



Document Title:

# Underground FCI Wireless Fault Indication System

Document Type:

**Specification**

Engineering Type

**Equipment Specificati**

Document No.:

**4350.041**

Department

**Distribution**

Version:

**02**

Effective Date:

**Jul 19, 2024**

**Shared document with: N/A**

*\*Select the Departments impacted by the document*

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Document Title:

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### Related/Referenced Documents

N/A

### Version History

Version	Date	Revision Comments
1	Oct. 7, 2022	Initial Release
2	Jul. 19, 2024	Format corrections, TOC update, Section 4 modified, and sections order rearranged.



## Item Version History

Warehouse Catalog #	Asset Suite #	Version	Date
032-83565	83565	2	7/19/2024
032-83566	83566	2	7/19/2024
032-83567	83567	2	7/19/2024



## 1. Introduction

This is a general specification that covers the minimum requirements for Underground FCI Wireless Fault Indication System to be used in the distribution system in Puerto Rico. Further information will be provided by LUMA Energy at the time of order placement and will provide information on site specific conditions, quantity, and other requirements. This document includes the general electrical and mechanical characteristics of the equipment/material.

## 2. Special Requirements

- 2.1. Samples shall be furnished as requested by LUMA Energy. Vendors that have supplied this equipment/material to LUMA on previous orders, will not have to furnish samples at bid opening. The equipment/material will be received at the LUMA's general warehouse (O11) at Palo Seco, Puerto Rico. Shipping will include transportation and unloading at the indicated warehouse.
- 2.2. Any changes or updates to the supplier's approved designs, procedures, quality routines and/or inspection layout shall be communicated to the LUMA Distribution Materials Section in writing.
- 2.3. The purchaser reserves the right to refuse shipment and to determine the acceptability and rejectability of FCIs received. The supplier shall be liable for all costs incurred for shipments that are refused, rejected, or replaced.

## 3. Literature

- 3.1. Descriptive and technical literature must be supplied by the vendor at time of bidding. This literature may include, but is not limited to details of material, drawings, documented testing, and instructions for use and installation. Failure to submit documents on time will cause bidder disqualification. If required by LUMA, final drawings shall be submitted by the vendor before the manufacturing and shipping process for approval.
- 3.2. In an agreed upon time frame, after receipt of purchase order, the vendor shall submit any special procedures, techniques, or precautions that must be followed during installation. The vendor shall provide digital and hard copies of Operation and Maintenance manuals (O&M Manuals).

#### **4. Compatible with**

For compatible manufacturer and model see Table 1. These models are examples of the equipment/material described in this document and do not represent a preference. LUMA will evaluate equally any model not listed here during any acquisition event.

#### **5. Markings**

- 5.1. Each FCI must be permanently identified with the supplier's catalog number, trip current value, minimum reset value, date code and tags shall be waterproof.

#### **6. Packaging**

- 6.1. All equipment/material shall be packaged and marked in such a way as to facilitate handling and protection from damage and that the receiving warehouse can readily identify it and send it, in one complete unit, to a field location without opening crates or boxes to sort items and/or parts.
- 6.2. FCIs must be individually boxed with the outside of each box marked with the LUMA warehouse item number, the supplier's name, and the supplier's catalog number.
- 6.3. If the devices are stored outdoors open to the elements, packaging shall prevent equipment from being damaged by rain, snow, ice, wind, etc.
- 6.4. The supplier must include installation instructions agreed upon by the purchaser. Warning Label shall be placed on the equipment for special handling and storage requirements.
- 6.5. All materials, elements, parts, and hardware crates shall be shipped on flatbed trailers and stored in such a way so that they can be unloaded by finger lifts. Deliveries in containers or closed platforms where finger lifts cannot be used will not be accepted.

#### **7. Number Per Package (Logistics)**

- 7.1. As requested by LUMA Energy.
- 7.2. A copy of each detailed packing list must be sent to LUMA Energy personnel in charge of the requisition, prior to the delivery.

