#### CATALOGUE EDITION 2025/02

## Fusesaver

Single, two and three-phase medium voltage outdoor circuit breakers

siemens.com/fusesaver





FUSESAVER

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### **Rural network challenges**

Since 80 percent of faults in rural networks are typically temporary, 80 percent of fuse blowouts are unnecessary.

In most rural network configurations, the feeder is protected by a circuit breaker or recloser. Lateral lines (also referred to as T-offs or spur lines) are usually protected by fuses.

As a fuse is unable to distinguish between temporary and permanent faults, it blows on all faults, causing downstream customers to lose power and requiring a line crew to replace the fuse. In rural networks, it may take hours for the line crew to drive to a site, patrol the line, replace fuses, and reconnect supply. This leads to unnecessary high operating costs for the utility.

Furthermore, downstream users are left without power for extended periods of time potentially resulting in financial penalties to the utility.

Due to the low customer numbers on rural lateral lines, it is often difficult for the utility to find a cost effective solution to this problem– until now!





### **Fusesaver**

The world's fastest medium-voltage outdoor reclosing vacuum circuit breaker.

Fusesaver<sup>™</sup> is a unique class of intelligent, compact and low-cost, single-phase reclosing circuit breaker.

With on board microprocessor control and wireless connectivity, Fusesaver has configurable protection, multi-phase operation functions, on-board event history, load profiling and can be integrated into a SCADA system for remote control.

It is an electrically floating device that hangs directly from the medium-voltage line.

It self-powers by harvesting and storing energy from the line current. Fault detection is achieved with a cutting-edge, high-speed protection algorithm that is capable of clearing a fault in as little as a half-cycle making it the fastest medium-voltage circuit breaker in the world.

The Fusesaver can be customer configured to either be installed in conjunction with a partner fuse or as a standalone protection device. Fusesaver (O-1s-C)\* with partner fuse While the fuse protects the lateral line, the Fusesaver protects the fuse from transient faults. Installed in series with the fuse. After tripping on a fault, the Fusesaver stays open for a pre-determined time (dead time) to clear a transient fault. Then, the Fusesaver closes again reconnecting supply. If the line is still faulted, the fuse now operates to clear the permanent fault. This is the traditional Open-Close (OC) Fusesaver approach.



Fusesaver (O-2s-C-O)\* without partner fuse The Fusesaver O-CO is the ultimate Fusesaver as the fuse is not required at all. Replace the fuse altogether. When installed in this manner, the Fusesaver can perform the same Open-Close functionality as above to clear a transient fault but can also perform a second "Open" operation (O-CO) to clear a permanent fault.



\*Highest customer flexibility: One hardware platform, two selectable operating sequences and multiple other configuration file settings.

### **Benefits**

Fusesaver is the most cost-effective solution for optimising reliability while minimising operating costs of rural overhead medium-voltage networks.

The world's fastest vacuum circuit breaker boosts availability for your distribution network by virtually eliminating the effects of faults on lateral lines. Helping utilities increase network reliability, as measured by indexes like SAIDI and SAIFI, Fusesaver also minimises operating costs for overhead MV networks.

Backed up by high energy density storage, Fusesaver can sustain

protection to suit utilities' operational requirements. Wireless multi-phase operation ensures that the impact of adverse environmental conditions is minimised, increasing availability.

With a unique clearing time of as little as 10 ms, Fusesaver minimises the risk of arcs igniting fires, reducing health, safety, and environmental impact.

One low CAPEX for the Fusesaver allows multiple applications to cater to changing requirements, whether seasonal or load evolution, providing operational flexibility.



**Operational flexibility** 



Improved network reliability

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Higher availability with a long hold up time



Fast return on investment, lower operating costs, reduced SAIDI & SAIFI



Minimises the risk of arcs igniting fires



Fast and easy installation



## Components

In order to minimise installation and operating costs, the Fusesaver was developed as part of an integrated system of tools and accessories. All system components work together, which permits easy installation, fast commissioning, and reliable operation in all conditions.

A typical Fusesaver installation includes the following items for each phase:

- 1 Fusesaver
- 2 Line-clamp assembly
- 3 Bird guard
- 4 Communications Module

The unit configures through a wireless connection to a PC application called Siemens Connect.





- 2 Fault-detection current transformer
- 3 Vacuum interrupter
- 4 Bird guard
- 5 Power current transformer
- 6 Magnetic actuator
- 7 Electronic module

#### Design of the switch unit

The Fusesaver is a fully integrated unit consisting of a vacuum interrupter driven by a magnetic actuator. Onboard current transformers both power the Fusesaver and provide current measurement inputs into the built-in electronics control and protection module.

The external insulation is high-grade silicone rubber and the mechanism housing marine-grade aluminium for long outdoor life.

#### Self-powering

The Fusesaver is capable of self-powering from the very low line currents found on rural overhead networks.

5 2 3

6

#### **Magnetic actuator**

The magnetic actuator is an innovation by Siemens that was applied to the Fusesaver to provide half-cycle interruption capability.

The magnetic actuator is directly coupled to the position indicator, which is visible from ground level.

#### **Position indicator**

The indicator is directly coupled to the magnetic actuator and has red/green colours to indicate closed/open status (colours can be reversed by special order).



