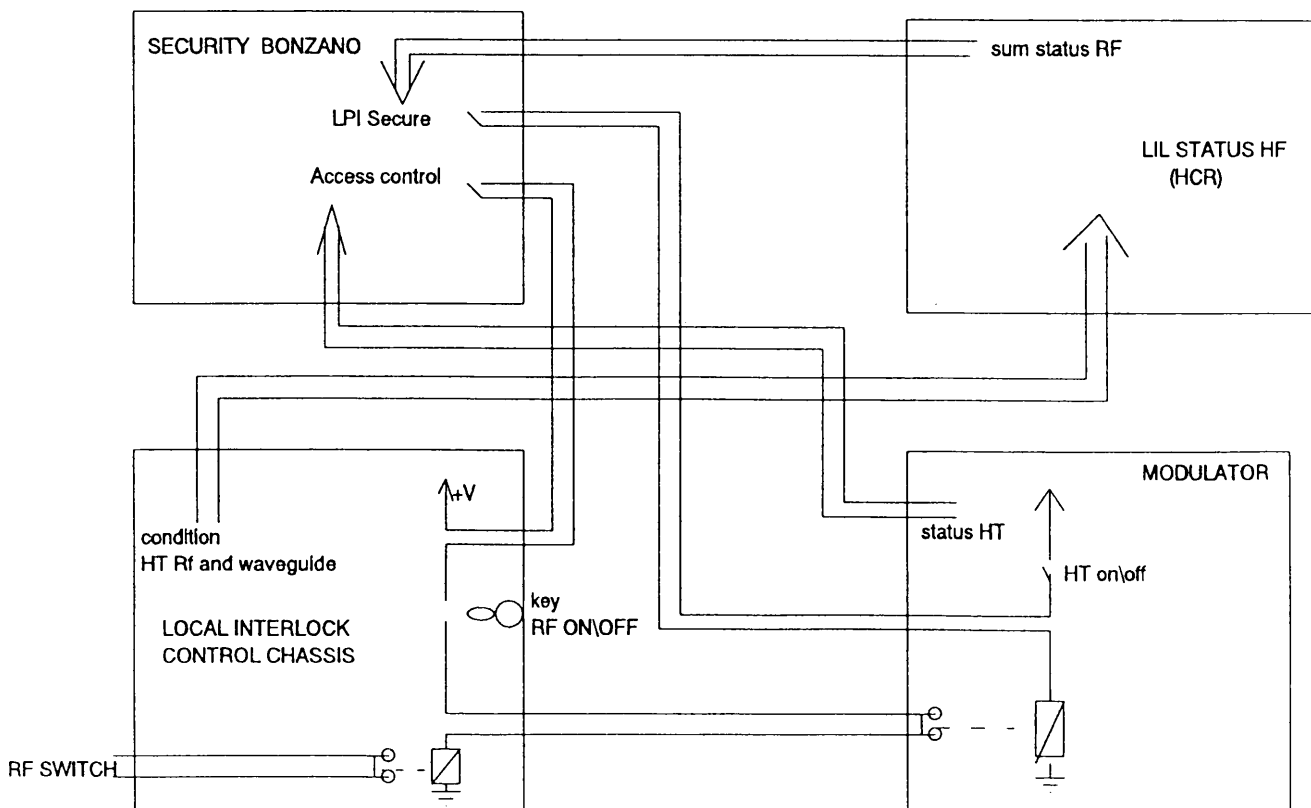


INTERLOCK SECURITY SYSTEM FOR MODULATORS IN GALLERY

OBJECTIVE

The local interlock chassis was installed to allow the testing of the modulators in diode mode, or with mobile RF source, while there was access to the machine. The purpose of the chassis was to ensure the safety of the persons working in the machine i.e. no RF power could be transferred from the modulator to the linac. This is done by using an interlock system which allows the access control interlock on the modulators to be short circuited locally only when the waveguide to the machine is disconnected and a dummy load is connected to the modulator. In parallel this disables the operation of the "Spinner" RF switch which supplies the RF from the baby klystron. (See block diagram below).



