

Multilin A60 Arc Flash System



Instruction manual

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A60 Arc Flash Instruction Manual for product revision 1.0.

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Part number: 1601-0037-A3 (March 2013)

CAUTION

GENERAL SAFETY PRECAUTIONS - ARC FLASH SYSTEM

- Failure to observe and follow the instructions provided in the equipment manual(s) could cause irreversible damage to the equipment and could lead to property damage, personal injury and/or death.
- Before attempting to use the equipment, it is important that all danger and caution indicators are reviewed.
- If the equipment is used in a manner not specified by the manufacturer or functions abnormally, proceed with caution. Otherwise, the protection provided by the equipment may be impaired and can result in Impaired operation and injury.
- Caution: Hazardous voltages can cause shock, burns or death.
- Installation/service personnel must be familiar with general device test practices, electrical awareness and safety precautions must be followed.
- Before performing visual inspections, tests, or periodic maintenance on this device or associated circuits, isolate or disconnect all hazardous live circuits and sources of electric power.
- Failure to shut equipment off prior to removing the power connections could expose you to dangerous voltages causing injury or death.
- All recommended equipment that should be grounded and must have a reliable and un-compromised grounding path for safety purposes, protection against electromagnetic interference and proper device operation.
- Equipment grounds should be bonded together and connected to the facility's main ground system for primary power.
- Keep all ground leads as short as possible.
- At all times, equipment ground terminal must be grounded during device operation and service.
- In addition to the safety precautions mentioned all electrical connections made must respect the applicable local jurisdiction electrical code.
- It is recommended that a field external switch, circuit breaker be connected near the equipment as a means of power disconnect. The external switch or circuit breaker is selected in accordance with the power rating of the A60.



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WARNING

This product itself is not a substitute for Personal Protective Equipment (PPE). However, it can be used in the computation of site specific Arc flash analysis to determine a new appropriate Hazard Reduction Category code for the installation.

The A60 product is designed to meet protective relay standards as described in the product data sheet.

- The alarm relay output must be connected to external equipment to monitor the condition of the A60.
- Install the A60 in a locking enclosure to avoid any tampering of settings.

Safety words and definitions

The following symbols used in this document indicate the following conditions:



Indicates a hazardous situation which, if not avoided, will result in death or serious injury.



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



Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.



Indicates practices not related to personal injury.



Indicates general information and practices, including operational information and practices, that are not related to personal injury.

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Multilin A60 Arc Flash System

Chapter 1: Introduction

Overview

The A60 Arc Flash System (AFS) is a stand-alone unit equipped with external sensors to detect an arc flash. The sensors are designed to detect the arc flash using the light and sound waves present during the fault. The detection, from a sensor, is sent via fiber optics to the AFS and drives onboard output relays. To achieve an instantaneous response (approx. 1 ms), a PLD is used in place of the conventional CPU.

Device Features

The A60 Arc Flash System provides the following features.

- **Fast arc flash protection using multiple sensors**
Multiple sensors, up to 5 per AFS device, can be applied. Each sensor can detect both light and sound from an arc flash event. The arc flash can be detected as quickly as 1 ms.
- **Self-supervision**
The sensor and fiber cable between the sensor and the AFS unit is supervised continuously. An LED is used to indicate the health of the sensor and its connection to the AFS unit.
- **Current supervision**
External current supervision from a separate Instantaneous Over Current (IOC) device can be used to enhance the security of the AFS unit.
- **Transfer trip**
The cascading of various AFS units to pass a trip signal from the farthest AFS unit to the AFS unit connected to the main circuit breaker. With this feature, there is no requirement to extend SSR outputs from all AFS units to the main circuit breaker.
- **Local and remote reset**
The reset feature is supported locally or remotely.

Specifications

Power Supply

- Nominal
 - 100 VAC to 240 VAC 50/60 Hz
 - 125 VDC to 250 VDC
- Range
 - 75 VAC to 265 VAC 50/60 Hz
 - 100 VDC to 300 VDC
- Power Consumption
 - Maximum Consumption: 10 W/20 VA

Relay Outputs

- SSR outputs
 - Maximum continuous current: 6 A
 - Operate time: 60 μ s
 - Make and carry for 0.2s: 30 A per ANSI C37.90
- SSR breaking capacity
 - AC resistive, 120 VAC:6 A
 - AC resistive, 240 VAC:6 A
 - AC inductive, PF=0.4 pilot duty:2 A
 - DC resistive, 30 VDC:6 A
- Form-C (alarm output)
 - AC Resistive, 240 V AC:6 A normally open, 5 A normally closed
 - AC Inductive, PF = 0.4 pilot duty: 2.5 A
 - DC Resistive, 30 V dc:.....6 A

Digital Inputs

- Total six 24 V dry inputs
- Isolated
- Current Draw @ Rated Voltage:..... 10 mA @ 24 V
- Type:..... Dry contacts

Sensor Inputs

- Five self-monitored inputs
- SMI to SMI (Small Media Interface), Duplex, 2.20 mm, Plastic Optical Fiber
- Bend radius of 25 mm max.
- Maximum distance of sensor from arc flash incident is 6 feet.

Industrial Test Certification

COMPLIANCE

Test	Reference Standard	Test Level
Impulse Voltage Withstand	EN60255-5	5 KV
Dielectric Voltage Withstand	EN60255-5	2.3 KV
Insulation Resistance Test	EN60255-5	500 VDC
Damped Oscillatory	IEC61000-4-18/IEC60255-22-1	2.5 KV CM, 1 KV DM
Electrostatic Discharge	EN61000-4-2/IEC60255-22-2	Level 4
	IEEEC37.90.3	8 KV Contact, 15 KV air discharge
RF Immunity	EN61000-4-3/IEC60255-22-3	Level 3
	IEEE/ANSIC37.90.2	20 V/m 80-1 Ghz
Fast Transient Disturbance	EN61000-4-4/IEC60255-22-4	Class A and B
	IEEEC37.90.1	4 KV, 2.5 Khz
Surge Immunity	EN61000-4-5/IEC60255-22-5	Level 3
Conducted RF Immunity	EN61000-4-6/IEC60255-22-6	Level 3
Radiated & Conducted Emissions	CISPR11 /CISPR22/ IEC60255-25	Class A
Sinusoidal Vibration	IEC60255-21-1	Class 1
Shock & Bump	IEC60255-21-2	Class 1
Siesmic	IEC60255-21-3	Class 2
Power Magnetic Immunity	IEC61000-4-8	Level 5
Pulse Magnetic Immunity	IEC61000-4-9	1000 A/m
Voltage Dip & interruption	IEC61000-4-11	0, 40, 70, 80%
		dips, 250/300 cycle
		interrupts
Voltage Ripple	IEC61000-4-17	15%
Environmental (Cold)	IEC60068-2-1	-20C 16 hrs
Environmental (Cold Storage)	IEC60068-2-1	-40C 16 hrs
Environmental (Dry heat and Storage)	IEC60068-2-2	85C 16 hrs
Relative Humidity Cyclic	IEC60068-2-30	6 day variant 2

