CHAPTER - 5

CHAPER-5

In this chapter we shall discuss in brief the different testing models used to test the measurement circuits. Further we conclude this chapter with a few comments on the achievement of the project. Additionally, extensions & redesign for the proposed design is also discussed in this section. The testing modules required for all the three measurement blocks are discussed separately.

VOLTAGE MEASUREMENT

For this measurement two testing modules are developed. One, the thermocouple selection module & the other, instrumentation amplifier gain selection module.

For the thermocouple selection mode, the short circuit condition of the inputs short circuit impedance of the circuit is instead, while for open circuit condition of the inputs the open circuit impedance is tested. These values satisfy those given in the data sheets. As the instruments for measuring these parameters with greater accuracy were not available in the departmental laboratory we have tested only the analog switching part. The test circuit is shown in fig.3,3. The TC selection format is given in table.3,4.

For the gain test of instrumentation amplifier, the control word format is given in table.3,3. The analog switching part has been studied. Final testing requires at least a $6\frac{1}{2}$ digit accuracy standard meter [digital multimeter], which was not available & hence only the basic tests are performed for this module.

RESISTANCE MEASUREMENT

The test circuit module for this measurement is the analog switching of variable current source. The analog switching part is carried out. To check the current value as low as one micro ampere, at the required accuracy, the sensitivity of the measuring instrument should be atleast one nanoampere. As high sensitivity instrument is not available at present, only the switching part is tested. The switching control word format for this measurement is shown in table. 3.26,

CAPACITANCE MEASUREMENT

The main blocks to be tested in this measurement are (1) VCO (2) Multiplier (3) Phase detector (4) D/A converter & A/D converter.

The VCO section is built around XR-205. XR-205 is a high cost IC & was not available in the market at the time of module testing. Therefore a functionally similar, IC 8038, is tested instead of XR-205. The frequency sweeping with the sweep-input voltage is carried out for IC 8083. The required results are obtained.

The test circuit for a multiplier with the gain factor 0.1 is enclosed in the appendix..E. The circuit is tested for its multiplying ability & offset adjustment.

The phase-detector circuit employing XR-2208 multiplier has been tested for its operation. As such there is a slight difference between the phase-detector circuit & multiplier circuit. In phase-detector the a.c. input is coupled to x & y terminals, while for multiplier d.c signal

is coupled to x & y inputs. Linearity of the phase detector over frequency is being tested.

The D/A & A/D converter IC 0800 & IC 7109 are tested using the standard interface cards to the 8085 trainer kit (INCONIX-85). The results are as we have expected. In this case also the errors could be estimated meaningfully if the department had a standardisation laboratory. At present the department does not have a standardisation laboratory & hence further tests are postponed.

CONCLUSIONS & FURTHUR EXTENSIONS

i] Within the tenure of M.Phil. we could design & test, at module level the measurement systems for (1) R at 1mΩ maximum resolution. (2) V at 1μV maximum resolution & (3) The impedance bridge for the capacitance measurement for the ranges indicated in sec.3... The design aspects of both hardware & software are covered. The part of circuit where the impedance occurs in the feedback parts of an operational amplifier are studied as at the practical assignments for the post graduate studies as the instrumentation speciliżation. These assignments are only at a single frequency, but the performance of the circuit is well known. Thus we have not made any specific attempt to test this module separately. As the complete design is interfaceable to any standard system bus, will has become an asset to the laboratory.

As a part of extentions proposed for this project a few comments are presented. We are redesigning the system, so

that it will become an I/O subsystem for the IBM PC. In this system the I/O card will have its own processor, say 8085, but the results of the measurement will be transferred to the IBM PC for higher level tasks on the measurand, as required for the piezoelectric/ferroelectric laboratory. For this purpose the hardware or software design performed at present is going to remain as basic building blocks. Higher levels of hardware & software design activities are proposed to add the dimensions of programmability to the instrumentation system that would evolve.