#### Nameplate

Note: For any request regarding spare parts, subsequent deliveries, etc., the following details are necessary:

- Type designation
- Serial No.
- Year of manufacture

D	SIE	MENS	$\bigcirc$
	Type <b>3AD8423</b>	Year of manuf. 2018	
	No. NGJ 3AD8/0001000	Ir 200 A	
	Ur 27 kV 50/60 Hz	Ima 6.3 kA	
	lsc 6.3 kA, tk 1 s	M 5 kg	
<u> </u>	Ud/Up 60/125 kV	0 - 2s - CO / 0 - 1s - C	
)	MADE IN AUSTRALIA	According to IEC 62271-100	-0)

#### Vacuum interrupter

Fusesaver relies upon Siemens well-established vacuum interrupter technology. The Siemens vacuum interrupter in the Fusesaver enables extremely fast fault interruption.





#### **External lever**

The Fusesaver is fitted with an external lever that allows an operator to change the protection and other operational parameters of the Fusesaver. For example, when live-line work is performed downstream of the Fusesaver, the operator can pull the lever down to change the Fusesaver protection to a fast curve with single trip to lockout.

## Mounting

Fusesaver is an electrically floating device, eliminating the need for grounding. This product architecture allows for a number of different mounting options. In enables a variety of mounting options, with the device designed to be mounted horizontally in all cases.

#### Line mounting

The preferred method for mounting the Fusesaver is to hang it directly from the line using the line-clamp assembly. The line-clamp assembly connects directly to the dead-end of the conductor and ensures that the Fusesaver is hung at its centre of mass. A cable connects the Fusesaver terminals to the conductor.

#### Crossarm or pole mounting

For locations where it is impractical to line mount the Fusesaver, an alternative is to use a crossarm or the pole. A post insulator with special end brackets is used to support the Fusesaver.

#### Wildlife guard

To prevent interruptions caused by wildlife, a specially designed wildlife guard fully insulates the Fusesaver's terminal.

#### **Crossarm mounting**



#### **Pole mounting**



- 1 Crossarm-mounting bracket
- 2 Stand-off insulator
- 3 Wildlife guard
- **4** Pole-mounting bracket

#### Line mounting



## **Communications Module**

The Communications Module plugs into the Fusesaver and provides a short-range wireless link between the Fusesavers and to an RCU and laptop. It also has a built-in battery to provide a backup energy source to the Fusesaver during periods without line current.

### The Communications Module serves multiple purposes:

- Enables configuration and testing of the Fusesaver during commissioning
- Allows manual operation, line data access, and event log downloads during service
- Provides multi-phase protection functionality
- Facilitates synchronous ganged manual operation
- Integrates the Fusesaver into the user's SCADA network by enabling connection to the Remote Control Unit (RCU) and the above functions

#### **Wireless communications**

The Communications Module includes an intelligent, short-range wireless transceiver, which enables encrypted communication using the public 2.4 GHz band.

#### Battery

The included battery cells provide power to run the Communications Module radio and manually operate the Fusesaver during periods without line current. The battery cells are rechargeable and charged by the Fusesaver's line current. If needed, the battery cells can be replaced through the access panel.

#### **Communications Module**



- 1 Trip actuator
- 2 Close actuator
- 3 LED
- Three-pin Fusersaver connection
- 5 Access panel

#### LED and fault-passage indication

The Communications Module features a highintensity status LED. When illuminated, this status LED is visible from the ground in daylight. The status LED can assist the operator during commissioning and when manually operating the Fusesaver. In the event of a line fault, the status LED flashes for up to seven hours to indicate a fault current has passed through the Fusesaver.

#### **Tripping and closing**

The Communications Module is fitted with external actuators that may be used to trip or close the Fusesaver. Using the wireless communications between the Fusesavers, it is also possible to synchronously trip and close Fusesavers on adjacent phases.

#### Attachment tool

A specialised attachment tool enables users with a live-line stick to insert and remove the Communications Module from ground level.





### **Siemens Connect software**

With the use of Siemens Connect (computer application) and a PC communications interface, communication with the Fusesaver is enabled. These items allow an operator in the field a short-range (approx. 20 m) access to the Fusesaver over the encrypted radio link.

#### Configuration

In a multi-phase application, Fusesavers are configured wirelessly via Siemens Connect. First, Fusesavers need to be identified and set up as a site. Next, the configuration file is uploaded, which includes the protection settings specified by the utility. After that, users must define the type and rating of the Fusesaver's partner fuse or the fuse it is replacing. The entire process takes only a few minutes.

If network requirements change, the Fusesaver can be reconfigured with new protection and operational settings while remaining in service.

#### PC communications interface



ain Menu	
o setup and configure a new installation, click on the 'New Installation' button	New Installation
o reconfigure or unconfigure an existing installation, click on the 'Update Installation' button	Update Installation
To operate an installation, click on the 'Operate an Installation' button	Operate an Installation
Update firmware on a fusesaver or manage firmware packages	Update Firmware +
o work with the event database, click on the 'Manage Events' button	Manage Events
o work with configurations, click on the 'Manage Configurations' button	Manage Configurations
To work with update log files, click on the 'Manage Logs' button.	Manage Logs

#### Operation

When on-site, the line crew can access the live data in the Fusesaver using the Siemens Connect PC application.

The operators also have the ability to trip and close the Fusesaver using controls from the PC.

