ZYGGOT® Arc

Ultraviolet Arc Flash Mitigation System

Manual ZYGGOT ARC

Relay: VZA/B1

Sensor UV

VERSION V3.0P-V.H.3

varixx

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Summary

1. Security

This symbol indicates the presence of high voltage and signals items or operations that may pose risks to the operator and other people using this equipment. Read the message carefully and strictly follow the instructions given.

This symbol is the “Safety Alert Symbol”. It is accompanied by one of two signal words: CAUTION or WARNING, as described below.

CAUTION

Indicates a potentially dangerous situation which, if not avoided, could result in serious injury or death.

WARNING

Indicates a potentially hazardous situation which, if not avoided, may cause minor to moderate injury or significant damage to the product. Situations described under CAUTION may result in serious consequences if not prevented. Important safety measures are listed under both CAUTION and WARNING.

CAUTION

Motor control equipment and electronic controllers operate under dangerous line voltages.

During maintenance of drives and controllers, exposed components may be energized. Protection against electric shock is essential.

Try to stand on an insulated base and inspect components with just one hand. In the event of emergencies, always work in company. Disconnect the power supply before carrying out checks or maintenance. Make sure the equipment is properly grounded and wear safety goggles when operating electronic controllers or rotating machines.

2. Application, Benefits and Features

DESCRIPTION

ZYGGOT® Arc Voltaic Protection System, part of the ZYGGOT® Temperature Monitoring family, has been designed to enable full-time monitoring of low and medium voltage electrical equipment such as panels, transformers, motors and generators.

ZYGGOT® Arc Protection System introduces an important innovation to the market due to the fact that it detects ultraviolet (UV) radiation from the start of the arc, i.e. from the pilot path, in phase 1 of the arc, before the light detection of other systems. The light phase is already the final phase of the arc, with expansion of gases and vaporization of copper and other metals. Another important advantage is that selective monitoring of ultraviolet radiation eliminates the need for simultaneous monitoring of current to confirm the occurrence of an arc, which visible light detection systems require. If ultraviolet radiation is emitted at certain levels, the system can be safely tripped. Systems that detect visible light could be activated by door openings or light entering through gaps, which requires simultaneous current monitoring to avoid undue trip and, furthermore, if unwanted and constant visible light enters, it could take the sensor out of operation for as long as the light remains, losing protection.

ZYGGOT® Arc Protection System, unlike light detection systems, can be applied even in direct sunlight*, thus opening up the possibility of using it in outdoor systems (substations, transformers, motors, etc.). The sensors have an opening angle of 90°, which makes it possible to monitor large areas. The effective monitoring distances are high due to the high sensitivity of the sensors. For the sensor to act, it must be connected to a relay that sends the signal to open the circuit breaker. A single trip unit can monitor up to 50 sensors.

The interconnection of the sensors to the detection and trip relay uses a high-speed CAN network with clean and efficient wiring, unlike star systems with analog signals, which require each sensor to be connected independently to concentrator or interface modules. The high speed of detecting the occurrence of arcing and sending the trip signal (less than 300 µs), allows for safety, since in the event of an arcing event, the sooner the power is removed from the system, the less data will be caused. Even when using circuit breakers with opening times in the order of tens of milliseconds, the system is guaranteed to trip, even if the mains interconnection cable is destroyed by the arc, because the signal has already reached the relay and circuit breaker before it is destroyed. Another important difference is that the signals transmitted are digital, already processed in the microprocessor sensor and transmitted via shielded cables, thus being immune to extremely strong electromagnetic fields generated by the arc current, unlike what can happen with visible light detection systems with photocells, which transmit an analog signal to the interface.

*Sensor Octagonal

APPLICATION

Arc flash protection for low and medium voltage electrical panels, transformers, motors and generators, substations, transmission lines, primary cabins, etc.

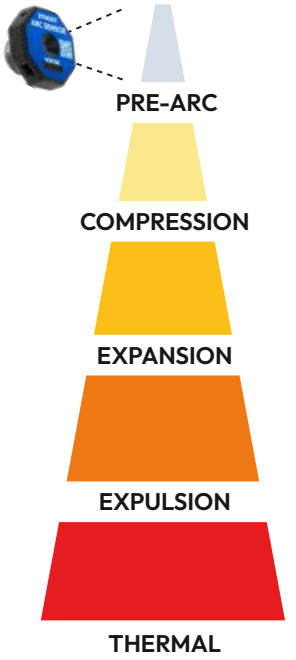
BENEFITS

- Monitors ultra violet radiation in the A and B bands.
- A single intelligent trigger relay with the latest generation ARM CORTEX microprocessor monitors up to 50 sensors.
- Detects phase 1 of the arc, before the visible light phase, i.e. expansion and destruction.
- Trip signal sent in less than 300 µs.
- Immune to strong electromagnetic fiels.
- Can be used under outdoor light (UVB sensors). Immune to visible light.
- Monitors sensor integrity, which is impossible with passive sensors.
- Sensors connected to a high-speed CAN network with digital signals.
- No need for simultaneous current monitoring to configure arcing.

MAIN FEATURES OF THE SYSTEM

- Intelligent trip unit (with ARM CORTEX microprocessor).
- Applicable to low and medium voltage.
- High-speed CAN network for sensors.
- Relay with Modbus RTU port for connection to PLCs.
- Intelligent sensors powered by their own CAN network.
- 90° measuring monitoring.
- Sensors status monitoring.
- No need for concentrators or interfaces.
- Relay and sensors are configured and tested by PC with a free program.
- Up to 50 sensors connected to a single relay. Plug-in sensor network.
- Each sensor has an LED that flashes to detect faults or location.
- Relay with 4 digital outputs, two of which are Trip, one Alarm and one Armed.
- Relay with 2 digital inputs.
- Easy testing with ArcSafe manual tester (arc generator).

ARC PHASES



Pre-Arc: Ionization of the air and formation of the arc path. In this phase, ultraviolet is released (O to 5 ms). Note: it is during this phase that the arc sensor activates.

Compression: The arc's energy is discharged into the air in the room with a consequent increase in pressure (5 to 15 ms).

Expansion: The increase in pressure caused by the previous stage triggers the relief mechanism and the air begins to be expelled outwards, reducing the internal pressure (15 to 40 ms).

Expulsion: The pressure inside the room decreases but the hot air continues to be expelled at an approximately constant pressure. The temperature potentially increases. The expulsion of air tends to cease when the environment acquires the temperature of the arc (40 to 60 ms).

Thermal: The arc totally affects insulating materials. The temperature reaches thousands of degrees Celsius and the conductive and structural materials begin to melt. This phase continues until the energy is dissipated.

SUBTYPES OF ULTRAVIOLET RADIATION

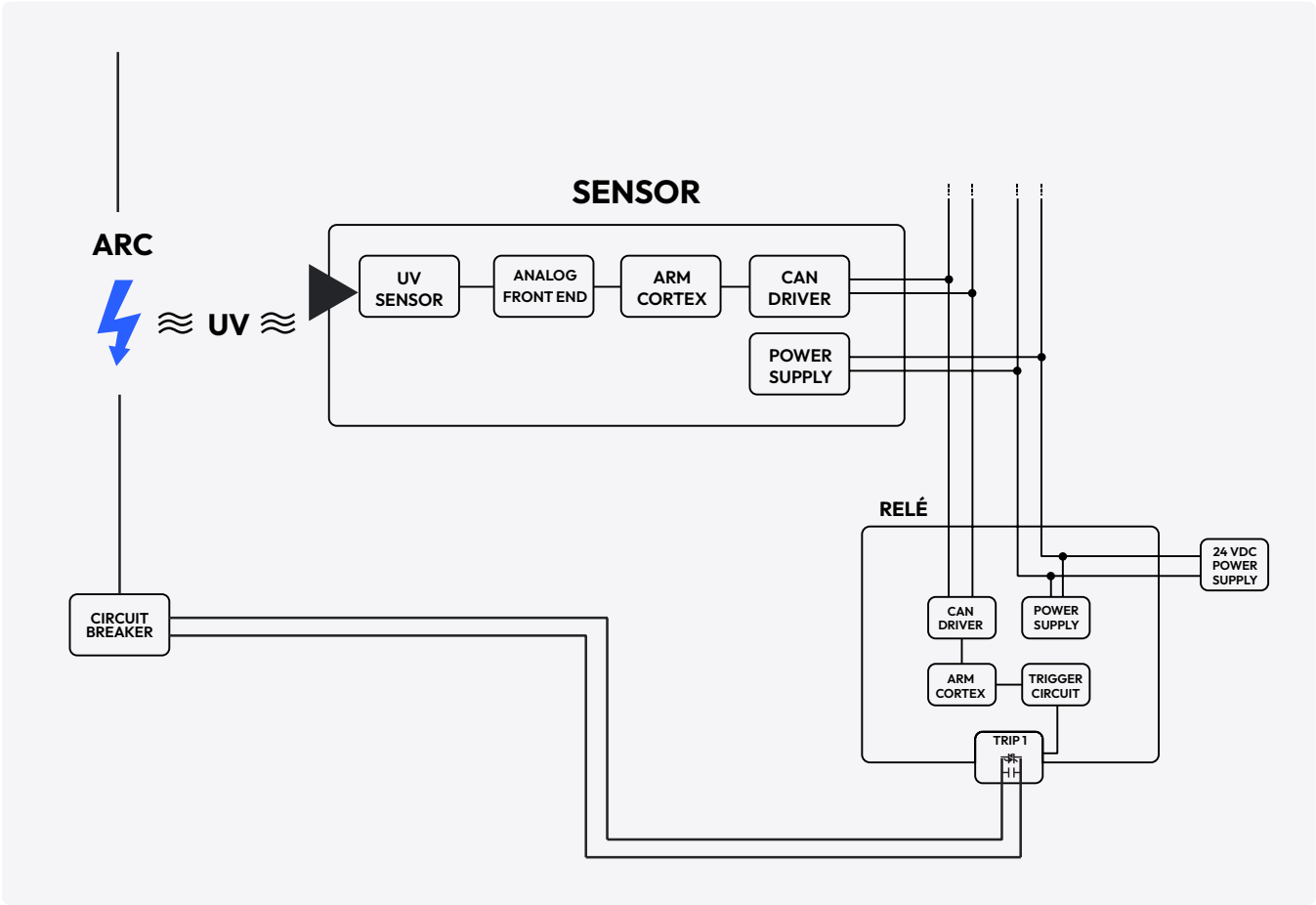
Name	Wavelenght range (nm)
Ultraviolet A or "Black Light"	315 nm - 400 nm
Near Ultraviolet	300 nm - 400 nm
Ultraviolet B	280 nm - 315 nm
Medium Ultravioleta	200 nm - 300 nm
Ultraviolet C or "gemicide"	100 nm - 280 nm
Far Ultraviolet	122 nm - 200 nm

Principle of Operation

Each sensor in the system has a high-speed, high-performance ARM CORTEX microprocessor. The *firmware* embedded in the sensor will be operating the communication and other tasks, but if an arc detection occurs, a high-priority interrupt will occur and the arc detection data transmission routine, with the sensor number will be immediately transmitted to the relay. The time from arc detection by the sensor to activation of the relay's TRIP 1 output is approximately 300 µs.

The relay also has an ARM CORTEX microprocessor, operating an on-board *firmware*, and when it receives a high-priority data packet relating to an arc detection, it immediately commands the static and dry output contacts. After detection, even if the communication cable is destroyed by the arc itself, the trip sequence will be terminated, protecting the system from catastrophic destruction.

