Table(9) : Stability of Transfer Resistance Standards

Function of Measurements 1kΩ step 100kΩ step		10kΩ step
R1 to R11 individually 129 mΩ to 200mΩ	2mΩ to 12mΩ	9mΩ to 23
R series Σ Ri 18Ω	31mΩ	83mΩ
R parallel = (Σ 1/Ri) 11mΩ	0.5mΩ	1mΩ

Ambient Temperature (24 ± 0.5) °C

VII-6-5 Solid-State; Zener Reference;; Transfer DC Voltage Standard:

A zener-diode-based DC voltage standard can be an excellent transfer standard for the unit of DC voltage because of its stability against physical shock and temperature changes.

The problems of transporting a unit of voltage and the properties of available Zener standards will be studied to develop a set of characteristics which are considered to be essential for an optimum transport standard.

We are going to examine the performance of some of the high-quality commercially available Zener standards for possible use as a transport standard of voltage with transport accuracies of 2ppm or better.

The purpose of a voltage transport standard is to determine the difference between the units of voltage in any two laboratories.

Therefore we will define a voltage standard as a complete instrument in one box containing four independent units and powered by the AC line or internal batteries. Each unit continuously produces one or more stable voltages such as; (10V, 1V and 1.018V).

The characteristics to be essential requirements of a Zener transport standard are:

1- Predictability of the output voltages .
2- *Multiple independent outputs.*
3- Battery operation .
4- Physical size and weight .
5- Sensitivity to applied AC .
6- Temperature coefficient of the voltage outputs .
7- Quality of the 1.018V output.

VII-6-6 Inductance Measurements:

The precision standard inductors are usually wound as toriods or solenoids on ceramic cores, and the position of connecting leads can greatly affect the measured value of low-valued inductors.

One of our customers sent 14 precision standard inductors to be calibrated at NSCL. According to their technical specifications, the accuracy of those inductors is 0.02% as stated. It was not possible to calibrate them because we do not have an appropriate inductance measuring system. It was then attempted to set up some precision methods "such as the Maxwell-Wien bridge, hay bridge and series owen bridge" to measure the inductance using our own standard capacitor and resistors.

The uncertainty of result obtained so far is 0.05% at 1kHz , and we are going to improve it using standard decade inductors and capacitors which are not available yet, and some better connecting shaded leads.

VII-6-7 An Automation of the Standard Cells Comparisons:

The NSCL's standard cells "locally made" will be calibrated by comparing them directly to NSCL-owned primary standard cells using a series opposition method and redundant measurement design. Two cells are connected in series opposition (one unknown, one reference) and the small voltage difference is read using a digital voltmeter by a desktop computer.

A Fully-automated voltage measuring system will be used for all cell comparisons. Actually only the selection of standard cells as well as the connection to a digital voltmeter (DVM) are manually obtained.

The DVM takes a number of readings of the voltage difference (usually three); the selector switch reconnects the cells with reversed polarity; and the DVM takes three more readings.

The computer records the readings, and when the experimental design is complete, it calculates the estimates' of the cell difference using a least-square method and records the cell emfs on the hard disk and on a floppy disk for back-up.

A summary of the basic statistics is printed after each measurement set.

VII-6-8 Triple point :

The prototype of water triple point container was manufactured at SSRC using glass (Pyrex, Duran Co.). The measurements conducted using our system of measurements (uncertainly ± 0.02°C) showed good stability but the value we measured was 0.06°C.

The shift from 0.01°C is probably due to the impurity of the water enclosed in the container.

VII-6-9 Device to measure Frequency Characteristics of Resistors :

The frequency characteristics of the YEW 2729, 1Ω resistor, in the range 50Hz to 1kHz, is very much needed . To study these characteristics we are accomplishing a home made device. We claim a resolution of about 100ppm which was confirmed by the preliminary measurements.

The second generation will be for a wider range of resistance.

VII-6-10 *I/V Convertor* :

NSCL actually do not have standards in the range (10 to 10)Ω. Mr. Matsumasa Inoue proposed and supervised the realization of a current to voltage convertor which can be used to calibrate resistors in the above mentioned range. The uncertainty claimed by NSCL is better than 5%. All theoretical study and practical measurements show that we can achieve2~1%.

VII-6-11 Electronic Household Watt Hour Meter :

The classical type of watt Hour Meter is manufactured by a Syrian public company. Some problems related to the production line are facing them. In addition, the actual trend in the world is to use digital (electronic) watt hour meters.

Based on the JEMIC extensive experience for development of electronic meter for tarif purposes especially house hold electronic watt hour meters, NSCL began to develop under JEMIC pulse a prototype fit to the Syrian City line.

ANNEX 16

STATE OF NATIONAL STANDARDS AND CALIBRATION LABORATORY (NSCL) , SYRIA

M.Aghbar, M.Kubeitari, C Yamanouchi

National Standard and Calibration Laboratory
Scientific Studies and Research Center
P.O. Box 4470,Damascus-Syrian Arabic Republic

Abstract

Syria began several years ago to establish its National Measurement System . It was clear that such a goal could not be achieved without maintaining National Standards (non specified prior to 1989 the year when the National Standards and Calibration Laboratory, NSCL, was inaugurated). This paper describes the present status of NSCL as well as its activities.

Introduction

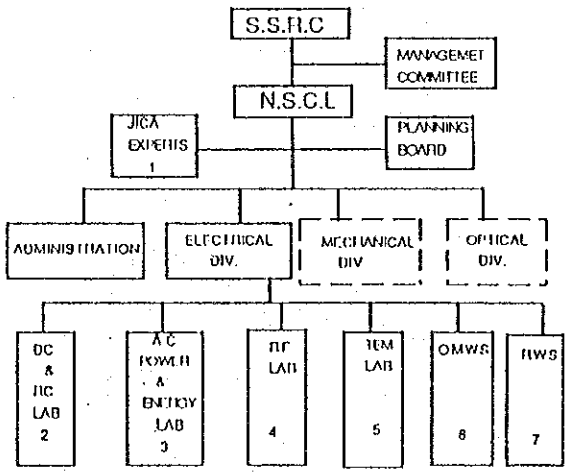
It is well known that no industry will survive in a country where a clear and strong measurement infrastructure is not implemented, in order to insure fair measurement in trade and commerce [1].

