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Remote Frequency Monitoring System

Ms. R. Kavitha, Mr. D. Kumar, Mr. Aju John, Mr. P. S. Balasubramaniam, Mr. DRJJ Nischal , Mr. R. Krishna Kumar

Abstract--- The launch complex is unmanned during the final countdown and launch phases of PSLV/GSLV. It is essential to monitor the status of launch complex parameters such as electrical generators, UPS system. Hence, a remote monitoring system was realized to monitor the Electrical and A/C parameters of Launch Complex. The remote monitoring system monitors the Electrical parameters of Generators, UPS system of Launch Complex. This system acquires the data from Launch Complex system and the data is transmitted to Mission Control Center (through Mission Computers) for Display at MCC consoles.

Index Terms---PSLV, GSLV, MCC, FLP, UDP, LSB.

I. INTRODUCTION

The launch complex is unmanned during the final countdown and launch phases of PSLV/GSLV. It is essential to monitor the status of launch complex parameters such as electrical generators, UPS system. Hence, a remote monitoring system was realized to monitor the Electrical parameters of Launch Complex.

Remote Monitoring system at FLP launch complex consists of two chains. Each chain is equipped with one ADAM 5510/TCP embedded controller, three numbers of ADAM 5017UH analog input modules and one number of ADAM 5051S optically isolated digital input module for data acquisition. Local console and controller is located at LSB and Remote Console is located at MCC. Data from the Substation and CTR is extended via twisted pair cable to LSB.

Application software was developed in C-Programming language. This software will run in the embedded controller. This will acquire data from input modules, convert the data in to the Packed BCD format and transmit the data to local PC and remote console at MCC in UDP format through Ethernet packets.

II. BLOCK DIAGRAM

The overall block diagram of the RPMS with the key parameters, modules, and controllers and how the data is transmitted to the local PC or Remote Center is illustrated below.

The frequency parameter that is given to the satellite is fed to the frequency transducers respectively.

III. HARDWARE

ADAM 5510 / TCP controller with Analog input (ADAM 5017UH) and Digital input module (ADAM5051 S) will act as a data acquisition system. ADAM 5510/ TCP are a 4 slot module which can accommodate 3 Analog input modules and 1 digital input module. Analog input module can accommodate 8 differential ended channels and each digital input module can accommodate 16 digital input modules. The required power supplies are connected and all these are housed on the top of the rack. Power supply schematic at LSB is shown in figure 3. The transducers and sensors are interfaced to the system at LSB. These transducers are located at electrical substation for measuring the electrical parameters the transducers and sensors are common to both the system

IV. SOFTWARE INTERFACE

The processed data from controller based system is transmitted through Ethernet cum FO link and is fed to Local PC at LSB and MCC servers at Mission computers. The data will be processed by MCC servers and will transmit the data to Merged Display system at MCC. The electrical and air – conditioning related parameters are displayed at Services Facility Console (SFC) at MCC. Data acquired by local PC will be processed and will display and log the data locally.

V. COMMUNICATION LINK

The data from the controller at LSB is transmitted to Local PC and MCC servers at MC through Ethernet cum FO link. MCC servers will process and will

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send the data to MCC. The data is then displayed at MCC Services Facility Console (SFC). A second Chain is also established to have redundancy from the PC to the MCC services.

Two modules are used here are

- Analog module (3 nos.)
- Digital module (1 no.)

A. Analog input module

This module is an extremely cost-effective solution for industrial measurement and monitoring applications. Its opto-isolated inputs provide 3000 VDC of isolation between the analog input and the module, protecting the module and peripherals from damage due to high input-line voltages. ADAM-4017 offers signal conditioning, A/D conversion, ranging and RS-485 digital communication functions. The module protects your equipment from ground loops and power surges by providing opto-isolation of A/D input and transformer based isolation up to 3000 VDC.

