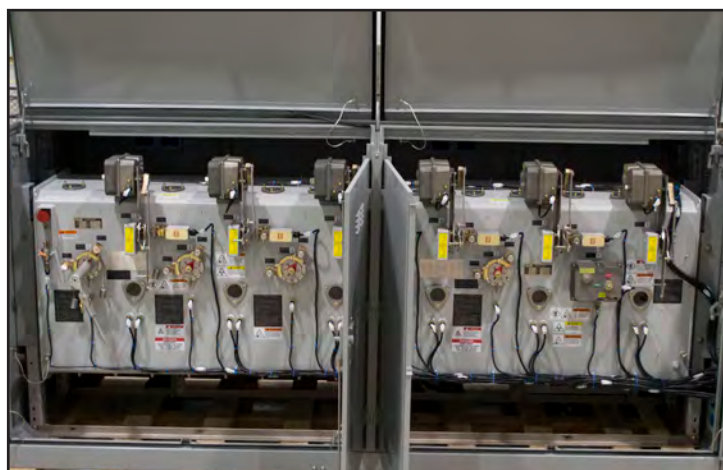


LAZER® Automated SF₆ Switches

The most versatile automation solution in the industry



- Lazer Automation solutions
- Performance guarantee
- Over 35 years of automated SF6 switch experience
- Front and back configurations
- Integrated sensors
- User choice of relay manufacturer
- System tested and installation ready

G&W Engineered to order. Built to last.

Catalog A-sf6-14

Lazer Automation

The distribution automation expertise and products of G&W and the high end software knowledge of Survalent Technology, our software company, have been combined to provide a state of the art solution – Lazer Automation. Three levels of Lazer solutions are available; Lazer I for peer-to-peer product applications, Lazer II for stand-alone controller based systems, and Lazer III for total system wide management and control.

Lazer II and III solutions can be customized and are infinitely scalable because they utilize a **model-based** platform. Model-based programming is easier to configure because the algorithms are already written. All that is required is inputting the system parameters, and configuring each of the Intelligent Electronic Devices (IED).



Engineered to order. Built to last.

- Over 105 years of industry experience
- Global installed base of stand-alone distribution automation systems
- Industry leader in SF6 switchgear, solid dielectric switchgear and reclosers in North America
- Thousands of IED's installed world wide



- Over 50 years of industry experience
- Excellent customer retention
- Full suite of automation software
- Most advanced user interface in the industry

FACTORY ACCEPTANCE TESTS

Factory Acceptance Testing of the Lazer Solution will confirm that it performs as intended by running realistic scenario simulations directly on your distribution equipment. Real time communication is exchanged between devices, and verifies operation of the devices and the communication system. Our Automation Engineer will work with you to develop meaningful scenarios to demonstrate and document your system performance requirements, and to select the events to be simulated when you are present.

Using information that is mutually developed, our Automation Engineer will generate a one-line diagram of your system detailing the status of each device as the testing of each scenario progresses.

All of the scenarios will be tested in the test cell prior to your arrival to validate the device configuration settings, and confirm the operation of equipment for each operation of the event scenarios. This ensures that the system will work as designed when you arrive to witness the Factory Acceptance Test and when you install it in the field.

All backed by a comprehensive performance guarantee.

G&W will warrant our Lazer® solution for 3 years, including parts and performance. The warranty does not include labor (in & out charges) and poor performance due to radio reception issues.

TABLE OF CONTENTS

2	Overview and Factory Acceptance Testing
3	Lazer Automation Solutions
4	Load and Fault Interrupting Switches
9	Sensors
11	Motor Operator
12	Controls
13	Communication
14	Accessories
15	Typical Specification

Lazer Automation Solutions

LAZER® I PROGRAMMING SOLUTIONS

G&W has many pre-packaged solutions and programming specifications for the following applications:

- Automatic Transfer
- Fault Detection, Isolation and Restoration (FDIR)
 - Radial and Loop
 - Loss of Voltage Transfer
- Microgrids
 - FDIR
 - Load Management
 - Shedding
 - Prioritized Restoration
 - Restoration Optimization
- Optimal Generation Dispatch
- Premium Power (24/7 Power Delivery)
 - Critical loads like Hospitals, Universities, Military installations, Factories and Data Centers

We also provide customized automation solutions for your application. Our automation solutions incorporate a wide variety and combination of suppliers' relays in order to provide an optimal solution. If desired, specific vendors and/or relays can be used when specified by the customer.

Open Loop

▲ Open loop FDIR Microgrid installation

▲ Open loop FDIR Microgrid installation

Closed Loop

▲ Closed loop FDIR installation

▲ Closed loop FDIR installation

Load and Fault Interrupting Switches

G&W has many types of gas insulated switches. The Linear Puffer Fault Interrupter (LPFI) and Triad NI (TNI) switch types are the most popular selections for Lazer automation solutions.

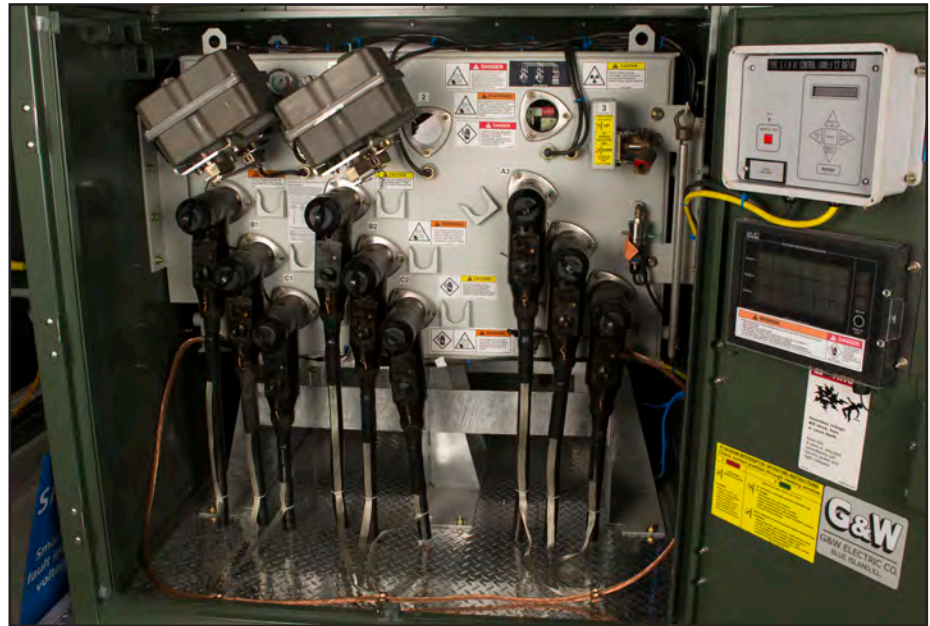
Two Position, Front Access Puffer Vacuum Interrupters

LINEAR PUFFER (LPFI)

Provides load break switch with visible break and three phase fault interrupting.