Syria began, several years ago, the preparation for such infrastructure. One of the most important elements of this structure is a laboratory (keeper of National Standards) in whom customers may have entire confidence and recognize the ability of its staff in conducting precise (relatively to Syrian needs) measurement.

Hence, the National Standards and Calibration Laboratory (NSCL) was created within the Scientific Studies and Research Center (SSRC) to maintain primary Syrian (National) Standards, to conduct relevant measurements and to ensure the function of the top Syrian hierarchy of physical units and standards.

NSCL maintains now standards of electrical and thermal quantities in addition to frequency. NSCL Fig1 consists of six sections where routine calibration works are performed.

Some of those sections have started original works which will be specified through this paper.



1- JICA: Japan International cooperation agency
2- DC & RC: direct current & resistance capacitance
3- AC: alternating current
4- R.F: radio frequency
5- TEM: temperature
6- O.M.W.S : office machine work shop
7- R.W.S: repair work shop

Fig. 1 NSCL ORGANIZATION

Uniformity of measurement

Syria is planning to join the " Convention du Metre" when formal exchanges of documents recognizing the equivalence of Syrian Standards to others are obtained.

NSCL began bilateral collaboration with some well known laboratories like JEMIC (Japan Electric Meters Inspection Corporation) and JMI (Japan Machinery and Metals Inspection Institute) to seek the evaluation of our standards and measuring systems.

In this paper we will limit ourselves to the evaluation of DC system (the transfer standard being Fluke 732A), frequency system (the transfer standard being rubidium NEC RB1008C) and resistance measuring system (the transfer standard being YOKOGAWA 2794), although the evaluation covered several other systems.

The very first results show that the overall uncertainty of measurements is 3ppm , 5ppm for Fluke 732A (1.018 range) and YOKOGAWA 2794 respectively. The dominant contribution to the present uncertainty results from NSCL's references.

NSCL 's Activities

Table 1 summarizes the calibration services NSCL is providing. NSCL is also providing repair of electronic measuring instruments to minimize the shortage Syria is suffering.

NSCL produced some samples of saturated standard cell[2] as well as fixed resistors and decade resistors[3].

on the other hand NSCL is working out the possibility of performing (summer 1992) a "Third Country Training Programme" addressed to specialized staff of those countries which have just started or intend to start a similar experience.

Table.1 NSCL's Calibration Services

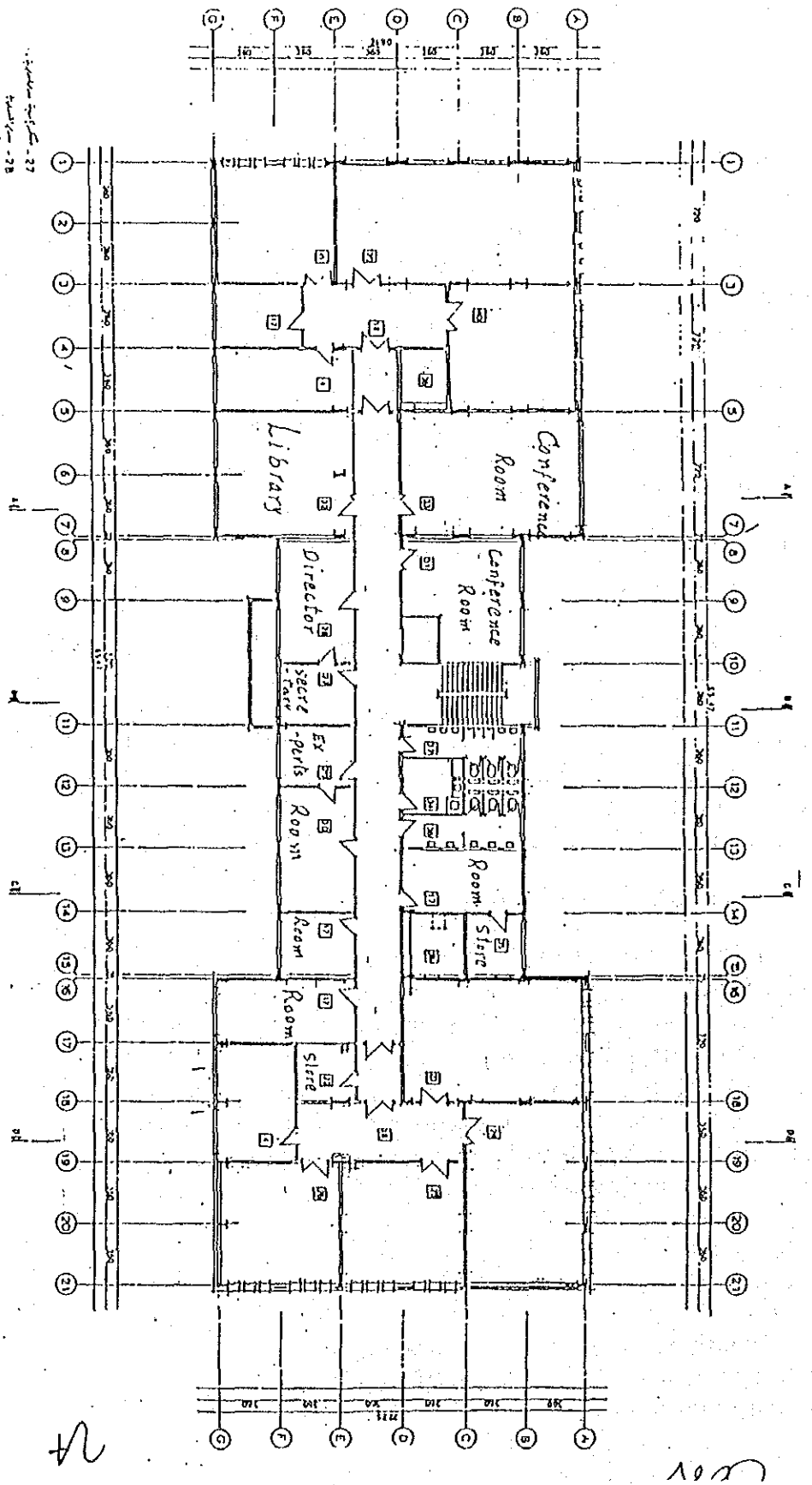
Item	Calib Range	Note	Cal Acc
Std. Res.	1Ω	both stab 1mK	2ppm
Std. Res.	1mΩ to 10MΩ	both Stab 1mK	(5 to 50)ppm
Std cells.	1,018xxxxV	both stab 1mK	2μv
Std cap.	10pF to 1μF	1kHz	100ppm
Cap.Meas.	1pF to 10μF	1kHz	(10 to 100)ppm
Std.Shunts	Up to 30A/100A	DC/AC	100ppm
Bridge/Boxes	*Up to $10^{8}\Omega$*		*(5 to 200) ppm*
Voltage. Cal'r	Up to 1000V	DC	(3 to 70)ppm
Cur. Cal'r	Up to 100A	DC	(20 to 200)ppm
DVM	*Up to 1000V*		*(3 to 20)ppm*
Volt./cur. Cal'r	Up to 1000V/100A	50Hz to 20kHz	0.01%
D.V.M	Up to 1000V	50Hz to 20kHz	0.05%
Cur/Pot.trans.	*Up to 1000A/6.6kV*	*50Hz*	*0.1%*
AC/DC Trans.	Up to 1000V	50Hz to 20kHz	0.01%
PWM	UP to 500V X 30A	50Hz	(0.05 to 0.1)%
WHM	*220V/5,30,40,120A*	*50 Hz*	*0.3%*
RTD	(0 to 630)°C		0.01°C
Thermocouples	Up to 1100°C		1.5°C
Freq.Std	1.5Hz to10MHz		Stab 10^{-10}/mon
RF PW. Meas.	(-20 to15)dBm	100kHz to 1GHz	05dB
Att. Meas	*(0 to70)dB*	*500kHz to 1GHz*	*(0.2 to 2)dB*
Imp. Meas.	R.L. (2 to 35)dB	10MHz to 1GHz	(0.2 to 2)dB
Sig. Gen.	(-110 to 10)dBm	100kHz to 1GHz	1dB
Count/RF Gen	0.1MHz to 1.5 GHz		Stab 5.10^{-8}/mon

