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INTRODUCTION TO THE ACCESS CONTROL SYSTEM AND THE SECURITY PC PROGRAM

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INTRODUCTION TO THE ACCESS CONTROL SYSTEM AND THE "SECURITY" PC PROGRAM

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1. Introduction

This report describes a fictitious simplified Access Control System (ACS) and how the ACS PC can be used to understand the real Access Control System at the AGS.

2. Radiation Safety

It should be emphasized that the Access Control System is one part of radiation safety or the protection of personnel. The whole topic of radiation safety includes the following elements.

1. Barriers and Shielding Blocks -- These prevent personnel from entering high radiation areas or prevent radiation from leaking to areas where personnel may be located. Barriers keep people from being too close to possible high radiation.

2. Alarms -- Chipmunks located around the AGS and the SEB floor alert personnel when the beam is on and radiation is present. If the radiation is above set limits, the beam stops are closed. The Wooper announces when extracted beam is on.

3. Training of Personnel -- The many training sessions required by AGS personnel are necessary to enhance our radiation safety.

4. Administrative Procedures -- The administration has emphasized following the OPM and also has stressed points such as not climbing over fences and wearing film badges.

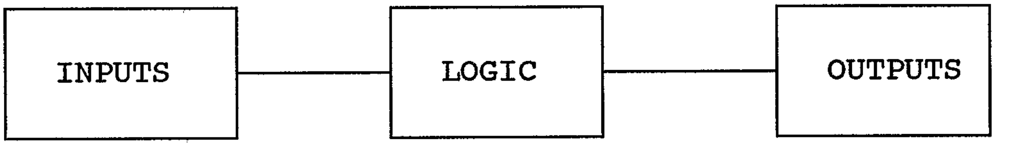
5. Pre-Startup Notification --After announcing that the beam is coming on, the MCR operators wait for 15 seconds as an extra warning. Lights are also dimmed in the ring and caves when they are reset and can receive beam.

6. Access Control System -- a means of excluding personnel from areas that at times can have dangerous radiation.

These six items are important and necessary to protect personnel and have a reliable radiation safety program at the AGS.

3. The Access Control System

The ACS controls access into high radiation areas. The hardware of the ACS includes doors and gates with their door switches, key switches, relays, lights, interlocks and crash buttons. These can be grouped into three separate sections or blocks as indicated in the following block diagram.



THE ACCESS CONTROL SYSTEM BLOCK DIAGRAM

The elements of the ACS are the Inputs, Logic, and Outputs.

Typical inputs are door switches, beam stop limit switches, chipmunk radiation detectors, power supply on/off status, magnitude, and polarity, position of extraction magnets, and key switches in MCR. The MCR operators only have control over the ACS Inputs.

Typical outputs are beam stop open commands, grant 'A' Line clearance, allow turning on of certain SEB power supplies, and lights and indicators in MCR. The operators can not control the outputs directly -- they can only change the inputs and the logic will produce an output. One should realize that the Logic controls the beam stops or other outputs and that the operators just try to put the inputs in the correct state to enable the desired output to occur.

As the block diagram shows, the Logic is a means of connecting the input signals to the outputs. The logic can be described in words, which is difficult to understand sometimes, or in logic diagrams. There are two important methods used to create the logic with hardware. Relays are used at the AGS and programmable controllers are used for the Booster main magnet power supply and for the future RHIC Access Control System. The design of the logic is the responsibility of the AGS Radiation Safety Committee. The Security group designs the relay hardware to implement the logic.

Figure 1 shows the logic diagram of a fictitious simplified accelerator Access control system to open the HEBT beam stops. The Ring North and South gates must be reset and either the Switchyard and the A cave must be reset or the extraction power supplies must be off. If the BNL-6 key is turned in MCR the HEBT beam stops will open. This simple block diagram shows part of the logic that was used before 1991 at the AGS. Now the option of putting the extraction power supplies safely off and having the Switchyard cave open is not allowed.