	EI	M	ΕR	1S								
perate	Line	- Ausn	etAuto	closeTe	əst	-	-	-	-	-	-	-
Live Data												
Pho	50	Status	Current RMS	External Lever	Protection Running	Protection		Mechaniam Trip Count	Poor	Battery Life	VI	Identify
А		Closed	Off	Up	Yes	Fast - Norm	al l	52	Yes	95% (R)	96%	Rask
В	1	Closed	Off	Up	Yes	Fast - Norma	al	324	Yes	95% (R)	85%	Flash
с	- 1	Closed	Off	Up	Yes	Fast - Norm	al	318	Yes	95% (R)	41%	Flash
Last Fault D	etals										Famil	Hetory
Phase	RMS	Peak	Dura	tion	Туре	Timestamp						,
A	49 A	70 A	10 mt		No Reclose	26 Mar 2024 16:	23:35				Device	Details
B	N/A N/A	N/A N/A	N/A 500 m		Cleared Cleared	26 Mar 2024 16: 26 Mar 2024 16:	24:24 24:24			[	Config	Report
Fuse Details						C	onfiguration Nam	e				
7A, Coo	per BB	U Class E	Standar	d Boric		1				1	Det	als
Operate						-ANT Signal						
						A	В	C				
	01			-		-		-			0.	

Event Time - UTC+10:00) Brisbane	A	В	c
12 Apr 2024 08:33:45		Communications Module Disconnected	
12 Apr 2024 07:47:47		Active protection mode set to: Fast - Normal	
2101202401.41.41		Active protection mode set to: Fast Single	
		Active protection mode set to: Fast - Normal	
2 Apr 2024 07:47:41		Battery Life Remaining: 95%	
		Active protection mode set to: Fast Single	
	Active protection mode set to: Fast Single		
26 Mar 2024 17:04:49	Communications Module Disconnected		
			Active protection mode set to: Fast Single
26 Mar 2024 17:04:09			Communications Module Disconnected
6 Mar 2024 17:04:05	Line Current Off		
6 Mar 2024 16:24:25	Cleared Fault		
		Outage - Duration 000:00:00:48	Outage - Duration 000:00:00:48
to Mar 2024 16:24:24		Cleared Fault	Cleared Fault
	Outage - Duration 000:00:00:10	Auto Close	Auto Close
6 Mar 2024 16:23:45	Line Current On		
	Auto Close		
26 Mar 2024 16:23:36	Protection Trip - 1st trip - Fault Instant - Maximum Recorded Peak 70A - Load 1A RMS - Estimated Fault Duration 10ms	Protection Trip - Backfeed Block	Protection Trip - Backfeed Block
	Cleared Fault	Outage - Duration 000:00:00:48	Outage - Duration 000:00:00:48
26 Mar 2024 16:11:50		Cleared Fault	Cleared Fault
26 Mar 2024 16:11:11	Outage - Duration 000:00:00:10		
Event time is o	ut of order. Time is unknown.	Indicates a calculated event.	
Outp	ut Options		
Fiter	older Print Excel	Time Zone: Configuration	V Refresh Close

#### Load profile data

The Fusesaver collects data on the electrical current flowing through each phase of an installation. It can report the following data for each 24-hour period:

- Minimum current (with timestamp)
- Maximum peak current (with time-stamp)
- Average daily current



#### **Event data**

The Fusesaver keeps a time-stamped record of significant events in its onboard memory. This record includes the history of up to 3,000 events, such as protection operations, fault data, outage durations, and configuration changes.

Users can view this event data through the Siemens Connect PC application, where it can be filtered and exported as needed.

To: Wednesday, 30 September 2 To: Wednesday, 24 April 2024, 2:	020, 9:55 AM 31 PM		
Parameter	A	В	С
No. of surges detected	0	0	0
No. of detected faults	0	2	0
No. of cleared faults	19	13	18
No. of permanent faults	0	0	1
Duration of outpages from permanent fo	ulte 0h 0m 0e (0e)	0h 0m 0s (0s)	1h 21m 0s
Duration of outages from permanent is			(4860S)

#### **Reliability data**

The line reliability analysis tool enables users to generate performance data that reflects the reliability of a specific line.

### **Fuse saving and reclosing applications**

#### **Time-current curve**

Fusesaver utilises two protection algorithms and can store a NORMAL and a FAST protection curve:

1. Fuse saving based on an i<sup>2</sup>t value: This state-ofthe-art, high-speed protection algorithm can detect faults within 2ms. On the first trip, the Fusesaver can clear the fault in the first half-cycle after contact part if necessary. The inverse part of the NORMAL curve (d) is defined by the i<sup>2</sup>t of the fuse type the Fusesaver is protecting or replacing. Additional configuration items required for each curve are the pick-up level (d1), the maximum time element (d2), the instantaneous multiplier (d3), the minimum time element (d4), and the FAST curve inverse multiplier (d5). 2. Reclosing using IDMT: This involves an inverse definite minimum time algorithm which calculates the operating time inversely proportional to the fault current, whilst ensuring a minimum operating time threshold if required. Standard inverse, very inverse and extremely inverse curves are , along with a universal definite time option.

#### Fusesaver with partner fuse - time-current curve<sup>1</sup>



- b K-type 15 A fuse
- d Fusesaver set to coordinate with a 15 A K-type fuse
- d1 Minimum trip-current multiplier (x2)
- d2 Maximum fault time (0.5 sec)
   d3 Instantaneous multiplier (x10)
- d4 Minimum fault time (OFF)

#### Fuse replacement protection - time-current curve



- Fusesaver set to coordinate with a 30 A K-type fuse
- **d1** Minimum trip-current multiplier (x2/x1)
- d2 Maximum fault time (1.5 sec/1 sec )
- d3 Instantaneous multiplier (x20/x8)
- d4 Minimum fault time (0.1 sec/OFF)
- d5 Fast curve inverse multiplied i<sup>2</sup>t

#### **IEC Extremely Inverse**



<sup>1</sup> A fast protection curve can be added as shown in the lower figure

#### **Protection modes**

The operation of the Fusesaver's protection can be modified by selecting different protection modes. The available modes depend on whether the Fusesaver is used alongside a partner fuse or as a replacement for a fuse. Additionally, the Fusesaver stores a mode selection that applies when the external lever is in the UP or DOWN position, enabling users to adapt to different operational requirements when a live line crew is working downstream of a Fusesaver.