APPROVALS

	Applicable Council Directive	According to
CE compliance	Low voltage directive	EN60255-5 / EN60255-27
	EMC Directive	EN61000-6-2 / 6-4/ 6-5 (Area G)
cULus Listed	NRTL	UL508 (NRGU), CSA C22.2 No.14
ISO	Manufactured under a registered quality program	ISO9001

Environmental Specifications

- Operating Temperature: -40 °C to +60 °C
- Humidity: Operating up to 95% (non condensing) @ 55 °C (As per IEC60068-2-30 Variant 2, 6 days)
- Altitude: 2000 m (max.)
- Overvoltage Category: II
- Ingress Protection: IP20 (To avoid contact with terminal blocks, it is advisable to install the A60 in a restricted area that is not readily accessible.)
- Environmental rating: 60 °C surrounding air
- Pollution Degree: II
- Insulation Class: 1

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Chapter 2: Installation

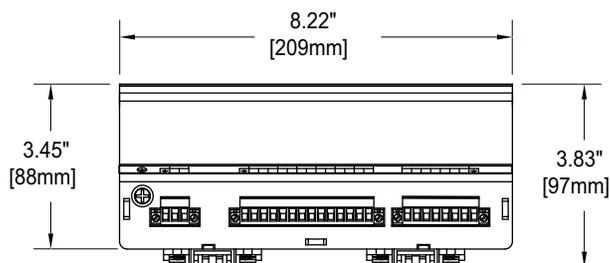
Mechanical Installation

The AFS should be mounted so that the display indicators and switches are accessible. Mounting of the unit is determined by location, environment and application.

Case Description

The AFS is contained in a compact housing with display indicators and switches on the front. The connections for the sensors and wiring are on the top and bottom panels. The AFS is equipped with 2 DIN rail clips on the back for mounting. An AFS unit (basic model) weighs 1.7 Kg (3.8 lbs).

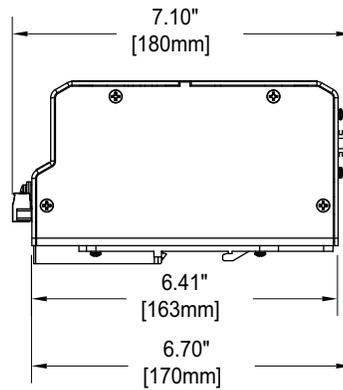
Figure 1: A60 Front view



CAUTION

A60 unit must be installed in the low voltage compartment of the switchgear.

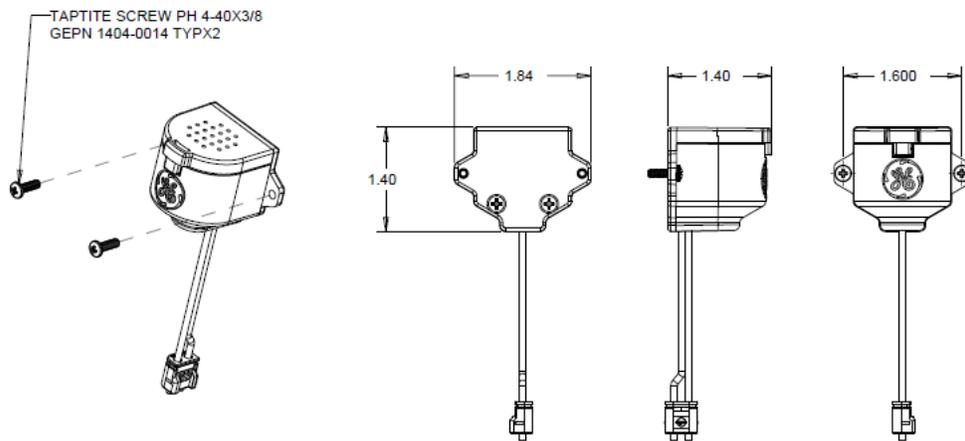
Figure 2: A60 Side view



Sensor Description

The AFS sensor houses the fiber optics and metal membrane that are used to detect the arc flash. Two mounting screw holes are provided to affix the sensors to the panel.