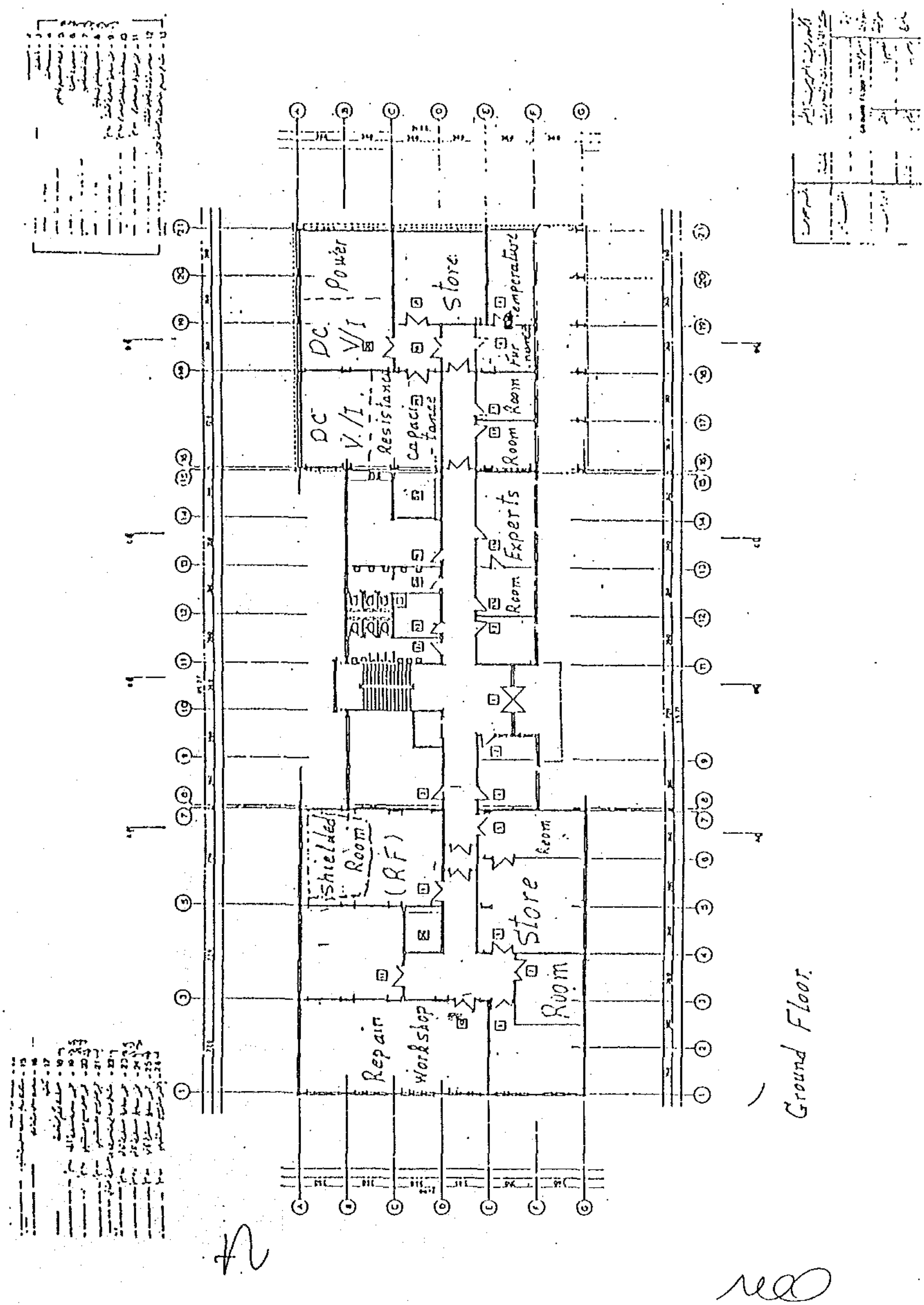
References

[1] W.R.Blevin, "Australia's National Measurement System", in proceedings of the Conference on Precision Electromagnetic Measurements, 1988, pp,250-251.