Load break switch (LP) ratings

Voltage Class (kV)	15	25	35
Maximum (kV)	15.5	27	38
BIL Impulse (kV)	110	125	150
1 Min Withstand AC (kV)	35	60	70
1 Min Withstand Production test rating AC (kV)	34	40	50
15 Min Withstand DC (kV)	53	78	103
Continuous and load break current (A)	630	630	630
Momentary Current (kA) asym	40	40	40
Fault-Close 3-times (kA) asym	40	40	40
1 Sec Current (kA) sym	25	25	25
Open gap withstand	200	200	200
10 operation overload interrupting capability (Amps)	3000	3000	3000
Operations load interrupting at 600A	1200	1200	1200
Mechanical Operations	2000	2000	2000



▲ Automated LPFI-9F shown.

Fault interrupter (FI) ratings

Voltage Class (kV)	15	25
Maximum (kV)	15.5	27
BIL Impulse (kV)	110	125
1 Min Withstand AC (kV)	50	60
1 Min Withstand Production test rating AC (kV)	34	40
15 Min Withstand DC (kV)	53	78
Continuous and load break current (A)	630	630
Symmetrical interrupting rating (kA)	12.5	12.5



▲ Voltage sensing bushings mounted on a LPFI switch.

IEEE C37.60 FAULT INTERRUPTING DUTY

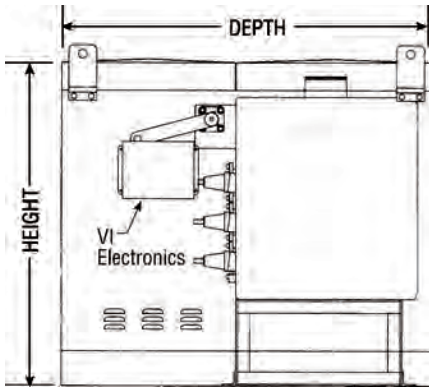
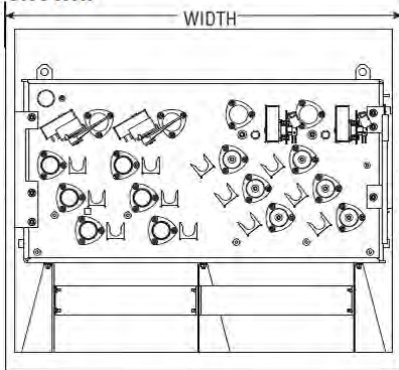
Percent of Maximum Interrupting Rating	Approx. Interrupting Current, Amps	No. of Fault Interruptions
15-20%	2,000	44
45-55%	6,000	56
90-100%	12,500	16
Total # of Fault Interruptions: 116		



▲ Load break switch visible break.

TWO POSITION, FRONT ACCESS, PUFFER VACUUM INTERRUPTERS CONTINUED

*Manually operated LPFI-9F
shown.*



* All voltage classes have a height = 85"
(2159mm); and depth = 54" (1372mm).

Model	One-line Diagram	Voltage (kv)	Catalog Number	Approximate	
				Width in (mm)*	Wt. w/SF ₆ lbs (kg)
6F		15	LPFI32-376-12-6F	92.3 (2344)	2625 (1193)
		25	LPFI32-386-12-6F	92.3 (2344)	2625 (1193)
7F		15	LPFI31-376-12-7F	91.7 (2329)	2950 (1341)
		25	LPFI31-386-12-7F	91.7 (2329)	2950 (1341)
9F		15	LPFI42-376-12-9F	104.3 (2649)	3275 (1489)
		25	LPFI42-386-12-9F	104.3 (2649)	3275 (1489)
11F		15	LPFI43-376-12-11F	104.8 (2662)	2925 (1330)
		25	LPFI43-386-12-11F	104.8 (2662)	2925 (1330)
12F		15	LPFI41-376-12-12F	103.8 (2637)	3000 (1364)
		25	LPFI41-386-12-12F	103.8 (2637)	3000 (1364)
43F		15	LPFI43-376-12-43F	116.2 (2951)	3150 (1432)
		25	LPFI43-386-12-43F	116.2 (2951)	3150 (1432)
51F		15	LPFI51-376-12-51F	115.7 (2939)	3450 (1568)
		25	LPFI51-386-12-51F	115.7 (2939)	3450 (1568)

Load and Fault Interrupting Switches

THREE POSITION, FRONT / BACK ACCESS, TRIAD™ SERIES 2 WITH BOTH LOAD BREAK AND FAULT INTERRUPTER GROUND SWITCHES

Model TNI

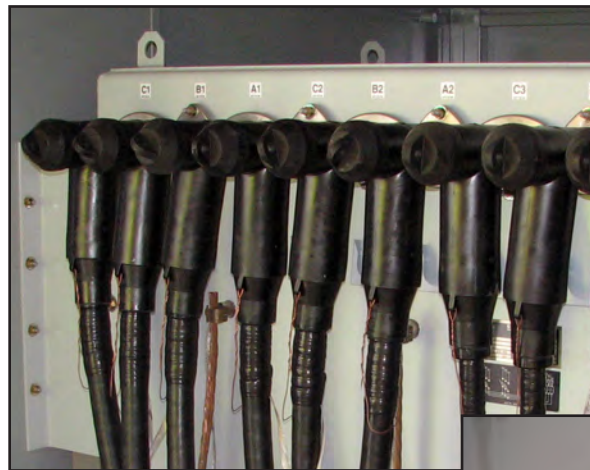
Switches incorporate rotary puffer style internal ground switching for both the load break and fault interrupter switch ways. Model NI vacuum interrupter three phase mechanisms are used.

