

Reyrolle
Protection
Devices

7XG3140 – RA40

Linear Fibre Optic Arc Fault Sensor

Energy Management

SIEMENS

7XG3140 – RA40

Linear Fibre Optic Arc Fault Sensor



Features

- Bare fibre optic type linear sensor for wide protection coverage for arcing faults
- Optional sensor length up to 30 metres
- Sensor link adds up to another 80 metres in length
- Loop topology allows sensor supervision
- Robust and durable 2mm plastic optical fibre
- No special tools required for installation
- Supplied with 2x fibre couplers
- Supplied with fibre cutter

Application

The RA40 is an optical sensor that is used to transmit the flash of light emitted during the incidence of an arcing fault back to an arc fault monitor such that detection of arcing faults can be achieved in as little as a few milliseconds.

The linear sensor may be applied to protect large volumes where multiple point sensors would otherwise be required. A separate RA40 linear sensor is required for each segregated protection zone.

The linear sensors kits provide both cladded and bare fibres. The bare fibres are located within the detection zone and cladded fibres allow routing of the linear sensor back to the relay.

Bare fibre and cladded fibres are joined through the use of optical fibre couplers. An optical fibre duplex connector is utilised for connection to the arc flash relay.

Description

The Linear Arc Sensor consists of four elements as depicted in Figures 3 to 5:

1. Dual optic fibre connection plug to allow interface to a suitable arc flash monitor unit, i.e. ReyArc 7XG3127;
2. Sections of opaque (Black) link fibre to connect both ends of the sensor fibre to the arc flash monitor;
3. A section of translucent optical fibre that acts as the collector for the intense visible light emitted during an arc fault event;
4. Through-panel couplers for proper in-line connection of the sensor and link fibres.

Figure 2 depicts how the dual optic fibre connection is plugged into an arc fault monitor.

Figure 8 describes the function of each section and the practical limitations for installation.

Linear sensor topology

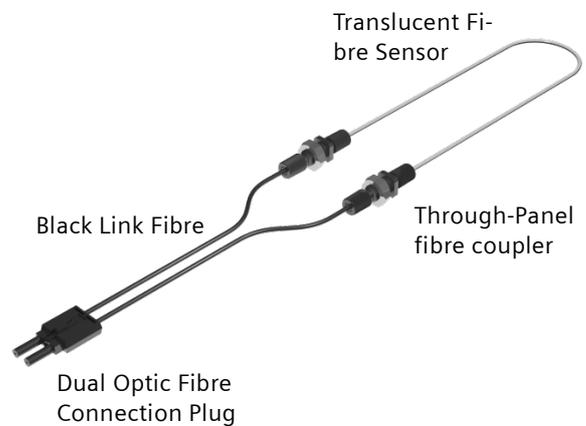


Figure 1: Linear sensor topology



Figure 2: Connection to 7XG3127 arc fault monitor

Components

Link Fibre Assembly

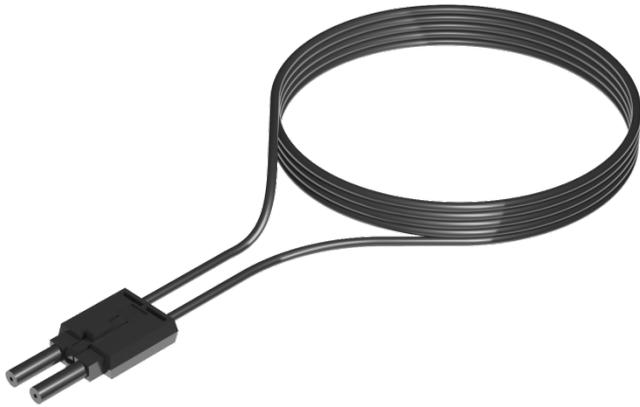


Figure 3: Link fibre assembly

The black Link Fibre assembly is supplied pre-terminated to the dual fibre connector ready to plug into the RA27 Arc Fault Monitor. The link fibre is not sensitive to light and is used to make a connection between the optically sensitive fibre and the arc fault monitor. The length of link fibre required is specified in the Order Code section.

Sensor Fibre



Figure 4: Sensor fibre

The sensor fibre is a 2mm OD translucent plastic optical fibre which is both robust and durable for application in metal clad switchgear and bus duct environments. The length of sensor fibre required is specified in the Order Code section.

Optic Fibre Coupler



Figure 5: Optic fibre coupler

Two Optic Fibre Couplers are provided per RA40 kit and are used to connect the link fibre and sensor fibre together at an appropriate position such as a compartment interface.

Optic Fibre Cutter



Figure 6: Optic fibre cutter

An optic fibre cutter tool is supplied to allow preparation of the Link Fibre and Sensor Fibre to the required length for installation.