Figure 2 shows the more complicated relay diagram implementing this logic. Control power (110 vac) is on the left buss and common (110 vac) is shown on the right buss. The Input signals are connected to relays K2, K3, K5 - K8, and K10. These consist of key switches, door and gate switches, and the beam stop open limit switch. The logic is shown feeding relays K4 and K9. The Output is the contacts 3&4 of relay K9 that opens the HEBT beam stop. It should be noted that the ACS power goes to the MCR key and out to each gate or power supply. The input signals are generated with switches or relays that control an ACS relay located, for this example, in the terminal room above the MCR. Optomux monitors are indicated on relay coils that monitor the state of the relays. The dotted line around the input signals indicate that these relays or switches are in different enclosures or cabinets from the ACS logic relays.

The relays are used in a fail safe manner. The de-energized relay makes the AGS machine process safe. A gate that is reset or an open beam stop is indicated with an energized relay. The relay system is tested every six months and always before the Physics run.

4. The ACS PC SECURITY Program

4.1 Hardware Description

The ACS PC in MCR is dedicated to run only the SECURITY program. This program is used to monitor the state of many relays in the Access Control System. Figure 2 shows a simple relay schematic with Optomux devices indicated on some relays. The program normally scans the state of all the Optomux monitors every 1.3 seconds. Only about 30% of the relays in the ACS are connected to Optomux devices and can be monitored each cycle.

This computer is connected to two different networks of Optomux cards. Each card can hold up to 16 monitors. As an example one can see many cards with monitors in the terminal room above MCR in Rack 21. Each input Optomux monitor is usually used to monitor the state of a particular relay and is connected to the relay coil as shown in Figure 2. A few modules act as output modules and can energize or pulse a relay on. The networks run at 19,200 baud from both Com port 1 and Com port 2 on the PC. Com port 2 communicates with Optomux cards in the Linac and Booster area and Com port 1 with cards in the Ring, SEB, and FEB areas. There are 38 cards used on the networks located in several enclosures around the AGS. In February 1992 the system used 38 cards to monitor 460 relays.

4.2 The SECURITY Program Choices

One important purpose of the SECURITY program is to keep the MCR operators informed of any changes to the state of the ACS by continuously scanning all the Optomux devices and detecting if a change occurs. This change is noted in the REAL TIME SCANNING WINDOW. This window records if a particular relay changes state. The state of each monitored relay corresponds to a certain state of equipment at the AGS. A one line message has been written describing the meaning of the energized and de-energized state of each relay. When a relay changes state, this message is displayed and written to the current LOG file. When some relays change state they indicate that a critical situation has occurred. These include crash buttons being hit or failure of the Security UPS or Booster battery charger. These critical alarms will be repeated every 30 to 60 seconds in red or blinking red until an Operator takes a corrective action. One should be cautious when interpreting the messages in the REAL TIME SCANNING WINDOW. The order of messages is determined by the order of the Optomux cards being interrogated. Thus, if several events occur within one scanning cycle (1.3 seconds), the first message may not be the cause of the other messages.

The program can accomplish other functions while continually scanning the monitors. An attempt was made to try to keep the program options consistent with other standard PC program practices. For example, the F1 key is used for HELP and a Lotus 123 type menu is used to select the options. Each option is chosen with the arrow keys or the first letter of the selection. A carriage return is necessary to "execute" the option. A description of the selected choice is displayed on the second line of the monitor as a HELP aid. The options can extend to more than one page but the last option is always QUIT or RETURN. The ESC key always returns up to a higher level of options. Following a standard convention two dots will follow a choice if more options follow, for example, BROWSE.. or STATUS.. Additional help messages are given on the bottom two lines of the monitor when necessary.

The standard choices that will be available in the program are: STATUS, BROWSE, statuslogic, CHMKS, RESET, DOSCMDS, and EXIT. If the choice is not available yet in the program, it is shown in lower case letters.

4.2.1 STATUS

As shown in Section 3.0 the ACS can be described with a block diagram of three blocks: INPUTS, LOGIC, and OUTPUTS. The MCR operators can only change the INPUTS in an attempt to change an OUTPUT. For example, to open the HEBT beam stops the operators can turn the HEBT BNL-6 key. If the other logic is satisfied, then an output command will be sent to the HEBT beam stop solenoid to open the beam stops. The purpose of the STATUS option is to indicate the status of all monitored relays that will prevent the chosen function from occurring or to list all the relays interlocking this selection. The relays interrogated depend on the logic diagram and relay schematics and are defined in a program data file. This is only a simple analysis of the logic and more messages may be given than necessary if several different paths (OR gates) are used to achieve the option.