Load break switch (RP) ratings

Voltage Class (kV)	15	25	35
Maximum (kV)	15.5	27	38
BIL Impulse (kV)	110	125	150
1 Min Withstand AC (kV)	35	60	70
1 Min Withstand Production test rating AC (kV)	34	40	50
15 Min Withstand DC (kV)	53	78	103
Continuous and load break current (A)	630	630	630
Momentary Current (kA) asym	40	40	40
Fault-Close 3-times (kA) asym	32	32	32
1 Sec Current (kA) sym	25	25	25
Mechanical Operations	2000	2000	2000

IEEE C37.60 FAULT INTERRUPTING DUTY

Percent of Maximum Interrupting Rating	Approx. Interrupting Current, Amps	No. of Fault Interruptions
15-20%	2,000	44
45-55%	6,000	56
90-100%	12,500	16
Total # of Fault Interruptions: 116		



▲ Front view of a TNI-9L. Contact viewing windows are on the top of the switch. See viewing window option below.

◀ Cable entrances are located on the back of the switch.

Fault interrupter (NI) ratings

Voltage Class (kV)	15	25	35
Maximum (kV)	15.5	27	38
BIL Impulse (kV)	110	125	150
1 Min Withstand AC (kV)	35	60	70
1 Min Withstand Production test rating AC (kV)	50	60	70
1 Min Withstand Production test rating AC (kV)	34	40	50
15 Min Withstand DC (kV)	53	78	103
Continuous and load break current (A)	630	630	630
Symmetrical interrupting rating (kA)**	12.5	12.5	32

**20kA and 25kA available



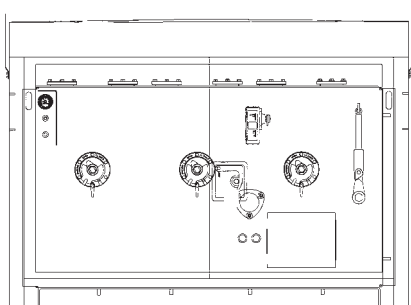
▲ Load break multi-position switch operator with keylocks.



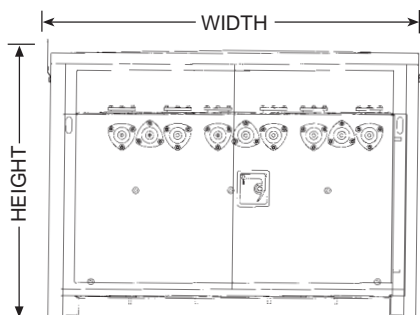
▲ Optional large viewing window for load break switch visible break.

**THREE POSITION,
FRONT / BACK ACCESS,
TRIAD™ SERIES 2
WITH BOTH LOAD BREAK AND
FAULT INTERRUPTER GROUND
SWITCHES
CONTINUED**

Front/back access design with all operating mechanisms in the front and all cable entrances in the back compartment. Contact viewing windows are located on the top of the switch tank.



Front view showing load break and vacuum interrupter operators.



Rear view showing all cable entrances.

* All voltage classes have a height = 77" (1956mm); and depth = 73" (1854mm).

Model	One-line Diagram	Voltage (kv)	Catalog Number	Approximate	
				Width in (mm)*	Wt. w/SF ₆ lbs (kg)
5		15	TNI21-376-12-5L	51 (1295)	1725 (782)
		25	TNI21-386-12-5L	51 (1295)	1725 (782)
		35	TNI21-396-12-5L	51 (1295)	1725 (782)
6		15	TNI32-376-12-6L	105 (2667)	3750 (1704)
		25	TNI32-386-12-6L	105 (2667)	3750 (1704)
		35	TNI32-396-12-6L	105 (2667)	3750 (1704)
7		15	TNI31-376-12-7L	105 (2667)	3520 (1600)
		25	TNI31-386-12-7L	105 (2667)	3520 (1600)
		35	TNI31-396-12-7L	105 (2667)	3520 (1600)
9		15	TNI42-376-12-9L	124 (3150)	4020 (1827)
		25	TNI42-386-12-9L	124 (3150)	4020 (1827)
		35	TNI42-396-12-9L	124 (3150)	4020 (1827)
11		15	TNI43-376-12-11L	124 (3150)	3945 (1793)
		25	TNI43-386-12-11L	124 (3150)	3945 (1793)
		35	TNI43-396-12-11L	124 (3150)	3945 (1793)
12		15	TNI41-376-12-12L	124 (3150)	4095 (1861)
		25	TNI41-386-12-12L	124 (3150)	4095 (1861)
		35	TNI41-396-12-12L	124 (3150)	4095 (1861)
40		15	TNI40-376-12-40L	124 (3150)	4020 (1827)
		25	TNI40-386-12-40L	124 (3150)	4020 (1827)
		35	TNI40-396-12-40L	124 (3150)	4020 (1827)
50		15	TNI50-376-12-50L	142 (3607)	4690 (2132)
		25	TNI50-386-12-50L	142 (3607)	4690 (2132)
		35	TNI50-396-12-50L	142 (3607)	4690 (2132)
51		15	TNI51-376-12-51L	142 (3607)	4690 (2132)
		25	TNI51-386-12-51L	142 (3607)	4690 (2132)
		35	TNI51-396-12-51L	142 (3607)	4690 (2132)
52		15	TNI52-376-12-52L	142 (3607)	4585 (2084)
		25	TNI52-386-12-52L	142 (3607)	4585 (2084)
		35	TNI52-396-12-52L	142 (3607)	4585 (2084)
53		15	TNI53-376-12-53L	142 (3607)	4540 (2064)
		25	TNI53-386-12-53L	142 (3607)	4540 (2064)
		35	TNI53-396-12-53L	142 (3607)	4540 (2064)
54		15	TNI54-376-12-54L	142 (3607)	4540 (2064)
		25	TNI54-386-12-54L	142 (3607)	4540 (2064)
		35	TNI54-396-12-54L	142 (3607)	4540 (2064)
60		15	TNI60-376-12-60L	160 (4064)	5115 (2325)
		25	TNI60-386-12-60L	160 (4064)	5125 (2330)
		35	TNI60-396-12-60L	160 (4064)	5125 (2330)
62		15	TNI62-376-12-62L	160 (4064)	5190 (2359)
		25	TNI62-386-12-62L	160 (4064)	5190 (2359)
		35	TNI62-396-12-62L	160 (4064)	5190 (2359)

Load and Fault Interrupting Switches

THREE POSITION, FRONT / BACK ACCESS, TRIAD™ SERIES 2 WITH BOTH LOAD BREAK AND FAULT INTERRUPTER GROUND SWITCHES

CONTINUED FROM PAGE 7

Front/back access design with all operating mechanisms in the front and all cable entrances in the back compartment. Contact viewing windows are located on the top of the switch tank.