Assembled Optic Fibre Sensor



Figure 7: Link and sensor fibres connected

Once the optic fibre sections have been cut with the tool provided, no further special tools are required to achieve the in-line connection using the optic fibre couplers.

Functional Overview

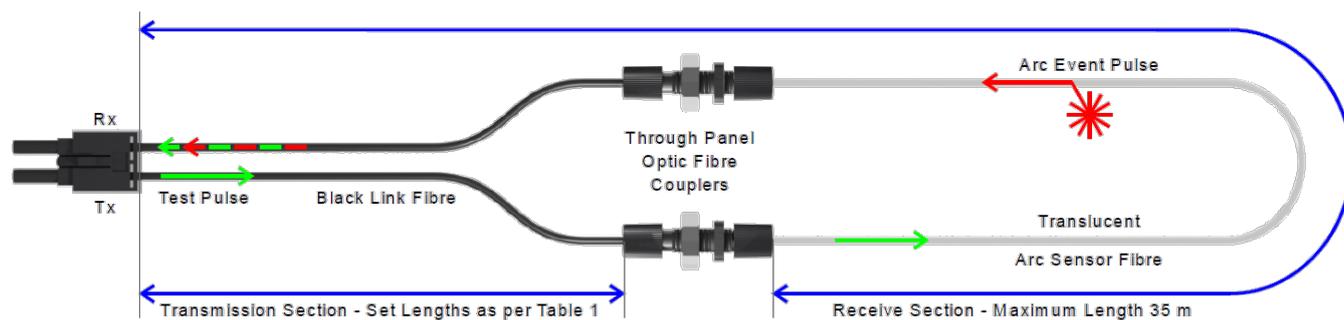


Figure 8: RA40 component function and installation limitations

Arc sensor detection function

Figure 8 shows the transmit (Tx) and receive (Rx) ends of the sensor terminated at a duplex plug ready to plug in to an arc fault monitor. Visible light generated by an electrical arc event enters the translucent section of the sensor fibre and is guided along the fibre through the couplers and into the monitor Rx connection where an optical detector is employed to sense the arc flash.

While the arc light will travel down the fibre in both directions, only the Rx end will detect the arc flash. The optical detector threshold is set below the level below that would otherwise cause nuisance tripping under ambient lighting conditions. A light intensity of $>7,500$ Lux over a length of 300mm is required to cause an arc trip. Additional security against mal-operation is achieved by allowing only sharp increases in light level to be detected.

Arc sensor supervision function

To monitor the integrity of the linear sensor, the arc fault monitor transmits a periodic optical test pulse. Provided this signal is received by the detector, the arc monitor front panel green LED will remain continuously lit to confirm correct sensor function and continuity. Refer to the appropriate arc flash monitor technical information for further details.

Arc monitor configuration setting

The arc monitor must be configured with the correct setting corresponding to the length of the optic fibre transmission section shown in figure 8 and listed in Table 1. The transmission section fibre must be cut to one of the set lengths as specified in Table 1 within a tolerance of 10%.

Transmission Section Length	Setting
<1 metre	A
1 metres	B
5 metres	C
10 metres	D
20 metres	E
30 metres	F

Table 1: Transmission section length settings

Arc sensor auto calibration

When the arc monitor unit is powered up a calibration routine is automatically initiated to adjust the supervision transmission level based on the configuration setting and to check that the supervision pulse is detected correctly.

Failure will cause an alarm LED to be illuminated to indicate that the RA40 connections and configuration setting should be checked.

Mounting Recommendations

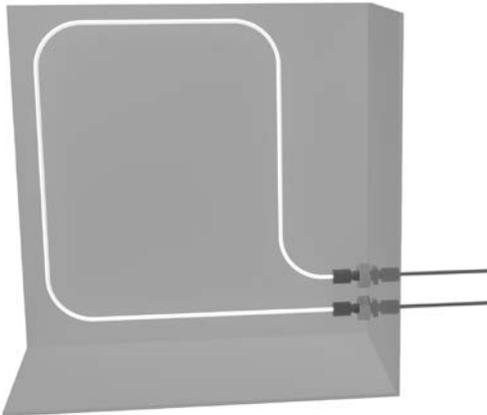


Figure 9: Example of sensor mounted through a panel and looped back internally for maximum coverage

Optic Fibre Sensor location

The translucent optic fibre sensor must be located within the switchgear or bus chamber where arcing faults could occur during operation. Care should be taken to ensure a minimum length of 300mm of fibre is exposed within the chamber. For long bus chambers the fibre may be run the full length and then returned back to the starting point to provide maximum coverage as illustrated in figure 9.

The sensor fibre should not extend beyond the chamber to be monitored and certainly not to an area that may be subject to high ambient light conditions or flash photography.

Link Fibre location

The opaque (black clad) link fibre may extend inside the chamber to be protected or terminate at the chamber interface using the in-line couplers provided.