The LIL STATUS HF chassis in the HCR sums up the status of all the modulators to give an indication to the security system of Bonzano which in turn gives security clearance back to each individual modulator.

OPERATION

1. Normal machine operation.

For this operation the waveguide must be connected and all the interlocks must be good, including access control.

The modulator can be put into operation as normal.

The interlock chassis does not allow the RF switch to be turned on until the modulator is in pulsing mode. i.e. the HT is on.

The key for the RF switch must be in the RF ON position.

2. TEST MODE.

This mode allows the modulator to be tested with a dummy load fixed to the output of the klystron while there is access to the machine.

When the waveguide is disconnected a microswitch is operated which inhibits the use of the RF switch and allows the short circuiting of the access control and RF network waterflow. This is done by turning the key in the local interlocks chassis from NORMAL to TEST.

If the waveguide is not disconnected it is not possible to put the modulator on in test mode.

3. CONDITIONING OF LIPS

Recently another option has arisen in that it is now necessary to have the facility of forming a LIPS on a modulator.

This creates two problems for the interlock system:-

(i) The waveguide is not dismantled at the same position as for dummy load tests.

(ii) The RF switch is needed in this operation.

This means that the microswitch at the waveguide does not operate and therefore the modulator cannot be put into test mode.

The machine must therefore be under access control to do this test.

Should the microswitch problem be overcome by incorporating another microswitch at the other point of disconnecting the waveguide this would allow the modulator to be run in test mode, but still disabling the RF switch and therefore no RF output.

Therefore without major modifications to the logic of the security system it is not possible to form a LIPS while there is access to the machine.

Another arrangement, to be agreed with security, must be found until the test modulator MDK 29 is in operation and the LIPS with a load are connected directly to the klystron output in the gallery.

LOCAL INTERLOCK CONTROL CHASSIS MODIFICATIONS FOR MDK29 AND MDK97 TO ALLOW TESTING OF THE "LIPS" SYSTEM WHEN THE MODULATOR IS IN TEST MODE.

At the moment all modulators in the gallery are connected via an interlocks control chassis which allows for two modes of operation.

The first being normal machine operation. i.e. the klystron is connected to the accelerating cavity in the machine via waveguide. See figure 1

To allow this operation the waveguide elbow must be in place. This activates a microswitch giving one open and one closed contact and all external interlocks must be good (*access control, SF6, RF network waterflow, RF network vacuum.*)

The second mode of operation is when there is access to the machine and the modulator can still be pulsed in test mode.

For this the waveguide elbow must be disconnected, the rf switch disabled and the external interlocks short circuited by the local interlocks control chassis.

Should rf power be applied, this is done via a mobile rf source and the power is dissipated into a dummy load. See figure 2.

Should the cable from the microswitch be disconnected at the local interlocks control chassis then this will give two open contacts and will thus not allow either mode to be operational.

Required Modifications

It is now foreseen that MDK97 and eventually MDK29 will be used for the testing of new or reconditioned "LIPS". This poses a problem in the existing system as the waveguide network has to be disconnected after the "LIPS" to allow the connection of the specified dummy load. See figures 3 and 4

To allow this operation another microswitch will have to be incorporated into the logic of the interlock chain and the local interlock chassis will have to be modified so as to comply with the original security requirements.

Figure 5 shows a proposed solution to this problem.

The diagram in figure 5 shows the state for the modulator to work in **machine mode**.
i.e. waveguide elbow connected _____ microswitch 1 gives _____ contact a closed
_____ contact b open
waveguide after lips connected to machine __microswitch 2 gives _____ contact c closed
_____ contact d open

these 2 conditions give the required contacts in the control chassis for modulator to supply rf power to the machine . contact X closed and contact Y open

The condition for the modulator to be run in **test mode** is that **contact X is open** and **contact Y is closed**. It is suffice to remember that on removing the waveguide at microswitches one or two inverses the contacts a,b c and d. Therefore in removing

either or both sections of waveguide contact X opens and contact Y closes and allows the modulator to go into test mode.