Model	One-line Diagram	Voltage (kv)	Catalog Number	Approximate	
				Width in (mm)*	Wt. w/SF ₆ lbs (kg)
63		15	TNI63-376-12-63L	160 (4064)	5115 (2325)
		25	TNI63-386-12-63L	160 (4064)	5115 (2325)
		35	TNI63-396-12-63L	160 (4064)	5115 (2325)
64		15	TNI64-376-12-64L	160 (4064)	5125 (2330)
		25	TNI64-386-12-64L	160 (4064)	5125 (2330)
		35	TNI64-396-12-64L	160 (4064)	5125 (2330)
65		15	TNI65-376-12-65L	160 (4064)	5125 (2330)
		25	TNI65-386-12-65L	160 (4064)	5125 (2330)
		35	TNI65-396-12-65L	160 (4064)	5125 (2330)



▲ Automated switch retrofit installation.

AUTOMATION RETROFITS FOR LEGACY EQUIPMENT

Many customers want to automate their legacy switchgear. This can be economical when compared with the cost of buying new switchgear, when there are automation provisions on the existing switchgear. What provisions should be considered?

All switchgear must have the following components or provisions for them:

- Position Indication (For each automated way)
- Voltage Sensing (PTs or Voltage Sensing Bushings)
- Current Sensing (CTs or Current Sensing Bushings)
- Cabinet Space for Communication and Control Equipment
- Cabinet Space for Control Power Transformers
- Motor Operators
- Pressure / Density Sensor

G&W can perform an analysis of your existing equipment to determine if we can provide a fully warranted automation retrofit solution for your legacy switchgear. We will also provide the cost for new equipment for comparison.

VOLTAGE SENSING

3-1/C, 600A Voltage Sensing Bushings (VS)

Compared to potential transformers, the VS bushing system offers these benefits:

- Significant cost savings
- Cleaner, less cumbersome installation
- Less space required
- Fewer add-on components which could potentially fail
- Installed and tested prior to shipment

LEA (Low Energy Analog) capacitive voltage sensors encapsulated within the 600 Amp apparatus bushings permit voltage reading for network reconfiguration while eliminating the need for add-on sensors and cabling. LEA voltage sensing accuracy is +/-2% over the temperature range of -20°C (-4°F) through +40°C (104°F) when tested as a system. The accuracy is +/-4% from -60°C (-76°F) through +65°C (149°F). The phase angle accuracy is +/-1° throughout the full temperature range.

Alternatively, the output is amplified by integral circuitry, resulting in a 0-120 VAC analog output suitable for direct connection to any relay, IED or RTU. The circuitry incorporates built-in calibration and temperature compensation. The amplified sensing accuracy is +/-5% over the temperature range of -60°C (-76°F) through +65°C (149°F).

Bushings are designed to IEEE 386 standards with standard interface accepting conventional elbow style connectors and include an aluminum conductor with 5/8"-11 aluminum threaded stud and aluminum single hole pad (*elbows must be ordered separately*). Bushings are bolt-on style. Copper studs are available. For bottom entry switches, recommended switch frame height is 42" for all voltages.



▲ 600A voltage sensing bushing

POTENTIAL TRANSFORMERS

Potential transformers or external voltage sensors provide alternative solutions for specific applications such as metering or retrofit.

CURRENT SENSING

G&W offers many options for current sensing. Each G&W switch is available with the option of internal current transformers (500:1 or 1000:1); external metering class current transformers such as the ABB CMV or RLC styles; or split core transformers for retrofit applications.

CONTROL POWER TRANSFORMERS

Control power transformers (CPTs) are available through G&W eliminating the need for the customer to provide power to the control package. G&W integrates solid dielectric CPTs that are supplied by ABB, GE and Ritz. CPTs are available as phase to phase or phase to ground on the primary side and tapped, 120VAC or 240VAC on the secondary side.

The CPTs can either be mounted internally or externally to the switch tank. When the CPTs are mounted internal to the tank, standard G&W practice is to fuse the primary side of the CPTs. For external CPTs, G&W can provide taps on the switch tank for use in making primary connections between the CPTs and the switch or; G&W can provide the primary cabling, including fused elbows, making it a complete site-ready solution.



▲ External CPT installation



▲ External CT Installation

The current transformers (CTs) and voltage transformers (VTs) shown in the tables are examples of CTs and VTs G&W has successfully integrated with our switchgear and controls. The listed CTs and VTs were used for metering purposes, directional overcurrent/power in special programming as well as powering the controls (VTs). G&W uses solid dielectric VTs with our underground switchgear as solid dielectric VTs have better accuracies than their oil-filled counterparts.

If there is a required CT or a VT that is not listed in the tables, please contact the factory with as much information about the requested CT/VT as possible. For CTs, information can include, but is not limited to, brand, ratio and accuracy. For PTs, information can include, but is not limited to, brand, ratio, secondary voltage, BIL rating, kVA rating and accuracy. When contacting the factory, please also include the switch type where the CT/VT will be used. If the CTs and VTs will be used to retrofit a switch, please include the switch serial number.

With the switch information, G&W will verify the CT/VT specified will physically work with the switch. This is done with CTs by looking at the inner diameter as well as the overall size to verify it will fit around the bushings as well as side-by-side on the way. For internal PTs, G&W will verify the VT(s) will fit in the switch tank. For external VT(s), G&W will verify the VT(s) will fit in the enclosure for existing switches that are padmount. For new padmount switch designs, G&W will verify an enclosure can be dimensioned to accommodate the VT(s).

SF6 External CTs		
Vendor/ Family	Ratio	Accuracy
ABB RLC	400:5	C50
ABB RLC	600:5	C100
ABB RLC	1200:5	C200
GE SCG	150:5	C50
GE SCG	600:5	C100
GE SCG	50:5	C100
GE SCG	500:5	C100
GE SCG	600:5	C100
GE SCG	2000:5	C400
Ritz DCGW	1500:5	C50
ABB CMV	600:5	C20
ABB CMV	100:5	1.2B0.1
ABB CMV	200:5	0.3B0.1 / C20
GE 145	100:5	C50