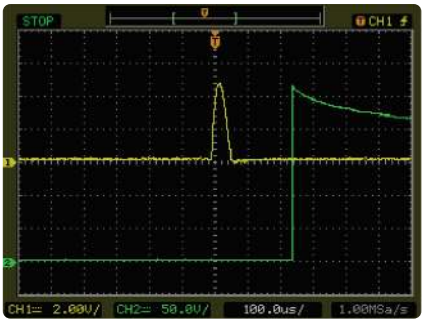
The system will be protected even during the Leds flash time or any other communication, because the CAN protocol has communication priorities, i.e. more than one or even all network elements can generate communication at the same time and the one with the highest priority for all communication of the lower priority packets is served immediately. As the arc detection data packet is the one with the highest priority, the arc detection signal will be read immediately by the smart relay. If more than one sensor detects arcing, a list of these sensors can be paged through on the HMI using the PREV and NEXT buttons.

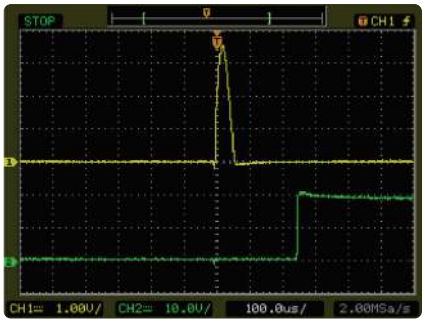


RESPONSE TIME BETWEEN ARC DETECTION (SENSOR) AND TRIGGER OUTPUT (RELAY)

TRIP 2 output response time:
Approximately 6 ms after ARC is detected by the sensor.

TRIP 1 output response time:
Approximately 300 µs after ARC is detected by the sensor.

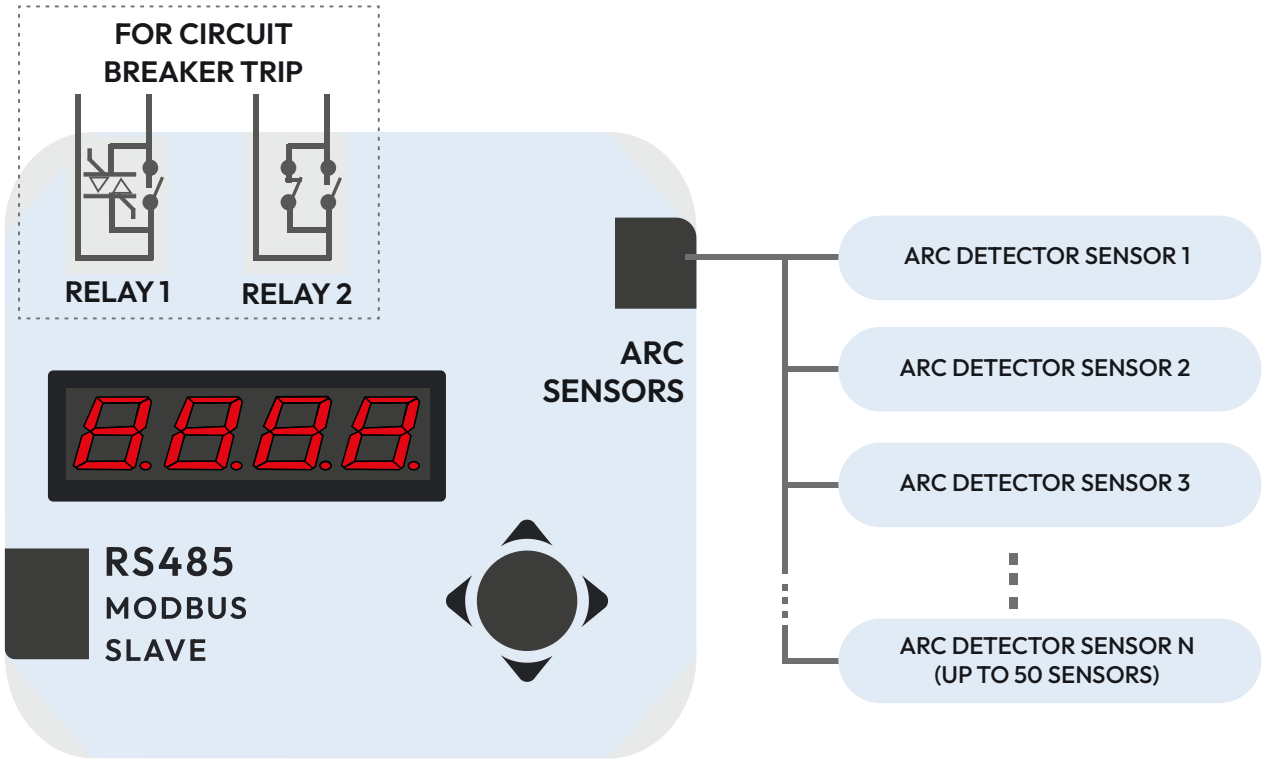




READING AND REFLECTION ANGLES

The opening (detection) angle of the sensor defines the UV measurement area, i.e. the area where the arc can be detected. The sensors have an opening angle of 90° covering practically the entire area of a cubicle depending on the point of attachment. In a single-room cubicle, a single sensor installed at a suitable point, such as in one of the corners, may be sufficient. Two sensors at opposite angles leave the entire volume with no shadow area. Ultraviolet radiation is reflected from surfaces like visible light (although it can be attenuated). ZYGGOT® sensors can pick up reflected UV radiation (depending on the reflected intensity), which facilitates detection throughout the volume of interest.

INTELLIGENT TRIP RELAY WITH ARM CORTEX MICROPROCESSOR FOR UP TO 50 SENSORS



OCTAGONAL SENSOR FOR ELECTRIC ARC DETECTION IN HARSH ELECTROMAGNETIC ENVIRONMENTS

In facilities with high levels of noise and electromagnetic interference (EMI) typical of medium-voltage systems, large drives, and substations the sensor's robustness is critical to maintaining consistent performance. For this reason, Varixx has evolved the UV platform and introduces the ZYGGOT® Octagonal (OCTO) Sensor: a sensor with improved architecture and construction for superior immunity in highly electromagnetically "polluted" environments, while maintaining full compatibility with existing systems.

01
Simple and Straightforward Retrofit

Maintains full compatibility with existing systems, using the same mounting hardware and connector, without requiring any mechanical or special infrastructure modifications.

02
Superior EMI Immunity

The core concept of OCTO is its resilience in electromagnetically "polluted" environments, ensuring consistent performance even with high levels of noise in specialized infrastructure.

03
Reinforced Internal Shielding

The design has been upgraded to include internal shielding and a redesigned PCB, drastically reducing susceptibility to external interference.

04
Enhanced Geometry and Architecture

The octagonal design reflects an optimized construction, specifically engineered to raise the standard for robustness in the field against electric fields.

05
Cost Competitiveness

Efficiency in construction and the targeted use of materials make the product more cost-competitive, facilitating standardization and upgrades.

06
Smart Commissioning

(Auto-Addressing)
It simplifies installation in large-scale systems through features such as auto-addressing, making the process faster and more convenient.

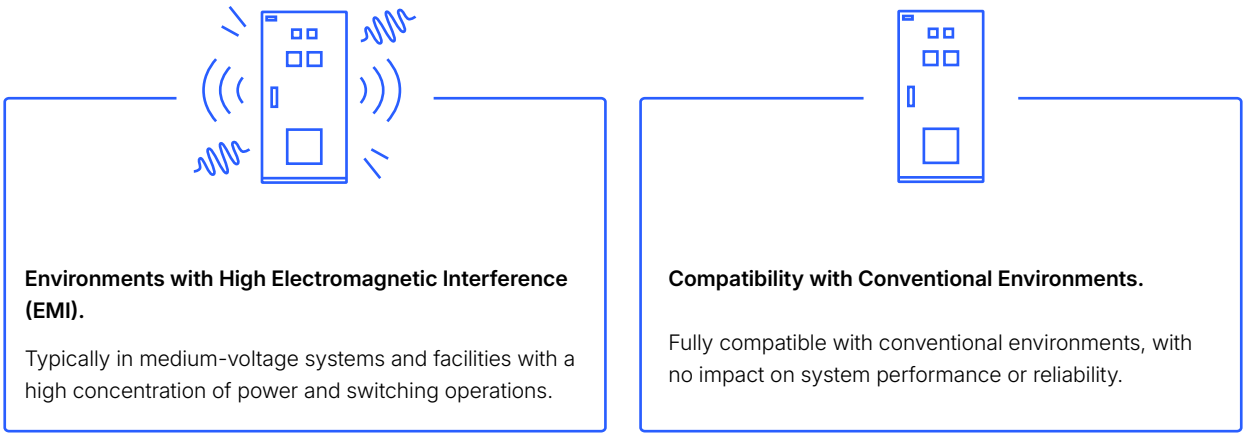
07
Material Efficiency with FARADEX™

Replacing part of the steel with the FARADEX™ composite results in a lighter, more durable structure with a lower logistical impact.

08
Consistent Detection Performance

Despite the physical changes, it fully preserves the reliability parameters: same field of view, same speed, and same sensitivity as the previous sensors.

APPLICATION



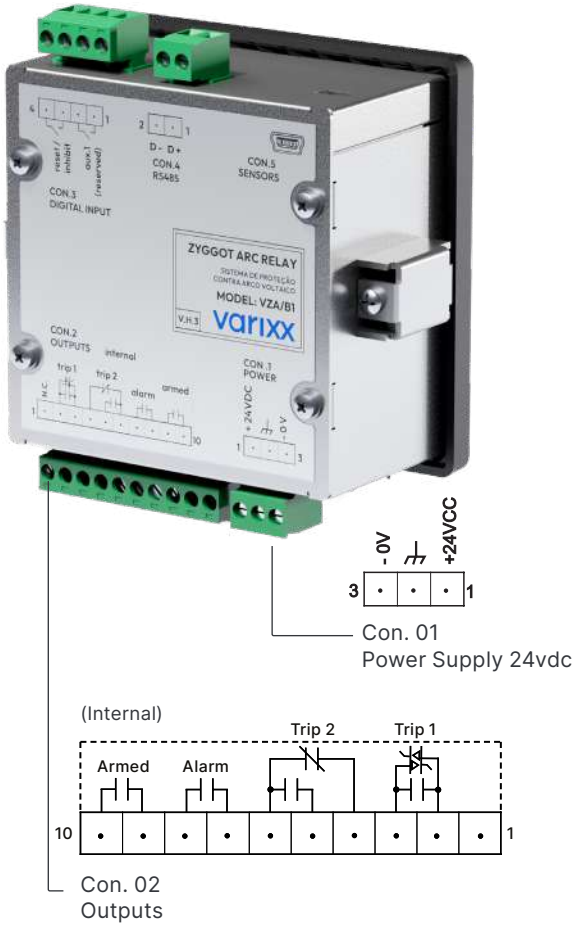
Environments with High Electromagnetic Interference (EMI).

Typically in medium-voltage systems and facilities with a high concentration of power and switching operations.

Compatibility with Conventional Environments.

Fully compatible with conventional environments, with no impact on system performance or reliability.