Figure 3: A60 Sensor – front, side and top views



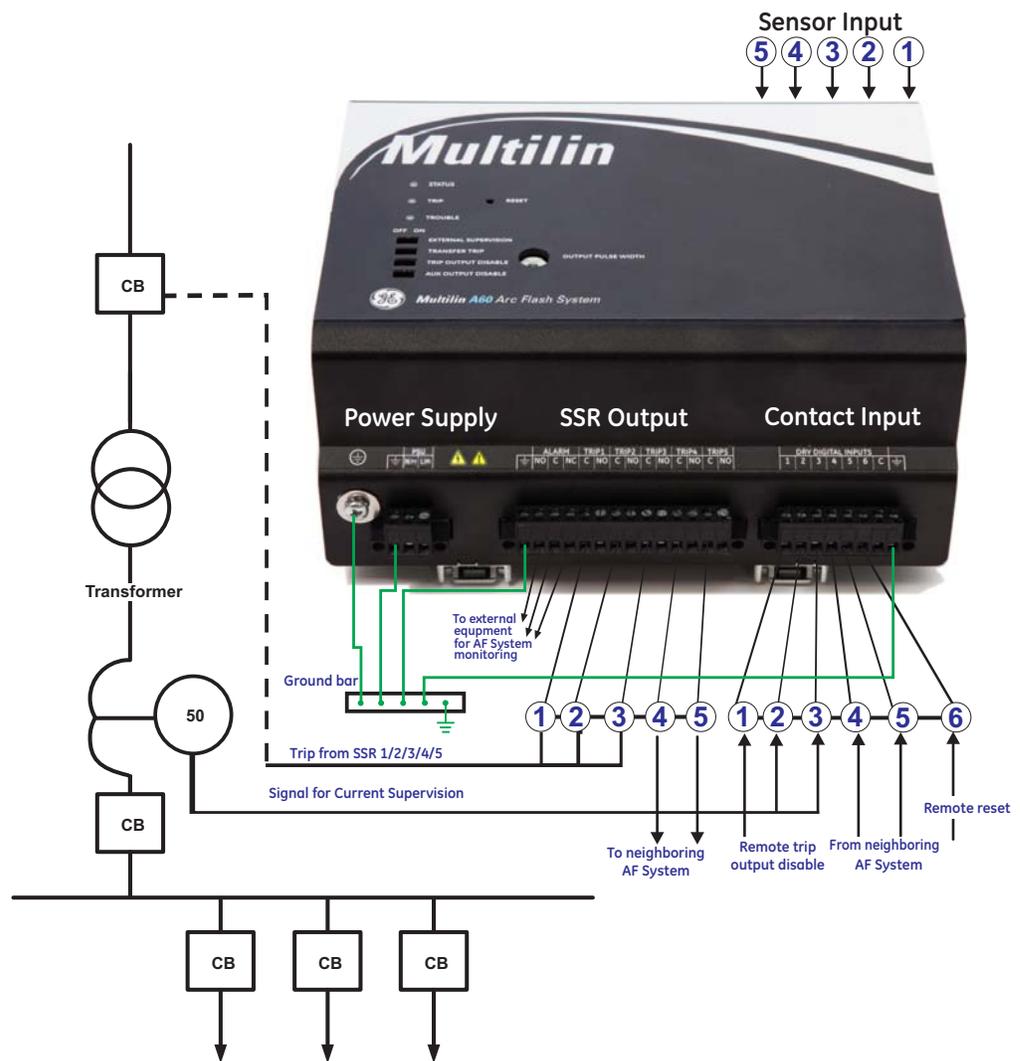
Electrical Installation

The AFS wiring diagram and a detailed view of the unit's terminal connections are shown below.

Wiring Description

The wiring of the AFS will vary depending upon the user's protection scheme. See Chapter 5 for examples of the wiring used in different applications.

Figure 4: Multilin A60 Arc Flash wiring diagram



NOTICE

AFS device must be installed in an electrical enclosure with authorized access.

⚠ CAUTION

It is recommended that a field external switch, circuit breaker be connected near the equipment as a means of power disconnect. The external switch or circuit breaker shall be selected in accordance with the power rating of the A60.

Terminal Connection Layout

The AFS can be connected to cover a broad range of applications, see Chapter 5.

Terminal	Description	Wire Gauge Range	Recommended Tightening Torque	Recommended Terminal Connection
Earth Symbol	POWER SUPPLY	14-18 awg	9 ft/lb	Ferrule Type
N (-)				
L (+)				
Earth Symbol		14		
NO	ALARM LATCHING	14-18 awg		
C				
NC				
C	TRIP 1 SS RELAY			
NO				
C	TRIP 2 SS RELAY			
NO				
C	TRIP 3 SS RELAY			
NO				
C	TRIP 4 SS RELAY			
NO				
C	TRIP 5 SS RELAY			
NO				
1	Digital Input 1		14-18 awg	
2	Digital Input 2			
3	Digital Input 3			
4	Digital Input 4			
5	Digital Input 5			
6	Digital Input 6			
Earth Symbol		14		

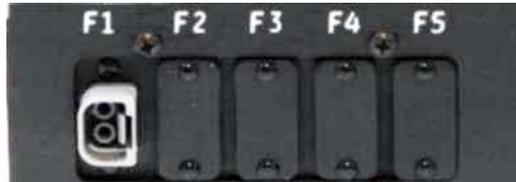
NOTICE

All protective earth connections to be terminated with green and yellow wire.

Figure 5: A60 Terminal connections



Figure 6: A60 Sensor connections



Multilin A60 Arc Flash System

Chapter 3: Interface

Front Control Panel Interface

The Multilin A60 Arc Flash System faceplate provides easy sensor detection transparency through LED indicators, a pushbutton, and slide switches.



The front panel includes the following interface components:

- Status
- Trip
- Trouble
- Reset
- External Supervision
- Transfer Trip
- Trip Output Disable
- AUX Output Disable

LED Status Indicators

STATUS

The status LED glows in green during normal in-service-operation mode. The not-in-service mode is represented by a red color indication of the status LED. An orange color indication of this LED shows the calibration mode.

TRIP

Upon direct arc-flash detection, or OC supervised AF detection, the trip LED turns on in a red color indicating operation of the arc flash system.

TROUBLE

During sensor detection any issues (or during no local calibration), the trouble LED turns on in an orange color. Based on the corresponding sensor number, the trouble LED gives blink indication consecutively (i.e., if a fault is detected by sensor # 3, the trouble LED blinks three times).

Pushbutton

RESET

This pushbutton resets the states of the Solid State outputs. Pressing the pushbutton creates a pulse for resetting the “TRIP” LEDs and the outputs. Resetting of the LEDs and the outputs can also be done remotely by energizing contact input # 6.

Slide Switches

EXTERNAL SUPERVISION

When the external supervision slide switch is at the “ON” position the triggering of the Solid State outputs depend on the detection of an arc flash, and the “On” state of any of the two contact inputs: Contact Input # 2 or Contact Input # 3. These contacts may be connected to Solid State output relays from a protective device to indicate overcurrent conditions during the arc flash. When the slide switch is at the “OFF” position, the detection of an arc flash does not depend on external Contact Inputs, and Solid State outputs depend on the detection of the arc-flash sensors.

TRANSFER TRIP

This switch has two positions – “ON” and “OFF”. The switch is set to “ON”, if direct transfer trip is permissible from neighboring AF system(s). Contact inputs 4 and 5 can be wired to SSR output from neighboring AF units. Select “OFF”, if these contact inputs are not used.

TRIP OUTPUT DISABLE

This slide switch is used to enable or disable all Solid State outputs at once. If the switch is set to “ON”, all SSR outputs are disabled and the arc-flash system does not send any SSR outputs. In case of “OFF”, all the SSR outputs are enabled. In addition, SSR (trip) outputs can be disabled/enabled remotely by energizing Contact Input # 1. Therefore, if input signal is received at Contact input # 1, all SSR outputs will be disabled.

AUX OUTPUT DISABLE

The SSR output contacts 4 and 5 are used for transfer trip to adjacent AF systems. Therefore, if the switch is set to “OFF”, both output 4 and 5 are enabled, and result in a send output command/trip in case of arc-flash detection.

Rotary Switch

OUTPUT PULSE WIDTH

The AF unit has a rotary switch for setting the pulse width time of the output trip signals in seconds for outputs 1, 2, 3, 4, 5, and 0. If the rotary switch is set to “0”, the solid-state output will remain energized upon AF scheme operation, after the conditions clear. The states of the outputs are cleared after the “RESET” operation.

Note: Pulse width tolerance is +10 ms of setting

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Chapter 4: Principle of Operation

Conditions conducive to arcing events

All current carrying conductors in electric power circuits or switchgear equipment are separated by some kind of insulating medium. Air can also serve as part or all of this insulation in some applications. If any of these conductors come too close to each other, or the voltage exceeds or is sufficiently higher than the insulation level, an arc can occur between conductors. Air or any other insulation (gas, solid, or liquid) between conductors can become ionized, making the insulation conductive and thereby enabling an arcing event. An Arc event also induces high temperatures which can reach as high as 20,000 °C, vaporize conductors and adjacent materials, and release an explosive energy that destroys surrounding circuits.