SF6 External VTs*				
Vendor/ Family	Wye or Delta	Primary Voltage	Ratio	kVA Rating
ABB VIL-95	Wye	7200	60:1	1.5 kVA
ABB VIL-95	Wye	7620	63.5:1	1.5 kVA
ABB VIL-95	Wye	7968	66.4:1	1.5 kVA
ABB VIL-95	Delta	14400	120:1	1.5 kVA
ABB VIL-95	Delta	13800	115:1	1.5 kVA
ABB VIL-95	Delta	12470	103.9:1	1.5 kVA
ABB VIL-95S	Delta	13800	115:1	0.75 kVA
ABB VIL-95S	Delta	12000	100:1	0.75 kVA
ABB VIL-95S	Wye	7200	60:1	0.75 kVA
ABB VIL-95S	Wye	7967	66.4:1	0.75 kVA
ABB VIL-12	Wye	12000	100:1	1.5kVA
ABB VIL-12	Delta	20780	173.16:1	1.5kVA
ABB VIL-12	Delta	20780	173.16:1	1.5kVA
ABB VIL-12S	Wye	14400	120:1	0.75 kVA
ABB VIL-12S	Wye	13800	115:1	0.75 kVA
ABB VIL-12S	Delta	24000	200:1	0.75 kVA

*Secondary voltage is 120VAC

SF6 Internal VTs*				
Vendor/ Family	Wye or Delta	Primary Voltage	Ratio	kVA Rating
ABB VIZ-11	Delta	13800	115:1	1.5 kVA
ABB VIZ-15	Wye	13221	110.2:1	2 kVA
ABB VIZ-15	Delta	12470	103.9:1	2 kVA
ABB VIZ-20	Wye	13200	110:1	2 kVA
ABB VIZ-20	Wye	19920	166:1	2 kVA

*Secondary voltage is 120VAC

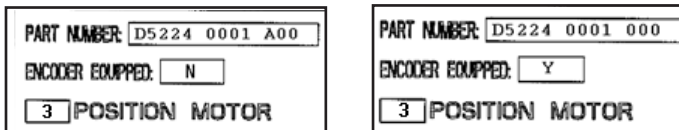
Motor Operators



THREE POSITION MOTOR OPERATORS

There are two types of Motor Operators. The first type is used in conjunction with switches equipped with internal position indication to start and stop the Motor Operator. The control uses the contacts inside the tank to start and stop the Motor Operator. The second type has built in position indication using an internal digital encoder. The digital encoder provides reliable, accurate open/close position indication and facilitates field retrofits of switches. The control uses the digital encoder to start and stop the Motor Operator. The operating time for a single close to open operation or a single open to ground operation is two to three seconds.

The labels on the exterior of the Motor Operator can be used to determine the type of Motor Operator. Examples of Motor Operator labels are shown below:



The Motor Operators are powered by 24VDC from the control. They have a maximum current rating of 12 Amps and minimum AC power requirements of 400 watts when used with a G&W control. They weigh approximately 32 pounds, have operating temperatures of -40°C to +50°C, storage temperatures of -50°C to +85°C and humidity rating of 10% to 100%.



▲ Motor operators installed on a G&W automatic transfer switch.

APPLICATION

- Permits automating manual switches for inclusion into distribution automation, smart grid and SCADA schemes.
- Permits remote operation using a variety of G&W controls.
- Provides a direct replacement for other styles of motor operators. The motor works with a large number of existing G&W controls so that it can be easily included into existing schemes.

FEATURES

Ease of Installation

Motor operators can easily be mounted on the operating mechanism of nearly all G&W SF₆ gas or solid dielectric insulated switches already installed in the field. Complete mounting kits and instructions are provided. Operators are applicable to both padmount and vault applications.

Reliable, Submersible Construction

The operator housing is made from cast 304 stainless steel which is permanently bonded and sealed for maximum corrosion resistance. It has been tested for submersibility to IP68 standards, under a 20 foot head of water for 20 days. It has been tested to 7,000 close/open/close operations assuring a reliable, long service life.



1. Programming Port
2. Optional Control Cable Connector
3. Pressure Seal

OPTIONS

1. Motor operators are available for controlling two position or three position mechanisms. The two position motor operator can be used on a three position mechanism if automating operations to the ground position is not desired. A decoupling mechanism would be required when using a two position motor on a three position mechanism.
2. A decoupling mechanism is available for detaching the motor operator from the switch mechanism without removing the motor from the switch. This feature requires an encoder and allows the motor to be used in schemes where the controls and motor can be tested without operating the switch. This feature also allows the user to manually operate a switch into ground position.
3. Both motor operator styles come with a standard hardwired control cable. An optional connectorized cable is available to easily disconnect the control cable.

Additional programming cables and software are available.

Choice of Relay Supplier

Each control can be customized with a user preferred choice of protective relay to assist in reduced training time, improved user interaction, and communication and coordination requirements.

Lazer® Automation Ready

The Lazer ready capability of the controls simplify the requirements for communication to other intelligent electronic devices for automatic power restoration schemes. The controls are pre-engineered to work with G&W's Lazer automation systems.

Enclosure Options

For padmount and dry vault applications, the control can be supplied in either a mild steel NEMA 4 enclosure or a stainless steel NEMA 4X enclosure. Both of these enclosures can be supplied in a compact size (24" tall by 24" wide) or in a larger size (30" tall by 24" wide) to accommodate additional equipment such as communication devices.



▲ Low profile curbside pedestal enclosure.

The NEMA 4 and NEMA 4X enclosures have several options including a padlocking handle, convenience outlet, and a document holder.

For submersible applications, the control can be supplied in an IP68 stainless steel enclosure. This enclosure has been tested to successfully withstand 20 days beneath a 20 foot head of water. The IP68 enclosure can be supplied with several options including:

1. Windows to see the front of the relay and any system status points
2. External handles for manual operation via hotstick or rope
3. A submersible DNP3.0 port for communications, and battery back-up in a NEMA 6P enclosure.



▲ IP68 submersible wall mount enclosure.

User Friendly Controls

Large, easy to read, push buttons for the most commonly used functions gives quick access on the front panel of the control.

Relays Integrated by G&W

Manufacturer	Control
SEL	351
	351A
	351S
	451
	487
	700GW and GT
	751
	751A
Basler	951
	MIFII
GE	F35
	F60
	URC
Siemens	7SJ6221
	7SJ8041



▲ SEL 451 and 751 relays



▲ GE F60 feeder relay

Test Switches

Controls that include load side overcurrent protection will be supplied with a variety of test switches, including ABB FT1.