RELAY DETAILS



OVERLAY

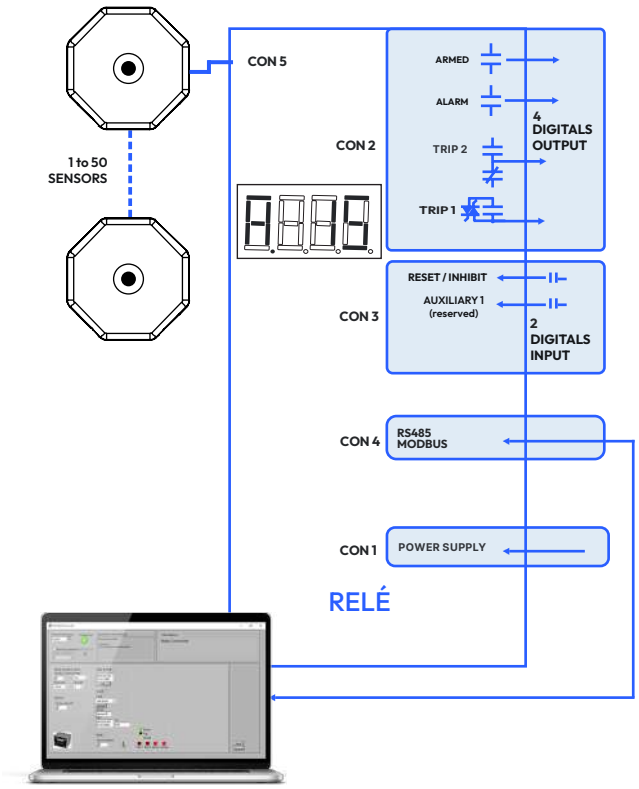
The figure above shows the arc relay overlay. The relay has a display that indicates the number of sensors disconnected or activated by arcing. The first digit on the left identifies the condition, and the next three digits show the corresponding number, which can be navigated using the PREV and NEXT keys. Three LEDs indicate: Power, Trip (arc detection) and Armed (arc monitoring), active even with disconnected sensors or no communication.

ZSA ARC GENERATOR TESTER

The ArcSafe tester is optionally available for system operation testing. The tester generates an extra-high voltage (3.800.000 Volts) which provides small, low-energy electrical arcs between its electrodes.

These arcs are detected by the sensors at a maximum distance of 1.5 m for UVA sensors and 0.2 m for UVB sensors.

SINGLE LINE DIAGRAM AND MAIN FEATURES



*Optionally, it can be integrated with a supervisory system (CLP OR PC) or also configured via PC.

CABLES

The ease of setting up the sensor network lies in the two mini USB connectors on the sensors and the shielded mini USB cables supplied in various sizes by Varixx.

DETECTION

The trigger relay provides arc detection of up to 50 targets or areas (50 sensores).

DISPLAY

Display is concise, as a specific relay for applying binary logic (ON/OFF) should be. Even so, it is of great value for defining the number of sensors in the network and identifying the sensors that led to the system shutting down (including the sequence in which the detections occurred). Ex: Sensor 3, Sensor 1, Sensor 2.

PROGRAMMING TOOLS

A program developed and supplied free of charge by Varixx allows you to parameterize and test the relay as well as each sensor.

EVENT MEMORY

The relay can store and display up to 50 sensors activated by arc detection. The display is sequential, i.e. its indicates the order in which the detections ocurred (if a sensor that has already detected an arc detects a new arc before the relay is reset, the number of that sensor will appear on the display, but the initial sequence will not be affected). You can navigate using NEXT and PREV buttons. To clean the event memory, press and hold the RESET button for a few seconds.

COMMUNICATION PORTS

The relays have 2 communication ports: An RS485 port with Modbus RTU protocol, for communication with supervisory systems, PLCs or for connection to a PC for parameterization, and a mini USB port with CAN protocol for communication with the sensors.

DIGITALS INPUTS

The relay has 2 digital inputs, 1 for Reset / Inhibit and the other auxiliary 1 which is reserved. The Reset / Inhibit contact, if closed momentarily, performs the Reset function and if kept closed performs the device's inhibit function.

DIGITALS OUTPUTS

4 digital outputs are avaiable, two of which are Trip outputs, triggered simultaneously. An Alarm output (N.O) that can be triggered if the system detects an inactive sensor or communication failure. An Armed output (N.O) informs you if the system is monitoring for arcing. One high-speed N.O Trip (TRIP 1) has a solid-state contact in parallel with the dry contact, guaranteeing a time between arc detection by the sensor and sending the command to open the circuit breaker of approximately 300 µs. The second output Trip (TRIP 2) has a shorter actuation time (approx. 5ms) and a NAF contact and is suitable for indication in the DCS system.

NOTE: A "Sensor not responding" Alarm condition doesn't deactivate the Armed condition or the arc detection of active sensors.

5. Connection Diagram

COMMUNICATION NETWORK DETAILS

MINI USB MULTI-FUNCTION SENSOR CONNECTOR

The mini-USB connectors on the sensor are used both for parameterization, using a standard mini USB / USB cable (supplied separately) and a PC, and for communication to the relay via the network cable (supplied separately). The sensor's mini USB ports ports are in parallel, so there is no difference between which port you connect the cable to. The double mini-USB port makes it easy to set up the network. For details on how to parameterize the sensor, see the programming section.

⚠ CAUTION!

Do not connect the sensor to the computer with the other end of the sensor connected to the sensor network. This could damage the sensor and the computer.

Optionally, it can be integrated with a supervisory system (PLC or PC). Or for configurations via PC for relays in version 3.01 or later.

CAN COMMUNICATION NETWORK DETAILS

The communication system between sensors and relay uses a CAN communication network. The CAN protocol allows the use of priority in the messages transmitted. The arc detection signal has high priority on the network, ensuring (together with the relay's high-speed TRIP contact) that the time between the detection of the arc by the sensor and the closing of the relay's output contact is less than 300 µs, regardless of the number of sensors present on the network. For the network to work without noise problems, it is necessary to use shielded cables between sensors, and between sensors and the relay.

To guarantee the correct impedance and the absence of a reflection signal on the network, it is essential to use the termination resistor on the last sensor in the network (the relay already has an internal termination resistor, so it must be the first device in the network). The VZA/B1 relay already has a termination resistor implemented internally in port CON 5. It is mandatory to connect the ZFR termination resistor (purchased separately) to the last sensor in the network.

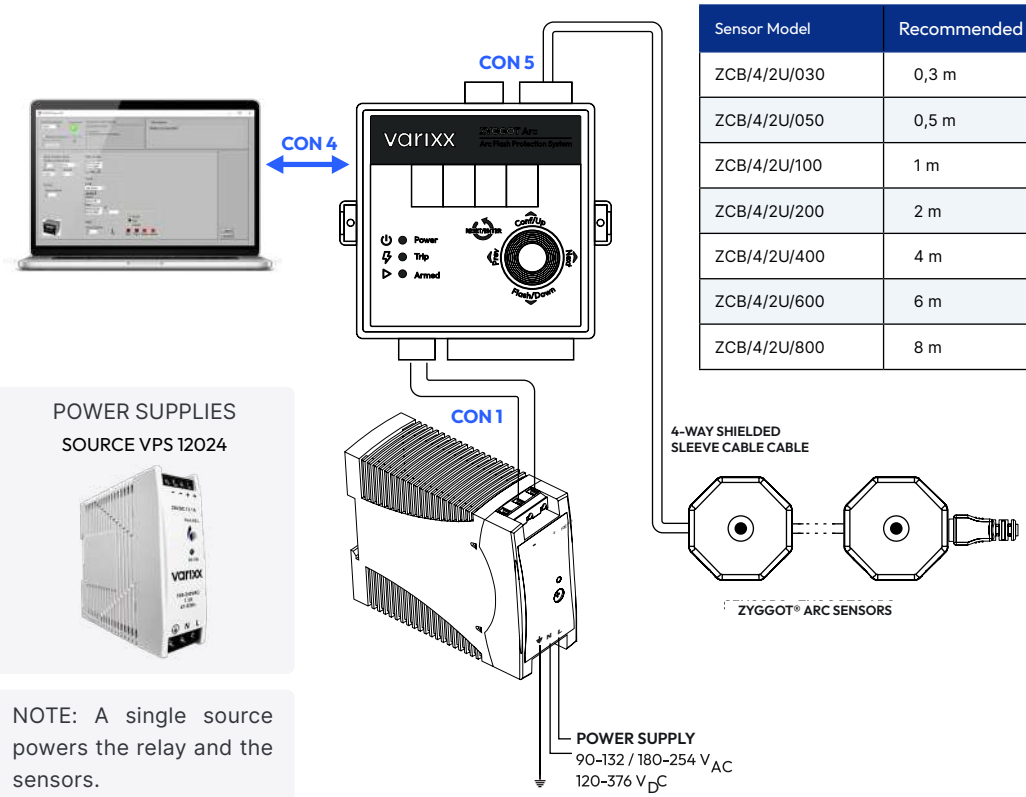
The mini USB CON 5 connector on the relay, should only be used to connect the CAN sensor network.

CABLE LENGTH SELECTION FOR EACH SENSOR

The sensors are networked with a shielded sleeve cable. These cables, with the mini USB connector at both ends, are supplied by Varixx in various lengths.

Check out the available codes and sizes below:

Sensor Model	Recommended Sensor Connection Cable Size
ZCB/4/2U/030	0,3 m
ZCB/4/2U/050	0,5 m
ZCB/4/2U/100	1 m
ZCB/4/2U/200	2 m
ZCB/4/2U/400	4 m
ZCB/4/2U/600	6 m
ZCB/4/2U/800	8 m



POWER SUPPLIES

SOURCE VPS 12024

NOTE: A single source powers the relay and the sensors.

TERMINATING RESISTOR

USE ZFR TERMINATOR

NOTE: The maximum length of the sensor network (from the relay to the last sensor) is 80m.

6. Technical Specifications

RELÉ VZA/B1 DE 96 X 96 C/ DISPLAY

ZYGGOT ARC - RELAY SPECIFICATIONS	
General Relay Specifications	Modelo VZA/B1
Nominal Supply Voltage	24 VDC
Nominal Power	130 mA
Nominal Power (Inrush)	30 A for 1ms @ 24 VDC
Voltage Range	20 ~ 30 VDC
Relative Humidity	5 to 95% Non Condensing
Operating Temperature	-10 to 50° Celsius
Terminal Type	Screw Type, Removable
Weight	12 oz. (340.19 g)
Dimensios (mm)	96 mm x 96 mm
Display	4 × 7 segments
User Keys	Joystick (1 × 5)
Communication Protocol	Modbus RTU
CAN Port	Up to 50Drops
Serial Ports	1x RS485
CE	Compliant

ZYGGOT ARC RELAY - MODEL VZA/B1	
Digital Relay Outputs	
Total Outputs per Module	4
Type	Dry Contact
Outputs per Module	2 SPST (N.O) + 1 SPDT (N.O.C)
Type	Static + Dry Contact
Outputs per Module	1 SPST (N.O)
Max. Output	10 A at 250 VAC, resistive 10 A at 30 vdc
Maximum Total Current	10 A Continuous
Maximum Output Voltage	250 VAC / 30 VDC
Minimum Output Voltage	22 VAC / VDC
Maximum Switched Power	2500 VA/ 300W
Contact Isolation to Ground	1000 vac
Maximum Voltage Droop at Nominal Current	0.95 V
Maximum Inrush Current	200 A
Expected Lifetime	No Load: 5.000.000 Nominal Load: 100.000

ZYGGOT ARC RELAY - MODEL VZA/B1	
Digital relay inputs	
Inputs per Module	2
Nominal Voltage	24 VDC
Absolute Maximum Voltage	240 VDC
Nominal Input Impedance	10 kΩ
Minimum Upper Threshold	10 VDC
Maximum Lower Threshold	3 VDC
Upper Threshold Current	0.9 mA
Lower Threshold Current	0.3 mA
OFF to ON Response	500 us
ON to OFF Response	500 us
Isolation	1000 VAC