Working principle and Logic diagram

GE Multilin’s advanced technology solution for Arc Flash (AF) detection logic utilizes two common facts of any arc flash event:

1. intensity of light and sound pressure above the threshold
2. the difference in the speed of light and sound signal detection

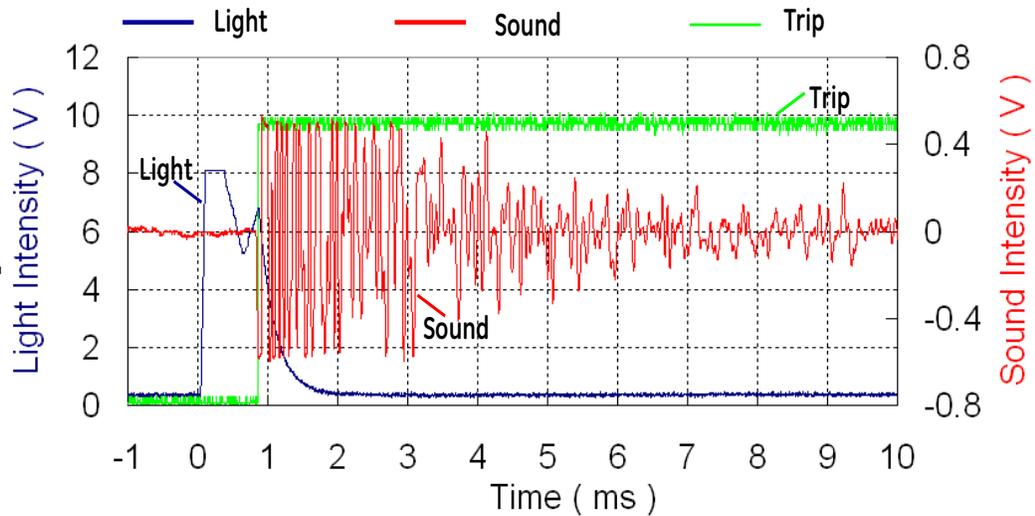


Note that the threshold values are adaptively calibrated by A60, and hence there is no need for any information for setting up these values. Refer to the self-calibration features in this article for more details.

The difference in speed between light (3×10^8 m/s) and sound (343 m/s) generates a unique time delay signature that may be used to differentiate an arc flash event from other sources of light and sound. Based on these two parameters, A60 first detects the light signal above the threshold value, and then waits for the pressurized sound signal (which should be received within a design specific wait-time value of a few milliseconds). If the pressurized sound signal (within the metal clad switchgear) is received with a higher than threshold value as well as within the design specific wait-time, then the A60 is activated and sends a trip signal.

The A60 is immediately reset within the wait-time (a few milliseconds), and again ready for the protection. This logic applies to any of the five individual fiber sensor of the A60, since all the individual optical sensors has its own redundant arc flash detection mechanism, as well as self-check functionality. This provides a higher level of redundancy/reliability of the system. In addition, the A60 also facilitates current supervision (optional), which relies on an external over-current device signal to be received, for the arc flash protection. In addition to the presented light and sound detection, this option provides additional security to the arc flash protection.

Figure 1: Arc flash quenching

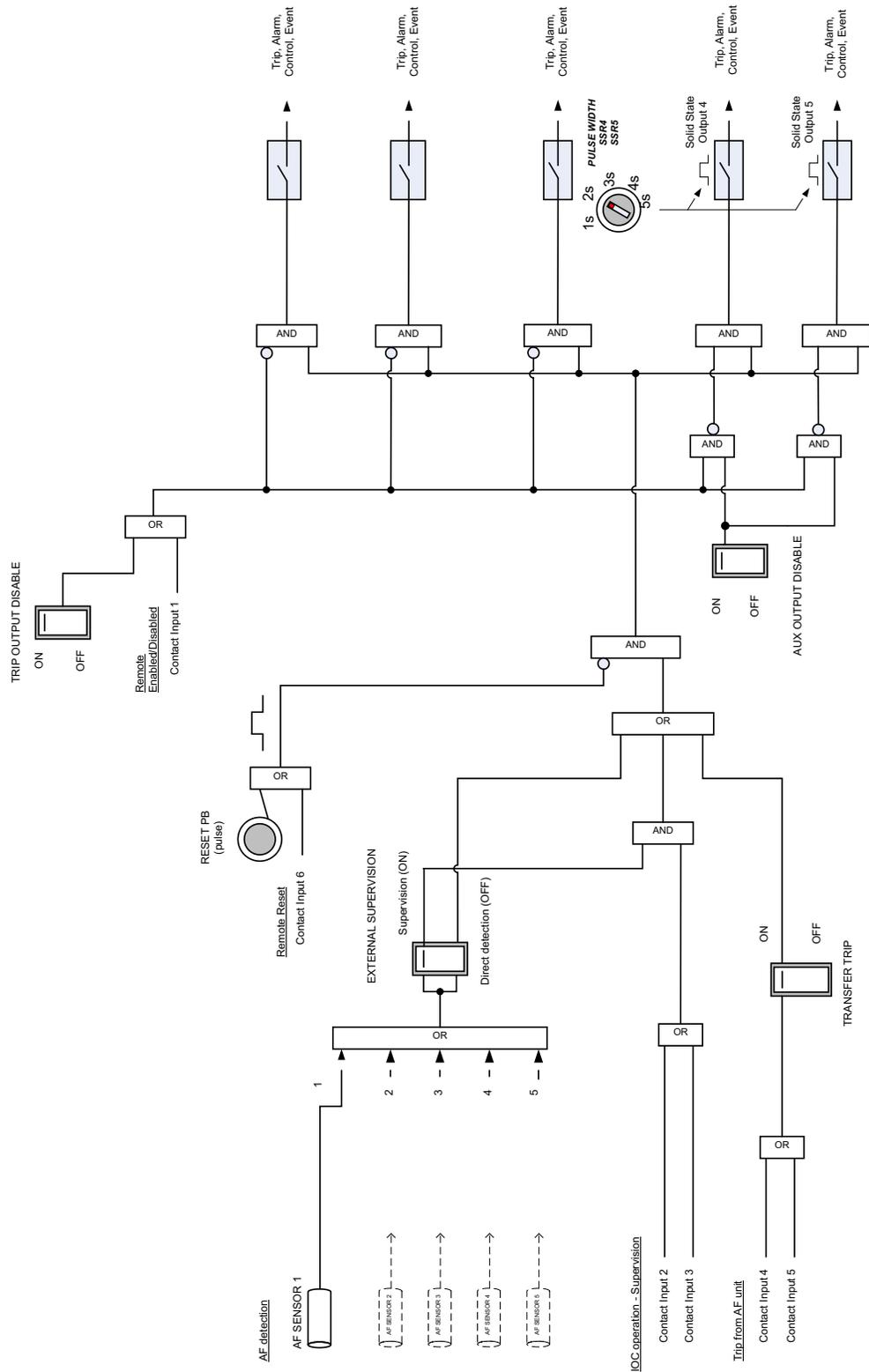


As explained earlier, Arc Flash detection is done by GE’s patented light and sound sensors. GE Multilin’s arc flash system can support up to 5 Arc Flash sensors. Each individual sensor has the capability to measure an arc flash (both light and sound). If any one of the five sensors detects arc flash, it drives an output signal to all outputs SSR-1 to SSR-5. If over-current supervision is required, the EXTERNAL SUPERVISION slider can be set to “ON,” and either of the contact inputs 2 or 3 can be utilized from separate over-current detection devices (not part of an AF system). In that case, both AF sensor inputs as well as external over-current detection are required to drive output signals.