#### **8. Acceptance Criteria**

- 8.1. Test required: certified by external qualified laboratories.
- 8.2. Product shall be manufactured in accordance with the latest issue below (section 8.3). When conflicts occur between purchaser's specifications and the latest issue below, the purchaser's specification shall prevail.
- 8.3. Latest applicable codes, standards, and other regulations:
  - a. ANSI/IEEE Std 495-2007 Guide for Testing Faulted Circuit Indicators or latest applicable ANSI/IEEE

- b. IEC 60529: IP 68 and IP 54
  - c. Each FCI shall be built following the latest applicable NEMA, NEC, IEC, and ASTM Standard and the herein included requirements.
- 8.4. If any other standard different from the ones indicated in this document are used, the supplier must provide information showing compatibility with the required ones.

## 9. Description

The PC FCI System is used to monitor a three-phase section of cable. The Radio Interface probe connects the FCI wireless probes to the FCI Wireless Interface Device. When the wireless interface monitor probes detect an out-of-phase condition, it sends a pulse from each wireless interface probes unit to the Wireless Interface, which latches the faulted phase condition. When the FCI Wireless Interface Device interrogates the Wireless Interface, the Wireless Interface then reports the faulted phase information.

### 9.1. Fault Circuit Indicator

- a. Material and Make-Up
  - 1. Materials for the FCI shall withstand, the environmental and operating conditions as defined in ANSI/IEEE Std. 495-2007. Shall be furnished in a sealed and waterproof protective case, in compliance with IP 68 standard. Must withstand continuous water submersion of at least 15 feet.
  - 2. The FCI device must withstand a temperature range of  $-40^{\circ}$  to  $85^{\circ}$  C ( $-40^{\circ}$  to  $185^{\circ}$ F).
  - 3. FCIs shall be compatible with cable insulation shields and elbow connectors (200 A and 600 A type).
- b. Current Sensor
  - 1. The current sensor portion of the FCI shall be capable of being installed on an energized cable or wire. All FCIs shall have provisions for installation with a hook stick.
  - 2. LUMA prefers that FCI be self-powered without the need of external power supplies or photocells. Batteries are acceptable but must have a minimum operating life of 10 years.
  - 3. Shall be able to automatically select the current trip value based on sampled load current or load tracking method. The trip thresholds shall range from 50 to 1,200 A.
  - 4. Shall automatically reset at a minimum current reset value of 30 continuous. The FCI must also be able to be manually reset with a tool supplied by the Supplier. The tool must be compatible with a standard hook stick.
  - 5. The FCI must have capability for inrush restraint to eliminate false tripping of the unit.

c. Remote Indication

1. Shall be manufactured with an integrated interface probe compatible with SEL-8300 wireless interface radio (SEL RadioRANGER).
  2. At the end of the interface cable, the probe must provide a locking mechanism that secures the probe to the wireless interface device and a permanent magnet that indicates the installation of the probe.
  3. The interface cable shall be 12 ft. or 20 ft. long, as requested by LUMA.
- d. Shall be able to be installed in cables sized 0.75 inches to 2.10 inches in overall diameter.

9.2. **FCI Wireless Interface Radio**

- a. Wireless interface radio to be used as an FCI remote indicator for underground vault installations.
- b. The wireless interface radio shall be able to transmit wirelessly the fault indication of multiple FCI devices to an external handheld reader device. The communication transmission frequency shall range from 902 to 928 MHz. The wireless indication shall be able to register in a handheld reader device from a minimum distance of 30 ft. Shall be compatible with SEL 8310 Handheld Fault Reader.
- c. Shall be able to accept a minimum of twelve (12) FCI devices connected using an FCI magnetic probe. The wireless interface radio shall be compatible with SEL-ARU devices.
- d. Shall include a provision to select one of a minimum of eight IDs. This will permit the use of multiple wireless interface radios in proximity.
- e. Shall be manufactured with an integrated antenna for signal transmission.
- f. Shall be self-powered using a battery with a minimum service life of 10 years.
- g. Shall be able to be installed using a maximum of four (4) 1/4-inch screws.
- h. Shall be furnished in a sealed and waterproof protective case, in compliance with IP 68 standard. Must withstand continuous water submersion of at least 15 feet.