For example, consider the simplified relay drawing of Figure 2. The relay K9 when energized will operate the HEBT beam stop solenoid and open the beam stop. To check the interlocks on K9 one would need to report the status of K2-K8 and only list the status of the relays if they would prevent energizing the K9 relay.

Note that for the OR gate, relays K5 and K6 both must be energized or K7 and K8 be de-energized. The program is not clever enough to analyze the OR gate or parallel relay combination. Ideally one would want no messages to occur if the logic were satisfied to open the beam stops. This will not occur in the program since it does not have the intelligence to analyze the OR gate and say "If the switchyard and A cave are secured, forget the status of the extraction power supplies." Instead a message will indicate the status of the extraction power supplies. This may be confusing to operators but experience and training on the logic diagrams will clarify the group of messages.

4.2.2 STATUSLOGIC

This option is similar to the STATUS option except that the state of all relays checked are given. This option can be used to identify which relays, from the descriptive message, are being checked with the STATUS option. When this option is selected more than 20 relays may be checked resulting in messages scrolling off the screen. These can be read using the BROWSE/NOWLOG option by browsing the log file. When this choice and the STATUS choice are selected, the messages appear inside a box without a time and date stamp. This is useful when one reviews the log file since these messages do not indicate any change in relays in the Access control system.

4.2.3 BROWSE

The Browse option allows the user to browse any file in the C:\QB4 directory on the PC while continuing to scan all the Optomux cards. The most popular use of this option is the BROWSE/NOWLOG choice which brings up the current Log file and moves to the end of that file. This choice allows the user to observe the most current messages in the Log and to scroll back in time. Previous Log files or program data or command files may be browsed while continuing scanning the relays. The REAL TIME SCANNING WINDOW is compressed to show only the five most recent messages. The file to be browsed is selected using the arrow keys from an alphabetical list of files meeting the chosen criteria (Log, Cmd, All files).

4.2.4 CHMKS

This choice is in the SECURITY program to satisfy the requirements of OPM 6.1.2 "Responding To Chipmunk Interlocks." At the end of each shift, the coordinator needs a printed listing of all the chipmunk interlocks that occurred during the shift. This option will read the Log files and extract the chipmunk interlocking messages and copy them to the CHIPMONK.LOG file which can be printed.

4.2.5 RESET

This selection is designed to reset certain latching interlocks at the AGS that can be reset with a relay controlled with an Optomux output module. Currently the Linac and Booster chipmunk interlocks can be reset. Crash button messages that occur every 15 to 45 seconds may also be reset. Some secondary SEB beam line latching interlocks may also be reset.

4.2.6 DOSCMDS

This option allows the user to copy, print, or delete files in the C:\QB4 directory without stopping scanning of the relays. Normally each morning an ACS member copies the Log files to a floppy disk and deletes Log files that are over a few days old. Files may also be printed to the ACS printer in the corner of MCR behind the MCR_4 console.

4.2.7 EXIT

This choice exits the program and returns to the DOS operating system. Scanning of the relays stops.