Moreover, cascading of GE Multilin's AF system can be achieved by turning "ON" the TRANSFER TRIP slide switch, which allows either Contact Input #4 or #5 to transfer output trip commands directly. In addition the AUX OUTPUT DISABLE switch allows the user to send outputs-4 and -5 to the upstream AF system, for transfer trip application. The duration for outputs-4 and -5 can be set by a rotary switch for 1 to 5 seconds or infinite duration. All outputs can be disabled during system testing mode using the TRIP OUTPUT DISABLE switch. And, the AF system can be reset after operation, by pressing the RESET pushbutton on the front panel. Further detailed operation of the slide switches and rotary switch are explained in the Interface section.

The logic diagram of GE Multilin's arc flash system is shown in the figure below.

Figure 2: Arc flash system logic diagram



Sensor coverage

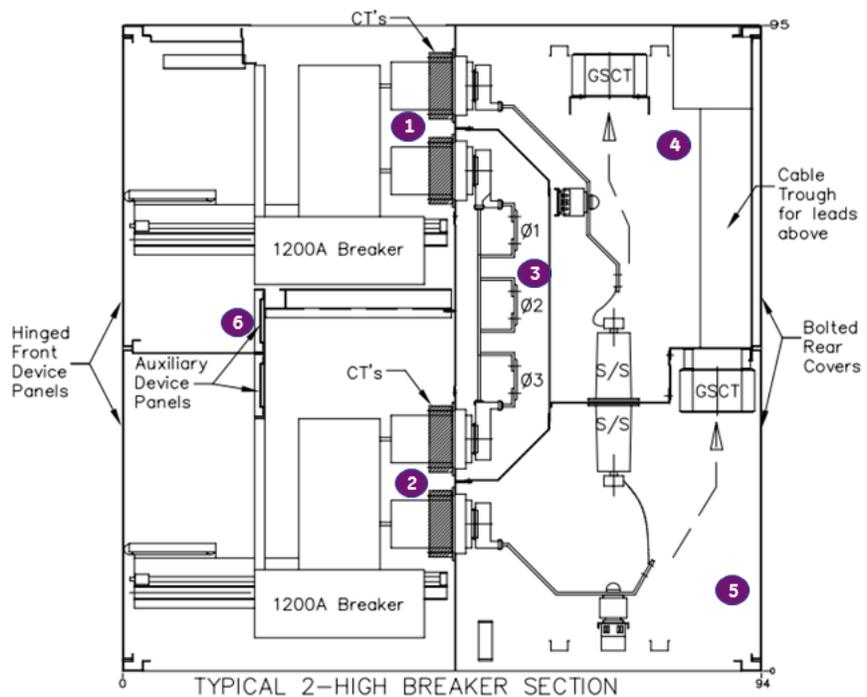
The sensors used for Arc Flash detection are based on light and sound sensing principles. The GE Multilin Arc Flash System supports a maximum of 5 sensors per A60 unit.

To cover a large area, more AF units can be connected together in a daisy chain. An optimal sensor coverage distance of 3 feet from the possible arc flash location is recommended to get fast arc flash event detection. The maximum length of fiber cable offered with each sensor is 12 feet. Most often it is sufficient to place one sensor for monitoring one section of the compartment, but in the case of a large compartment, more than one sensor is required.

Below is an example of a two-high design switchgear application showing the compartments or sections of the switchgear where the five arc-flash sensors and the AF module can be placed.

See figure below, (1) and (2) represent sensor locations in the breaker compartment, (3) sensor location in the busbar, (4) and (5) represent sensor locations in the cable compartment, and (6) shows the location of the AF module installation.

Figure 3: Sensor placement in a two-high design switchgear, side view



Automatic Calibration

The Multilin A60 Arc Flash system is equipped with state-of-the-art “auto-calibration” functionality. The purpose of auto-calibration is to re-confirm the (existing) threshold setpoints of each sensor of the A60, and to check if these thresholds need to be adjusted based on the surrounding presence of light and pressurized sound.



Make sure that the A60 system (which includes the device sensors) is not exposed to arc during the auto-calibration mode. If the device is exposed, repeat the process again without the arc exposure.

How to put the A60 System into Calibration mode

1. Press and hold down the “Reset” button.
2. Power on the unit.
3. Wait until the STATUS LED is lit an orange color.
4. Release the “Reset” button.
5. When the orange-colored STATUS LED light starts blinking, the A60 system is successfully starting the auto-calibration.
6. When the A60 completes the auto-calibration process, the STATUS LED changes from a blinking orange to a steady orange light.
7. If the Trouble LED light illuminates and is orange-colored, it means the A60 system cannot successfully pass the auto-calibration. It is necessary to check for any incorrectly installed sensors.
8. If the Trouble LED light remains off, the A60 system passed the auto-calibration. It is necessary to cycle power the unit and let it go into normal operating mode.



We recommend performing the auto-calibration steps for any change in installation, such as a change in location OR a change in any component of A60 (i.e. sensor, fiber cable, etc.).

Multilin A60 Arc Flash System

Chapter 5: Application

Typical applications

This section provides several examples, for the purpose of illustration, of the Multilin Arc Flash System (AFS) usage and the corresponding front panel switch settings.

In the following, the first case describes a one unit setup. Case 2 includes the supervision capability. The next two cases describe setups with multiple AFS units.

Case 1: Application

The figure below illustrates a simple application of the AFS. It shows how the unit is set up to protect circuit MV (medium voltage) switchgear compartments from arc flash and provide personnel safety. Sensors from the AFS can be installed in different compartments or only in a single compartment depending upon the size of the compartment to be protected. Refer to the *Sensor coverage* section for further information about the number of sensors required per compartment.