#### Pseudo three-phase trip and reclose and three-phase lockout protection

Mode	ос	осо	Functionality
Protection OFF	Yes	Yes	The Fusesaver does not trip on a fault.
Normal	Yes	No	The Fusesaver trips based on the NORMAL curve settings and recloses after the dead time.
Fast	Yes	No	The Fusesaver trips based on the FAST curve settings and recloses after the dead time.
Normal- normal	No	Yes	The Fusesaver trips based on the NORMAL curve settings. The Fusesaver recloses after the dead time. If the fault is still present, the Fusesaver trips a second time based on the NORMAL curve settings and then stays in the open state.
Normal- fast	No	Yes	The Fusesaver trips based on the NORMAL curve settings. The Fusesaver recloses after the dead time. If the fault is still present, the Fusesaver trips a second time based on the FAST curve settings and then stays in the open state.
Fast- normal	No	Yes	The Fusesaver trips based on the FAST curve settings. The Fusesaver recloses after the dead time. If the fault is still present, the Fusesaver trips a second time based on the NORMAL curve settings and then stays in the open state.
Fast-fast	No	Yes	The Fusesaver trips based on the FAST curve settings. The Fusesaver recloses after the dead time. If the fault is still present, the Fusesaver trips a second time based on the FAST curve settings and then stays in the open state.
Normal- single	Yes	Yes	The Fusesaver trips based on the NORMAL curve settings. The Fusesaver does not reclose and stays in the open state.
Fast-single	Yes	Yes	The Fusesaver trips based upon the FAST curve settings. The Fusesaver does not reclose and stays in the open state.

#### Inrush restraint

When the line is re-energised following an outage, short-term inrush currents occur due to motor starting and transformer core-magnetisation. The Fusesaver can be configured with an inrush pick-up multiplier to temporarily raise the fault pick-up threshold, thereby preventing unnecessary tripping caused by inrush currents.

#### **Cold-load pickup**

Following an extended outage, the loss of load diversity can result in higher-than-normal current levels upon restoration, until diversity returns. The Fusesaver can be configured with a cold-load multiplier to temporarily raise the fault pick-up threshold for a set period, preventing unnecessary tripping due to elevated load currents.

#### **Dead-time setting**

The dead time is the interval between when the Fusesaver trips on a fault and when it closes again. Generally, a longer dead time increases the likelihood that the Fusesaver will clear a transient fault. Dead time is adjustable within a range of 1 to 60 seconds, depending on the application.

### Pseudo three-phase trip and reclose

When all Fusesavers at a site are equipped with communication modules, they can be configured such that if one unit detects a fault and trips, the other two phases trip shortly afterwards. Subsequently, all three phases reclose simultaneously after the dead time of the Fusesaver that tripped first. This feature can be used to block backfeed current on a delta load circuit.

#### **Three-phase lockout protection**

When all Fusesavers at a site are equipped with communication modules, they can be configured to ensure that if any one unit trips to lockout, all three phases will trip to lockout after a brief delay. The Fusesaver can be configured with both the pseudo three-phase trip and threephase lockout functions enabled.



# Switching application

Temporary isolation of a line at non-designated switching locations is often necessary for maintenance purposes. Traditional in-line tension disconnects, lacking ganged switching capability, lead to operational inefficiencies due to:

- Restrictions in load breaking capability
- Restrictions in load pickup
- The risk of ferroresonance due to single-phase switching operations
- Additional time required to isolate upstream devices before operating the in-line disconnect

#### Switching operation

When manufactured for switching applications, the Fusesaver addresses these issues by being pre-configured as a 3-phase synchronous portable switch. Equipped with an optional in-line tension mounting arrangement that eases installation and provides visible isolation, the Fusesaver enhances operator safety and reduces network stress during maintenance.

- Ferroresonance is eliminated: Wirelessly ganged switching eliminates ferroresonance by operating all phases synchronously.
- Reduced network disruption: A 400A load current rating removes the need to offload transformers before switching.
- Improved Operator Safety: No external arc is drawn during switching operations.



# Sectionalizer application

Automatic line sectionalizers work in tandem with an upstream recloser or circuit breaker. A Fusesaver equipped with sectionalizing firmware will automatically open after detecting a predetermined number of fault-clearing attempts by the upstream recloser.

#### Sectionalizing operation

The Fusesaver identifies the main current impulse generated by a fault and the subsequent absence of current when the upstream recloser opens. If the fault persists when the recloser closes, another main current impulse will occur. The recloser trips again, and the sectionaliser increments its sequence count.

This process continues until the count reaches a user-configured threshold. Once this threshold is met, the Fusesaver opens during the reclose interval, isolating the faulted line segment.

#### Pickup level

Users can configure the pick-up level to detect when a downstream fault has occurred. The current must exceed this value for at least 15 ms. The pick-up level is adjustable from 5 to 200 A.

Pick-up modifiers, such as inrush restraint and cold load pickup, can also be applied when the Fusesaver operates as a sectionalizer.

