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About This Standard

This specification details the hardware requirements for the SRA standard “S-2000 J/1.1VIO” Vital Indication Optoisolator (VIO) boards. There are three types of VIO: for 12 volt operation, for 50 volt operation, and for 120 volt operation.

This specification is intended to be read by persons involved in the design, manufacture, installation or maintenance of Vital Indication Optoisolator boards.

This specification presumes a reasonable familiarity with printed circuit board construction practices and of electronic theory.

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1. Introduction

1.1. Purpose of this Document

This specification details the hardware requirements for the standard “S-2000 J/1.1VIO” Vital Indication Optoisolator (VIO) boards. There are three types of VIO: for 12 volt operation, for 50 volt operation, and for 120 volt operation.

This specification is intended to be read by persons involved in the design, manufacture, installation or maintenance of Vital Indication Optoisolator boards.

This specification presumes a reasonable familiarity with printed circuit board construction practises and of electronic theory.

1.2. Related Documents

- International standard VDE 0110 "Specification for clearances and creepage distances in electrical equipment".
- International standard DIN EN 50022 "Mounting rails".
- International standard DIN EN 50035 "Mounting rails".
- British Rail Board Standard 930 "Relays for Signalling purposes".

2. Functional Specification

- a) The Vital Indication Optoisolator Boards are used to provide an output, which indicates the state of an intermediate point in a signalling circuit. The signalling circuits being monitored are directly involved in the safe operation of trains.
- b) In order to maintain the integrity of the signalling circuits, the isolation between the signalling circuit and the indication output is required to conform to the same standards as the signalling circuits.
- c) The Vital Indication Optoisolator boards will generally be located in locations with no temperature regulation, heat generating equipment and dust. They are expected to have a life of 15 years with no preventative maintenance.
- d) The Vital Indication Optoisolator is a four (4) terminal module. Terminals 1 and 2 connect to the signalling circuit (1 is positive). Terminals 3 and 4 connect to the Indication circuits (3 is positive). Each terminal shall be suitable for terminating two red pin lugs.
- e) The isolation between the signalling circuit and the indication circuit, between adjacent signalling circuits and between a signalling circuit and earth shall comply with the dimensions for air and creepage distances specified by VDE 0110 b/2.79 at 1200 Volts DC, insulation group C for unlacquered printed circuit boards. That is, 9mm air distance and 16mm creepage distance.
- f) A schematic circuit for a Vital Indication Optoisolator is shown on attached drawings 1033-1 and 1033-2. These circuits are for guidance only.
- g) The device that provides the electrical isolation shall not fail under any conditions in a manner that provides an electrical connection of less than 2

megohm at 500 volts between the signalling circuit and the indication circuit.

- h) The VIO shall withstand a minimum of 10,000 volts DC between the signalling circuit terminals and the indication terminals when applied for one (1) minute. No breakdowns or flashovers are permitted.
- i) The insulation resistance between the signalling terminals and the indication circuit terminals shall be greater than 100 megohm when 1,000 volts DC is applied for 1 minute.
- j) Drawing 1033-3 provides example circuits for the intended use of the Vital Indication Optoisolator.
- k) Transition time from on to off and off to on shall be less than 30 mS. The expected repetition rate is less than once per second.

3. Interface Specification

The Vital Indication Optoisolator has two (2) interfaces:

- To the Signalling Circuits.
- To the Indication Circuits.

3.1. Signalling Interface

3.1.1 General

- a) The electrical isolation shall be provided by using a discrete LED and Phototransistor separated by a gap of greater than 15 mm.
- b) The signalling interface circuit shall not be damaged by connection of reverse polarities.
- c) Resistors shall be rated for a continuous working voltage of 500 volts or greater.
- d) The LED shall have a continuous forward current rating of 40mA or greater.
- e) The circuits monitored by the signalling interface will contain relays containing 8 Henry coils and no method of limiting the back EMF when a contact opens.

3.1.2 12 volt operation

A resistor shall be provided in each leg of the Signalling Circuit. The resistors shall have the same value. The resistor values shall be such that when 12 volts is applied to terminals 1 and 2, and one of the resistors and any other active component is shorted out, the current drawn is less than 8 milliampere.

The maximum expected input voltage will be 24 volts.

The indication output shall be ON when the voltage applied to terminals 1 and 2 is greater than 8 volts and OFF when the voltage applied is less than 2 volts.

3.1.3 50 volt operation

- a) A resistor shall be provided in each leg of the Signalling Circuit. The resistors shall have the same value. The resistor values shall be such that when 55 volts is applied to terminals 1 and 2, and one of the resistors and any other active component is shorted out, the current drawn is less than 5 milliampere.
- b) The maximum expected input voltage will be 70 volts.
- c) The indication output shall be ON when the voltage applied to terminals 1 and 2 is greater than 30 volts and OFF when the voltage applied is less than 10 volts.