B. Digital input module

Digital Input Module, built with 2500 VDC optical isolation, suitable for critical applications. Different from other modules, the ADAM-4051 accepts 10~50V input voltage to fit various digital signals, such as 12 VDC, 24 VDC, 48 VDC. Moreover, users can read the current status from the LED indications on the front panel.

The frequency transducers is used in analog module and one digital module is used just to check the status of the power generator and ups that gives the power supply to the satellite.

C. Frequency Transducer

Frequency Transducer measures Power Frequency over a specified Frequency Range and converts it to an industry standard output signal which is directly proportional to the measured input. These Transducers provide an output which is load independent and isolated from the input. The output can be connected to Controllers, Data-Loggers, PLC's, Analog / Digital Indicators, Recorders for display, analysis or control. They are ideal for SCADA, Energy Management, and Telemetering for Remote, Local as well as Central Monitoring Systems.

IV. CHARACTERISTICS CURVES

A. Schematic Diagram of Data Acquisition System

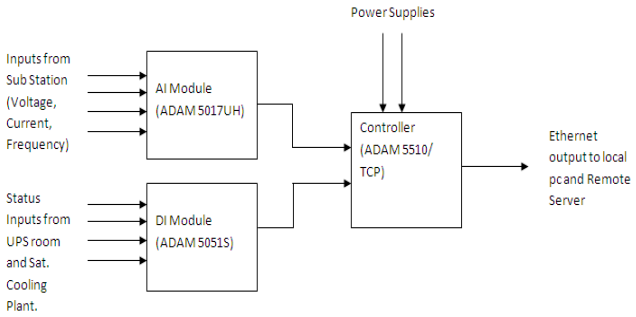


Fig. 2 Schematic Diagram of Data Acquisition System

This diagram illustrates how the two modules combine into the controller by acquiring the inputs from the Power Supply.

B. Power Supply Scheme At Lsb

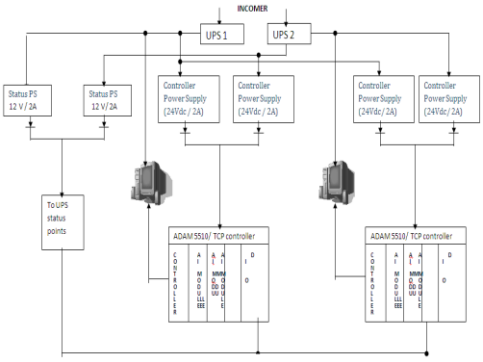
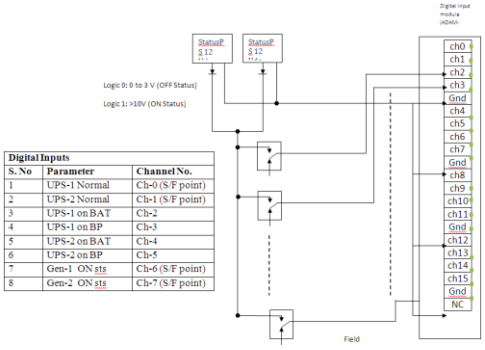


Fig. 4 Power Supply Scheme at LSB

This figure illustrates how the redundancy of the system works by connecting the controllers, power supplies and the PC.

C. Scheme For Digital Inputs



Digital Inputs		
S. No	Parameter	Channel No.
1	UPS-1 Normal	Ch-0 (S/F point)
2	UPS-2 Normal	Ch-1 (S/F point)
3	UPS-1 on BAT	Ch-2
4	UPS-1 on BP	Ch-3
5	UPS-2 on BAT	Ch-4
6	UPS-2 on BP	Ch-5
7	Gen-1 ON sts	Ch-6 (S/F point)
8	Gen-2 ON sts	Ch-7 (S/F point)

Fig. 5 Scheme for Digital Inputs

The three indicators- Normal, Battery and Bypass for the respective Channels are connected in the circuit diagram. It also illustrates how the switching works.