#### Sequence count

If an upstream recloser detects a fault then trips, resulting in a deadline, the Fusesaver's sequence count will increment. The Fusesaver can be set to have a sequence count ranging from 1 to 4.

#### **Three-phase lockout protection**

When Fusesavers are used at a multi-phase location as a sectionalizer, they can be configured to trip to lockout after a short delay if any unit performs a sectionalizer trip.



### Ratings

#### Standards

The Fusesaver conforms to the relevant sections of IEC 62271-100.



Fusesaver is available in several models, differentiated by their load current, fault current, and ability to self-power from line current as follows:

Model type	Unit	Low Range	Standard range	High Range
Minimum line current for operation and battery charging	A	0.15	0.5	1
Rated current I <sub>r</sub>	A	40	100	200
Rated short-circuit breaking current $I_{sc}$	kA	1.5	4	6.3
Rated short-circuit making current I <sub>peak</sub>	kA	3.75	10.4	16.4
Rated short-time current $I_k$	kA	1.5	4	6.3
Rated short-time current duration $t_k$	S	0.2	0.2	0.5
Fault-break operations at 100%	No.	300	70	30
Rated operating sequence		0 – 1s – C/O – 2	s – CO	
Rated clearing time (1st O/2nd O in sequence)		< 20ms / < 60m	S	
Opening and closing times		< 20ms		
Rated line-charging current	А	20	20	20
Mechanical operations	No.	2,000	2,000	2,000
IP rating		67	67	67

All Fusesaver models are offered with the following voltage rating options:

Rated voltage	kV	15.5	27
Rated lightning-impulse withstand voltage $U_p$	kV	110	125
Rated power-frequency withstand voltage $U_d$ (60 s)	kV	50	60

#### Altitude correction factor

The dielectric strength of air insulation diminishes with increasing altitude due to lower air density. The rated withstand voltage values specified above correspond to a site altitude of 1,000 m above sea level.

For altitudes exceeding 1,000 m, the insulation level must be adjusted according to IEC 62271-1. This adjustment applies to the rated power-frequency withstand voltage and the rated impulse withstand voltage.

To select the devices, the following equation is used:

#### $U \ge U_o \ge K_a$

- U = Rated withstand voltage at reference atmosphere
- $U_o =$  Rated withstand voltage requested for place of installation
- $K_a$  = Altitude correction factor from the diagram

#### **Ambient conditions**

The Fusesaver is designed for use in outdoor environments with ambient temperatures ranging from  $-40^{\circ}$ C to  $+50^{\circ}$ C and relative humidity ranging from 0% to 100%.

Service Environment	Rating
Humidity	0 to 100%
Maximum altitude	4,000 m



+50°C

-40°C

#### Altitude correction factor



## Battery performance

#### **Battery capacity**

The Rechargeable Communications Module (RCM) is fitted with two 18650-sized Li-ion battery cells, each with a capacity of 2,000 mAh.

An RCM with fully charged batteries under standard temperature and pressure conditions can supply backup power to the Fusesaver with inadequate line current as follows:

Battery use type	Performance specification
Fusesaver hold-up time	> 10 days, or
Number of trip/ close operations	> 300 operations

The battery capacity decreases at low temperatures, as indicated in the following chart. To determine expected performance at low temperatures, multiply the percentage from the chart by the expected hold-up time or the number of trip/close operations shown in the table above.

As the battery cells age and approach the end of their lifespan, the available capacity diminishes, and the rated performance may not be met.

#### **Temperature effects on battery capacity**



Temperature (°C)

#### Recharging

When the unit's battery is depleted, the time required to recharge the consumed energy is inversely proportional to the available line current. The time needed to replenish the charge used to provide 24 hours of hold-up for the Fusesaver is illustrated in the accompanying figure.

#### **Electrical life**

The electrical life of the Fusesaver is determined by the fault interruption capacity of the vacuum interrupter. The electronic controller monitors the frequency and magnitude of interruptions to estimate when the vacuum interrupter has reached the end of its lifespan.

For instance, the vacuum interrupter would become worn out after performing 1,000 load-current interruptions at 100 A, using 50% of its available life, and 35 fault-current interruptions at 4,000 A, consuming the remaining 50% of its life.

#### Battery recharge time (after 24 hour outage)



#### Vacuum interrupter electrical life



### **Remote Control Unit**

#### Gateway to remote access. Unlock efficiency.

The Remote Control Unit (RCU) is an optional component of the Fusesaver system that facilitates connection to a utility's SCADA system. The RCU is housed within a pole-mounted enclosure containing a microprocessor and a short-range (approx. 20 m) radio for communication with the Fusesaver. To enable communication with the control centre, the utility installs a long-range radio or modem.

#### **RCU** principle

Fusesavers are installed on each phase of the power line and are organised to work as a set to control that line. This arrangement can include one, two, or three Fusesavers for single-phase, two-phase, or threephase lines, respectively.

The RCU serves as an interface between a set of Fusesavers on the power line and a utility's SCADA system. It utilises its configuration to locate and access the installed and operational Fusesavers, communicating with them via its built-in short-range radio.

During operation, the RCU collects data from the Fusesavers and stores it in its database. This data is then transmitted to the utility's SCADA system master station over a long-range radio or modem using the DNP 3 protocol. The long-range radio, provided by the utility, is installed in the radio tray by the utility and powered by the RCU. The data in the RCU database includes information about both the Fusesavers and the RCU itself. Typically, a subset of this data is mapped into the protocol utilised by the SCADA system.