9.3. **Handheld FCI Fault Reader**

- a. Handheld FCI fault reader device that connects wirelessly to the FCI wireless interface device to project to the user possible circuit fault in an underground vault installation.
- b. The handheld device shall be able to accept a communication transmission frequency range of 902 to 928 MHz. The device shall be able to establish a connection in a minimum range of 30 ft. Shall be compatible with SEL-8300 Wireless Interface Radio.

- c. Shall be able to identify and present to the user the following information:
    - 1. The ID of at least eight wireless interface devices (when within range). The handheld device shall show green for detected wireless interface devices and yellow for selected wireless interface device.
    - 2. The fault indications of at least 12 possible connected FCI devices to the wireless interface. The indication shall be arranged in a matrix type configuration so the user can identify the FCI device by circuit phase and way.
    - 3. Indication of the handheld device power status and connected wireless interface device health status.
  - d. Shall be manufactured with a flexible antenna for communication transmission.
  - e. Shall be furnished with a protective case IP54 rated or above.
  - f. The handheld device shall accept standard double AA batteries or similar for operational power. The device must be provided with a set of the corresponding type and quantity of batteries.
- 9.4. All devices described in this specification shall be a part of the one system to ensure compatibility across all devices to be installed.
- 9.5. Each device shall be permanently identified with the appropriate catalog number, supplier's catalog number, trip current value, minimum reset value, and date code.

## **10. Qualification and Testing Requirements**

- 10.1. At the time of request for quotation, the supplier shall submit a certified report of the design tests performed demonstrating full compliance to ANSI/IEEE 495-2007 (or latest) and IEC 60529: IP 68 and IP 54. The test report shall include description, details, results, and pertinent data of samples tested. Retesting is required for a change in any product.
- 10.2. At the time of request for quotation, the supplier shall submit a copy of their Quality Control Manual to show how the supplier has incorporated the measures to produce a quality product in their operation. The quotation shall include SPC data in graph form containing routine test results for the last 1000 fault indicators produced.
- 10.3. Suppliers will be required to submit product samples for inspection by LUMA's Material Specifications Section. This inspection will verify that the Supplier's product meets the requirements of applicable specifications.

## **11. Guarantee**

- 11.1. In reply to the purchaser's request for a quotation, suppliers shall respond to the terms and conditions for the FCIs being proposed to include warranty period and coverage. Replacement costs associated with premature fault indicator failure due to inadequate design or faulty manufacturing shall be the responsibility of the supplier.



- 11.2. Replacement costs associated with FCI failure due to inadequate design, faulty manufacturing, or software errors are to be the responsibility of the supplier.
- 11.3. Non-conformance observed during sampling will require the supplier to bring the FCIs into compliance with the specification 14 days after notification. The units to be brought into compliance with the specification shall be shipped to the supplier at the supplier's expense.

**12. Inspection**

The acceptance of any equipment/material shall in no way relieve the vendor from his responsibility to meet all the requirements of this specification, and it would not prevent subsequent rejection if such equipment/materials were found later to be defective.

**13. Proposal Information**

- 13.1. Submitted proposals must include:
  - a. Technical information, tests, and drawings.
  - b. Any exceptions taken to this specification.
  - c. Copies of sample nameplates.
  - d. Lists of special and standard maintenance tools.
  - e. List of recommended spare parts.
  - f. Table of Compliance completed by the bidder with reference (see Appendix 1).

**14. Table 1: Warehouse and Asset Suite Identification Number**

Warehouse Catalog #	Asset Suite #	Equipment	Compatible Manufacturer	Part #
032-83565	83565	FCI w/Probe 12 ft.	Schweitzer Engineering Laboratories	SEL ARU NJB8
032-83566	83566	FCI Wireless Interface Device	Schweitzer Engineering Laboratories	SEL-8300.
032-83567	83567	Handheld FCI Fault Reader	Schweitzer Engineering Laboratories	SEL-8310