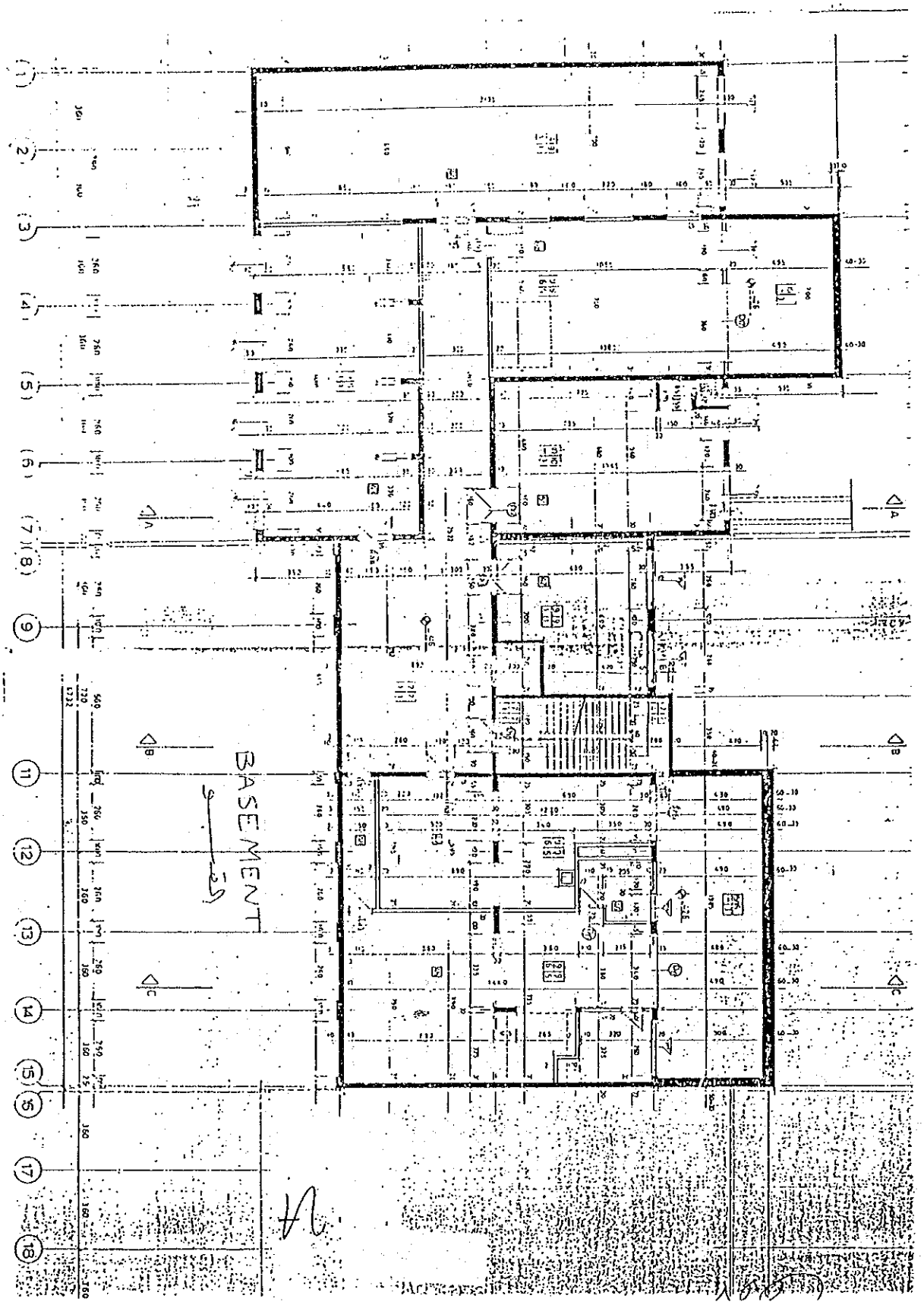
[2] H.Hirayama and K.Shimazaki, "Standard cells with cd-pb amalgam electrode", IEEE Trans Instrum, Meas., 1972 vol. IM-21, pp, 319-323.

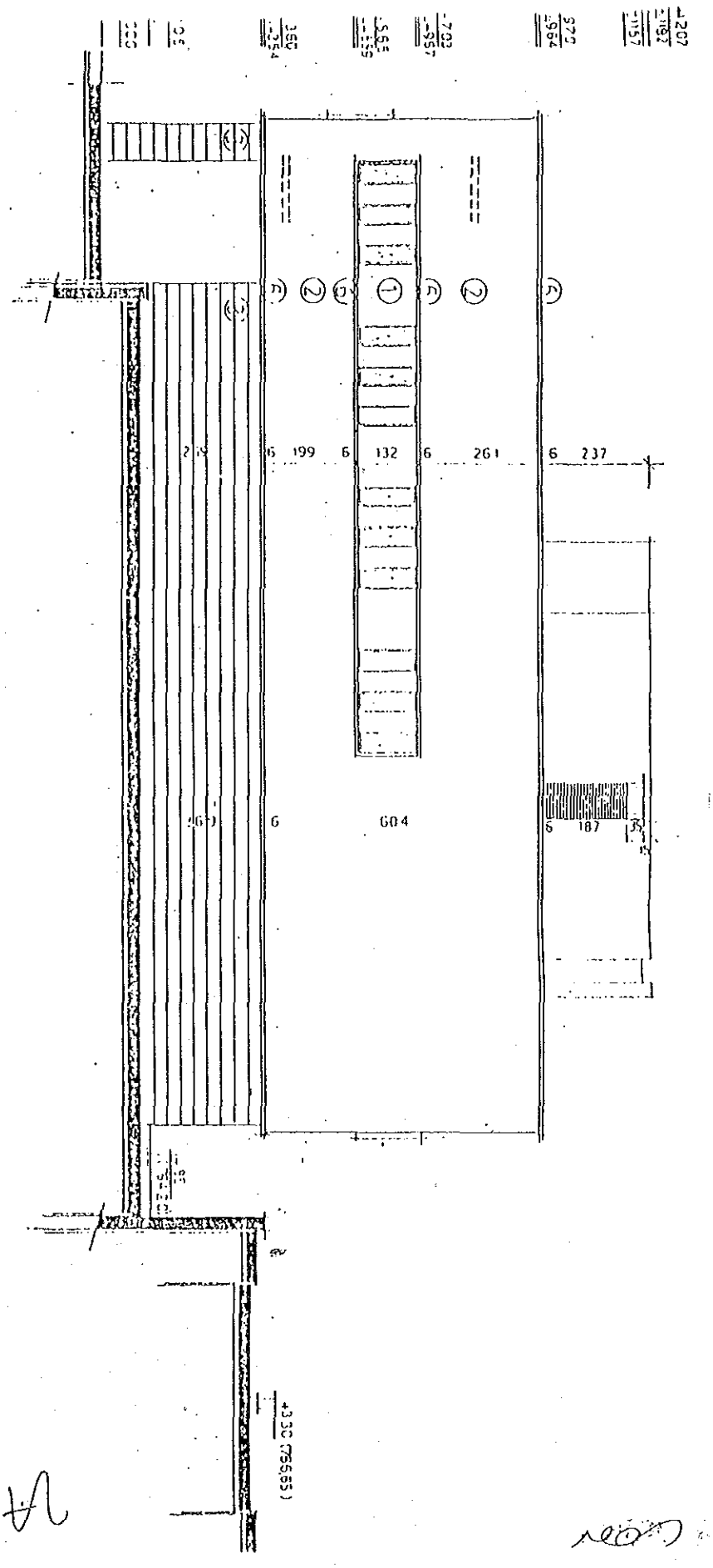
[3]Ibrahim M.H.Saad, "Theory and Design of A new series of Decade Resistors", in Proceedings of Conference on Precision Electromagnetic Measurements, 1988,pp 168-169.