D. Scheme for Frequency Transducer

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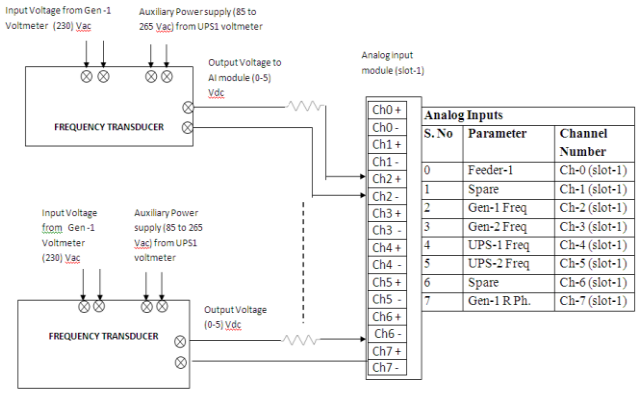
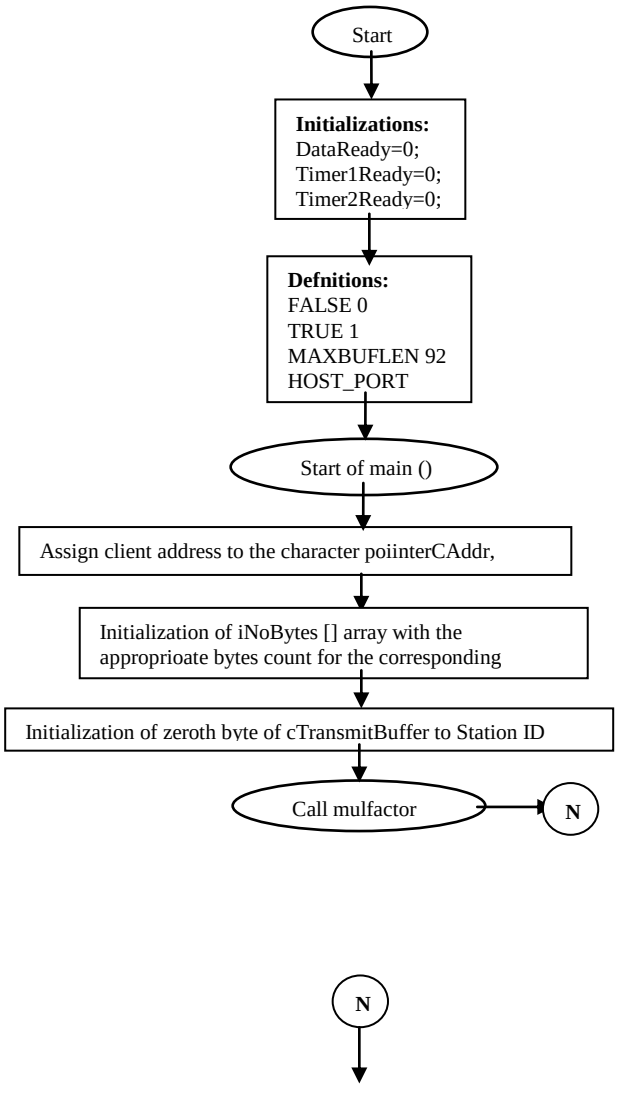