▲ ABB FT1 test switches

The test switch provides the user with the ability to:

- Block tripping by opening the trip circuit
- Short the current transformer leads when working inside of the control enclosure
- Test the relay using a secondary current injection method

Convenience Outlet

The standard ground fault circuit interrupter (GFCI) outlets supplied by G&W are rated 125VAC/15A for domestic, 240VAC/20A for international and use a snap-in connector for the wiring which fully encloses the back of the outlet. The actual current available at the outlet will depend on the voltage source wired to the outlet. Customer specified voltage outlets are available upon request.



▲ SEL-451 mounted in NEMA 4 enclosure with convenience outlet.

Communication

Communication

Lazer automation solutions are designed to interface with a wide variety of protocols and communication equipment options. Lazer II and III are Multi-Speak compliant to ensure seamless integration of legacy hardware and software.

Lazer communication option examples from some major vendors can include:

Single/Multimode Fiber Optic Transceivers

- SEL 2831 sends serial data up to 68 miles at up to 40kbs
- H&L 570 sends serial data up to 53 miles at up to 115kpbs
- Ruggedcom RMC 20 sends serial data up to 1 mile at up to 115kpbs

Ethernet Switches

- SEL 2725 unmanaged switch with five (5) self configurable ports sends data up to 9 miles at 10 or 100Mbps
- GE/Multilin ML600 unmanaged switch with six (6) self configurable ports sends data up to 8 miles at 100Mbps
- RuggedCom RMC 40 unmanaged switch with four (4) self configurable ports sends data up to 56 miles at 100Mbps

Point-to-Point/Point-to-Multipoint Radios

- SEL 3060A sends data up to 15 miles at 1Mbps via ethernet at 900Mhz
- GE/MDS Orbit sends data up to 60 miles at 1.25Mbps via ethernet at 900Mhz
- ABB/Tropos sends data up to 31 miles at up to 108 Mbps via ethernet at 3.3-5.8Ghz

SCADA ready

Controls come standard with a DNP3.0 serial point map to control and monitor the switch using SCADA. Multiple protocols are available including DNP3.0, DNP IP, Modbus/Modbus IP and IEC 61850. Ethernet or fiber optic ports for communications are also available.



▲ SEL 2800M transceiver



▲ H&L 570 transceiver



▲ RuggedCom RMC40 Ethernet switch

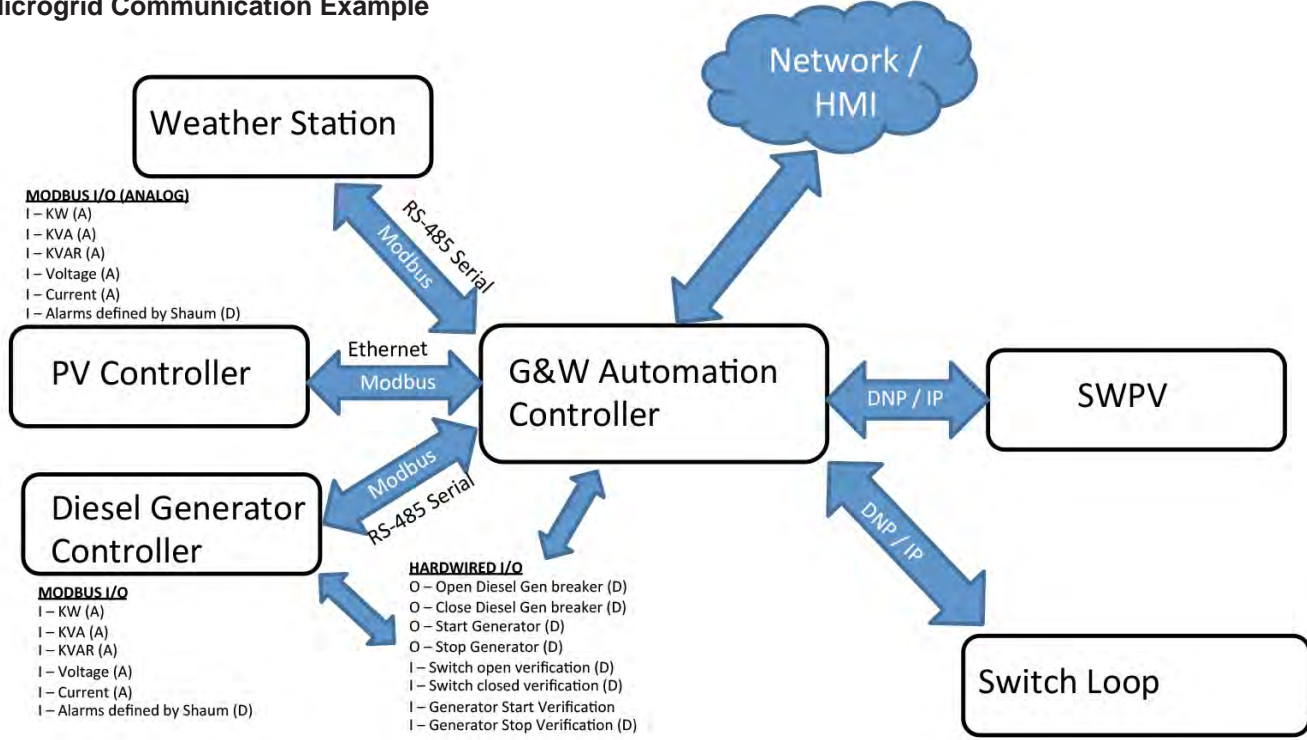


▲ SEL 3060A radio



▲ GE/MDS Orbit radio

Microgrid Communication Example



Gas Pressure Gauge and Fill Valve (Standard)

is a “GO-NO-GO” style which is color coded to simplify verification of proper operating conditions. A Schraeder type fill valve permits refilling in the field. The gauge and fill valve are made of brass for corrosion resistance. Both components are protected by a steel guard.



Temperature Compensated Gas Density Gauge (Optional)

measures internal tank gas density for maximum precision of switch operating conditions. The gauge is colored coded to simplify reading by operating personnel.



Viewing Windows (Standard)

provide a means to visibly verify switch contact position. Single phase or three phase contact viewing is available.

Ground Lugs (Optional)

are bronze, eyebolt style for 4/0 maximum conductor cable.