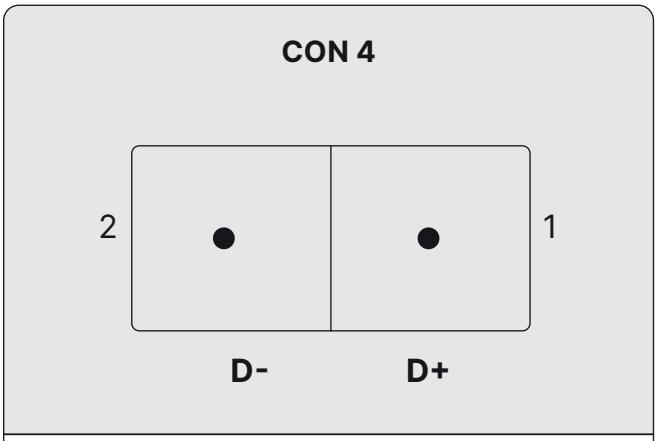
96 X 96 VZA/B1 RELAY WITH DISPLAY ARC SENSORS

GENERAL CHARACTERISTICS

- 4x7 segments display
- RS-485
- Mini USB (CAN) port for sensors
- 1 Joystick with 5 function contacts

POWER SUPPLY

Model	VPS12024
Input Voltage Range	90~132 / 180~264 VAC
Output Power	120W
Output Voltage	24VDC



Port RS485 - Port Pins Assigment

Pin	Signal	Signal description	Direction
1	D (+)	RS-485 Send/Receive Positive	In/Out
2	D (-)	RS-485 Send/Receive Negative	In/Out

ZYGGOT SPECIFICATIONS	
Arc Sensors	(No Contact)
Tightening	2 Screws
Power Supply Types	Via CAN Network
UV Wavelenght	200 to 320 nm
Case Type	Stainless Steel
Sensor Measurement Angle	90°
Radiation Ranges	UVA and UVB, insensible to visible light and IR
Sensor Transmission Type	High Speed CAN
Temperature Operation	-20 to 89 °C
Temperature Storage	-40 to 125 °C
Max. Measurement Range (distance from sensor to target)	30 m, depending on the Arc Power
Maximum CAN Cable Lenght	500 m
Configuration (Address, Sensivity)	By Computer with Free Program
Indication	LED at rear face
Max. Sensors per Relay	50
CE	Compliant

POWER AND CONTROL CONNECTION

Once the entire system has been mechanically installed, make the low-voltage electrical connections.

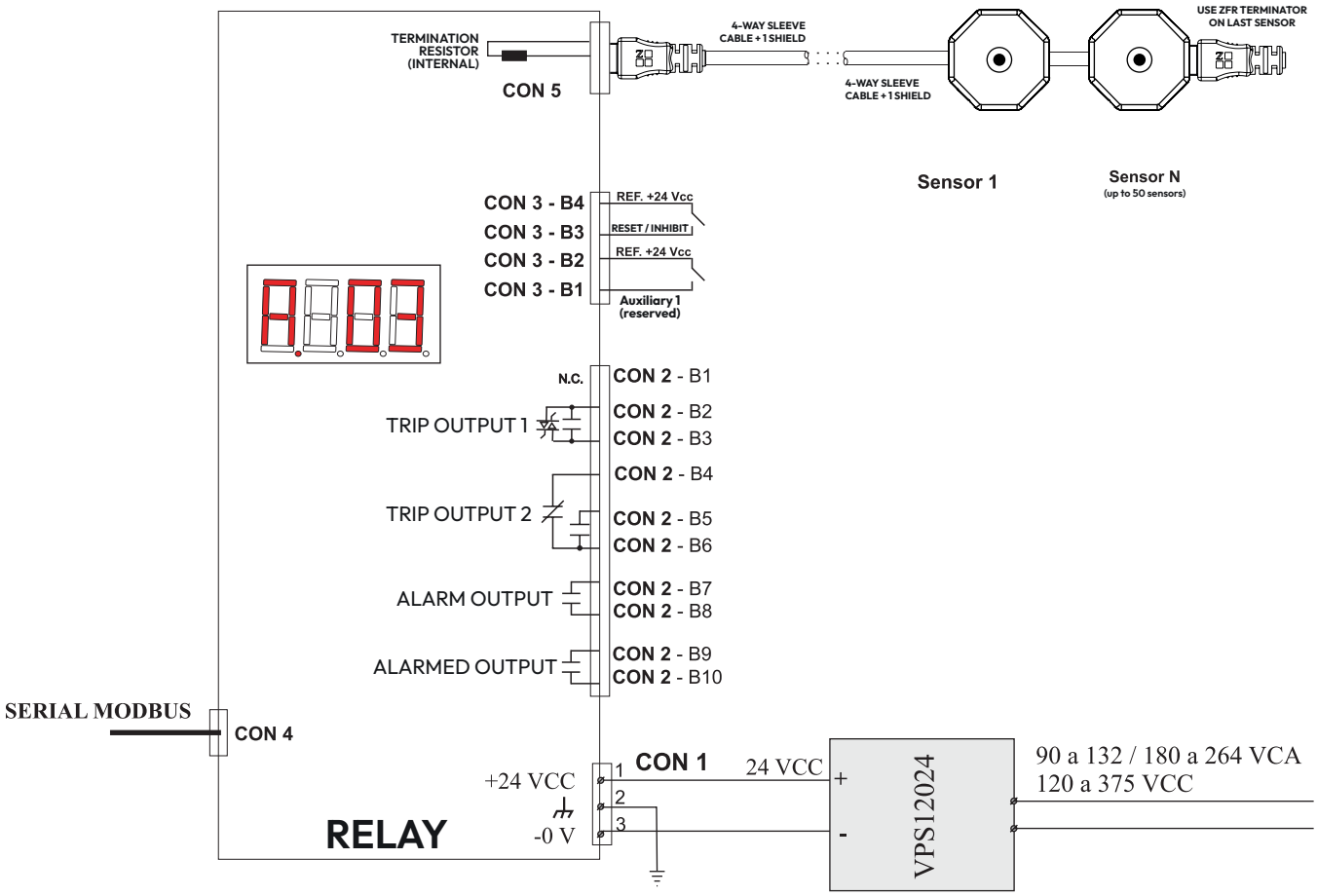
For the trigger relay, follow the connections according to the diagram. The cables supplied by Varixx are shielded, ensuring greater network reliability.

There are 2 digital inputs available, one for Reset/Inhibit and the other reserved (Auxiliary 1).

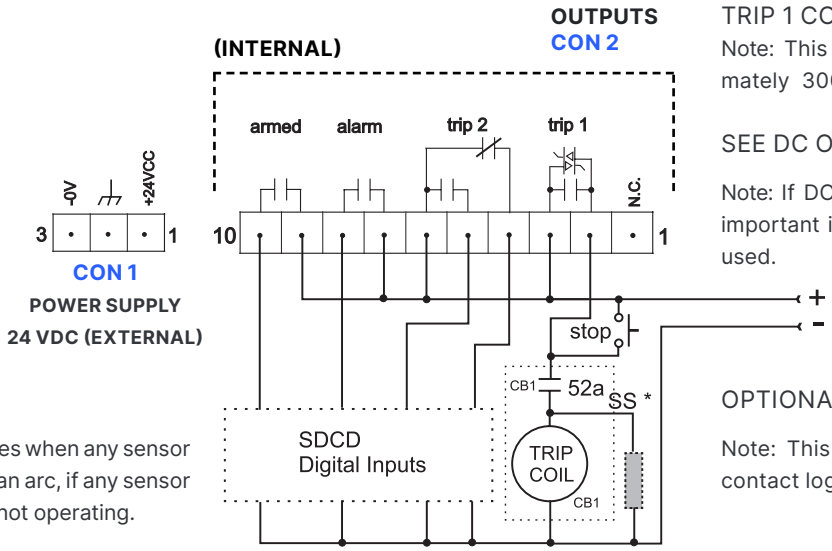
There are 4 digital outputs available, two for Trip, one for Alarm and one for Armed indication.

The relay has 2 communication ports, a CAN port for the sensor network and an RS485 port with Modbus RTU protocol, which can also be configured for connection to a PC, to configure the relay and obtain data in real time. The Modbus RTU communication port can be connected to a PLC, DCS or SCADA.

Once the system has been installed, you can check its integrity by using the NEXT and PREV buttons to view a list of sensors that may not be responding or by pressing the joystick down (FLASH/DOWN button) and flashing the sensor LEDs. For details, see the operation section.



GENERIC APPLICATION EXAMPLE WITH 300µs Relay Actuation Time



TRIP 1 CONTACT N.O.

Note: This contact closes in approximately 300 µs.

SEE DC OR AC VOLTAGE RANGE

Note: If DC voltage is used, polarity is important if Free Wheeling diode D1 is used.

ALARM CONTACT

Note: This contact closes when any sensor in the network detects an arc, if any sensor is not responding or is not operating.

OPTIONAL STOP CONTACT

Note: This contact represents all the contact logic used in the circuit.

ARMED CONTACT

Note: This contact closes if the system is armed, if a mains sensor detects an arc, and opens otherwise or if power fails to the relay, offering *"Fail Safe"* protection.

TRIP COIL: CIRCUIT BREAKER TRIP COIL

Note: It is important to connect directly to the circuit breaker and not via PLC or auxiliary contact so that the signal reaches the coil within 300 µs.

52A: CIRCUIT BREAKER AUXILIARY CONTACT

Note: The use of this N.O. contact is mandatory when using DC voltage in order to reset the system.

TRIP 2 CONTACT N.O.

Note: This contact closes in approximately 6 ms.

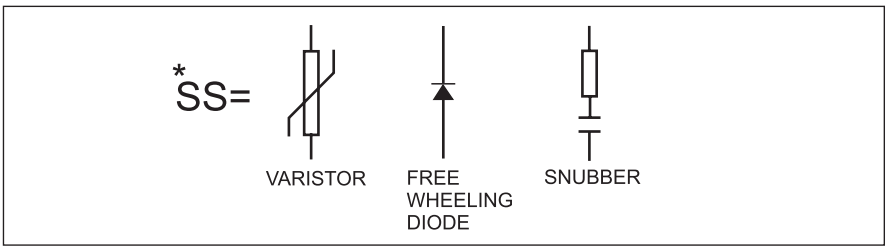
TRIP 2 CONTACT N.C.

Note: This contact opens in approximately 6 ms and can be used as an input to the DCS or for trip using the circuit breaker's minimum coil, which should be avoided as the 300 µs response speed of the static contact is lost.