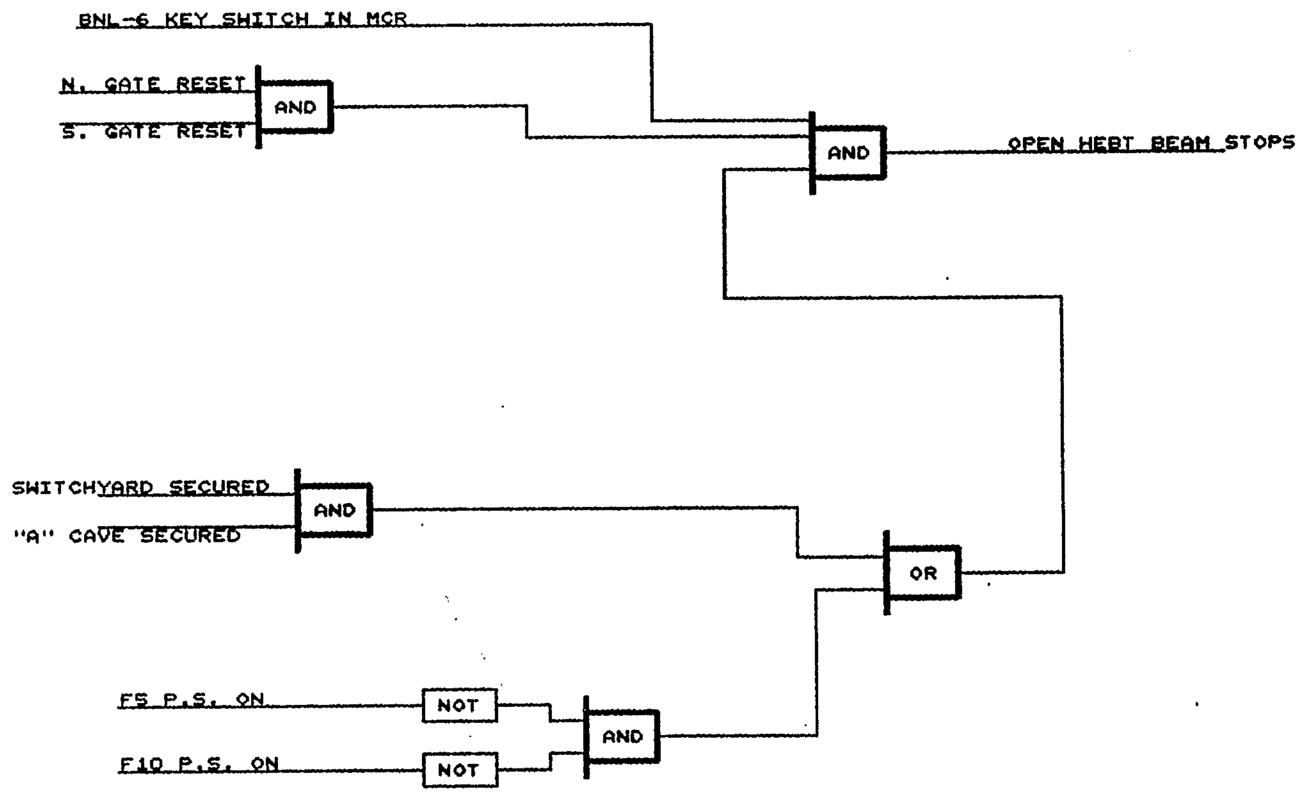
4.2.8 Other Program Functions

Scanning of the monitored ACS relays is important. For this reason a "watchdog" relay is held energized with a 60 second pulse from an Optomux output module each time the program scans all the relays. If the program stops scanning, this relay drops out and causes a light to blink above the ACS PC. If this occurs the operators may need to take certain actions as defined in OPM 6.1.2, Paragraph 3.1.

All data messages written on the PC monitor are also recorded in LOG files. The PGMERROR.LOG lists any errors received from any Optomux card. These usually are a result of loss of power or change of power supply dc voltage to the Optomux card in a particular enclosure. These messages are also written on the bottom box line of the REAL TIME SCANNING WINDOW. To prevent the LOG file from being saturated, only 20 error messages maximum per hour are written.

The normal daily log file keeps a record of the messages written on the PC monitor. The LOG file name is coded from the date and time when the log file was started. The file name 02-06-01.LOG indicates that the file was started on 02-06 (Feb. 6) at 01 hours (between 0100 and 0200). The year is not indicated in the file name. A new log is started each morning between 0001 and 0130 and sometimes each time the program is restarted.

Both the error log and the daily logs are saved automatically every 85 minutes as indicated in the Log files. The messages displayed on the daily log indicate the date and time if they occur as a result of a change in an ACS relay. If the messages occur because a status was requested, they are enclosed inside a box. Two numbers are typed before each message. These indicate the card from which the message occurred and which Optomux monitor on the card generated the message. If the numbers are 41 5 then the 5th message in the PANEL41.DAT file will have that message. The PANEL41.DAT file also indicates the relay being monitored by that Optomux device.