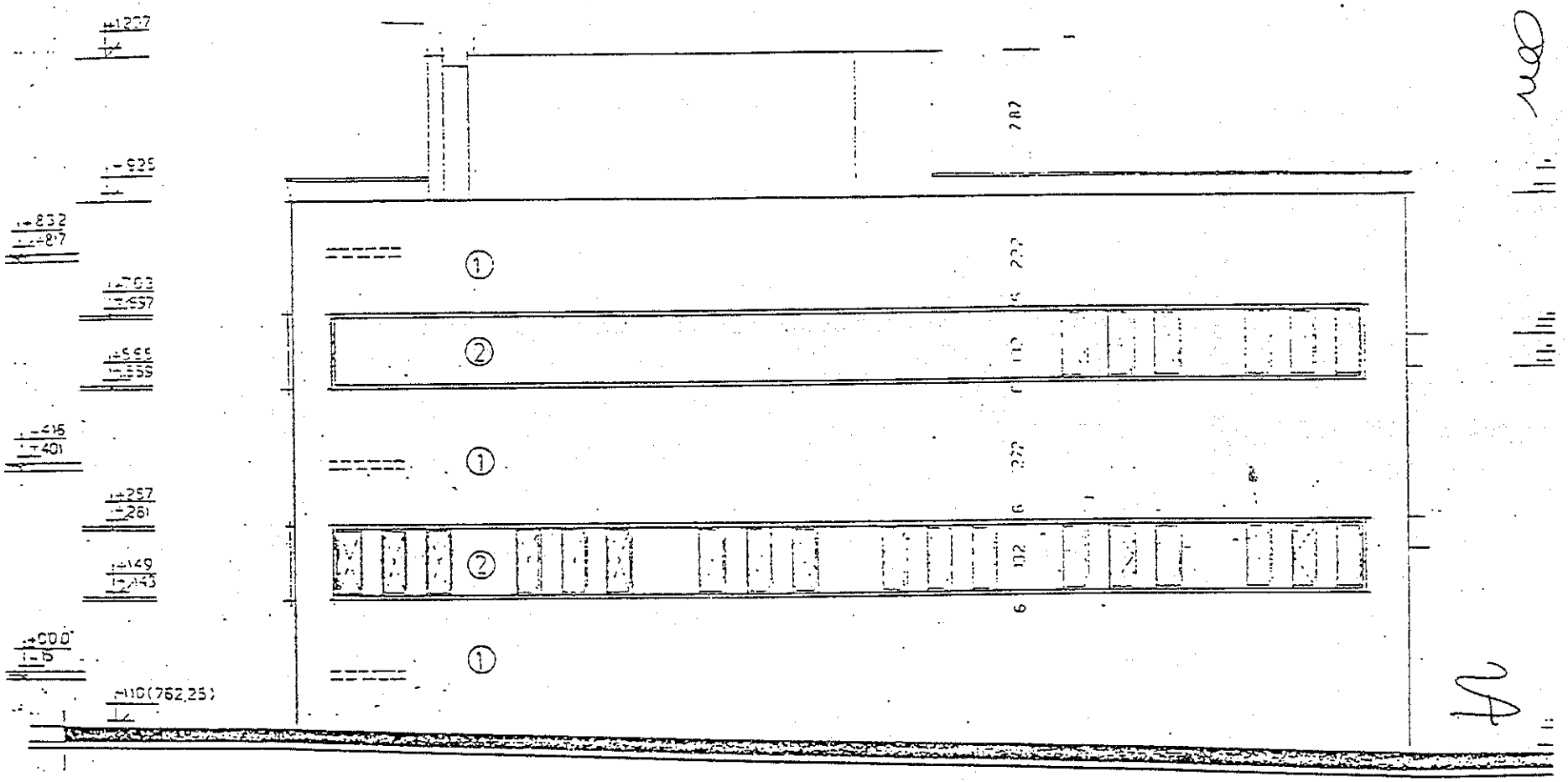

Library
Conference Room
Conference Room
Director
Room
Room
Room
Room
Store
Store



Power
DC V/I
Store
Temperature
Room
DC V/I Resistance
Capacitance
Room
Room
Experts
Room
Shielded Room
(RF)
Room
Store
Room
Repair
Workshop
Ground Floor