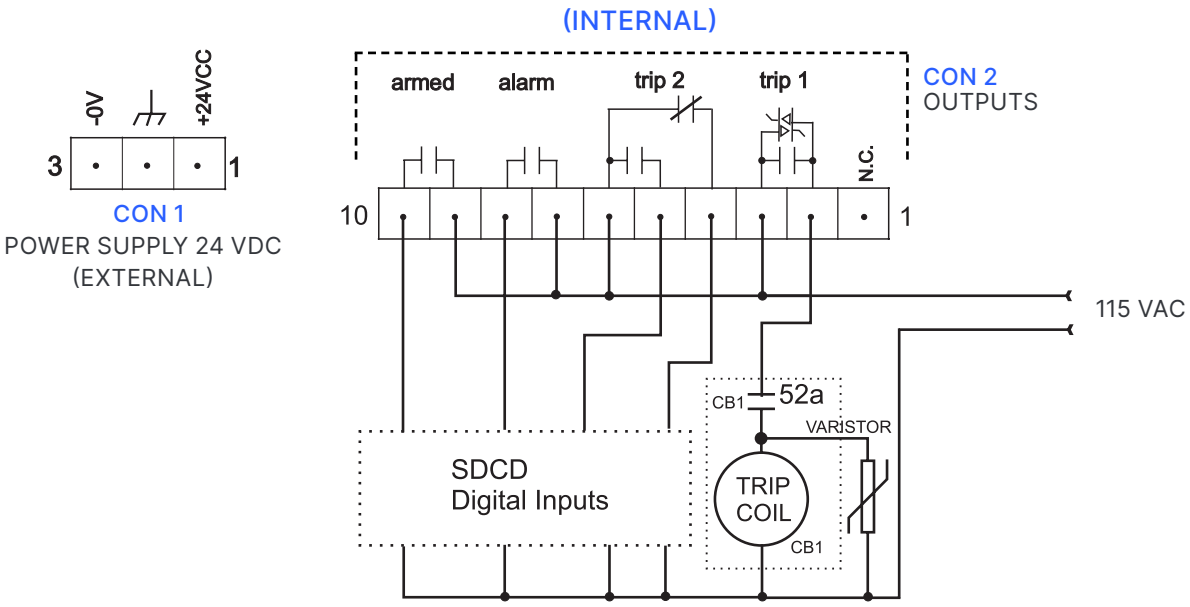
TRANSIENT AND INTERFERENCE SUPPRESSOR:

It is mandatory to use a type of transient suppressor compatible with the type of load. For trip coils (which are very inductive), it is advisable to use a Varistor with suitable characteristics. Possible variations for this circuit are "Diode Free Wheeling" (for DC supply) and a "Snubber" circuit made up of a Resistor and Capacitor. This minimizes the generation of arcs on contact 52a of CB1 and noise, increasing the useful life of the system and avoiding interference and improper operation of other equipment. When in doubt between circuit types, use the varistor.

SEE THE CIRCUIT BREAKER MANUAL

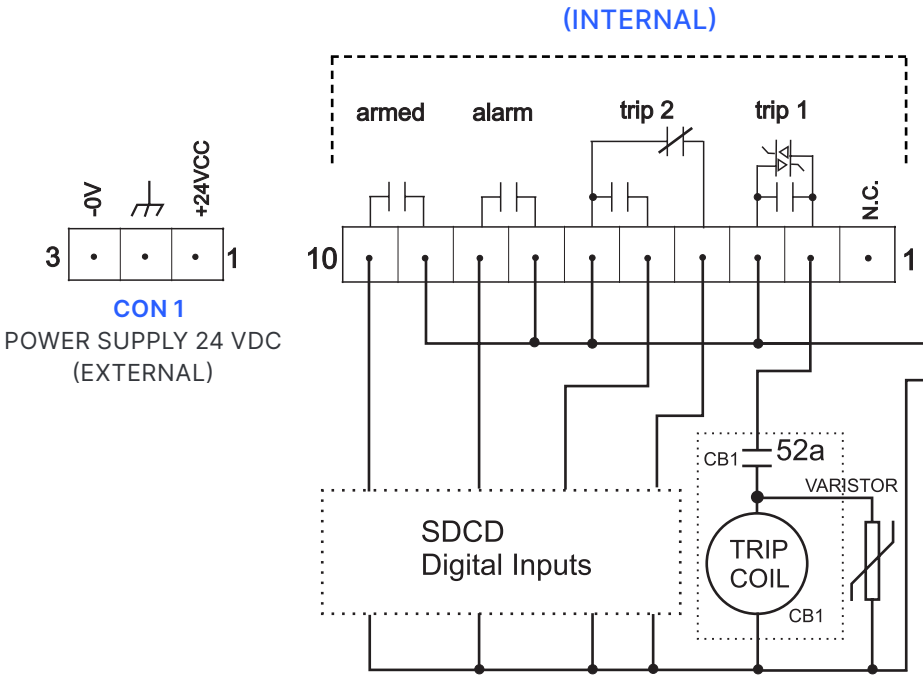


APPLICATION EXAMPLE WITH TRIP COIL OF 115 VAC
WITH A RELAY ACTUATION TIME OF 300µs



52a: Circuit Breaker Auxiliary Contact
Note: Optional use to prevent the coil from energizing for a long time.

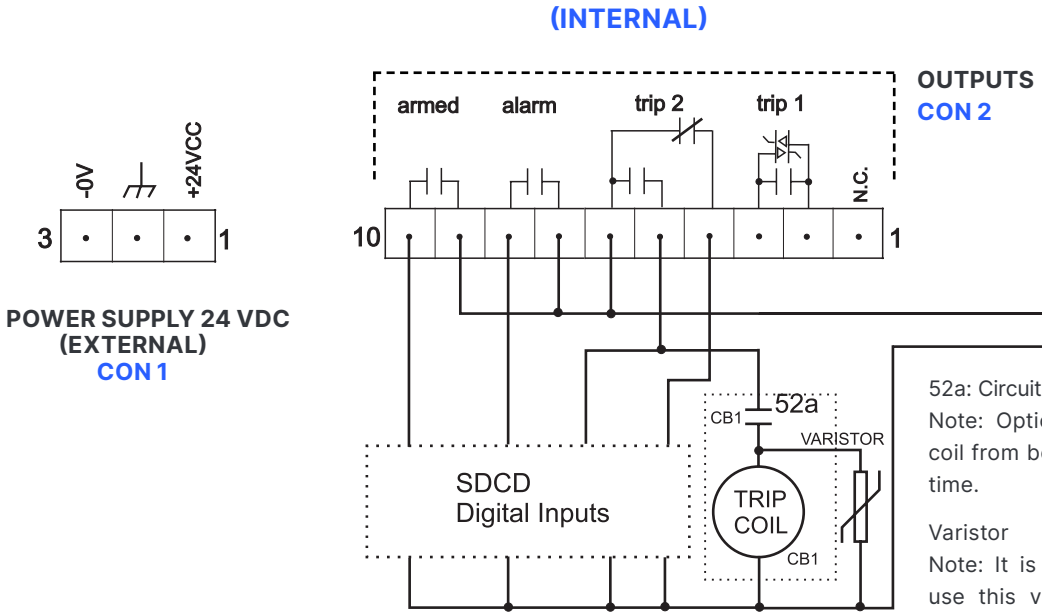
APPLICATION EXAMPLE WITH 125 VDC TRIP COIL
WITH A RELAY ACTIVATION TIME OF 300 µs



52a: Circuit Breaker Auxiliary Contact
Note: The use of this N.O. contact is mandatory if DC voltage is used in order to reset the system.

Varistor
Note: It is highly recommended to use this varistor for the trip coil. See the circuit-breaker manual.

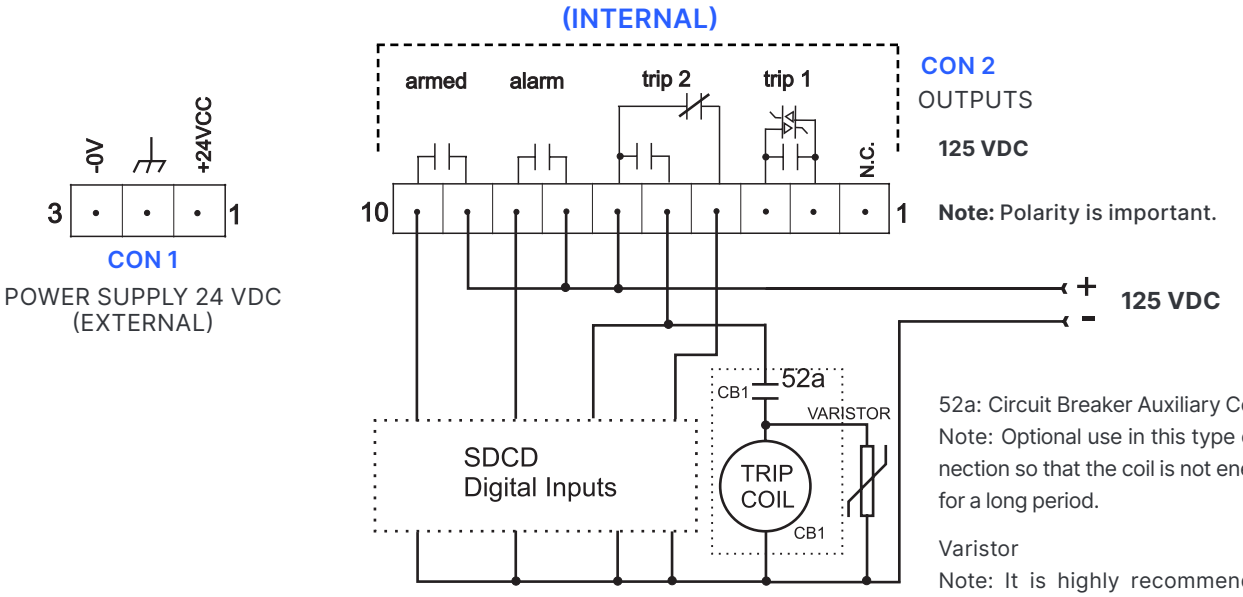
APPLICATION EXAMPLE WITH 115 VAC TRIP COIL
WITH RELAY ACTIVATION TIME OF 6 MS



52a: Circuit Breaker Auxiliary Contact
Note: Optional use to prevent the coil from being energized for a long time.

Varistor
Note: It is highly recommended to use this varistor for the trip coil. Consult the circuit-breaker manual.

APPLICATION EXAMPLE WITH 125 VDC TRIP COIL
WITH RELAY ACTIVATION TIME OF 6 MS

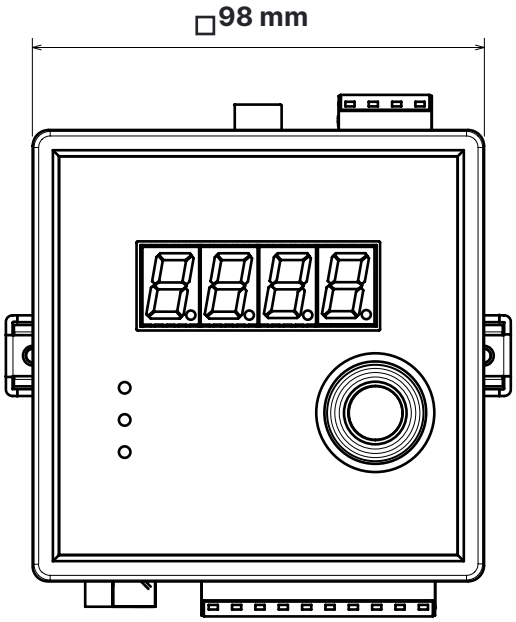


52a: Circuit Breaker Auxiliary Contact
Note: Optional use in this type of connection so that the coil is not energized for a long period.

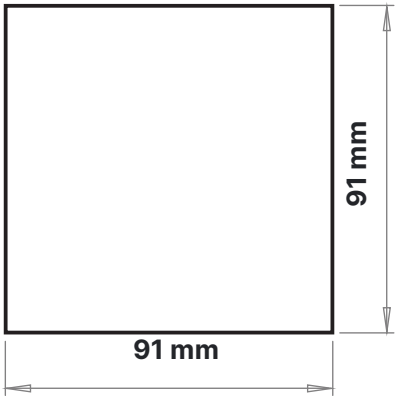
Varistor
Note: It is highly recommended to use this varistor for the trip coil. Consult the circuit-breaker manual.