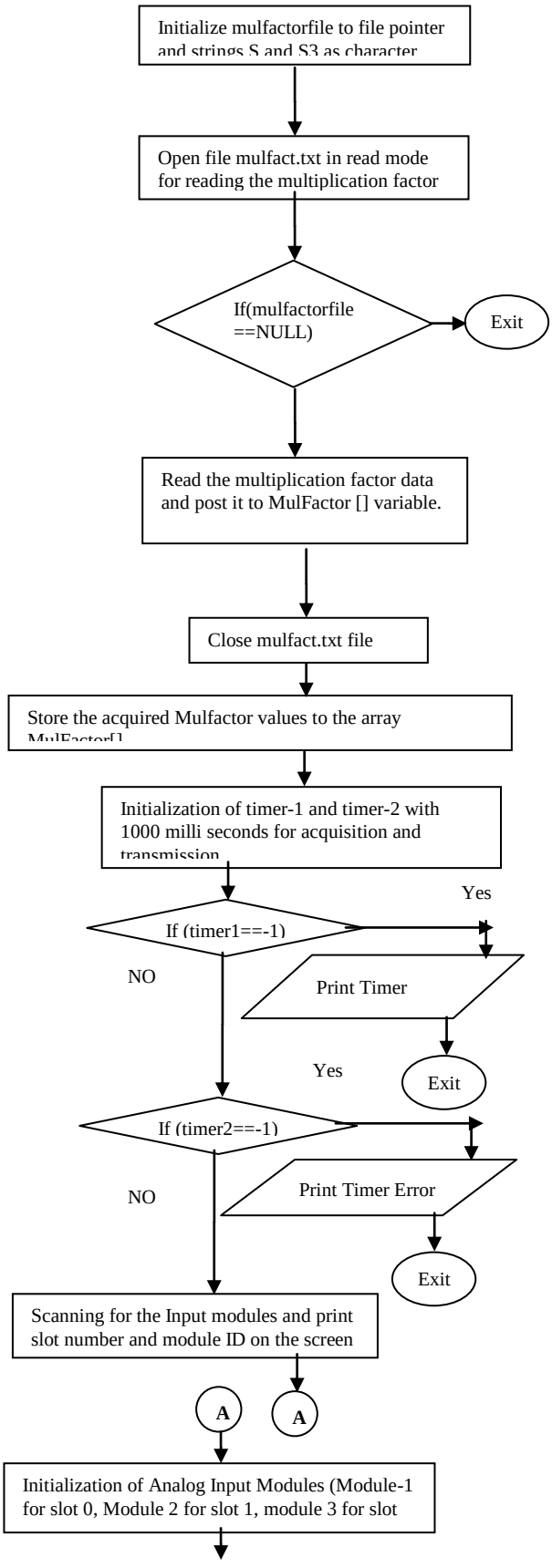
Analog Inputs		
S. No	Parameter	Channel Number
0	Feeder-1	Ch-0 (slot-1)
1	Spare	Ch-1 (slot-1)
2	Gen-1 Freq	Ch-2 (slot-1)
3	Gen-2 Freq	Ch-3 (slot-1)
4	UPS-1 Freq	Ch-4 (slot-1)
5	UPS-2 Freq	Ch-5 (slot-1)
6	Spare	Ch-6 (slot-1)
7	Gen-1 R Ph.	Ch-7 (slot-1)

Fig. 7 Scheme for Frequency Transducer

Similarly, for the frequency transducer it converts the actual frequency which is 45-55Hz into 0-5V dc.

