
	A	GND			GND	ISE DIL syringe upper dead point	Detect by dark	P438 – 11	J438 – 11
13	B	+5			+5			P438 – 12	J438 – 12
	A	Sig			Sig			P438 – 13	J438 – 13
14	B								
	A	24 V			24 V	ISE SV3		P439 – 1	P439 – 1
15	B	ISESV3			Sig			P439 – 2	P439 – 2
	A	24 V			24 V	Stepping motor for ISE syringe		P439 – 3	P439 – 3
16	B	24 V			24 V			P439 – 4	P439 – 4
	A	φ4			φ4			P439 – 5	P439 – 5
17	B	φ3			φ3			P439 – 6	P439 – 6
	A	φ2			φ2			P439 – 7	P439 – 7
18	B	φ1			φ1			P439 – 8	P439 – 8
	A								
19	B	GND			GND	ISE is syringe upper dead point	Detect by dark	P439 – 11	P439 – 11
	A	+5			+5			P439 – 12	P439 – 12
20	B	Sig			Sig			P439 – 13	P439 – 13
	A								



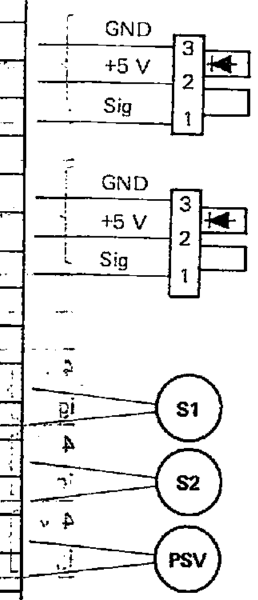




15. ISE Solenoid Valve

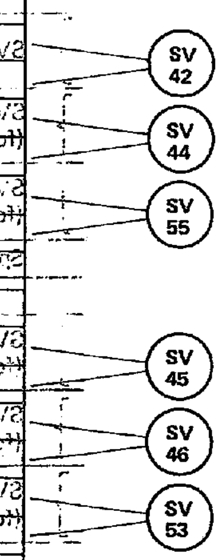
P331 J434 ISE Solenoid

Pin No.		Symbol	In/Out	I/O Logic	Application	Remarks	Connector No./Pin No.	Control IC
1	B							
	A	GND			PCP for ISE door open		J433 – 1	P433 – 1
2	B	+5					J433 – 2	P433 – 2
	A	Door					J433 – 3	P433 – 3
3	B							
	A	GND			PCP for vacuum nozzle down		J434 – 1	P434 – 1
4	B	+5					J434 – 2	P434 – 2
	A	Nozzle					J434 – 3	P434 – 3
5	B							
	A							
6	B	24 V			24 V Solenoid for vacuum nozzle up/down		J434 – 4	P434 – 4
	A	S1			Sig		J434 – 5	P434 – 5
7	B	24 V			24 V Solenoid for shutter		J434 – 6	P434 – 6
	A	S2			Sig		J434 – 7	P434 – 7
8	B	24 V			24 V Pinch valve		J434 – 8	P434 – 8
	A	PSV			Sig		J434 – 9	P434 – 9
9	B							
	A	24 V						
10	B							
	A							



P82-3

Pin No.		Symbol	In/Out	I/O Logic	Application	Remarks	Connector No./Pin No.	Control IC
1	B							
	A							
2	B				SV42 DC S. VALVE (IS)		P435 – 1	
	A						P435 – 2	
3	B				SV44 DC S. VALVE		P435 – 3	
	A				(for exchange DIL syringe)		P435 – 4	
4	B				SV55 DC S. VALVE		P435 – 5	
	A				(for vacuum)		P435 – 6	
5	B				Spare			
	A							
6	B				SV45 DC S. VALVE		P436 – 1	
	A				(for drain waste solution)		P436 – 2	
7	B				SV46 DC S. VALVE		P436 – 3	
	A				(for KCL supply)		P436 – 4	
8	B				SV53 DC S. VALVE		P436 – 5	
	A				(for DIL supply)		P436 – 6	
9	B							
	A							
10	B							
	A							