Low SF₆ Remote Monitoring Devices:

1) **Low Pressure Warning Devices** are factory set at 5 psig and permit remote indication of internal tank pressure. It can also be used for low pressure control lockout. One Form C contact is provided for wiring by the customer. *Recommended for installations where ambient temperature does not fall below 0°F (-15°C).*



2) SF₆ Density Switches

permit remote indication of internal tank gas density to assure proper pressure/temperature operating conditions. One Form C contact is provided for wiring by the customer. *Recommended for non-submersible installations where ambient temperatures fall below 0°F (-15°C).*



Typical Specifications

DESCRIPTION

A. The switch shall consist of load interrupting, SF6 insulated, 630A rotary puffer switches and manually operated, electronically controlled fault interrupters. The switches shall be designated G&W SF6 insulated switchgear with Control Package

SWITCH CONFIGURATION

A. Each switch shall be equipped with 3-phase load break switch ways with integral ground position and 3-phase fault interrupter ways with internal ground switch.

B. Switches shall be designed for front access to switch operators and rear access to cables.

SWITCH CONSTRUCTION

A. General

Switch contacts and cable entrance terminations shall be contained in a single welded mild steel tank with entrances internally connected by copper conductors. Construction shall be a dead front design. Switches shall be shipped factory filled with SF6 gas conforming to ASTM D-2472. Switch tanks shall be painted ASA70 light gray using a corrosion-resistant epoxy paint. Switch tanks shall be Arc Resistant when switches with a ground position are required.

B. Load Break Source Switch

Each switching way is to be equipped with an internally mounted operating mechanism capable of providing quick-make, quick-break operation in either switching direction. The operating mechanism shall be actuated from outside the switch tank with a motor operator. Switch contacts shall be clearly visible in the open position through viewing windows.

C. Fault Interrupters

The fault interrupter shall consist of vacuum bottles and a spring-assisted operating mechanism. The mechanism shall consist of three vacuum bottles mechanically linked to a single spring-assisted operating mechanism. The vacuum interrupter operating mechanism shall consist of the support assembly, linkage, spring latch mechanism, and solenoid utilized for electronic tripping. Maximum interrupting time shall be three cycles (50 msec). The mechanical linkage assembly shall provide for a "trip-free" operation which allows the fault interrupter to interrupt independent of the operating handle.

DESIGN RATINGS

A. Switch Ratings

The switch shall be rated (*select appropriate column*):

Ratings	IEEE / IEC		
	15.5	27	38*
Max System Voltage (kV)	15.5	27	38*
Impulse Level (BIL) Voltage, kV	110	125	150
Continuous Current (A)	630	630	630
Load Break Current (A)	630	630	630
One Minute Withstand (dry), AC kV	35	60	70
Production Test Rating	34	40	50
15 Minute Withstand, DC kV	53	78	103
Momentary Current, kA, ASYM	40	40	40
Fault-Close Current, kA, ASYM	32 or 40**	32 or 40**	32
One Second Current, kA, SYM	25	25	
Fault Interrupting Rating, kA, SYM	12.5	12.5	
Mechanical Endurance, Operations	2000	2000	

*38kV applies to TNI only.

**40kA LPFI only

B. Interrupters shall be tested to IEEE C37.60 Fault Interrupter Duty per the table below.

Percent of Maximum Interrupting Rating:	Approx. Interrupting Current Amps:	No. of Fault Interruptions:
15-20%	2000	44
45-55%	6000	56
90-100%	12000	16
Total Number of Fault Interruptions: 116		

Typical Specifications

Cable Entrances

A. Cable entrances shall be tested to IEEE 386 and be, as indicated on the switch drawing:

- ____ 600A Apparatus bushing with integral voltage sensing bushings
- ____ 200 amp Deepwell bushing (external digital voltage sensors required for source ways equipped with voltage sensing bushings)

B. Fault Interrupters

Cable entrances shall be tested to IEEE 386 and be, as indicated on the switch drawing:

- ____ 600 amp G&W Quik-Change disconnectable apparatus bushing,
- ____ 200 amp Deepwell bushing.

Motor Operators

A. Motor operators for local and remote supervisory control shall be available for load break and fault interrupter ways.

B. Each motor operator shall have its own motor interface board, located within the control enclosure.

C. Decoupling shall be required to manually operate a way equipped with a motor operator.

D. Removing the motor operator for decoupling shall be a simple, quick process requiring only standard tools.

E. The motor operators shall take no more than five seconds to change state from the time a local or remote control signal is received.

F. The motor operator shall be watertight. Each unit shall be submersion-tested to verify that water under pressure does not enter the operator housing.

G. A mechanical interlock shall be provided to prevent a decoupled motor operator from being incorrectly recoupled.

Current Transformers

A. Current transformers are required for each phase of each fault interrupter way.

1. Integral current transformers shall provide outputs of 1A or 5A for overcurrent controls.
 - a. 500:1 / 1000:1 ratio to be used (user to select ratio)
 - b. External current transformers shall provide outputs of 1A or 5A for overcurrent controls.
 - c. ____ ratio and ____ accuracy are required

Voltage Sensing

A. Voltage sensing is required for each phase of each load break way.

1. Integral voltage sensors shall be used when the system is grounded wye.
 - a. Low energy signals will be used when using a relay that has low energy voltage inputs available.
 - b. Amplified energy signals will be used with a relay that only has high energy voltage inputs available.
2. Voltage transformers may be used when high accuracy is required such as voltage syncing before operation. Voltage transformers are required for ungrounded wye and delta systems.
 - a. ____ ratio, ____ accuracy, ____ kVA ratings are required

Control

A. Product Construction

1. Enclosure shall be NEMA 4 (mild steel) or NEMA 4X (stainless steel).
2. Power supply
 - a. Requires 120VAC/240VAC control power for operation.
 - b. Power supply shall include battery test (control sends a battery test command either via included programmable timer or specific customer request). AC power and battery status are displayed on the front panel (for 120VAC or 240VAC power supply only).
3. Control shall include a GFCI outlet with an AC throw-over switch.
4. Control shall include a document holder and a padlockable handle.
5. Control shall include test switches for all current transformer (CT) and potential/power transformer (PT) connections.
6. Control shall include din rail mountable terminal blocks for all non-CT/PT connections.
7. Communication Ports - The control shall have two communications ports for dedicated relay-to-relay communications.
8. Environment - The control shall be suitable for continuous operation over a temperature range of -20° to +50°C if batteries are included and -40°C to 70°C if batteries are not included.

B. Product Features

1. Communication - device communication capability shall include Distributed Network Protocol (DNP), Modbus RTU or IEC61850. The control shall incorporate certified DNP3 Level 2 Slave protocol.
2. Event Reporting and Sequential Events Recorder - Events shall be stored in nonvolatile memory. The relay shall also include a Sequential Events Recorder (SER) that stores the latest 1000 entries.
3. The control shall include the following front panel interface features:
 - a. Operation pushbuttons for each operated way
 - b. Local/Remote pushbuttons.
 - c. LED indication for:
 - i. Source switch status
 - ii. Source health status
 - iii. Load way position status
 - iv. Cause of events
 - v. Malfunction or blocked conditions.