#### **RCU system**

To minimise installation and operating costs, the RCU is designed as part of an integrated system of tools and accessories. All system components are designed to work together seamlessly, allowing for easy installation, quick commissioning, and reliable operation under all conditions.

A typical Fusesaver and RCU installation includes the following items for each phase:

- 1. Fusesavers with communications modules permanently installed
- 2. RCU
- 3. Power supply for the RCU

The RCU is configured via a wireless connection to a PC application called RCU Connect.



### **RCU cubicle**

The RCU enclosure is mounted to the pole using a pole-mounting bracket and is constructed from powder-coated stainless steel for long service life. Material options are available at time of ordering, including 304 (standard) and 316-grade stainless steel.

The enclosure features a handle with an internal three-point locking mechanism and can accommodate an external padlock to restrict access.

At the top of the RCU enclosure, there is a high-grade, UV-stabilised plastic shade hood. This hood helps reduce solar heating and provides an aperture for the short-range radio.

The base of the RCU enclosure includes a ground stud and several openings fitted with cable glands, allowing external wiring to access the internals of the RCU.





#### **Electronics housing**

The electronics housing contains the microprocessor, battery, power connection terminals, data connection points, and the user interface for the RCU. It features a simple user interface designed for operations and maintenance purposes. The front panel of the RCU is equipped with several LED indicators.

To conserve power, the LEDs are usually off and automatically illuminate when the door is open, controlled by the position of the door switch.

The electronics housing also accommodates a 12 V, 7.2 Ah lead-acid battery. It is typically powered by a selectable 115/230 Vac low-voltage supply.

#### **Radio panel**

The radio panel is designed to accommodate the installation of utility-specific equipment, such as a radio, modem, or other devices used to connect to the utility's SCADA system.

The panel is hinged on the left, allowing access to the radio behind it. When closed, the panel offers a level of protection against driving rain.



### **RCU** accessories

#### **Operator panel**

The operator control panel is an optional accessory mounted on the front of the radio panel and connects to the RCU's electronics compartment. It enables a local user to trip and close the Fusesavers or to change the active protection mode within the Fusesavers. Additionally, it provides further status information.

Two types of operator panels are available: one for Fusesavers configured in OC mode and another for Fusesavers configured in O-CO mode.



#### Low-temperature option

The low-temperature option includes a positive temperature coefficient element, that functions as a thermostatic heater. This element maintains the battery and electronic compartment above -15°C, even when the ambient temperature drops as low as -40°C. The element is concealed from view.

#### **ANT Extender Kit**

The ANT Extender Kit enhances resilience against signal interference between the RCU and the Fusesaver. It is particularly beneficial in urban environments where other communication devices are in proximity.



#### Solar panel

In environments with consistent sunlight throughout the year, the RCU can be powered using an optional solar power kit. This kit includes the solar panel, mounting bracket, and cable. Solar powering of the RCU depends on the power consumption of the utility's radio or modem being less than 100 mW on average.

The solar panel is connected to a dedicated set of terminals within the terminal compartment as an alternative to the mains supply.

Solar ratings	Value
Power ratings	65 W
Nominal voltage	18 V
Cell type	Polycrystalline

### **RCU communications**

#### **Communications interface**

#### Standards

To communicate with the SCADA system master station, a long-range radio or modem is required. The RCU electronics provide a serial, asynchronous data interface (RS232) and an Ethernet port (RJ45) for this purpose.

A purpose-built cable connects the radio/modem to the RCU interface. The design and construction of this cable can be carried out by the utility or provided as a value-added service by Siemens.

#### **Communications protocol**

The RCU supports the DNP 3.0 protocol over both serial link and IP and the IEC 60870-5-104 protocol over IP. It has over 200 digital points and more than 40 analogue points, providing status information on the Fusesavers and the RCU. Additionally, the RCU can receive a wide variety of control commands from the SCADA master.

#### **RCU** configuration

The RCU is configured wirelessly via the short-range radio using the RCU Connect PC application.

The design and testing of the RCU comply with the relevant parts of IEC 60950-1: 2005, which pertains to information technology equipment – Safety.

#### **Ambient conditions**

The RCU is suitable for outdoor use in environments with ambient temperatures ranging from -40°C to +45°C and relative humidity between 5% and 95%. For temperatures below -15°C, the low-temperature version is required.

#### **Remote Engineering Access (REA)**

Remote Engineering Access leverages the power of Siemens PC tools to offer significant benefits through seamless remote configuration, monitoring, and control.

With REA, engineer workload is reduced and early detection of operational issues is facilitated by allowing the downloading of event logs and load profiles for analysis without the need for on-site visits. Enhanced with IEEE 1686-2022 compliant cybersecurity, REA allows devices to be updated with the latest features and capabilities, thereby reducing the need for site visits.



CU Status lanufacture Date:	27/06/2018	7:03:37 AM	Switchgear Status Line Name:	Fusesaver Line		
CB Revision:	MCU: 3	Power 4 Padia: 3	Number of Switchgear i	n line: 3		
ICU Asset Number:       lestat Count:       attery Life (Days Left rotocol RX Success:       notocol RX Error:       notocol TX:       vent Read Errs:       P Address:       0.0.0       letmask:     0.0.0       attery:     0.0.0	64 64 0 0 99 0 0 0 0 0 0 0 0 0 0 0 0 0	Switchgear Unaccessable Remote Control On Source Power On Battery On Battery Needs Replacing Solar Panel Problem RCU Dummy Point Switchgear Contig Error Switchgear Tribal Fault Battery Roat Charge	Communications OK: Coord: Lever Down: Protection Running: Dummy Point: CM Batery Low: Line Qurrent On: Line Qurrent (Arms): In Force Protection: ANT Signal:	Phase A	Phase B Phase B Pha	Phase C Phase C 0 0 Normal Single
Restart RCU	Sa	ve RCU Configuration				





### **Product selection**

How to choose the right product for your needs.