12-3 Position of Noise Filters (Right Side View)

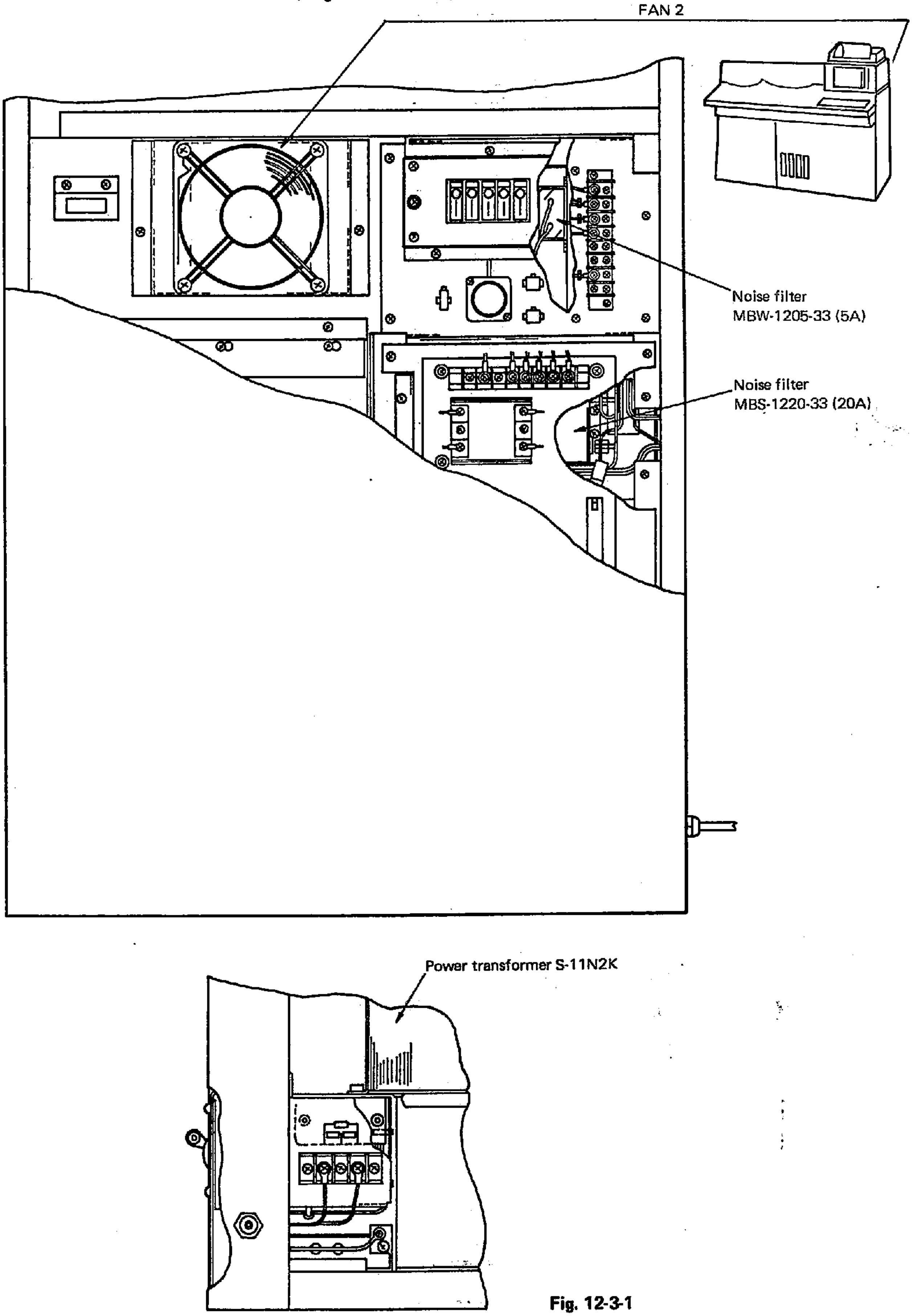


Fig. 12-3-1