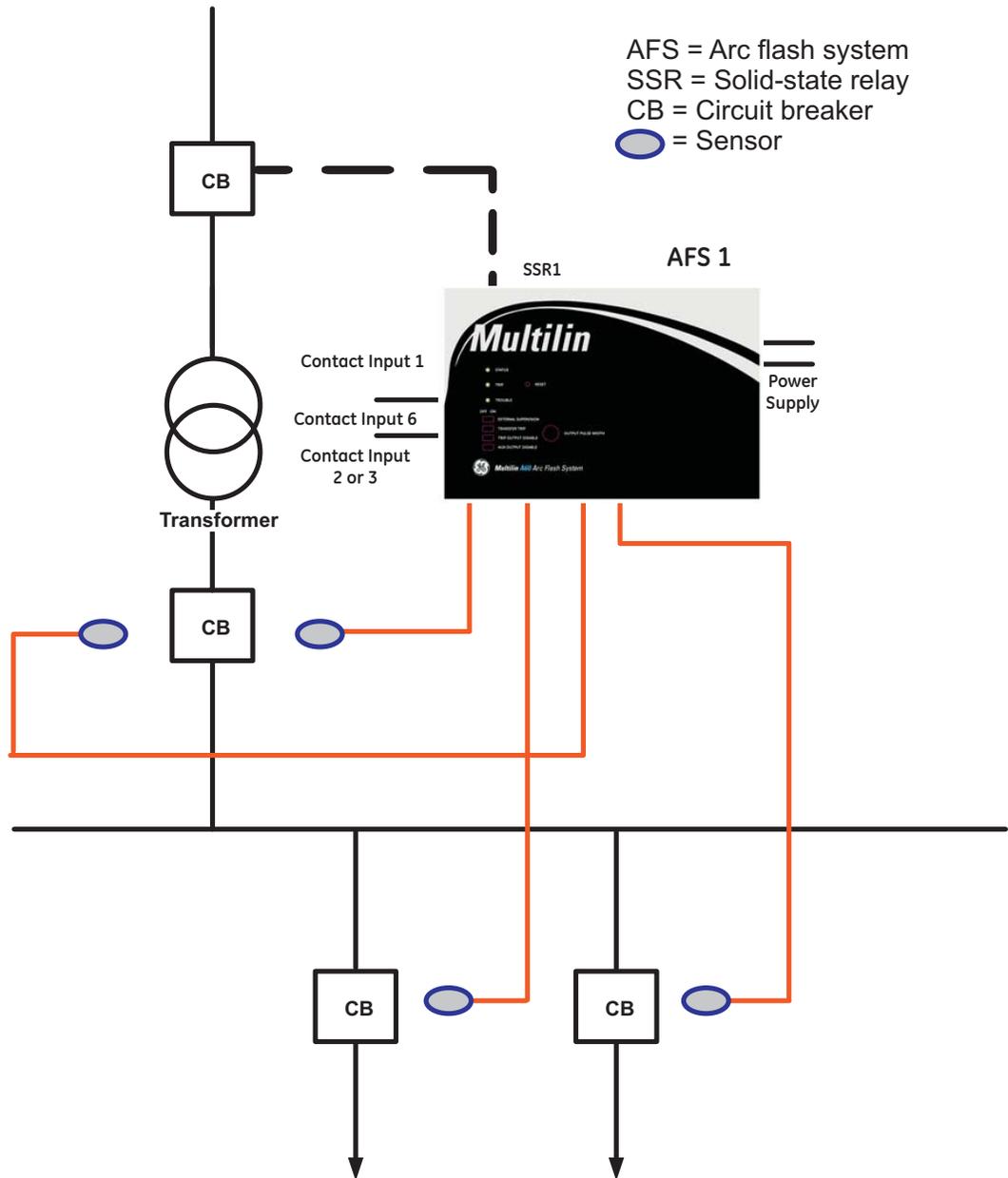
The slide switch settings for this particular application are tabulated in the table below.

AFS 1

Slide Switch	Position
External Supervision	OFF
Transfer Trip	OFF
Trip Output Disable	OFF
Aux Output Disable	OFF

Since the external current supervision contact inputs are not used, in this case, the "External Supervision" slide switch is set to "OFF". The transfer trip contact inputs (from other AFSs) are not used, so the transfer trip slide switch is also set to "OFF". At the same time, SSR outputs 4 and 5 are also not used to send a transfer trip to any other AFS so the "Aux Output Disable" is set to "OFF". Since SSR contact output 1 is used to send a trip command to the main circuit breaker, "Trip Output Disable" is set to "OFF". See the figure below.

Figure 1: AFS protection application



Case 2: Current supervision

The current supervision function of the Multilin AFS from the previous application (Case 1) is described in this application (Case 2).

In the event of an arc flash in any of the compartments, the resulting light and sound and high current, in that corresponding compartment, will be drawn from the incoming feeder. In this case, the output of the Instantaneous Over Current (IOC) protection device (connected to a current transformer (CT) on the main incoming feeder) is used as current supervision input for the AFS. As a result, an AFS device detects the arc flash from its sensors and the current supervision function further enhances the security provided by the AFS.