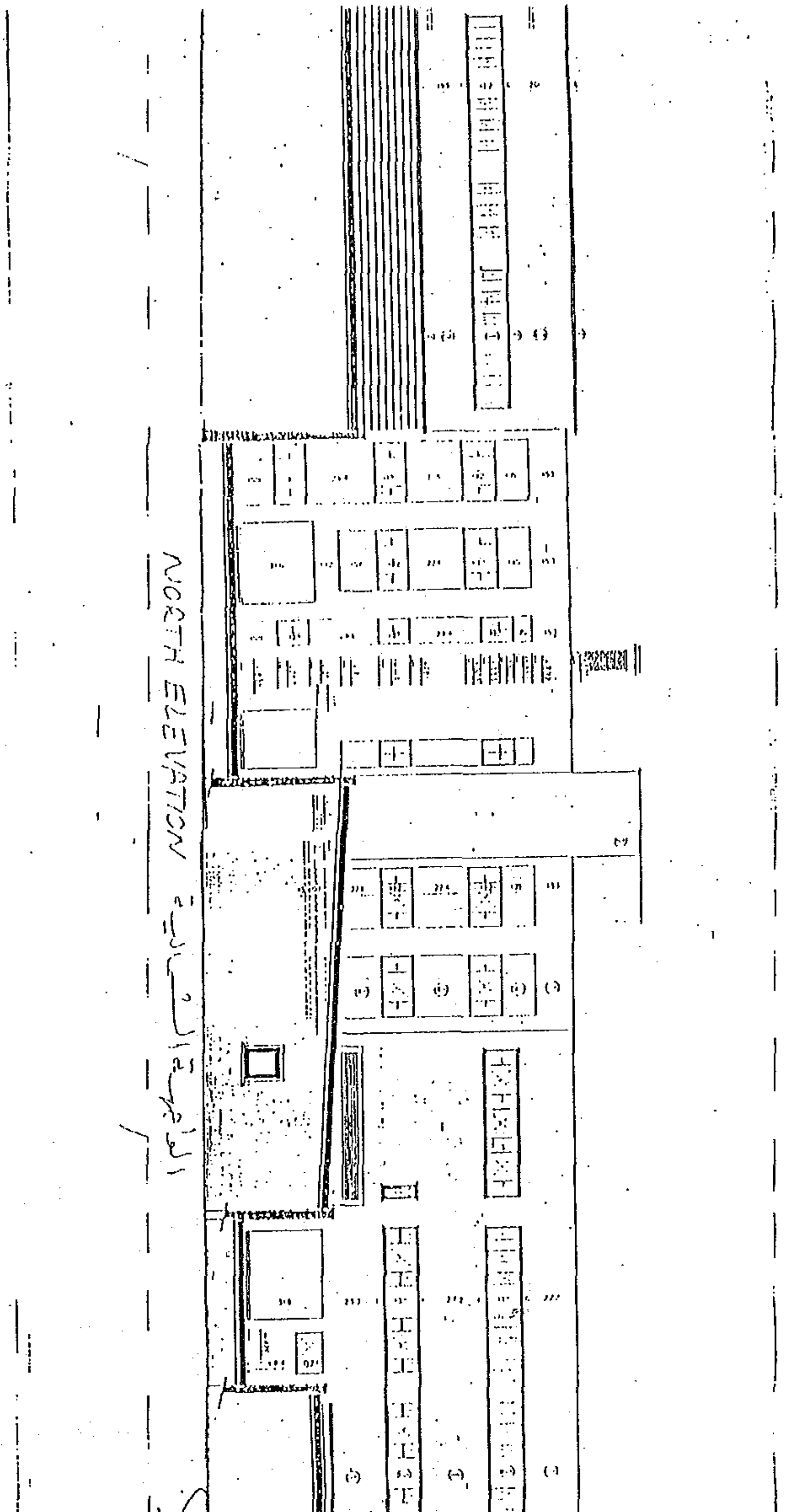

BASEMENT

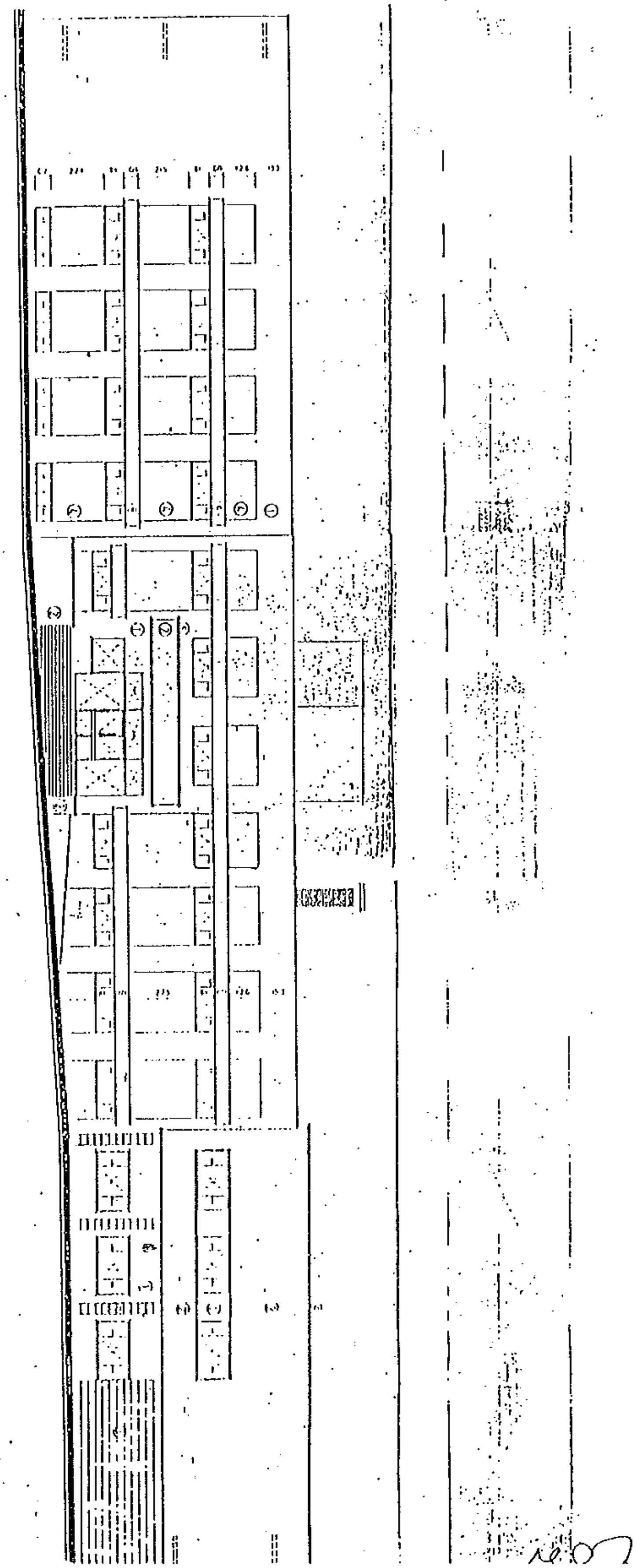

199
132
261
237
187
604



WEST ELEVATION

الواجهة الغربية


NORTH ELEVATION



الواجهة الجنوبية

SOUTH ELEVATION

2. Aide Memoire

Aide Memoire

During the mission of the Japanese Evaluation Team organized by the Japan International Cooporation Agency which visited the Syrian Arab Republic from July 23 to August 2, 1992, informal discussions were held with the SSRC Team on the following matters;

1- The new phase of the NSCL Project which had been officially submitted in 1991 by the Syrian side and relating to the optical and mechanical standards and calibration facility.
2- The possibility of extending the current NSCL project
3- The possibility of benefitting from various JICA and MITI programs for the purpose of enhancing present NSCL capabilities and related activities.
4- The possibilty of implementing several proposals submitted by NSCL for consideration and which had been presented to the previous JICA mission which visited NSCL in July 1991.

Following is a summary of the discussions conducted relative to the above matters:

1- The proposed new phase of NSCL is under review by the Japanese side. Two matters of concern to the Japanese side relate to the availability of the experts having the level required, and the provision of the required budget for the Project. It was agreed that it would be useful that the Syrian side draw up a list of representative organizations and related equipments that will require calibration, and the levels of calibration required in addition to elaborating other technical information associated with this new phase. This will facilitate completing the review of the proposal that was officially submitted.
2- It was pointed out that extension of the current project is not possible since the conditions for extension do not apply to the current project which is considered to have met its objectives in a very satisfactory manner.
3- It was instead suggested that enhancement of the current Project's capabilities would be better met by recourse to a variety of programs available at JICA or MITI, subject to the

specific terms and conditions that apply to such programs. The programs in question include:

a. After - care program

This normally becomes operational 2-3 years after termination of the project in order to permit demonstration of project sustainability before the application of the program. Details of the scope of after-care programs were not at hand.

b. Spare parts

These are normally available on a one time basis and within a limited budget. An application for this program should be made through official channels.

It was pointed out that a more flexible spare parts program may be more cost effective, whereby a contingency sum is allotted, to be used as required and under control of the relevant Japanese party (e.g. JICA Office in Damascus). Such an approach is not presently practiced within JICA.

c. The dispatch of Individual Experts

It was pointed out that such requests should be passed through official channels independently of the Project which is officially terminating in October 1992.

d. Research Cooperation

It was pointed out that this matter can be best pursued through existing programs such as those available through The Institute for Transfer of Industrial Technology, ITIT(a MITI organization). The R and D initiatives already undertaken at NSCL in the area of calibration represent a promising example of potential research cooperation projects.

e. International Research Projects

This is another MITI program which seeks to group international research teams within the framework of specific research fields. It is not clear whether NSCL can presently participate in such programs.