3.1.4 120 volt AC operation

- a) A resistor shall be provided in each leg of the Signalling Circuit. The resistors shall have the same value. The resistor values shall be such that when 120 volts AC is applied to terminals 1 and 2, and one of the resistors and any other active component is shorted out, the current drawn is less than 4 milliampere AC.
- b) The maximum expected input voltage will be 130 volts.
- c) The indication output shall be ON when the voltage applied to terminals 1 and 2 is greater than 60 volts and OFF when the voltage applied is less than 30 volts.

3.2. Indication Interface

- a) The Indication output shall switch 120 mA 0.5 henry inductive loads at 35 volts DC without harm to any component. Normally the output will switch 60mA 0.5 henry 24 volt relays or 8mA 24 volt circuits driving LED's.
- b) When the Indication output is ON there shall be a maximum voltage drop across terminals 3 and 4 of 2.2 volts for currents in the range 0.5 to 120 mA. Normally this should be less than 1.6 volts.
- c) When the Indication output is OFF the leakage current between terminals 3 and 4 shall be less than 0.2 mA at 35 volts.
- d) Direct sunlight or flash light incident on the unit shall not provide a false ON indication.
- e) The indication interface circuit shall not be damaged by connection of reverse polarities.

4. Mechanical Specification

4.1. Physical Characteristics

- a) All copper areas of the printed circuit board, all soldered terminations and component leads shall be insulated using a solder-through lacquer such as ISONEL 642 or equivalent.
- b) The printed circuit board shall be mounted in a Phoenix Contact UEG 20 electronic component holder or exact equivalent. Drawing 1033-4 provides the

required external details of the component holder.

- c) The tracks on the printed circuit board shall have 2mm or greater radius bends.

4.2. Mounting

- a) The mounting rail is mounted vertically with the larger lip of the rail on the left hand side when viewed from the front. The module shall fit on the rail so that terminals 1 and 2 are on the left hand side and terminals 3 and 4 are on the right hand side.
- b) The component holder shall have a universal mounting foot, suitable for DIN EN series mounting rails.

5. Environmental Specification

The Vital Indication Optoisolator board shall perform as specified in:

- ambient temperatures of 0 C to +70 C and in humidities up to 90% non-condensing.
- bright direct sunlight.

6. Maintenance Specification

6.1. Labelling

- a) The Vital Indication Optoisolator printed circuit board shall have printed on the component side of the board in Large Characters, the manufacture's name, and a batch number, component labels, and the either: "S-2000 J/1.112V VIO", or "S-2000 J/1.150V VIO", or "S-2000 J/1.1120V VIO" as appropriate.
- b) A Unique serial number (Unique for the manufacturers batch number) shall be indelibly marked on the component side of the printed circuit board.
- c) The Vital Indication Optoisolator terminals shall be labeled with their terminal number. The second terminal of each terminal pair shall have a blank label fitted.
- d) The outside of the component holder shall be labeled as per drawing 1033-4. The appropriate voltage label shall be used.
- e) All labels shall be in English, clearly legible and sufficiently hardy so that they shall not fade due to weathering over the years and/or continuous handling. The lettering shall be as large as practical. All symbols used in the identification of components, sub-assemblies, wires, terminals etc shall coincide with those on drawings.

6.2. Components

The Vital Indication Optoisolator shall be designed to utilise generally accepted standard components wherever possible and shall maintain its guaranteed performance of operation under all the conditions laid down in this specification without adjustment following any replacement of components with parts having equivalent characteristics.

7. Acceptance Tests

- a) Each unit shall be megger tested at 1000V DC in accordance with section 2 (i).
- b) One unit from each batch manufactured, (this unit shall not be considered as one of the ordered quantity) shall be selected at random, and tested for the following:
 - b1) Indication turn ON voltage.
 - b2) Indication turn OFF voltage.
 - b3) Labelling and serial number are as specified.
 - b4) Terminal 3, 4 voltage drop at 100 mA with VIO ON.
 - b5) Terminal 3, 4 leakage current at 35 volts in bright direct sunlight with VIO OFF.
 - b6) Current drawn when 55 volts DC, 12 volts DC or 120 volts AC (as appropriate) is applied to terminals 1, and 2 with one of the resistors shorted out.
 - b7) Manufacture quality of printed circuit board, components, etc.
 - b8) Volts withstand test (as per section 2 (h)). This test shall be considered as a destructive test.
- c) A test report showing the results of the tests carried out shall be provided with each delivery of units.