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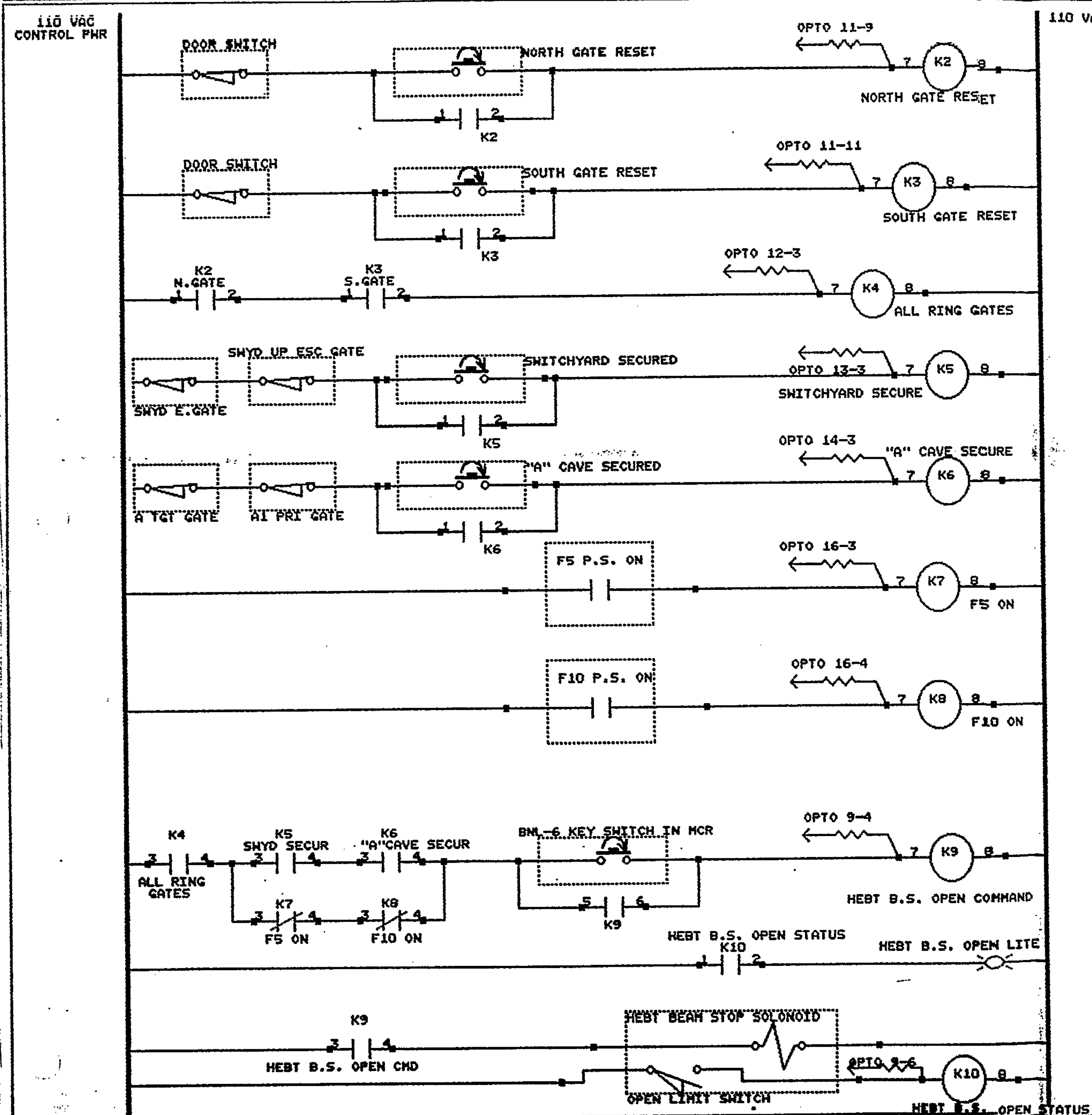

NOTES:

1. RELAY CONTACTS SHOWN IN DE-ENERGIZED POSITION
2. WHEN RELAY IS ENERGIZED, THE NOTE IS TRUE .. IE. WHEN K7 IS ENERGIZED THEN F5 IS ON.

Size	Document Number	REV
B	FIGURE 2	
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