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विद्युत सिगनल प्रयोगशाला
प्रयोग नं: ई एस एल 31

IRISET
ELECTRICAL SIGNALLING LABORATORY
EXPERIMENT NO.: ESL – 31

नाम
Name : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

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Roll No : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

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प्राप्त अंक
Marks Awarded :

अनुदेशक का अधाक्षर
Instructor Initial :

MICROLOK-II ELECTRONIC INTERLOCKING SYSTEM

(RDSO/ SPN/192/2005)

Aim: STUDY OF MICROLOK-II ELECTRONIC INTERLOCKING SYSTEM.

SYSTEM DESCRIPTION: - It is a microprocessor based electronic interlocking system. This system provides:

- Control and monitoring functions for all elements of basic railway vital interlocking.
- Supervision and control of point machines, point switch locks and signal lamps are managed by the vital microprocessor on the system Cardfile CPU board.
- Standard vital output boards interface discrete commands from the CPU board to point machine relays or other types of vital relays as required.
- Vital input boards interface various external circuit inputs back to the CPU board. Typical vital inputs include point machine correspondence (NWKR/RWKR) and interlocking track circuit occupancies (TPRs).

BASIC HARDWARE/SOFTWARE ELEMENTS:

The Microlok II system hardware and software can be easily configured as per the requirement.

The basic hardware and software elements of the Microlok II system include:

1. System Cardfile

- Vital CPU for overall system monitoring, control, diagnostics and data recording.
- Executive and application logic for vital interlocking functions.
- Executive and application logic for non-vital control/communication functions.
- Vital outputs for point machines and signal lamps.
- Vital inputs for point switch correspondence.
- Serial I/O channel for application logic and executive software loading and upgrades.

- User controls/displays for on-site system configuration and access to diagnostic codes.

2. Vital Cut-Off Relay

- Provides CPU-controlled switching of Battery power to Vital Output Circuits.

3. Circuit Isolation/Protection

- Isolation module for double-break type vital output circuit isolation.
- Surge suppression/isolation units for non-vital serial communication lines.

CPU Serial Communications

- The CPU board incorporates five serial data ports, four of which are intended for communications with external vital and non-vital systems. The remaining port interfaces communications with a PC connected to the board's front panel 9-pin connector.

Port No. 1 & 2	RS-485 :	For communication with other MLK systems.
Port No. 3	RS-423/ : 232	For communication with non-vital code system/ VDU Panel / Genisys
Port No. 4	RS-232 :	For communication with non-vital code system/ VDU Panel / Genisys
Port No. 5	RS-232 :	(Debug port) For communication with Maintenance PC for debugging.

<u>OVERVIEW OF OPERATING SOFTWARE AND SOFTWARE HANDLING</u> :

- Depending on the system application, the Microlok II system cardfile can contain up to two different software elements.
- All Microlok II systems contain **vital** executive and application software on the CPU board.
- In addition, an EEPROM, located on the CPU board edge connector housing, is programmed with site-specific configuration data that is unique to the cardfile of that station.

Executive software:

- **The executive software is standard for all Microlok II systems (US&S-developed) and is responsible for the overall vital monitoring and control of the system**.
- The responsibilities of the executive software include:
  a) Interlocking vital input monitoring, decision making and commands.
  b) Monitoring of all vital input and output channels for intended on/off states.
  c) Processing of user inputs received from a laptop PC/maintenance PC or the CPU board front panel.
  d) Continuous internal and external diagnostics.
  e) Recording and playback of routine event and error codes.
  f) Recording and playback of user-specified events.
  g) Management of the serial data ports.
  h) Execution of the application software.

- All Microlok II CPU boards are provided with the executive software already loaded into memory.
- Executive software version upgrades are downloaded to the CPU using a laptop PC connected to a serial data port (Debug Port) on the CPU board front panel.
- US&S supplies its own Windows□-based programming interface, the Microlok II Maintenance Tools program, for this purpose.

Application software:

- The vital application software contains the application-specific logic (user-developed) appropriate for the overall Microlok II system configuration.
- Generally, the user develops this software using the same US&S programming tools used for executive software version upgrades.
- Site-specific configuration data stored in the CPU board edge connector housing EEPROM can be loaded using the CPU board front panel toggle switches and LED displays or with the laptop PC connection to the CPU board front panel serial port (debug port).
- The PC-based method controls a greater range of configuration options.