The Fusesaver order number is used to configure either a Fusesaver or a Remote Control Unit. The relevant data forms a 16-digit order number. The primary part of this number covers the main electrical data of the Fusesaver or specifies an RCU, while the secondary part includes the mounting assembly, communication options, and other features.

#### **Order codes**

Individual equipment versions, marked with 9 or Z in the 8th to 16th position, are detailed through a 3-digit order code. Multiple order codes can be added to the order number in succession and in any sequence.

#### **Special versions**

For special versions, "-Z" is appended to the order number, followed by a descriptive order code. If multiple special versions are needed, the suffix "-Z" is included only once. Should a requested special version not appear in the catalogue and thus be unavailable via order code, it must be identified with "Y 9 9" after consultation. This agreement is arranged between your responsible sales partner and the order processing department.



#### **Configuration example**

Here you can fill in the order number you have determined for your Fusesaver and RCU.

### **Fusesaver configuration**

				Position	: 1	2	3	4	5	6	7	8	9 10	11	12		13 1	4 1	516		0	rder co	des
				Order No	: 3	А	D	8	٠	•	• -	•	• •	•	•	-	•	• •		- ★	•	•	
Rated voltage	Rated lighting impulse withstand voltage	Rated short-duration power-frequency withstand voltage	Rated short-circuit or breaking current	Rated nominal current																			
U <sub>r</sub>	U <sub>p</sub>	U <sub>d</sub>	I <sub>sc</sub>	l <sub>r</sub>																			
kV	kV	kV	kA	А																			
15.5	110	50	1.5	40	з	Α	D	8	2	3	4		А	0	0		0	A A	<u>،</u>				
			4	100	3	Α	D	8	2	2	2		Α	0	0		0	A A					
			6.3	200	3	Α	D	8	2	4	3		Α	0	0		0	A A					
27	125	60	1.5	40	3	Α	D	8	4	3	4		Α	0	0		0	A A					
			4	100	3	Α	D	8	4	2	2		Α	0	0		0	A A	۱.				
			6.3	200	3	Α	D	8	4	4	3		Α	0	0		0	A A					
<b>Fusesaver Mounting Assen</b>	nbly																						
No Fusesaver Clamping/Mounting	Assembly											0											
Line Clamping Assembly incl. Bird	Guard											1											
Pole Mounting Assembly incl. Wild	Pole Mounting Assembly incl. Wildlife Guard																						
Crossarm Mounting Assembly incl.									3														
Pole Mounting Assembly (304 grad									5														
Crossarm Mounting Assembly (304	f grade s/s) incl. Wildlife Guard											6											
Underhung crossarm mount assem	nbly (304 grade s/s)											7											
Communications Module f	or Fusesaver																						
Without Communications Module													с										
With Communications Module (Red	chargeable)												E										
Firmware for Application																							
Fusesaver firmware													А									_	
Sectionalizer firmware													S										
Language of Operation Ma	nual, Nameplate																						
English																			1				
Other languages on request (increa	ased delivery time)																		9		R	1	Υ
Position indicator with interchange	ed colours "Green: CLOSED, Red: OPE	N″																			т	0	7
Fusesaver configuration ex	ample																						
1 x Fusesaver (27 kV, 4 kA, 100 A),	1 x line clamping assembly incl. bird	l guard, 1 x Communications Modul	e		3	Α	D	8	4	2	2 –	1	B A	0	0	-	0	A A	1				