V. FLOW CHART





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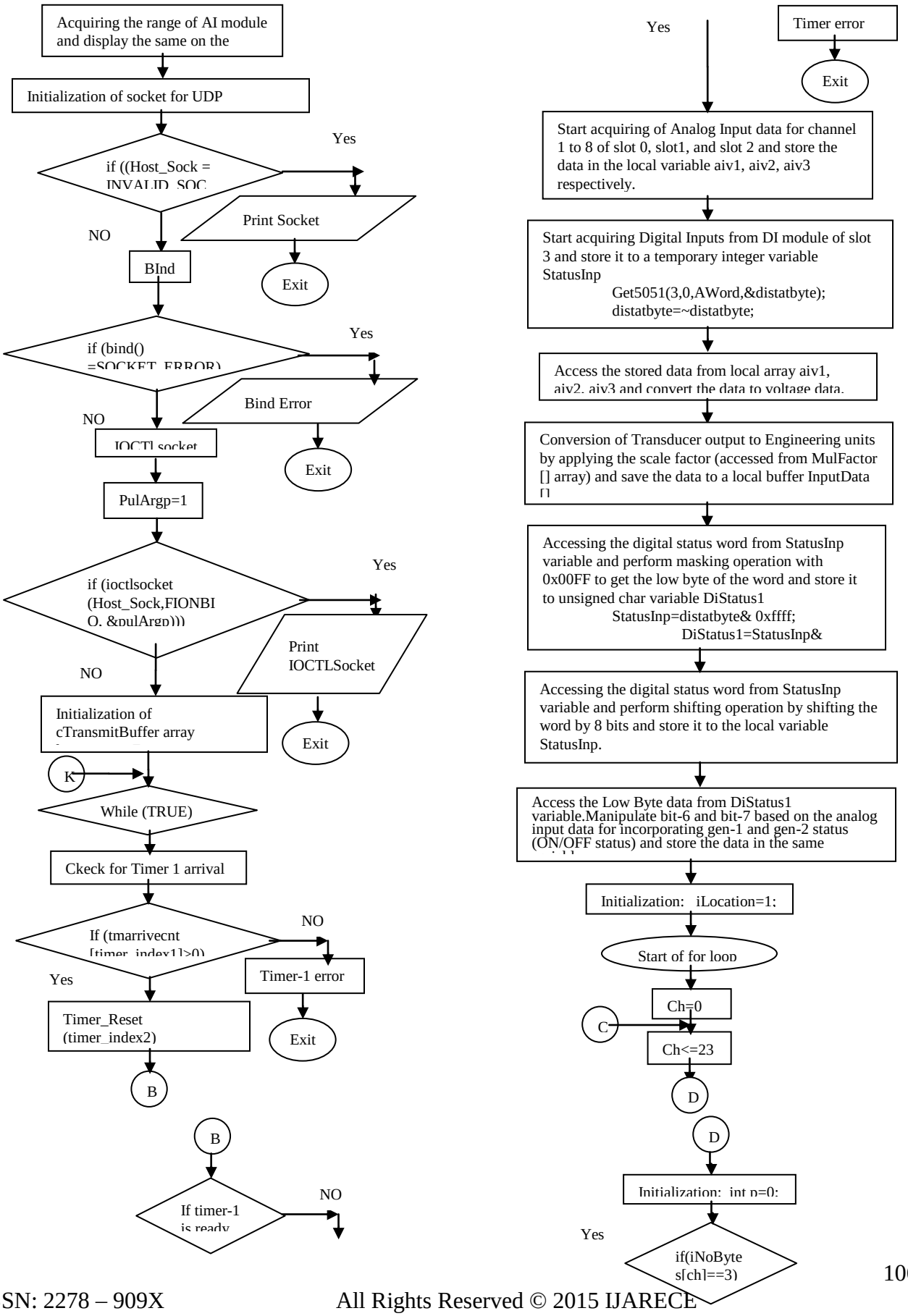