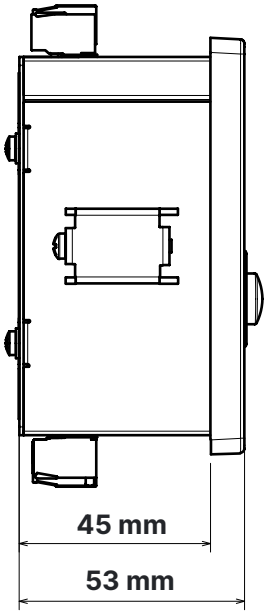
8. Mechanics

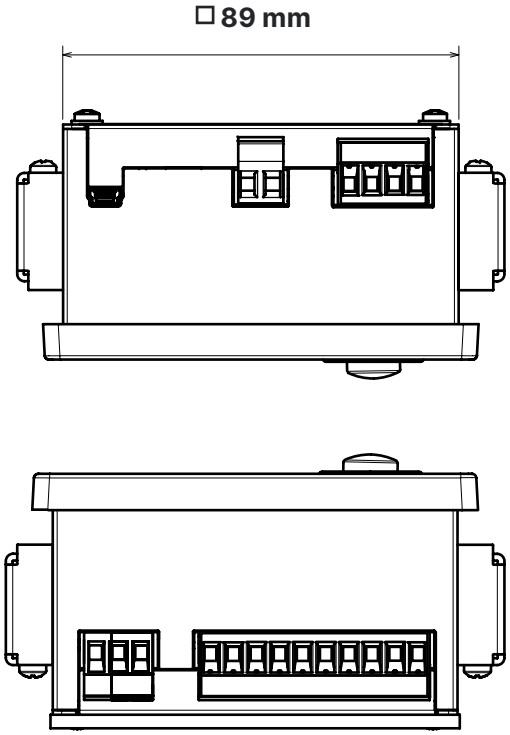
96 X 96 VZA/B1 RELAY WITH DISPLAY



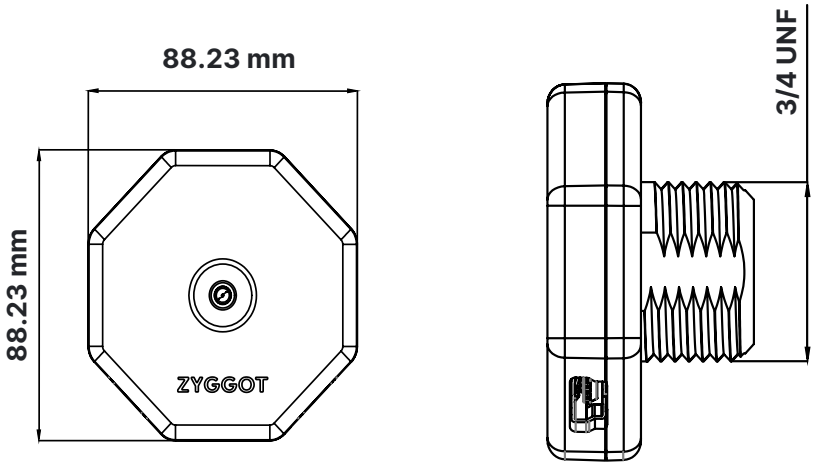
Size of tear in panel door

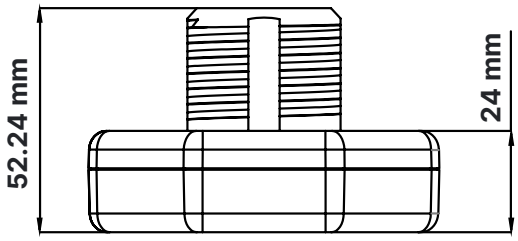






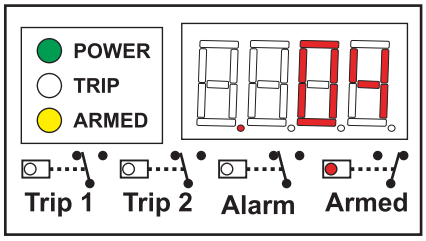
OCTAGONAL ARC SENSORS





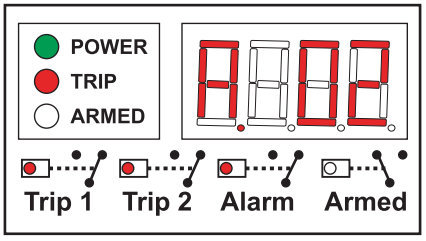
9. Operation

INDICATIONS ON DISPLAY, RELAYS LEDS AND CONTACTS



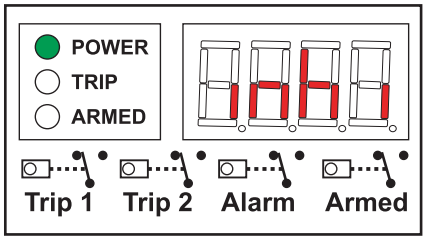
.XXX

This is the normal operating condition. The value of XXX will indicate the number of sensors installed and communicating normally on the CAN network. The number of sensors is one of the parameters set in the relay configuration (by software or via the configuration key). In this condition, the Power (green) and Armed (yellow) LEDs are lit. In normal operation, only the Armed output is active.



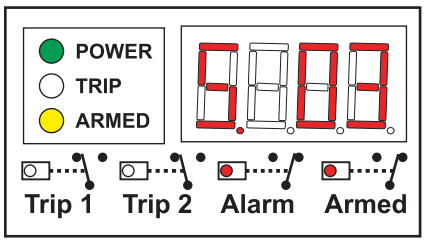
A. XXX

The letter A stands for ARC and then indicates the number of the last sensor that sent the trip signal. To see all the sensors that have sent a trip signal, use the NEXT and PREV navigation keys. The sequence in which the sensors are displayed follows the sequence in which the arc detection occurred. If the same sensor detects an arc again before the relay is reset, the relay display will show the number of that sensor, but the initial sequence of detected arcs will be maintained. To reset the condition, press and hold the joystick (Reset/Enter button) for a few seconds. In arc trip condition, the Power (green) and Trip (red) LEDs are lit. In the Trip condition, both Trip outputs and the Alarm output are activated.



INHI

The acronym inhi stands for “Inhibited” or non-armed. This condition exists if the Remote Reset/Inhibit input is kept active. Caution: In this condition the relay cannot protect the system! If the input is momentarily activated, it will perform the Reset function of the trip or alarm condition. In the inhi state, only the Power LED (green) is lit and no output contacts are activated.



S. XXX

The acronym S.XXX where XXX is a number from 1 to 50 indicates that the sensor with the corresponding number on the CAN network is not communicating with the relay. To see all the sensors that are not communicating, use the navigation buttons NEXT and PREV. All “not responding” sensors are indicated sequentially. To reset the condition, check the indicated sensors, their communication cable and, if necessary, check the address configured for the sensor using the software supplied by Varixx. In the S.XXX condition, the Power (green) and Armed (yellow) LEDs light up and the Alarm and Armed outputs are active.

Note: In this condition, the sensors that are responding are still active and operating and can generate trips, but the entire system is not lost.

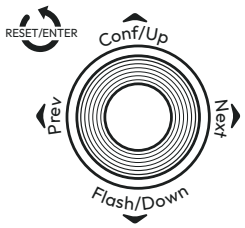
⚠ CAUTION!

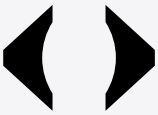
Do not connect the sensor to the PC while the other mini USB port is connected to the network.

NEVER connect two or more sensors simultaneously to the PC.

ALWAYS address one sensor at a time.

COMMANDS AND PARAMETERIZATION





PREV / NEXT

A quick press of these keys performs paging, to go to the next item press NEXT, to see the previous item press PREV. These keys can be used to:

Displaying the numbers of sensors that detected arc

If the display is indicating the condition of sensors that have sent the TRIP signal by arc (A. XX being indicated on the display), each press of these keys will show the number of the subsequent sensor that generated this condition.

For example:
If there are 10 sensors installed and an arc is detected initially by sensor 3, then by sensor 6 and finally by sensor 2, the number shown on the display when this situation occurs will be “A. 02”, because sensor 2 was the last sensor to detect an arc. If you use the NEXT key at this exact moment, nothing will change in the display, because in the list of sensors that detect arcing, sensor 2 is the last one on the list, so to view the numbers of the other sensors that detected arcing before, use the PREV. key, and you can navigate to the number of the first sensor that detected an arc, which in this example is sensor 3. Use PREV and NEXT to navigate between the first and last sensors that detect the arc. If the same sensor that has already detected an arc detects another arc, the number of that sensor will be shown on the display, but the initial sequence will remain the same.

View the numbers of the sensors that are not communicating:

If the display is indicating the condition of sensors not communicating (S. xx being indicated on the display), each press of these keys will show the number of the subsequent sensor that generated this condition, with the list always going from the lowest number to the highest. For example: If there are 10 sensors installed and sensor number 2, number 5 and number 7 are not communicating, the number displayed when the situation occurs will be “S. 02”, as this is the lowest number of all the sensors not responding. The first press of NEXT will show “S.05”, the second press will show “s.07”, the third will show “S.02” again, creating a navigation loop (unlike the arc detection list, which doesn’t go forward after the last and doesn’t go back before the first). The PREV key will have the same functionality, but in the opposite direction of the list.

Select Parameters:

Once the display information is in a menu, you can use the PREV and NEXT keys (or Conf/Up and Flash/ Down) to navigate through the configurable parameter options.

RESET / ENTER

Pressing the central joystick button sends the RESET/ENTER command.
If you are on the main screen, pressing and holding the button for a few seconds sends a RESET signal, restoring the status of the outputs. When in the Configuration or Flash menu, the button becomes the ENTER command.

COMMANDS AND PARAMETERIZATION

CONF/ UP

In the main menu, pressing the CONF/UP button brings up a submenu with the relay configuration options. Use the NEXT and PREV or UP and DOWN keys to select the desired configuration and press ENTER (RESET/ENTER button).

SENS. (SENSOR NUMBER): Selecting this option will display C.XXX where XXX indicates the number of sensors configured. Use the NEXT and PREV or UP and DOWN keys to increase or decrease the number of sensors installed on the network. To save the new number, press the ENTER button once so that C.XXX starts flashing, then press the ENTER button a second time to confirm.

SAVE message will appear on the ***display*** and the system will return to the main screen, thus configuring the number of sensors installed on the network. If the ENTER button is pressed only once, the C.XXX indication will flash for a few seconds and then the system will return to the main screen and will not save the changed value.

MODB: Modbus configuration, this option contains all the parameters needed for the relay to connect to a Modbus network. To change the values of the Modbus parameters, select the desired parameter (using the NEXT and PREV or UP and DOWN keys) and press the ENTER button, inside each parameter there are the values that can be assigned to it, select the desired one and press ENTER, the value will then start flashing on the screen, press ENTER again to save. Then the message SAVE appears on the display and the system returns to the main screen, saving the new parameter value. If the ENTER button is pressed only once, the value will flash for a few seconds and then the system will return to the main screen without saving the changed value.

TIME: This option allows you to set the relay's internal date and time, which is important if you want to check when each event occurs. To change the values of the date and time parameters, select the desired parameter and press the ENTER button. Within each parameter there are the values that can be assigned to them, select the desired one and press ENTER, the value will start flashing on the screen, press ENTER again to save. The SET message will then appear on the ***display*** and the system will return to the main screen, saving the desired value for the parameter. These values set in TIME will only remain saved and keep the relay's internal clock running as long as the relay is switched on; when the relay is switched off, these values will be lost and a new date and time setting will be required.