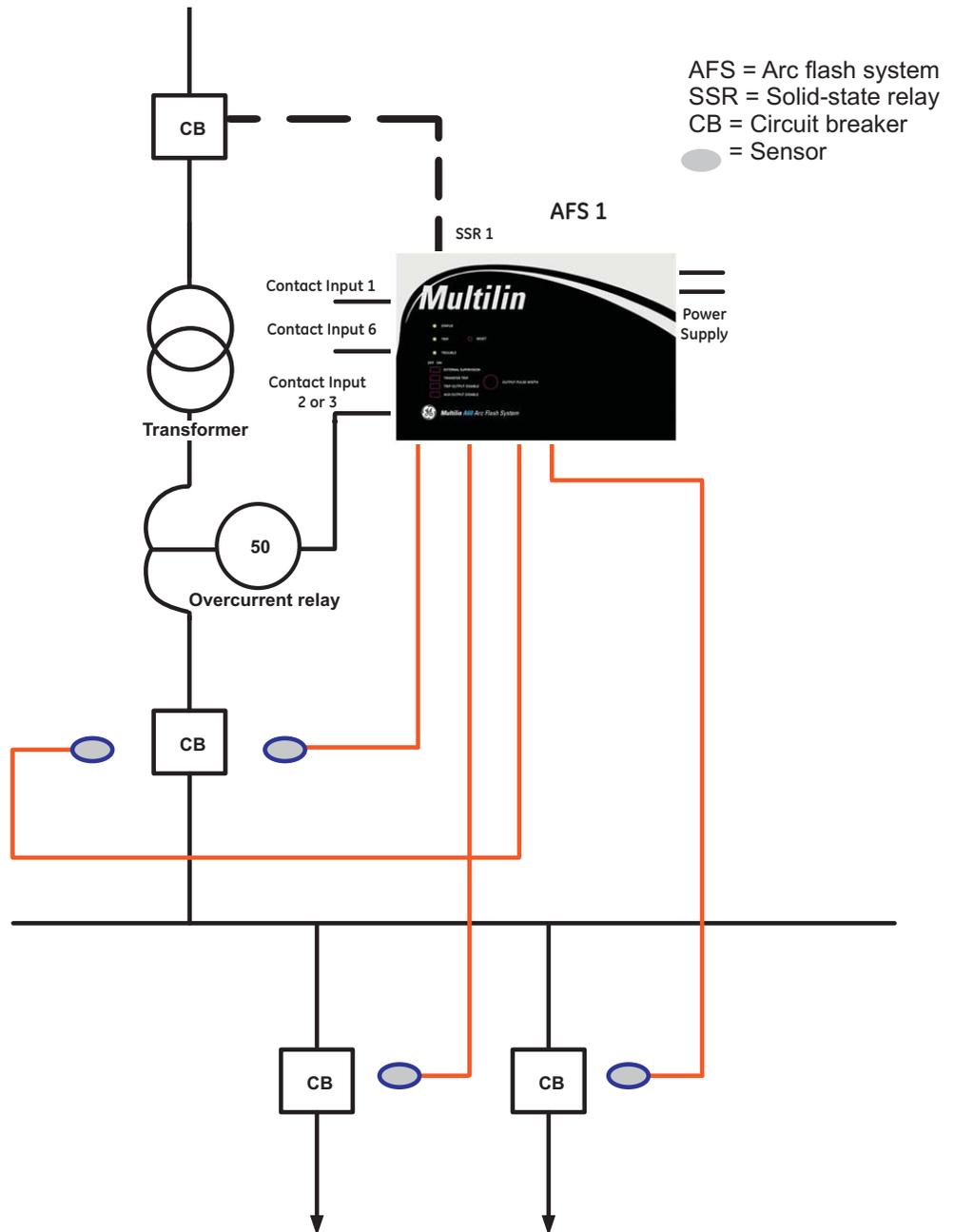
The slide switch settings for this particular application are tabulated in the table below.

AFS 1

Slide Switch	Position
External Supervision	ON
Transfer Trip	OFF
Trip Output Disable	OFF
Aux Output Disable	OFF

Since contact input 2 or contact 3 is connected to an IOC device, the “External Supervision” switch is slid to the “ON” position. The other slide switches are set to “OFF”, as explained in the previous application. See figure below.

Figure 2: AFS protection application with current supervision enabled



Case 3: Cascade connection

This application describes how a cascading of multiple Multilin AFSs using the support transfer trip features can be implemented.

In the figure below, the AFS 1 unit protects a large incoming feeder circuit breaker compartment, and the AFS 2 sensors are connected to the outgoing feeder's compartments. The SSR 4 or 5 of the AFS 2 unit is connected to contact input 4 or 5 in order to transfer trip from the AFS 2 unit to the main circuit breaker through the AFS 1 unit. With this implementation, there is no need to extend many trip signals to the main circuit breaker. The trip signal from AFS 2 is connected to the transfer trip inputs (contact inputs 4 or 5) of the AFS 1 unit, so the "Transfer Trip" slide switch should be set to "ON" in the AFS 1 unit. This allows transferral of the AFS 2 trip to the main circuit breaker.

The slide switch settings for this application are tabulated in the following tables.

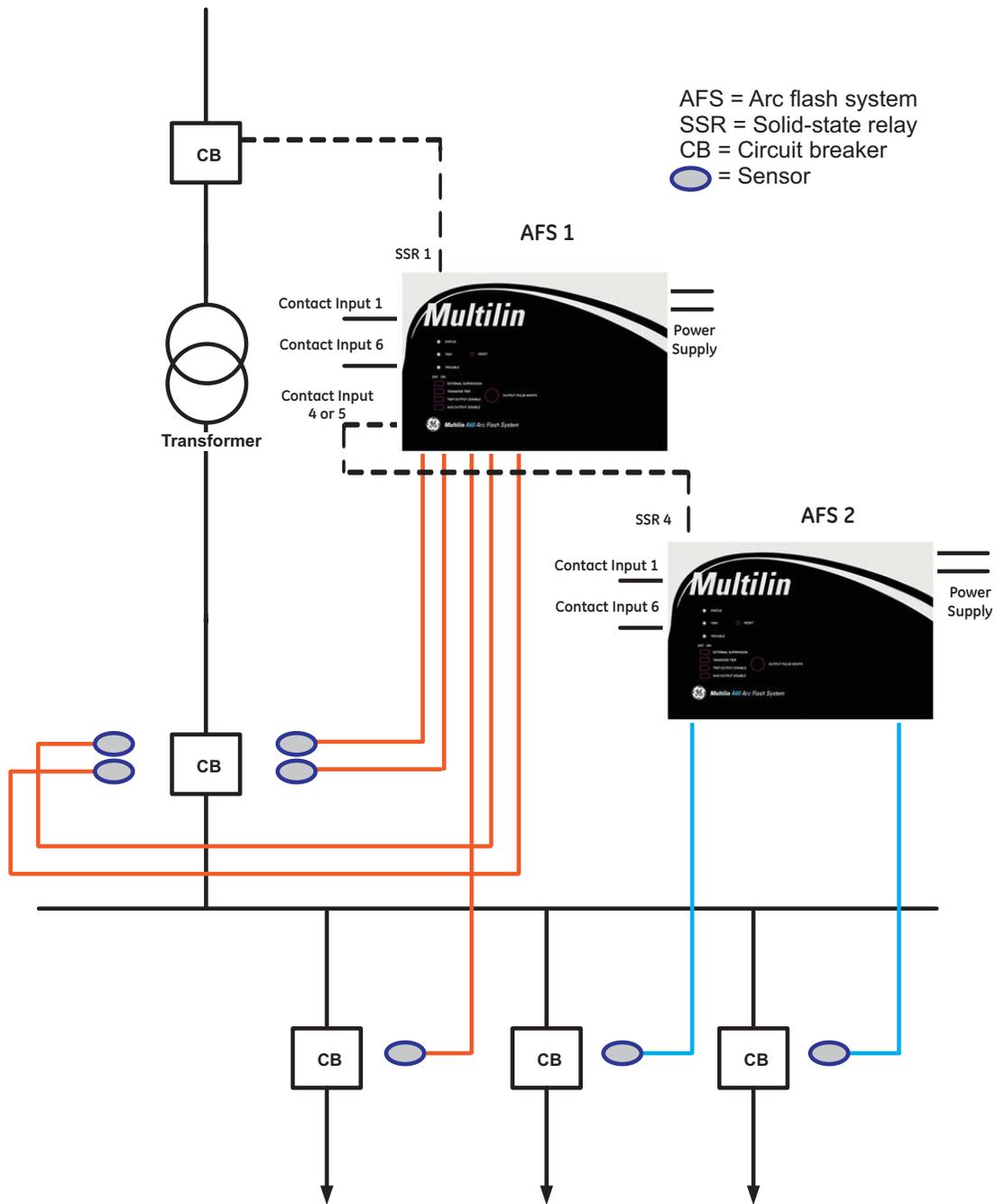
AFS 1 unit

Slide Switch	Position
External Supervision	OFF
Transfer Trip	ON
Trip Output Disable	OFF
Aux Output Disable	OFF

AFS 2 unit

Slide Switch	Position
External Supervision	OFF
Transfer Trip	OFF
Trip Output Disable	OFF
Aux Output Disable	OFF

Figure 3: Protection application with multiple AFS units



Case 4: Bus bar coverage with cascade connection

This application describes the ability of the Multilin AFS to protect multiple MV switchgear compartments and a substation bus bar vault. The sensors can be installed at a certain distance from each other to cover the entire bus bar. Refer to the *Sensor coverage* section for further information about the number of sensors required per compartment, and to cover the entire bus bar vault.