If the connector is removed from the chassis contact X and contact Y are both open and therefore as in original system neither machine or test mode can be operated.

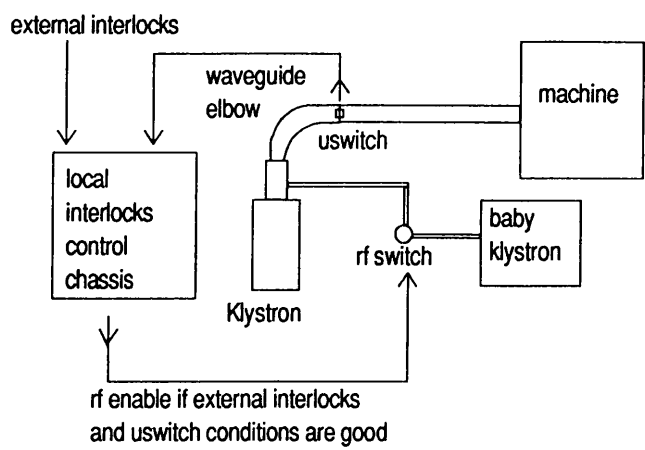


FIGURE 1

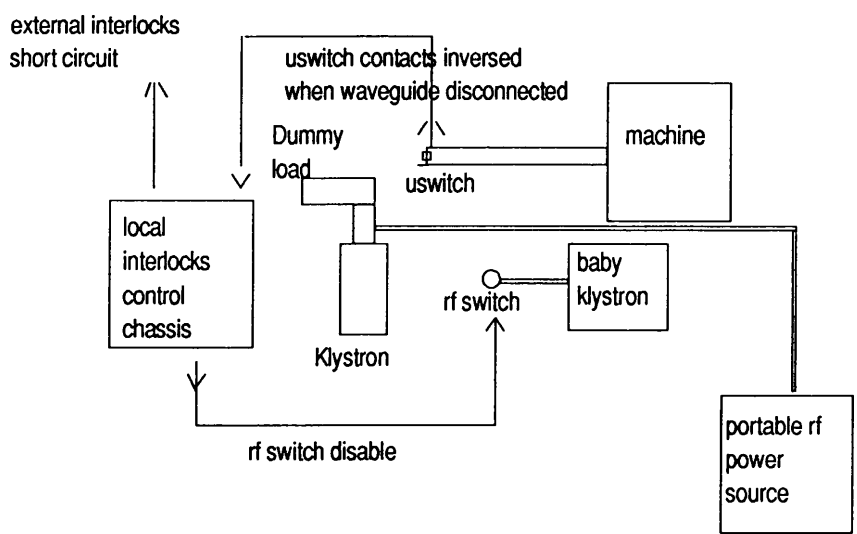


FIGURE 2

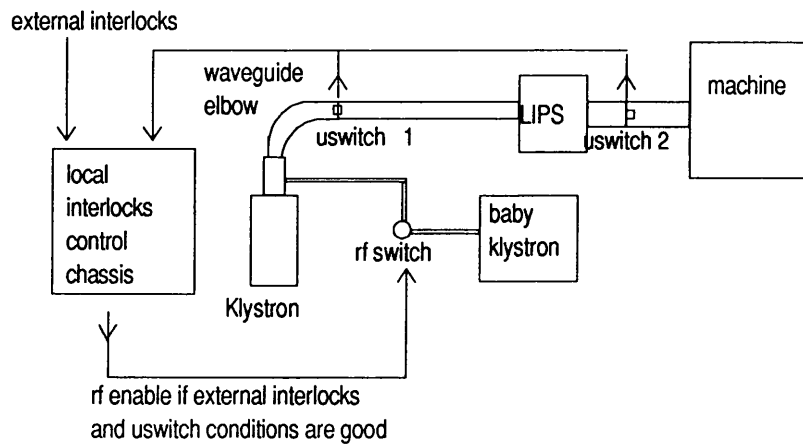


FIGURE 3

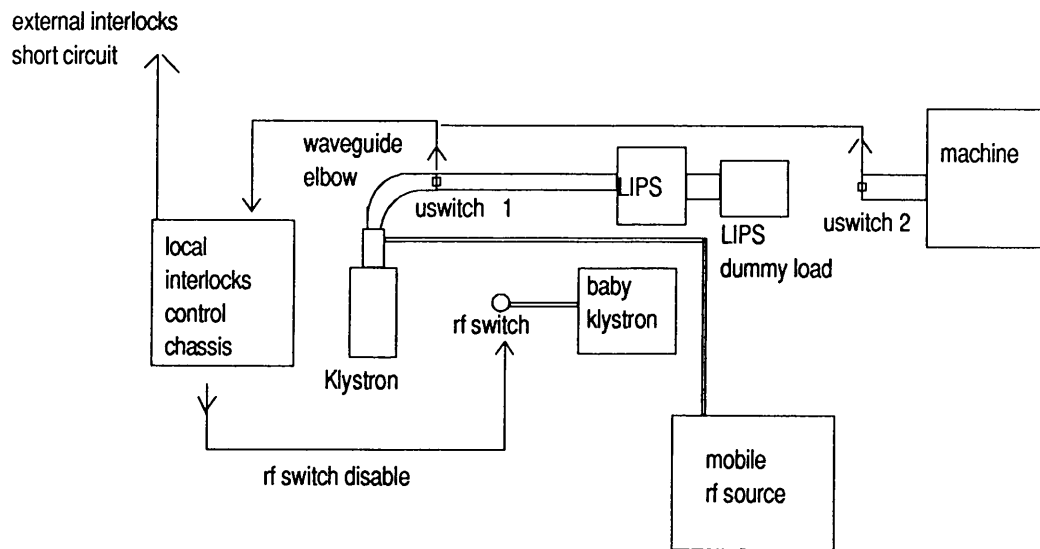


FIGURE 4

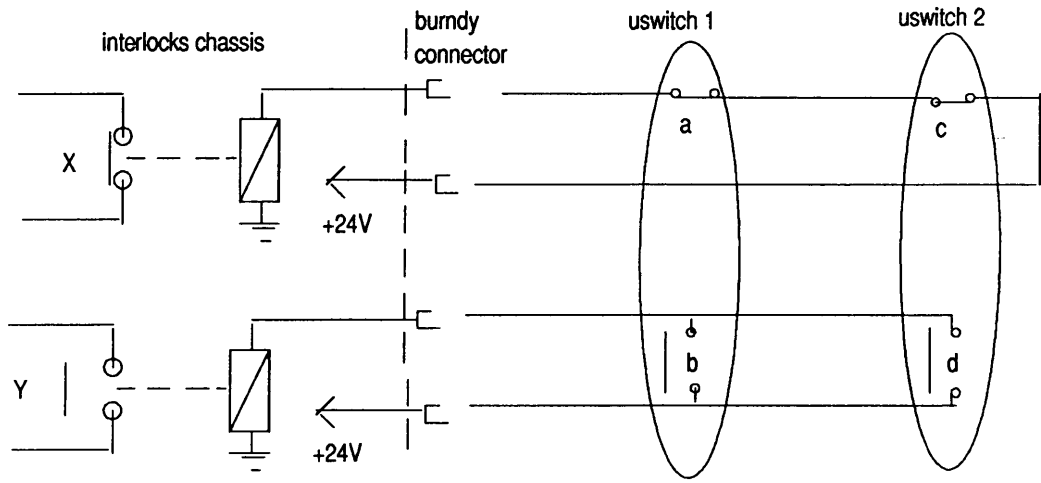


FIGURE 5