SYSTEM CARDFILE DESCRIPTION:

General Configuration:

- The system cardfile contains 20 card slots, although not all slots will be used in every application.
- Each installed circuit board plugs into a common backplane motherboard.
- The backplane distributes circuit board operating power and enables the CPU board to control and monitor other boards in the cardfile.
- In addition, the board configuration must agree with the configuration defined in the application logic software.
- To prevent accidental insertion of a board in the wrong cardfile slot, each board is equipped with **male keying pins**. These pins correspond with keying plugs installed in the associated backplane slot connector. The keying pins are installed in the field once the board configuration is determined.
- In order to allow communications between the CPU board and the other boards in the cardfile, each board must have its bus address configured in hardware. This is accomplished by means of a set of six two-position jumpers, mounted at the rear of the cardfile in the external cable/connector housing attached to the top connector of each board. Jumper settings are generated in the application software while compilation.

General Functions and Designs of Plug-In Components:

CPU Board: The same CPU board is used in all Microlok II applications.

The general functions of this board include:

- Monitoring external indications from vital input boards, non-vital input boards.
- Processing vital external indications and executing logic defined in the application software.
- Driving vital output boards as required by the application program.

- Monitoring and controlling serial communication ports (links to other controllers).
- Testing individual vital input and output channels for faults (in parallel with control of these channels) and responding to detected faults.
- Monitoring system internal operation for faults and responding to detected faults.
- Controlling power to vital outputs through the cardfile power supply and an external VCOR relay (fail-safe function).
- Recording system faults and routine events in user-accessible memory.
- Responding to CPU board front panel switch inputs and operating the associated displays.
- Interacting with a laptop PC during system diagnostic operations, application logic programming, and executive software upgrading.
- Jumpers are provided on the board to enable or disable the flash EPROMs for programming and to select the required programming voltage.

Standard Vital Output PCBs:

- The Microlok II standard vital output cards, part numbers N17060502 -**24V**,interface CPU vital outputs to external relay coils.
- It has 16 independent 24V outputs.
- Outputs are controlled by "**high side**" **software-controlled switches** that connect battery positive to the output.
- Each output is also protected with a **polyswitch.** A polyswitch functions like a circuit breaker. When the over current trip point (about 0.75 amp) is exceeded, the device switches to high impedance. The polyswitch returns to low impedance when the overload or short circuit condition is removed.

Non-Vital I/O PCBs:

- The non-vital I/O PCB s enables the Microlok II system to generate and monitor the status of non-vital discrete inputs and outputs. Examples of non-vital I/O include controlled outputs to light remote indicator lamps, and the I/O associated with the switches and indicators on the local control panel (if installed).
- I/O board part number N17061**501** is used for **external I/O circuits** only, and provides **32 inputs and 32 outputs** through its **rear 96-pin connector**. This board employs polyswitches to protect the output circuitry.
- Outputs on board are protected by 5.0A fuse.
- Outputs are designed to operate at battery voltages between 9.5 and 35VDC. Outputs switch positive battery and are capable of supplying up to 0.5AMPS. Nominal voltage drop per output is load dependent and usually less than 2.5volts.

Power Supply Board and System Power Configuration :

- The power supply board provides two regulated output voltages that are needed for the operation of the cardfile circuitry.
- The power supply board performs the following functions:
  - Converts the external supply voltage (9.8 to 16.2 Vdc) to regulated +12V and +5 for outputs to the system cardfile internal circuits.

- Provides an isolated source voltage for external contact sensing.
- Supplies energy to the VCOR relay coil under the control of the CPU Card.

- The power supply board serves a vital role in the fail-safe design of the Microlok II system.
- The CPU board outputs a 250 Hz check signal to the power supply board as long as the diagnostic checks performed continuously by the CPU detect no internal or external system faults.
- Failure of a diagnostic check results in the removal of the check signal from the power by removing the hold voltage from the VCOR relay coil (400Ω). This, in turn, results in removal of power to all vital system outputs.
- The regulated +12V and +5V power is distributed to all system cardfile PCBs through the cardfile backplane bus. Both voltages are used to power board components and circuits.
- The +12V output of the power supply board is not used as a source for any vital or non-vital outputs. External battery power is used for this purpose.
- The optional Microlok II power-off relay provides a means of reporting a commercial power failure (serving the battery charger) to the Microlok II system. The output of this relay can be tied to a non-vital or vital input.

VCOR Relay:

- The vital cut-off relay (VCOR) is used by the Microlok II system to control power to all vital outputs.
- This relay is energized by the conditional output from the power supply PCB in the system cardfile.
- The CPU board controls this fail-safe function.
- A US&S PN-150B vital biased relay is used for the VCOR. This relay incorporates a 400 Ω coil, and 6F/B contacts consisting of low voltage silver-to-silver fronts and silver-to-silver backs.

1) Draw the block diagram of the Microlok-II SSI system?

2) How many cards can be provided in a cardfile?

3) What are the cards provided in the cardfile of IRISET Microlok-II system?

4) Write the functions of the VCOR relay?

5) What is the procedure for change over from panel mode to VDU mode?

Date:

Signature of the trainee