Optic Fibre retention

Both the translucent and opaque optic fibres may be retained using cable ties or silicon adhesive provided not more than 10% of the sensor fibre is masked by the silicon or other fasteners.

Optic Fibre bend radius

The minimum bend radius for both the bare sensor and opaque clad link sections of the optic fibres is 75mm.

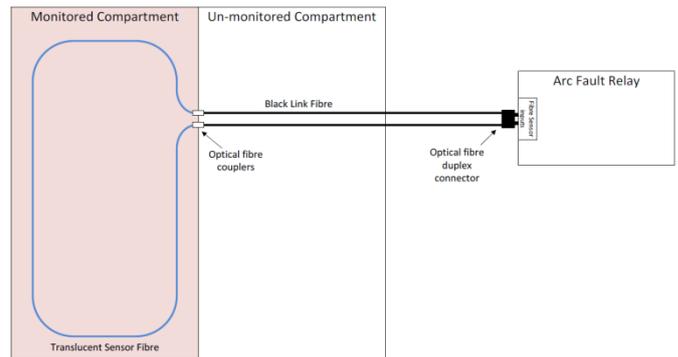


Figure 10: Diagram illustrating how neighboring compartments can be selectively monitored by passing the black clad link fibre through the compartment not to be monitored

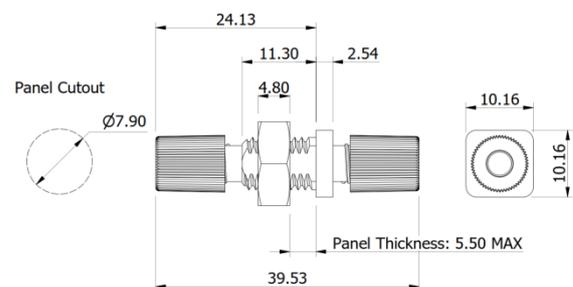


Figure 11: Optic Fibre Coupler dimensions

Dimensions

Optic Fibre Coupler dimensions

The optic fibre coupler allows easy in-line connection of the link and sensor fibres as per Figures 8 and 9. The clean cut fibre ends are simply inserted into either end of the coupler and the clamp screws finger tightened. The coupler may be mounted through a panel or left to be supported by the optic fibres.

Technical Data

Temperature

IEC 60068-2-1/2

Operating Range	-40 °C to +85 °C
Storage range	-40 °C to +85 °C

Humidity

IEC 60068-2-78

Operational test	56 days at 40 °C and 95% relative humidity
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IP Ratings

IEC 60529

Type	Level
Installed	IP 5x

Vibration - Sinusoidal

IEC 60255-21-1 Class I

Type	Level	Variance
Vibration response	0.5gn	≤5%
Vibration endurance	1.0gn	≤5%

Shock and Bump

IEC 60255-21-2 Class I

Type	Level	Variance
Shock response	5gn, 11ms	≤5%
Shock withstand	15gn, 11ms	≤5%
Bump test	10gn, 16ms	≤5%

Seismic

IEC 60255-21-3 Class I

Type	Level	Variance
Seismic response	1gn	≤5%

Material

Category	Remarks
Chemical	All components of the RA40 are RoHS compliant.
Flammability	The components of the RA40 which are directly in contact to the monitoring system are made from flame retardant material. Duplex connector plug: SABIC ULTEM flame retardant plastic (UL file E121562) Opaque plastic optic fibre: fire-resistant polyethylene (FRPE) – meets UL VW-1 flame retardant specification (UL file E116331, style 5538)

Mechanical

Parameter	Value
<i>Duplex connector plug</i>	
Insertion force, connector to transceiver	20 N
Retention force, connector to transceiver (Latched)	24 N
Retention force, connector to transceiver (Unlatched)	20 N
Tensile force, Connector to POF cable	90 N
<i>Black opaque plastic optical fibre (POF)</i>	
Absolute minimum bend radius	35mm
Short term tensile force (30 minutes)	50 N
Long term tensile force	1 N
Typical outer diameter	2.20 mm
Maximum outer diameter	2.27 mm
<i>POF coupler</i>	
Retention force, POF cable to coupler	10 N*

*May vary depending on tightness of plastic clamping nut

Ordering Information

Product description	Variants	Order No.
		7 X G 3 1 4 0 - 0 □ □ 0 0 - 0 A A 0
Reyarc – Arc		
Fault Protection	<u>Category</u>	
Components	Arc Protection	
	<u>Device</u>	
	RA40 Arc Sensor	
	<u>Arc Sensor Fibre Length (m)</u>	
	5m	A
	10m	B
	20m	C
	30m	D
	<u>Black Link Fibre Length (m)</u>	
	5m	A
	10m	B
	20m	C
	30m	D
	40m	E
	80m	J

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