4 - The proposals submitted by NSCL for consideration in the Minutes of Discussions of the 1991 Japanese Consultation Survey Team and which were repeated in the Report about NSCL Achievements in 1992 submitted during the present visit of the Japanese Evaluation Team, were presented and briefly discussed. These and other new needs are addressed below.:

>Third Country Training Program (TCTP)

>Participation in group training courses (new need)

>Traceability of NSCL standards

>Service Car

>Dispatch of Trainees (new need) : (1) DC
(2) RF
(3) Repair
(4) Marketing

>Collaboration with Japanese organizations (e.g. JEMIC, ETL)

The following points were made;

>The official request for setting up TCTP in electrical metrology should be submitted.

>The most recent brochure about JICA Group Training Courses will be sent to SSRC.

>Requests for dispatch of trainees should be officially submitted (on the basis of independent requests).

>An official request should be submitted for the Service Car.

>Traceability of NSCL standards was considered to be a very important issue for the sustainability of NSCL. This matter should be further explored and the various options examined. The question of cost of calibration by the relevant Japanese laboratories was of particular concern since it involves foreign currency.

It has been further noted that realization of all avenues discussed above is subject to availability of budjet, human resources and other considerations.

After concluding the discussions related to the above points the SSRC Team strongly expressed a request for extension of the stay of both the Chief Advisor, Dr. Yamanouchi, and Long-Term Expert, Mr. Hatakeyama, beyond the termination date of the Project, and for a period to be determined in accordance with the time necessary to complete the tasks listed in what follows, and which constitute justification for this request :

1- There is a need for the presence of the two Japanese Experts to oversee successful installation and operation of equipment scheduled to arrive (e.g the Power generator and frequency and time receiver). It is to be noted that

successful operation cannot be adequately confirmed except after a certain period of observation.

2- The need to elaborate a specific list of spare parts for NSCL equipment. This list is considered crucial for NSCL sustainability after the Project termination and the experience of the Japanese Experts mentioned above is instrumental in making the appropriate selections. Such a task has already begun but it is expected it will take some period of time beyond project termination date to complete.

3- The arrival date of evaluation standards, which are still in Japan, has been tentatively scheduled for the beginning of September, 1992. The technical inspection of these evaluation standards as well as the recalibration of the NSCL systems require at least 45 working days for completion after the date of arrival of the above mentioned evaluation standards.

4- Two short-term Experts (Mr. Maeda and Mr. Kato), will complete their asignments on September 29 and 22 respectively. This is too short a time before official termination date of the Project. The effective interaction between these short-term experts and the Chief Advisor and the Long-Term Expert, will not provide the latter with adequate time to complete their final tasks at NSCL.

Finally the continued presence of the two Japanese Experts beyond Project termination date can provide an important caralyst, communication, and support role for any preliminary activity that may be initiated in relation to the new project phase or other activities envisaged in this Aide - Memoire.