The slide switch settings for this application are tabulated in the tables below.

The AFS 1 and AFS 2 receive the transfer trip signal from AFS 2 and AFS 3 respectively, hence, the “**Transfer Trip**” slide switches for AFS 1 and AFS 2 are set to “**ON**”.

AFS 1

Slide Switch	Position
External Supervision	OFF
Transfer Trip	ON
Trip Output Disable	OFF
Aux Output Disable	OFF

AFS 2

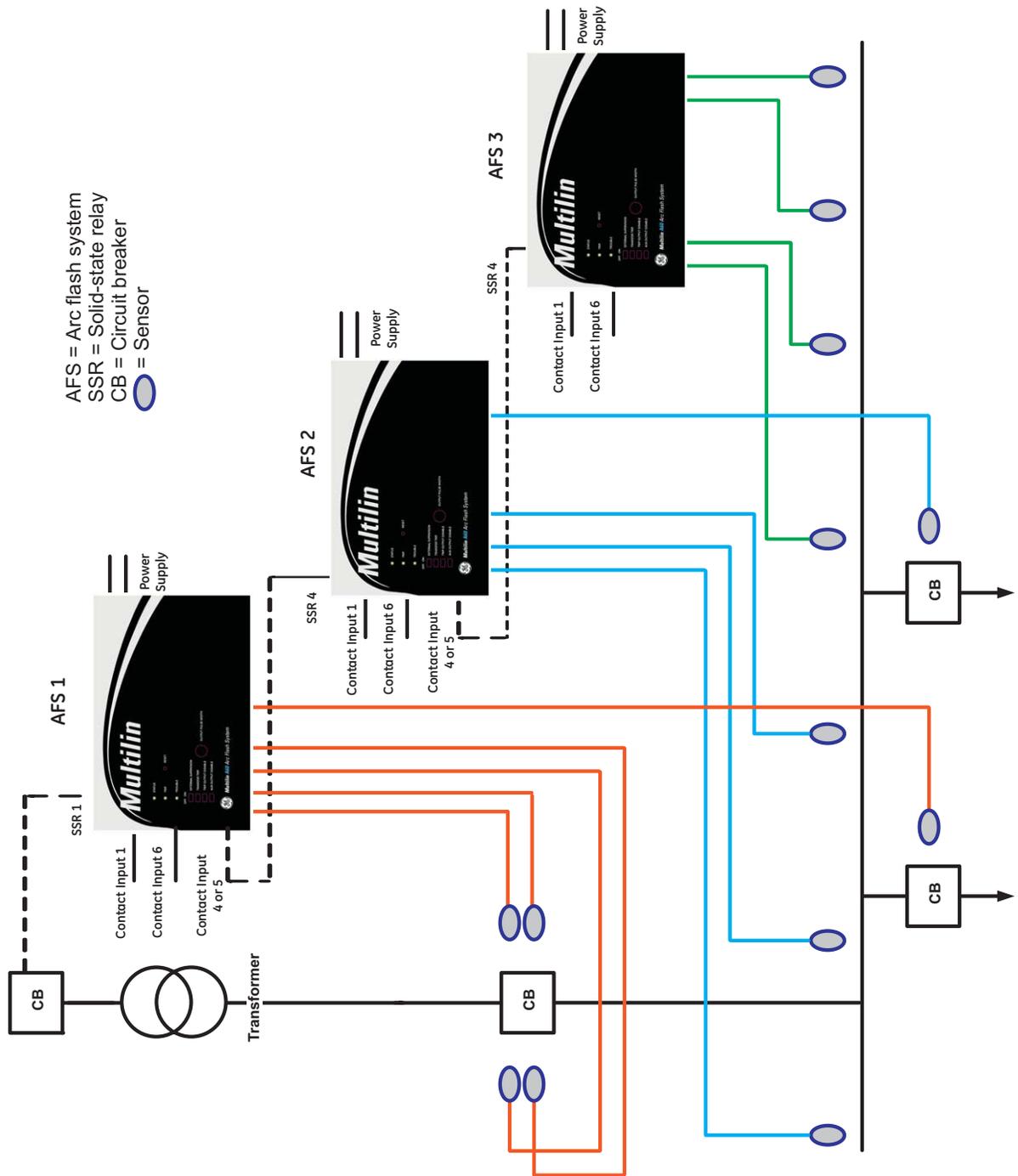
Slide Switch	Position
External Supervision	OFF
Transfer Trip	ON
Trip Output Disable	OFF
Aux Output Disable	ON

The remainder of the slide switches are set to “**OFF**”. See figure below.

AFS 3

Slide Switch	Position
External Supervision	OFF
Transfer Trip	OFF
Trip Output Disable	OFF
Aux Output Disable	ON

Figure 4: Switchgear compartment and bus bar protection application



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Chapter 6: Appendix

Change notes

Manual Revision history

Table 1: Revision History

MANUAL P/N	RELEASE DATE
1601-0037-A1	August 2012
1601-0037-A2	December 2012
1601-0037-A3	March 2013

Table 2: Major Updates for Multilin Arc Flash-A2 to A3

Page Number	CHANGES
Chapter 2	Updated A60 wiring diagram
Chapter 4	Removed arc events figure
Chapter 4	Updated arc quenching figure
Chapter 4	Updated two-high switchgear figure
Chapter 4	Updated Auto Calibrations section
General	Minor Corrections

Table 3: Major Updates for Multilin Arc Flash-A1 to A2

Page Number	CHANGES
Cover	Add OSHA statement
Chapter 1	Update specifications

Table 3: Major Updates for Multilin Arc Flash-A1 to A2

Page Number	CHANGES
Chapter 2	Update AF wiring diagram
Chapter 2	Add sensor description and diagram
Chapter 4	Replace AF logic diagram
Appendix	Add revision history
General	Minor Corrections