HIST: Option for viewing the history of events, select READ in this option and a list will appear with all the events saved in the relay so far. An indication will appear like this XX.XX, where the two numbers before the dot represent the event ID and the two numbers after the dot represent the sensor that triggered that event. By pressing ENTER on the desired indication, you can view all the information relating to that event: Day, month, year, hour, minute and second of the event. Select DONE to return to the list of events. To clear all the events saved on the relay, select CLR (Clear) and press the ENTER button, the word CLR will flash on the screen, then press ENTER again to confirm the command.

COMMANDS AND PARAMETERIZATION

FLASH / DOWN

In the main menu, pressing the down arrow is equivalent to the FLASH command. The FLASH command makes it possible to flash the LED on the back of a specific sensor on the network to confirm/discover its location or to flash the LED of all sensors that are communicating normally. After pressing the FLASH/DOWN key, the SENSOR FLASH menu is displayed. The initial option is “ALL”, which corresponds to all the sensors. Use the NEXT and PREV navigation keys if you want to choose a specific sensor. Once you have defined which sensor should flash, press the RESET/ENTER button to start the process.

Press RESET/ENTER again to stop the Flash and return to the start menu. In the Flash menu, if no key is pressed for 5 seconds before starting the process, the system automatically returns to the main menu. When the Flash is started, and the process is not interrupted by clicking the RESET/ENTER button, it keeps the sensors flashing for 5 minutes, after which the system ends the process and automatically returns to the main menu.

Note: The system will be protected even during FLASH time of the LEDs or any other communication.

WARNING!

For safety reasons, you should never open energized panels. Always remove the power and use safety devices to make sure there is no risk of inadvertent energization or residual energy in the equipment.

AUTO FLASH

When the power to the sensors is turned on, each sensor will flash its rear LED indefinitely until the first communication with the relay occurs. This allows you to quickly check communication with the relay and the integrity of the sensor. If in doubt, disconnect the sensor and then reconnect.

The LED should flash for a very short time and then stay on continuously. If it continues to flash, it is not communicating. Check the cables, the sensor address programming and the number of sensors in the relay. Of course, if the sensor is not communicating, the relay will also indicate a lack of communication.

PROGRAMMING THE SENSORS

1. Download and install the free "ZYGGOT® Arc Configurator" software from Varixx website (http://www.varixx.com).
2. Open the configuration program.
3. Connect the sensor to the computer's USB port using a mini USB/USB cable (connect one sensor at a time). When the sensor is connected, its back light comes on. The program automatically detects the sensor. If this doesn't happen, you can choose Manual connection, select the serial port corresponding to the USB port to which the sensor cable is connected and press the Connect key to attempt a connection. When you connect (in either manual or automatic mode) a green light comes on in the program indicating that the connection was successful.
4. Program the sensor's address (from 1 to 50) in the corresponding window and press Send to write the information to the sensor. Disconnect the sensor simply by removing it from the cable.
5. It is advisable to label the sensor with its programmed address to make it easier to mount in the field. If you want to configure another sensor, go back to step 3. Then make sure there are no repeated addresses between the sensors.
6. Once all the sensors have been programmed with the addresses, fix the sensors in the defined positions using the two nuts on the front of the sensor. As a mounting suggestion, we recommend using our metal "adjustable fixing bracket" (REF. ZSF2), with adjustable angle, which allows you to use just one bolhoff rivet or similar in the chosen location, to fix the sensor and direct it.

PROGRAMMING THE RELAY

Connect the relay to the power supply. The screen will indicate the version and then the number of sensors installed or sensors not responding. There are two ways to program the relay: it can be programmed via its own interface or via a program on the PC, via the relay's interface:

1. Press CONF./UP button to enter the configuration menu.
2. Select SENS. option and press RESET/ENTER button. The message "SENSOR NUMBER" will appear on the screen.
3. Use the NEXT/PREV or UP/DOWN buttons to select the number of sensors installed in the network.
4. With the number of sensors already set, press the RESET/ENTER button so that the screen starts flashing. At this point, press the RESET/ENTER button again to confirm. The message "SAVE" will appear on the screen. If no button is pressed while the screen is flashing, the configure command is canceled.
5. If you are using Modbus communication, to configure the parameters press the CONF./UP button, select the MODB option and configure the desired parameters.
6. The relay will display the main screen again and if the sensor network is connected to the relay and all the sensors are correctly configured, it will indicate the number of sensors installed. If any sensor is not responding, the relay will indicate the sensors that are not responding.

USING THE SOFTWARE - ZYGGOT® ARC

1. On the relay Press the CONF/UP button to enter the configuration menu.
2. Select the MODB option and press the RESET/ENTER button.
3. Within MODB select the PORT parameter and press the RESET/ENTER button.
4. Set the PORT value to “P.OFF” and press the RESET/ENTER button so that the screen starts flashing. At this point, press the RESET/ENTER button again to confirm. The message “SAVE” will appear on the screen.
5. Download and install the free “ZYGGOT® Arc Configurator” software from Varixx website (http://www.varixx.com).
6. Open the configuration program.
7. Connect the relay to the computer’s USB port using a USB / RS485 converter cable (USB / Rs485 serial converter cable kit, supplied separately) on the relay this cable should be connected to CON 4. The program automatically detects the relay. If this doesn’t happen, you can choose Manual connection, choose the serial port corresponding to the USB to which the relay cable is connected and press the Connect key to attempt a connection. When you connect (in either manual or automatic mode) a green light comes on in the program indicating that the connection was successful.
8. Program the number of arc sensors that the relay should monitor (max. 50) on the SENSOR panel. If you are using Modbus communication go to the next step, otherwise skip to step 10.
9. Configure the Modbus communication parameters on the RELAY MODBUS SLAVE panel (This configuration can also be done via the relay interface).
10. Press the SEND button to write the information to the relay.

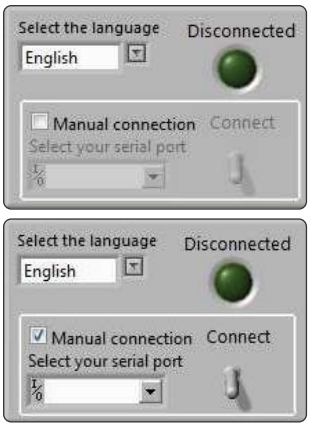
⚠ CAUTION!

Do not connect a computer to the Relay’s mini-USB port.
Note: The mini-USB port is exclusively for the sensor network.

Connect the computer to the Relay’s CON 4 Port.
(USB/ serial Rs485 converter cable kit supplied separately)

USING THE SOFTWARE - ZYGGOT® ARC

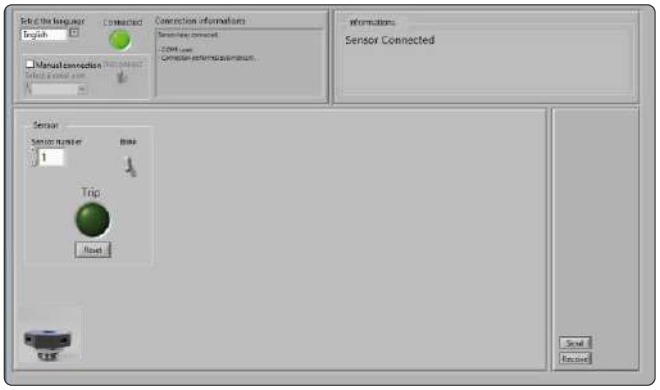
ZYGGOT® Arc is a software configurator that addresses and tests the sensors as well as parameterizing and configuring the relay. The software is available to download free of charge from Varixx website (http://www.varixx.com). The figure below shows the initial screen of the ZYGGOT® Arc software.

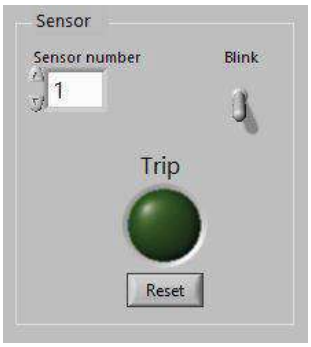


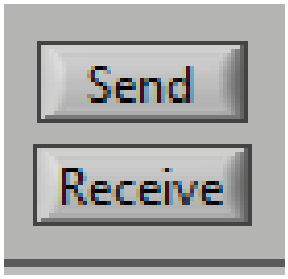
⚠ CAUTION!

NEVER connect two sensors simultaneously at the PC.

The software automatically recognizes the device and the port on which it is connected to the computer. If the port is not recognized, you can choose the port manually using the Manual Connection box. If you choose to connect manually, choose the serial port to which the device is connected and press the Connect button. When a sensor is connected to the computer, the program screen automatically changes to the image below. When you connect a sensor, the program automatically reads the address settings.







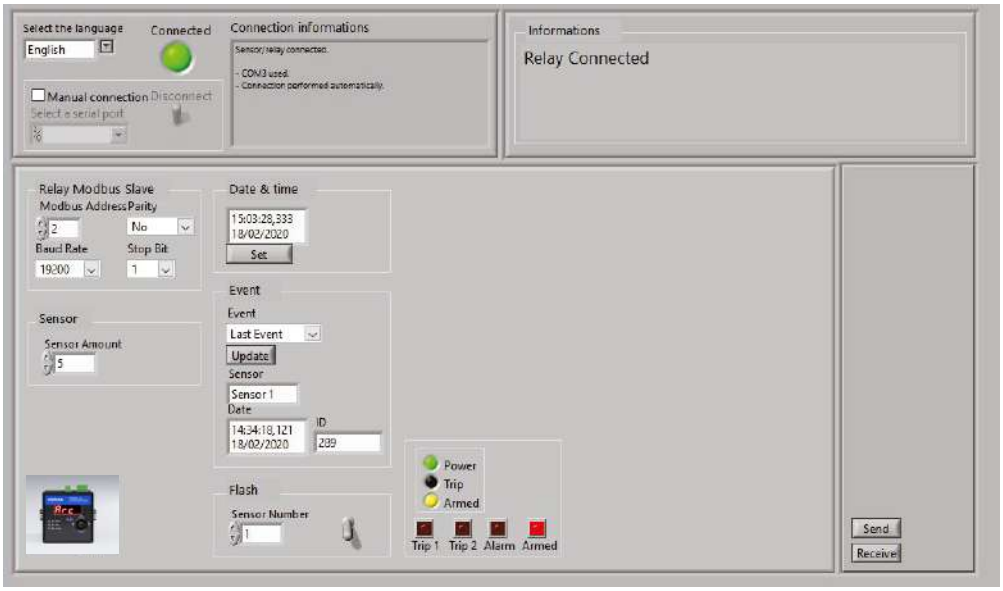
To set a new address for the sensor, you must change the sensor number in the Sensor tab. When you do this, the sensor number will flash red, indicating a change that has not yet been sent to the sensor. To save the change, press the Send button. The sensor's Trip display is also available on the Sensor tab. Use the ArcSafe tester to generate an arc in front of the sensor. When an arc is detected, the Trip indicator will change to red and the sensor's rear LED will flash for a few moments. To restore the sensor's status, press the Reset button. Use the Blink switch to make the LED on the back of the sensor blink indefinitely. Press again to stop.

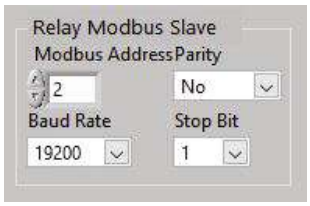
When you want to disconnect the sensor, simply remove it from the mini USB port.