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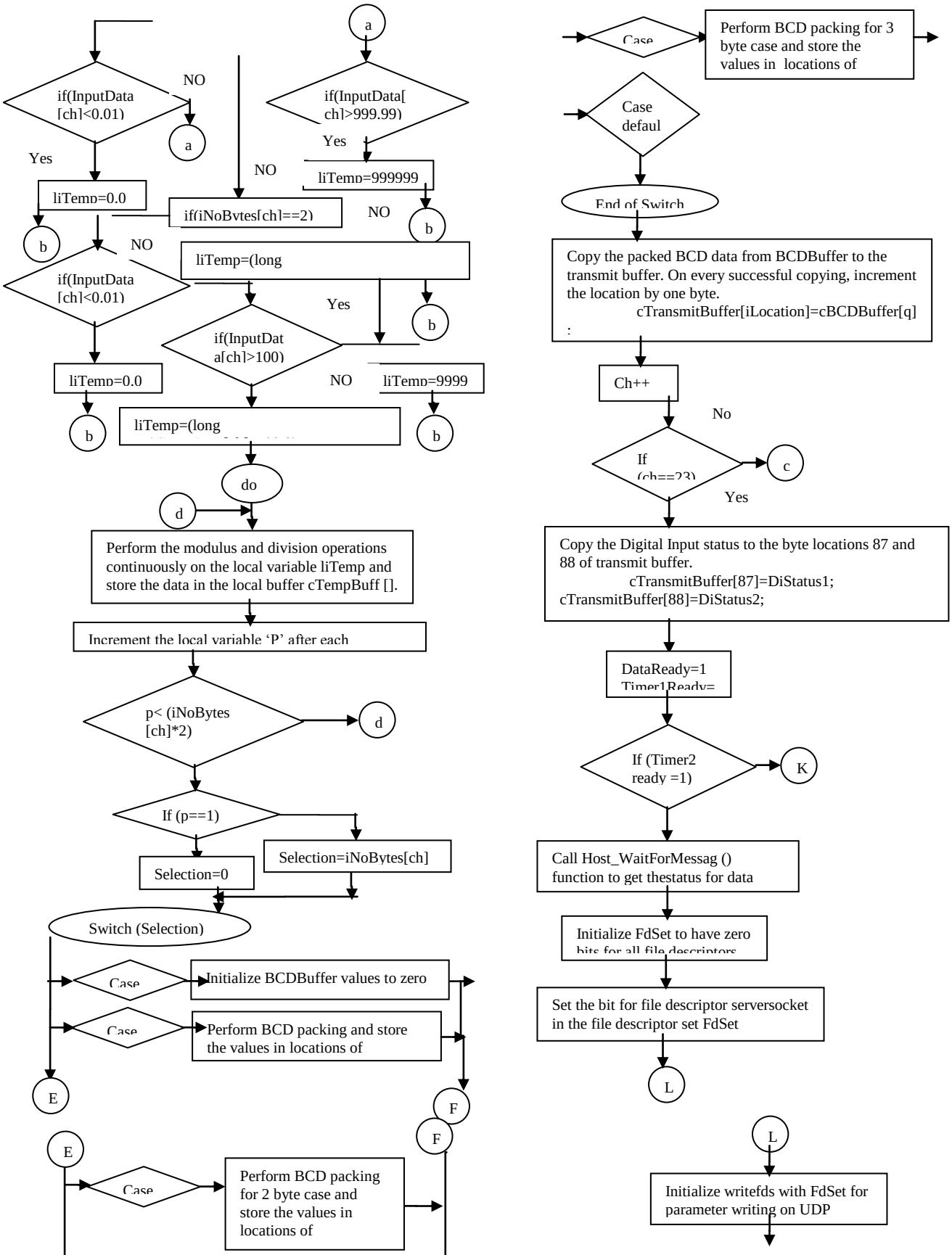

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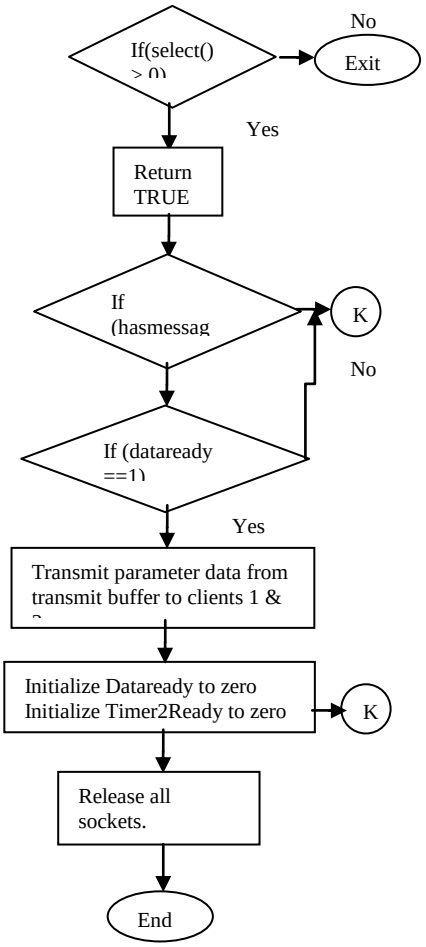

