R.F. Note # 94 214-0095-01-01_00 March 29, 1984
Jack Riedel

Computer Data Storage Continuous Monitoring Read Out And Alarming

Prelude

When, about 1978, the design of the K500 RF system was conceived we decided to include in all the important modules the capability of communicating with a computer for both data taking and eventual control. It immediately became obvious that this communication and or control would have to be deferred to a future time because there weren't enough people or time to implement it. Six years later it is still in a future time, due, in my opinion, to inadequate engineering management! Blagh! There were always more important things to do with the available manpower, or something like that.

And then we had this recent disaster resulting in three days down time when the transmitter stem was cut in two at the short.

This wouldn't have happened if the "dee volts low" monitor had been working properly, but for some reason it was inactive. So it needs a back-up, which we will provide. Still, as I told H.B. back in 1974, this RF system is almost impossible to build, it will be very unforgiving of errors, so it is not surprising to me that we continually have problems with it.

Problems: The 450 KVA Transrex P.S. periodically blows up components, the Moog servo valves for the fine dee tuners and the coupler capacitors frequently become inoperative resulting in instabilities in the tuning control, the fast phase servoes become unstable etc! The dee coupler windows are regularly destroyed and the outer conductor fingers on the dee and transmitter stems frequently fail. And in this last instance the transmitter inner conductor fingers failed. One solution to all these problems is to simply give up!

The above was written last night when I must have been in a funk. Now, in the bright sunshiny spring morning I set myself to solve these problems. After all, all problems except death and taxes can be solved!

I propose that we immediately start working on the project listed in the title of this note. We should have a 100 channel mosfit switch multiplexer for analog signals to be fed to a 12 bit + sign ADC and a 200 channel multiplexer for 1 bit digital signals. These would be fed to a computer for storage and processing. Associated with this would be a printer terminal (Deckwriter or equivalent) to which the computer would print out alarms, and other things on request from the terminal.

The sequence of events would be as follows. In the beginning the rf operator would tune everything up to a new frequency and when everything is running properly, type "P store F = XX.XXXMHz" meaning permanent storage. Appendix I lists the quantities for each station that we would initially store.

After this the computer sequentially reads the signals and stores them. Each signal should be read once a second, at least. At the same time the computer is comparing these signals with the "P store" data and prints out an alarm on the terminal that the new value of this quantity is less or more than X(N)% of the "P store" value, where X is a number (like 5%) of the "P store" value. If the new value is Y(N)% greater than the "P store" value, then the computer shuts the rf off and prints out why.

At any time the operator can request (on the terminal) the present value of any quantity it has read and can also change the value of X(N) and Y(N). The operator can also request that the terminal print out all the quantities and their percentage difference from the "P store val e". This refers only to the analog inputs to the MX.

For the 1 bit digital inputs (mostly spark detectors, first event and crowbar signals) the computer will keep a running count of how many of these occur in a given time interval (hours, days, weeks, months, years, etc.) and on request will print out this number. But in addition there will be a stored number A(N) for each. If during a stored time interval B(N) for each the number of times the 1 Bit changed more than A(N) times, the computer will shut the rf off and say why. A(N) and B(N) can be changed from the terminal.

This would be enough to start with, but provision should be made for expanding the function of the computer. First, of course, is that the rf should be interlocked so that the Transrex cannot be turned on unless the computer is operating properly. Then we can add the feature that the computer multiplies the transmitter dc voltage by that transmitters dc current and subtracts the forward power from this (the forward power signal will have to have a frequency dependent calibration to be corrected for as will many of the other signals) and thus give us a measure of anode dissipation and if this exceeds a certain value C(N) the computer shuts us off and says why.

All the above would probably have protected us from the cutting of the transmitter stem mentioned above and probably from the problem encountered on 3/28/83 when we burned up the C transmission line. However, to be doubly sure this latter doesn't happen again, if a spark monitor shuts us down and, after the 1.1 second wait before automatically turning on again the spark bit has not returned to normal the computer shuts us down again, by crowbarring the Transrex, because this means there is a persistent fire.

At any time during a run the operator can command that the present conditions should replace the "P store, F = ---" data. When new frequencies are operated, the computer retains permanently the P store, F = ---" for that frequency. After several frequency "P store" sets of data are in memory, then when a new and different frequency is to be run the computer will make a second order interpolation or extrapolation from the nearest three stored values and print out what the proper analog values should be for that new frequency. All this should be duck soup for our software writers!

APPENDIX I ANALOG SIGNALS

	DEVICE	RANGE	QUANTITY
1.	Fast Phase Shifter +P1	-10 to +10V	3
2.	Phase detector (0 shifter)	"	3
3.	" " (P. Grid)	"	3
4.	" " (F. Grid)	"	3
5.	" " (F. Anode)	"	3
6.	" " (Dee)	"	3
7.	Dee volts	0 to +10V	3
8.	Anode volts	"	3
9.	Anode current	"	3
10.	Driver current	"	3
11.	V-/V+	"	3
12.	V+	"	3
13.	V-	"	3
14.	Transrex V	?	1
15.	D. Grid Knob and Pot V	"	6
16.	P. Anode " " " "	"	6
17.	F. Grid " " " "	"	6
18.	F. Stem " " " "	"	6
19.	Output Coup." " " "	"	6
20.	Input Coup. " " " "	"	6
21.	U Dee Ft " " " "	"	6
22.	L " " " " " "	"	6
23.	U A-B Ncut " " " "	"	6
24.	L A-B " " " "	"	6
25	U A-C " " " "	"	6
26.	L A-C " " " "	"	6
		Total	141

APPENDIX II DIGITAL SIGNALS (LED DRIVERS)

Devices	Range		Quantity
Spark detectors	0 or 12V	(1 bit)	36
First event detectors	0 or 12V	"	18
R.F. ON	0 or 12V	"	3
R.F. limited	0 or 12V	"	3
Transrex	0 or 12V	"	6
Fast trip	0 or 12	"	72
Parasite	0 or 12	"	3
			141

and then we have

Phase meter	16 bits	2
Frequency meter	16 bits	1

I note that for both the analog and digital signals we have very large numbers. These can be reduced to fit the reasonably priced availability of commercial multiplexers.

JR/as