3．校正・修理件数の推移

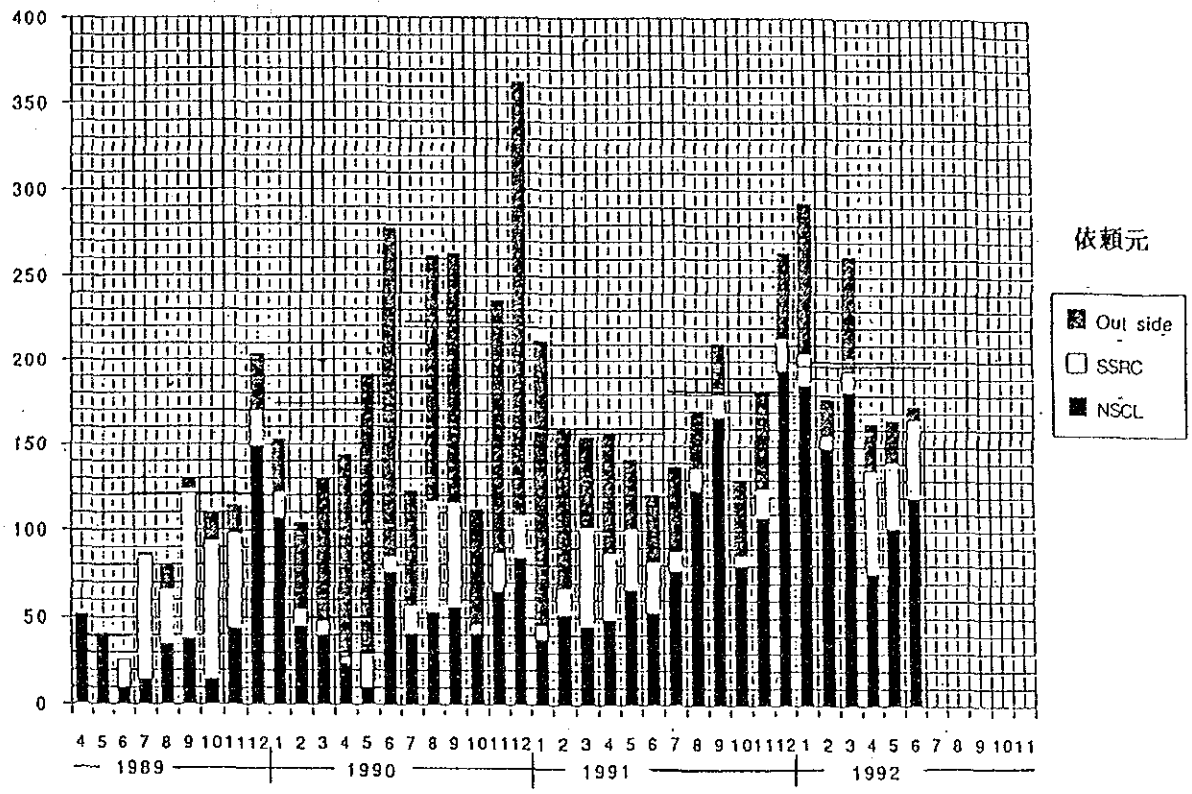


Fig : Monthly calibrated instruments

校正件数

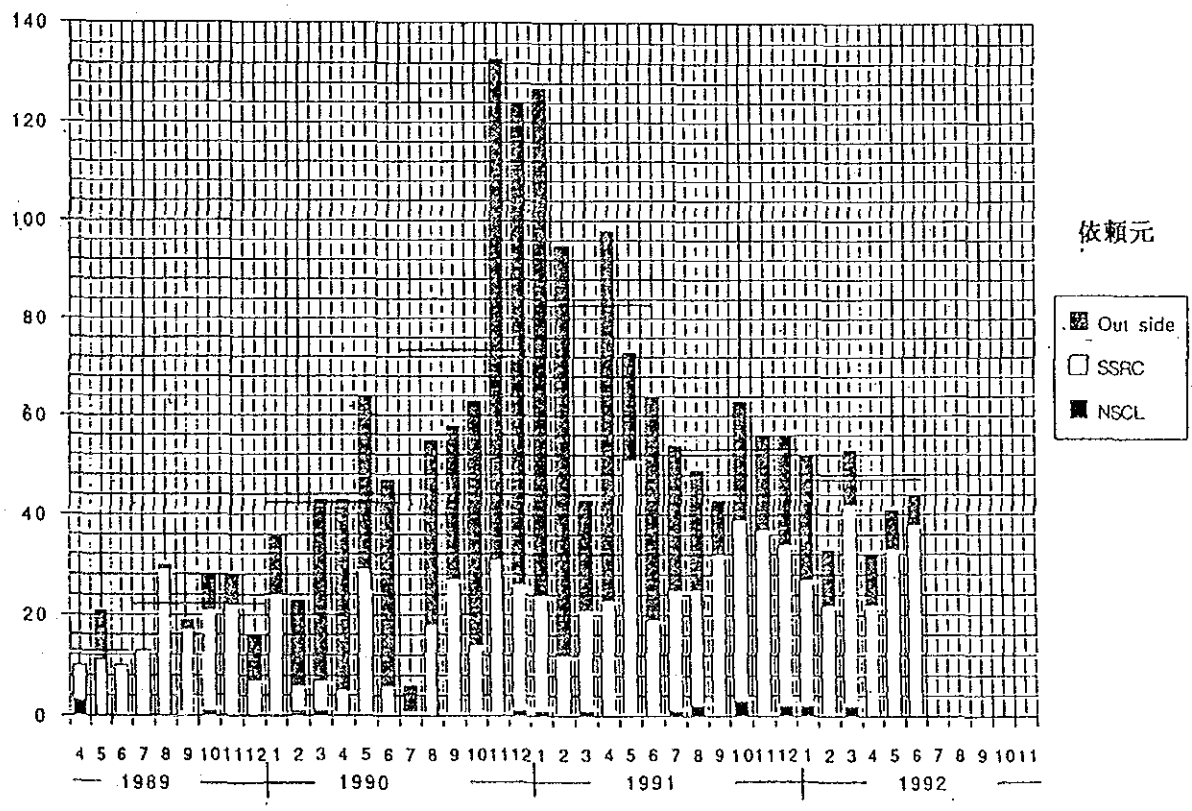


Fig : Monthly repaired instruments

修理件数