VII. RESULTS

Remote Frequecy Monitorinng System: Chain 1

A. UPS 1 And UPS 2 ON

Analog parameters				Digital parameters			
legend	value	legend	Value	legend	value	legend	status
Gen1 freq	0	Gen2 freq	0	Spare	0	ups2 on bat	Off
						ups2 on BP	Off
Ups1 freq	49.97	ups2 freq	49.99	Spare	0	Cmp2 sts	off
						Blwt2 sts	off

Fig. 11. UPS 1 And UPS 2 ON

Result of output parameters when UPS1 and UPS2 are in ON condition.

B. UPS 2 Bypass ON State

Analog parameters				Digital parameters			
legend	value	legend	Value	legend	value	legend	status
Gen1 freq	0	Gen2 freq	0	Spare	0	ups2 on bat	Off
						ups2 on BP	Off
Ups1 freq	49.97	ups2 freq	49.99	Spare	0	Cmp2 sts	off
						Blwt2 sts	off

Fig. 12. UPS 2 Bypass ON State

Result of output parameters when UPS1 and UPS2 Battery are in ON condition.

C. UPS 1 And UPS 2 ON Battery

Analog parameters				Digital parameters			
legend	value	legend	Value	legend	value	legend	status
Gen1 freq	0	Gen2 freq	0	Spare	0	ups2 on bat	On
						ups2 on BP	Off
Ups1 freq	50.05	ups2 freq	50.06	Spare	0	Cmp2 sts	off
						Blwt2 sts	off

Fig. 12. UPS 1 and UPS 2 ON battery

Result of output parameters when UPS1 and UPS2 Battery are in ON condition.

D. UPS 1 And UPS 2 ON Bypass

Analog parameters				Digital parameters			
legend	value	legend	value	legend	value	legend	status
Gen1 freq	0	Gen2 freq	0	Spare	0	ups2 on bat	Off
						ups2 on BP	On
Ups1 freq	50.02	ups2 freq	50.03	Spare	0	Cmp2 sts	off
						Blwt2 sts	off

Fig. 13. UPS 1 and UPS 2 ON bypass

Result of output parameters when UPS1 and UPS2 Bypass are in ON condition.

VIII. CONCLUSION

Thus a Data Acquisition System was realized in the First Launch Pad to monitor the key parameters of the UPS Systems and Diesel Generators which provide the

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Power Supply to the launch Vehicle. The Converted Frequencies are sent to the Mission Control Centre (MCC) are retrieved in its original form to ensure the proper functionality of the launch vehicle. Our project is fully focused on remote power monitoring so this project can be implemented in tsunami alert systems. This project can also be implemented in various industries where power parameters can be monitored from a remote place, even from home.

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Ms. R. Kavitha, M.E., MISTE, Assistant Professor, Department of Electronics and Communication Engineering, RMK College of Engineering and Technology, Chennai.

Mr. D. Kumar, Scientist/Engineer-SF, EECF/ VAST, ISRO / SDSC-SHAR, Sriharikota, India

Mr. Aju John, UG Student, Department of Electronics and Communication Engineering, RMK College of Engineering and Technology, Chennai.

Mr. P. S. Balasubramaniam, UG Student, Department of Electronics and Communication Engineering, RMK College of Engineering and Technology, Chennai.

Mr. DRJJ Nischal, UG Student, Department of Electronics and Communication Engineering, RMK College of Engineering and Technology, Chennai.

Mr. R. Krishna Kumar, UG Student, Department of Electronics and Communication Engineering, RMK College of Engineering and Technology, Chennai.

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