Padmount Enclosure

The enclosure shall be fabricated of 12 gauge galvanized steel and manufactured to ANSI C37.72 and C57.12.28 standards. The enclosure shall be tamper resistant incorporating hinged access doors with pentahead locking bolts and provisions for padlocking. The enclosure shall be provided with lifting provisions and painted with a Munsell 7.0GY3.29/1.5 green finish.

Automated Switch Selection

SYSTEM INFORMATION:

Mechanisms:

- 5 Second Operation (TNI, LPFI)
Number of Ways: _____
- 8 Cycle Operation (LPFI – LP mechanism only)
Number of Ways: _____

Voltage Class:

- 15kV
- 25kV
- 35kV

Symmetrical Current Interrupting Rating for Fault Interrupter Ways:

- 12.5kA
- 20kA (NI only)
- 25kA (NI only)
- 32kA (NI only)

Bushings:

	Source	Tap
Copper Rod VS Bolted Apparatus (default for source ways)	<input type="checkbox"/>	<input type="checkbox"/>
Copper Rod Bolted Apparatus	<input type="checkbox"/>	<input type="checkbox"/>
Aluminum Rod Bolted Apparatus	<input type="checkbox"/>	<input type="checkbox"/>
Bolted Quick Change	<input type="checkbox"/>	<input type="checkbox"/>
Bolted Deepwell	<input type="checkbox"/>	<input type="checkbox"/>

Way Numbers of Load Break Mechanisms Being Motor Controlled:

- Two Position Motor
Ways: _____
- Three Position Motor (TNI only)
Ways: _____

Motor Connection Type:

- Hardwired (default)
- Connectorized

Type of Motor:

- No encoder – required internal feedback on the switch (default)
- Encoder – can be used with internal feedback if customer wants to run the motors while decoupled from the switch (required on most retrofit applications)

Automated Switch Selection

Way Numbers of Fault Interrupter Mechanisms Being Controlled:

(G&W supplies FIs as standard on Source Ways)

Overcurrent Only

Ways: _____

Overcurrent Control and Motor Control

Ways: _____

Way Numbers of Load Break Mechanisms Not Being Controlled: _____

Way Numbers of Fault interrupter Mechanisms Not Being Controlled: _____

Voltage Sensing:

Integral Voltage Sensing Bushings (default)

Lindsey Sensors (default)

Digital Elbow Mounted Sensors

SEL Sensors (FCI Division of SEL)

PTs (default supplier is ABB)

PT(s) mounted internal to the tank (required if switch is 38kV)

PT(s) mounted external to the tank (15kV and 25kV switches)

Ways requiring voltage sensing _____

System Type:

4 Wire Grounded Wye

3 Wire Wye or Delta - Highly suggested to use PTs for voltage sensing

CONTROL OPTIONS:

Preferred Relay Brand:

ABB

GE

SEL

Siemens

Enclosure Rating:

Mild Steel (NEMA 4)

Stainless Steel (NEMA 4X)

IP68 (Without batteries)

IP68 (With external NEMA 6P Battery Option)

NEMA 4/4X Enclosure Options:

Document Holder

Padlockable Handle

IP68 Enclosure Options:

Viewing Windows

Submersible Serial DNP Port

Manual Operating Handles

Handle Operations: _____

Control Selection

CONTROL OPTIONS CONTINUED:

Control Power:

- 120VAC without battery backup
- 120VAC with battery backup
- 240VAC without battery backup
- 240VAC with battery backup
- Other: _____

Terminal Strip Style:

- Din rail mounted terminal blocks (default)
- Barrier style terminal strip

Test Switches for Fault Interrupter Connections (for all current transformer and trip connections; wiring to and from the test switch will be labeled):

- ABB Test Switches (default)
- Megger MTS States Test Switches
- GE-ITI Test Switches
- Customer Specified Test Switches _____

Other:

- Laptop Power Outlet (GFCI – default – will include an AC throw over switch)
- No Laptop Power Outlet

If cabinet entrances are to be provided, select from the following options:

- 0.138 – 0.315" Cable Diameter
- 0.197 – 0.472" Cable Diameter
- 0.512 – 0.709" Cable Diameter
- 0.748 – 1.0" Cable Diameter

Faulted Circuit Indicators (Default Brand is Horstmann/Power Delivery Products):

- None
- One
- Two
- Total Quantity if More Than Two _____
- Customer Supplied

Communications Options:

- GE MDS Orbit Radio (default)
 - Protocols: _____
 - Platform: 2 Ethernet, 1 Serial 1 Ethernet, 2 Serial
 - Media Types (up to 2): 3G/4G LTE Verizon 3G GSM WiFi b/g/n 900MHz
- Customer Specified Radio Part Number and Protocol _____
- Customer Specified Modem Part Number _____
- Provisions for Radio
 - Radio Manufacturer and Part Number _____
- Antenna
 - Yes No
 - If Yes, brand/type of Antenna (i.e. Laird, Yagi) _____
- Fiber Optic Communication Accessories
- Single Mode Fiber Multi Mode Fiber Connector Types (i.e. ST, LC) _____

G&W offers a complete line of **smart distribution equipment** including:

Lazer® Automation

- Multiple levels of protection
- Open, flexible communication
- Pre-engineered, factory tested
- Transfer, loop, and network applications



Solid Dielectric Switchgear

- To 38kV, 16kA interrupting
- Submersible vault and padmount
- Smart Grid / Lazer® solutions
- Single phase and three phase
- Integral Visible Break Designs



SF6 Insulated Switchgear

- To 38kV, 25kA interrupting
- Submersible vault and padmount
- Smart Grid / Lazer® solutions
- Load and fault interrupting



Solid Dielectric Reclosers

- To 38kV, 12.5kA interrupting
- To 27kV, 16kA interrupting
- Overhead, substation and padmount
- Smart Grid / Lazer® solutions
- Single phase and three phase
- Six voltage sensing available



G&W Electric Company

305 W. Crossroads Pkwy
Bolingbrook, IL 60440-4938 USA
Tel 708.388.5010 Fax 708.388.0755

www.gwelec.com
ISO 9001:2008 Certified
ISO 14001:2004 Certified

Catalog A-sf6-14
April, 2014