### **Fusesaver accessories/spare parts**

	Position:	1	2	3	4	5		6	7	8	9	10	11	12	13	14	15	16			0	rder co	odes
	Order No:	3	А	х	•	•	-	•	•	•	•								-	$\star$	•		•
Communication Accessories																						Ī	
Fusesaver Communications Module Carry Case Kit		3	Α	х	1	3	5	0	-	1	D												
Fusesaver Communications Module (Rechargeable	e)	3	Α	х	1	3	5	0	-	1	Е												
Fusesaver Communications Module Attachment To (Rechargeable)	loc	3	A	x	1	3	5	0	-	1	G												
Fusesaver Communications Module (Rechargeable excluding batteries	e) —	3	A	x	1	3	5	0	-	1	Н												
Molicel Battery Cell (Qty 1)		3	Α	х	1	3	5	0	-	1	J												
PC Communications Interface (Powered)		3	Α	х	1	3	5	0	-	1	к												
Mounting Accessories																							
Fusesaver Bird Guard		3	Α	х	1	3	5	0	-	2	Α												
Fusesaver Crossarm Bracket Fish Plate Kit		3	Α	х	1	3	5	0	-	2	С												
Fusesaver Wildlife Guard (1 piece) includes 6 clips		3	Α	х	1	3	5	0	-	2	D												
Fusesaver Crossarm Bracket Fish Plate Kit (304 grade s/s)		3	A	x	1	3	5	0	-	2	F												
Fusesaver Crossarm Bracket Fish Plate Kit (316 grade s/s)		3	A	x	1	3	5	0	-	2	G												
Fusesaver Line Clamping Assembly		3	Α	х	1	3	5	0	-	3	Α												
Fusesaver Pole Mounting Assembly		3	Α	х	1	3	5	0	-	3	в												
Fusesaver Crossarm Mounting Assembly		3	Α	х	1	3	5	0	-	3	F												
Fusesaver Bracket to composite insulator		3	Α	х	1	3	5	0	-	3	к												
Fusesaver Pole Mounting Assembly (304 grade s/s)	)	3	Α	х	1	3	5	0	-	3	L												
Fusesaver Crossarm Mounting Assembly (304 grad	le s/s)	3	Α	х	1	3	5	0	-	3	Ν												
Sandwich plate kit for crossarm mounting		3	Α	х	1	3	5	0	-	3	Ρ												
Fusesaver Pole Mounting Assembly (316 grade s/s)	)	3	Α	х	1	3	5	0	-	3	R												
Fusesaver Crossarm Mounting Assembly (316 grad	le s/s)	3	Α	х	1	3	5	0	-	3	т												
Fusesaver Pole Mounting Assembly 170kV		з	Α	х	1	3	5	0	-	3	v												
Underhung crossarm mount assembly (304 grade	s/s)	3	Α	х	1	3	5	0	-	3	w												
Demonstration Kits																							
Demo Kit (27kV/1,5kA/40A Fusesaver)		3	Α	х	1	3	5	0	-	4	D												
Demo Kit (27kV/4kA/100A Fusesaver)		3	Α	х	1	3	5	0	-	4	Е												
Current Injection Set		3	Α	х	1	3	5	0	-	4	F												

### **Remote Control Unit (RCU) configuration**

Pc	osition:	1	2	3	4	5	6	7		8	9	10	11	12		13	14	15	16			Or	der co	des
Ord	der No:	3	А	D	8	•	٠	•	-	٠	•	•	•	٠	-	٠	•	•	•	-	$\star$	•	•	٠
RCU Battery																								
7,2 Ah Lead acid												В												
RCU Enclosure																								
316 stainless powdercoated													2											
304 stainless powdercoated (standard)													3											
RCU Mounting Assembly																								
No RCU Mounting Assembly														0										
Standard Pole Mounting Assembly														1										
Side Mounting Assembly														2										
Standard Pole Mounting Assembly (304 grade s/s)														3										
Standard Pole Mounting Assembly (316 grade s/s)														4										
RCU Protocols																								
DNP3																1								
RCU Isolator and Heater																								
None																	Α							
External Isolated Mains Input																	В							
External Isolated Mains Input and Heater																	с							
Operator Panel																								
None																		Α						
RCU Operator Panel – Fusesaver OC (Modes)																		С						
RCU Operator Panel – Fusesaver OCO (Modes)																		D						
Language of Operation Manual, Nameplate																								
English																			1					
Other languages on request (increased delivery time	e)																		9			R	1	Y
See above at 16th position																								
RCU configuration example		3	А	D	8	8	0	0	-	0	В	В	3	1	-	1	А	А	1					

RCU battery type: 7.2 Ah lead acid, RCU enclosure: 304 stainless steel powder-coated, standard pole mounting assembly, RCU protocol: DNP 3.0, without RCU isolator and heater, without operator panel

### **Remote Control Unit (RCU) accessories/spare parts**

Pos	tion:	1	2	3	4	5		6	7	8	9	10	11	12	13	14	15	16			Orde	er codes	
Orde	r No:	•	•	•	•	•	-	•	•	•	•								-	$\star$	•	• •	
RCU battery 7,2 Ah Lead acid		3	Α	х	1	3	5	0		6	Α												
Solar panel kit 65W		3	Α	х	1	3	5	0		6	В												
RCU Battery 11 Ah Lithium		3	Α	х	1	3	5	0		6	J												
RCU Electronic Enclosure (excluding battery)		3	Α	х	1	3	5	0		6	L												
RCU Power cable		3	Α	х	1	3	5	0		6	м												
Serial Cable RS232 + Power		3	Α	х	1	3	5	0		6	Ρ												
RCU Side Mounting Assembly		3	Α	х	1	3	5	0		7	Α												
RCU Standard Pole Mounting Assembly		3	Α	х	1	3	5	0		7	В												
RCU Standard Pole Mounting Assembly (304 grade s/s)		3	Α	х	1	3	5	0		7	с												
RCU Standard Pole Mounting Assembly (316 grade s/s)		3	Α	х	1	3	5	0		7	D												
RCU Operator Panel – Fusesaver OC		3	Α	х	1	3	5	0		8	с												
RCU Operator Panel – Fusesaver OCO		3	Α	х	1	3	5	0		8	D												

### Dimensions

#### Fusesaver

Dimensions in mm (in)





#### Fusesaver with Rechargeable Communications Module

Dimensions in mm (in)





#### Fusesaver, Rechargeable Communications Module and line-clamp assesmbly

Dimensions in mm (in)





### Dimensions

15.5 – 27 kV Fusesaver pole-mounting assembly – composite insulator

Dimensions in mm (in)



### 15.5 – 27 kV Fusesaver crossarm-mounting assembly – composite insulator





### Dimensions

Remote Control Unit (RCU)

Dimensions in mm (in)





#### Solar panel (RCU powering option)

Dimensions in mm (in)









### Accessories



Wildlife guard



PC communications interface



**Current injection set** 



**Communications Module attachment tool** 



**Communications Module** 



Pole-mount bracket assesmbly

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