SOFTWARE ZYGGOT® ARC

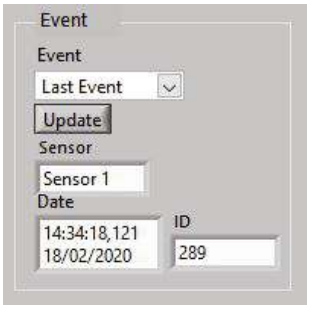
When you connect a relay to the computer, the screen automatically changes to the image below.

The settings described below can also be made manually directly on the relay itself, see the “OPERATION - Commands and parameterization” section.
This section describes the options available in the ZYGGOT® Arc software for the relay.





Relay Modbus Slave tab allows you to configure the Modbus RTU communication data. It defines the relay’s address on the Modbus network, Baud Rate, Parity and Stop Bit. When you modify any parameter in the program, the modified parameter flashes red indicating that there are modifications not sent to the relay. To send the settings, use the Send button. The relay stores the last 45 TRIP events, and the Zyggot® Arco program allows you to view the last 20 of these events. To view the events, use the Event tab. Select the Event and press Update. This will display the sensor number, the date and time of the event and an ID, the unique number relating to that arc event. To set the clock, use the Date & Time tab. Press Set to synchronize the relay’s date and time with the computer. Please note that this date and time setting will only be retained while the relay is switched on, and will be lost when the relay is switched off.



The Sensor tab defines the number of sensors installed in the arc detection network. Once the network is set up, you can use the Flash command to check where a particular sensor is in the network. The program also indicates the status of the Power, Trip and Armed lights and the Trip 1, Trip 2, Alarm and Armed contacts.

11. Operation Test

USING THE ARCSAVE (COD. ZSA) TESTER

ARC ZSA GENERATOR

The figure opposite shows the ArcSafe Varixx tester (supplied separately), for testing system operation. The ArcSafe is rechargeable from a 110 or 220 VAC socket. The equipment generates an extra-high voltage (3,800,000 Volts), generating small, low--energy electrical arcs between its electrodes, which are detected by the sensor up to an average distance of 1.5 meters (UVA sensor) within its viewing angle. You can either hold down the trigger button, generating a sequence of arcs (the arc will always be detected by the sensor and relay on the first arc) or quickly press the button and generate a single arc.

WARNING! CAUTION!

CAUTION WHEN USING THE ARC TESTER **ARC SAFE!**

The ArcSafe tester generates very low current arcs, with a low risk of injury, but not without danger. Use in high or confined spaces can increase the risk of falls, collisions with energized objects and involuntary movements in the event of a shock, which can cause serious muscle damage or even death. Use the ZSA with extreme caution, turning off the slide switch when not in use and activating it only moments before each test, deactivating it immediately afterwards. With each activation, the front light will flash and the power-on LED will light up.

HOW TO RUN THE SYSTEM TEST WITH THE ARCSAFE GENERATOR

1. Fully assemble the system and make sure that the relay is indicating Armed, i.e. monitoring for arcing. In this condition there will be no indication of previous trips. Note that the condition of sensors not responding only triggers the Alarm output, and does not prevent the Armed condition, since even if some sensors on the network are not responding, others may be operational and active. It is highly recommended to use the Alarm output for indication on the DCS system or panel door.

2. For each sensor to be tested, position the ZSA arc generator in front of the sensor, within the 90° viewing angle, i.e. up to 45° from the line extending from the center of the sensor. Remember to comply with the tester's maximum detection distance for UVA (1.5 m) and UVB (0.2 m) sensors.

   Note: in the case of a real arc, the detection distances are greater due to the large amount of energy released in the UV radiation. Real arcs can be detected at a distance of up to 30 m*.

3. Preferably generate a single arc by quickly tapping the ArcSafe trigger button.

4. The arc will be detected and the Trip output will be triggered, with the Trip Led on the relay and the corresponding sensor indicated. (The sensor's rear LED will also flash for a few moments).

5. After checking that it is working correctly, reset the relay by holding down the RESET/ENTER front button or the RESET/INHIBIT contact for a few moments.

6. Repeat the test operation for each sensor in the system.

   * Maximum detection limit of the sensors. The actual detection distance of an arc depends on the intensity at which the arc occurs.

FLASH TEST

Common camera flashes are also a spark gap in a vial of inert gas, so most flashes emit ultra violet light in addition to visible light.

UVA sensors can detect some of these flashes, while UVB sensors have a lower detection spectrum and are therefore immune to photographic flashes.

Note: Not all photographic flashes emit UV radiation.

HOLDING REGISTERS		
Endereço	**Nome**	**Range**
6	CLEAR_ALL_EVENT	0 = KEEP, 1 = CLEAR
10	CLOCK_CONTROL	0 = KEEP, 1 = READ, 2 = WRITE
11	CLOCK_DAY	1 - 31
12	CLOCK_MONTH	1 - 12
13	CLOCK_YEAR	2000 - 2099
14	CLOCK_HOUR	0 - 24
15	CLOCK_MINUTE	0 - 60
16	CLOCK_SECOND	0 - 60
20	BLINK_SENSOR	0 - 100 (0 = All)
21	BLINK_COMMAND	0 = BLINK_OFF, 1 = BLINK_ON
30	EVENT_ACTIVE_NUMBER	0 - 45 (0 = LASTEST)
31	EVENT_ID_LSB	Ready Only
32	EVENT_ID_MSB	Ready Only
33	EVENT_SENSOR	Ready Only
34	EVENT_TIMESTAMP_DAY	Ready Only
35	EVENT_TIMESTAMP_MONTH	Ready Only
36	EVENT_TIMESTAMP_YEAR	Ready Only
37	EVENT_TIMESTAMP_HOUR	Ready Only
38	EVENT_TIMESTAMP_MINUTE	Ready Only
39	EVENT_TIMESTAMP_SECOND	Ready Only

The registers described below are all **Holding Registers type.**

Clock: The registers that go from address 10 to 16 are related to the relay's internal clock: Register 10 is where you enter the command value to read or write to the other registers related to the clock (registers 11 to 16) you must use register 10 "clock_control", where by sending the value "1" to this register, the relay will return the clock data and by sending the value "2" all the values that were in registers 11 to 16 will be written to the relay.

For Example:

To read - Enter the value "1" in register 10 and give the command to send it to the relay. The relay will then return all the values from the relay clock to registers 11 to 16.

To write - Enter all the desired values in the registers related to the clock (from 11 to 16) and send the command, then enter the value "2" in register "10" (clock_control) and send the command again, and all the values related to the relay clock will be sent.

The other registers, from 11 to 16, contain the relay's date and time parameters, which are:

DATE/ TIME	
REG.	**PARAMETER**
11	Days
12	Month
13	Year
14	Time
15	Minute
16	Seconds

For more information, see the main table on the previous page.

Flash: Using these registers, you can locate a specific sensor on the sensor network and send a command for the rear LED of that sensor to start flashing. To do this, send the relay the address of the sensor you want to locate, through register 20, then through register 21, send the value 1 so that the rear LED of that sensor starts flashing and send the value to 0 so that it stops flashing.

Events: Through registers 30 to 39, you can receive the events of past events that have been saved in the relay. To do this, first send the number of the event you want to consult to register 30 (from 0 to 45) and the relay will return all the information saved for that event through the following registers:

EVENTS	
REG.	**DESCRIPTION**
6	Delete event list.
31	ID of the selected event.
32	IDof the selected event.
33	The address of the sensor that triggered this event.
34	The day this event happened.
35	The month this event happened.
36	The year this event happened.
37	The time this event happened.
38	The minute this event happened.
39	The second this event happened.

For more information, see the main table on the previous page.

By sending the value 1 to register 6, all the events that were saved in the relay are deleted.

INPUTS REGISTERS	
Address	Name
1	SYSTEM_VERSION
2	SERIAL_NUMBER_LSB
3	SERIAL_NUMBER_MSB
4	STATUS_WORD
5	LAST_SENSOR_NUMBER
100	ARC_LIST_SIZE
101	ARC_LIST_1
102	ARC_LIST_2
103	ARC_LIST_3
104	ARC_LIST_4
105	ARC_LIST_5
...	...
195	ARC_LIST_95
196	ARC_LIST_96
197	ARC_LIST_97
198	ARC_LIST_98
199	ARC_LIST_99
2001	SENSOR_VERSION_1
2002	SENSOR_VERSION_2
2003	SENSOR_VERSION_3
2004	SENSOR_VERSION_4
2005	SENSOR_VERSION_5
...	...
2095	SENSOR_VERSION_95
2096	SENSOR_VERSION_96
2097	SENSOR_VERSION_97
2098	SENSOR_VERSION_98
2099	SENSOR_VERSION_99

RELAY STATUS

The registers described below are all Holding Registers type.

Register 1: Relay program version.

Register 2: Relay serial number.

Register 3: Relay serial number.

Register 4: Relay status. This register provides information on the status of the relay. Each of the first 7 bits of the register contains a piece of information, as shown in the table below:

STATUS_WORD	
BIT 7	RELAY_ARMED
BIT 6	RELAY_ALARM
BIT 5	RELAY_TRIP_2
BIT 4	RELAY_TRIP_1
BIT 3	LED_ARMED
BIT 2	LED_TRIP
BIT 1	LED_POWER

When any BIT in this register returns a value of 1, it means that the specific parameter is active. For example: if bit 6 of register 4 returns the value "1" it means that the alarm is triggered on the relay.

The same status information can also be found in these other registers, but now as ***Discrete Inputs.***

DISCRETE INPUTS	
Address	Name
7	STATUS_RELE_ARMED
6	STATUS_RELE_ALARM
5	STATUS_RELE_TRIP_2
4	STATUS_RELE_TRIP_1
3	STATUS_LED_ARMED
2	STATUS_LED_TRIP
1	STATUS_LED_POWER

Register 5: Returns the address of the last sensor in the sensor network.

Register 100: Indicates the size of the arc alarm list currently being shown on the relay's ***display.***

Registers 101 to 199: From register 1 01 to 199, a list will be created of the arc alarms active on the relay at that time. Each register will return the address of each sensor that recorded the arc in exactly the same sequence as indicated on the relay *display*, with 101 always being the first on the list. Pressing and holding the "Reset/Enter" button for a few moments will reset the alarms and reset the relay to zero.

Registers 2001 to 2099: In these registers, the versions of each sensor in the network can be consulted: register 2001 corresponds to the sensor addressed as 1 in the network, and holding down register 2002 corresponds to sensor 2, and so on in sequence.

RELAY STATUS

The registers described below are all Holding Registers type.

INPUTS REGISTERS	
Address	Name
201	SENSOR_STATUS_1
202	SENSOR_STATUS_2
203	SENSOR_STATUS_3
204	SENSOR_STATUS_4
205	SENSOR_STATUS_5
...	...
295	SENSOR_STATUS_95
296	SENSOR_STATUS_96
297	SENSOR_STATUS_97
298	SENSOR_STATUS_98
299	SENSOR_STATUS_99

Registros 201 até 299: In these registers, the versions of each sensor in the network can be consulted: register 2001 corresponds to the sensor addressed as 1 in the network, and holding down register 2002 corresponds to sensor 2, and so on in sequence. The value returned to the register must be consulted in the table below, thus identifying the sensor's condition through the "STATUS" column.

SENSOR_STATUS_(201-299)					
STATUS	HEX	16 BITS			
		BIT 16-4	BIT 3	BIT 2	BIT 1
NOT CONFIGURED	0×00	X	0	0	0
NO RESPONSE (S.)	0×01	X	0	0	1
OK	0×03	X	0	1	1
TRIP (A.)	0×07	X	1	1	1

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