— End of Specification —



## Appendix



## Appendix 1: Table of Compliance

Line	Description	Pass/Fail (P / F)	Comments
1	The Proponent complies with the corresponding specification document (4350.041).		
2	The Proponent complies with the industry standards established in the specification document (ANSI/IEEE, ASTM, IEC, NEC & NEMA).		
3	Tech. info., tests & drawings provided.		
4	<b>Fault Circuit Indicator</b> <ul style="list-style-type: none"> <li>• <b>Material and Make-Up</b> <ul style="list-style-type: none"> <li>• ANSI/IEEE Std. 495-2007</li> <li>• Temperature range of -40° to 85° C (-40° to 185° F)</li> </ul> </li> <li>• <b>Current Sensor</b> <ul style="list-style-type: none"> <li>• Automatically select the current trip value</li> <li>• automatically reset at a minimum current reset value.</li> </ul> </li> <li>• <b>Remote indication</b> <ul style="list-style-type: none"> <li>• Interface cable shall be 12 ft. or 20 ft. long</li> <li>• Able to be installed in cables sized 0.75 inches to 2.10 inches in overall diameter.</li> </ul> </li> </ul>		
5	<b>FCI Wireless Interface Radio</b> <ul style="list-style-type: none"> <li>• Frequency ranges from 902 to 928 MHz</li> <li>• Accept a minimum of twelve (12) FCI devices connected using a FCI magnetic probe</li> <li>• Provision minimum of eight IDs</li> <li>• Self-powered using a battery with a minimum service life of 10 years</li> <li>• Sealed and waterproof protective case IP 68.</li> <li>• Water submersion at least 15 feet</li> </ul>		
6	<b>Handheld FCI Fault Reader</b> <ul style="list-style-type: none"> <li>• Frequency range of 902 to 928 MHz</li> <li>• Establish connection with a minimum range of 30 ft.</li> <li>• At least 12 possible connected FCI devices</li> <li>• Protective case IP54</li> <li>• Standard double AA batteries or similar for operational power</li> </ul>		
7	All devices described in this specification shall be a part of the one system to ensure compatibility across all devices.		

**NOTE: This table is only a check list for reference. The compliance shall be with the complete document. Marking a PASS in the table won't be accepted as a compliance without the technical information required to certify it.**











# 4350.041 UG FCI Wireless Interface Indicator(July 2024)

Final Audit Report

2024-07-19

Created:	2024-07-19
By:	jose torres (JoseR.TorresIrizarr@Lumapr.com)
Status:	Signed
Transaction ID:	CBJCHBCAABAAfDp0QDsUf0ogKdwk26Qq5eh_CucLOsIT

## "4350.041 UG FCI Wireless Interface Indicator(July 2024)" History

-  Document created by jose torres (JoseR.TorresIrizarr@Lumapr.com)  
2024-07-19 - 2:33:12 PM GMT
-  Document emailed to jose torres (JoseR.TorresIrizarr@Lumapr.com) for signature  
2024-07-19 - 2:33:16 PM GMT
-  Email viewed by jose torres (JoseR.TorresIrizarr@Lumapr.com)  
2024-07-19 - 2:33:36 PM GMT
-  Document e-signed by jose torres (JoseR.TorresIrizarr@Lumapr.com)  
Signature Date: 2024-07-19 - 2:33:47 PM GMT - Time Source: server
-  Document emailed to Rodolfo Flores (rodolfo.floresortiz@lumapr.com) for signature  
2024-07-19 - 2:33:48 PM GMT
-  Email viewed by Rodolfo Flores (rodolfo.floresortiz@lumapr.com)  
2024-07-19 - 2:33:58 PM GMT
-  Document e-signed by Rodolfo Flores (rodolfo.floresortiz@lumapr.com)  
Signature Date: 2024-07-19 - 2:34:51 PM GMT - Time Source: server
-  Document emailed to Ricardo Castro (ricardo.castro@lumapr.com) for signature  
2024-07-19 - 2:34:53 PM GMT
-  Email viewed by Ricardo Castro (ricardo.castro@lumapr.com)  
2024-07-19 - 2:49:11 PM GMT
-  Document e-signed by Ricardo Castro (ricardo.castro@lumapr.com)  
Signature Date: 2024-07-19 - 2:50:07 PM GMT - Time Source: server

✔ Agreement completed.

2024-07-19 - 2:50:07 PM GMT