

SIMOVAC and SIMOVAC-AR

Medium-voltage controllers 2.3 kV - 6.9 kV

usa.siemens.com/simovac



SIMOVAC™ and SIMOVAC-AR™ - the latest generation of Siemens successful motor controls.

Siemens' experience gained in 50+ years of supplying medium-voltage controllers in the U.S. has been captured in the design.

The objective has been to incorporate features designed to provide safety, while simplifying operation and maintenance, and reducing installation cost.

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Features and benefits

The SIMOVAC™ non-arc-resistant and SIMOVAC-AR™ arc-resistant controllers are the latest generation of Siemens' successful medium-voltage control family.

Introduction
The SIMOVAC family of medium-voltage controller designs brings together increased personnel safety, ease of use, cost-effectiveness, reliability, innovation and flexibility.

Personnel safety
Available in both non-arc resistant (SIMOVAC) and arc-resistant (SIMOVAC-AR) construction, SIMOVAC is designed and tested to comply with UL 347 (6th Edition) (also identified as CSA C22.2 No. 253-09)[1].

For safe operation, mechanical and electrical interlocks are provided to prohibit the user from accessing a controller compartment until the isolating switch is open.

SIMOVAC-AR arc-resistant controllers have also been tested to IEEE C37.20.7 for 63 kA, 0.5 second, with accessibility type 2B.

Easy to use
Securing the 12SVC400 (400 A) controller access door is fast and simple with a six-point latch system. The plug-in option for 12SVC400 contactors makes the removal and installation of the vacuum contactor easy without the need of tools or extra steps.

Snap-in phase barriers provide greater access to the controller power fuses and load-cable terminal lugs. A viewing window provides visible open verification of the isolating switch.

Cost effective
Installation time and cost are improved with the pressure-relief channel (PRC) (for SIMOVAC-AR) shipped assembled and installed on top of each shipping group and the need for spare parts reduced.

Reliable
The rugged bolted enclosure construction is designed to meet the performance criteria for IEEE C37.20.7 for arcing faults up to 63 kA for 0.5 seconds in SIMOVAC-AR. Epoxy insulation applied using the fluidized-bed process is used for main bus to decrease the likelihood of arcing faults. Proven vacuum contactors are rugged and tested for increased reliability. The controllers have improved performance with total current carrying capability per vertical section with two 12SVC400 (400 A) contactors up to 740 A.

Innovation
The universal components approach reduces the number of main components for increased interchangeability and reduced ownership costs. The pressure door flange on SIMOVAC-AR provides containment of hot gases and other by-products resulting from an internal arcing event.

Flexible
SIMOVAC and SIMOVAC-AR controllers have compact footprints. Fixed-mounted contactors or optional plug-in 12SVC400 contactors are available. The main horizontal bus bars are bolted at each section for flexible shipping split arrangements. The medium-voltage and low-voltage compartments have ample space for mounting protective relays and other control devices. For SIMOVAC-AR, connection for the exhaust duct (plenum) is available in front, either side or to the rear, to suit the installation conditions.

Footnote:
1. UL/cUL listing not available for 720 A SSRVS controller.

Applications and solutions

Siemens has provided medium-voltage controller solutions to users in the U.S., Canada, and around the world for construction, industrial, and utility projects for over 50 years.



Typical SIMOVAC non-arc-resistant controller



Typical SIMOVAC-AR arc-resistant controller

The Siemens SIMOVAC medium-voltage family of controllers has a modular design incorporating up to two 12SVC400 (400 A) controllers or one 12SVC800 (720 A) controller per vertical section. The enclosure is designed for front access, allowing the equipment to be located with the rear of the equipment close to a non-combustible wall.

To meet your needs, the Siemens SIMOVAC family of controllers are available as:

- SIMOVAC non-arc-resistant medium-voltage controller, or
- SIMOVAC-AR arc-resistant medium-voltage controller (minimum two vertical sections).

Type SIMOVAC-AR equipment is classified as arc-resistant, for an additional degree of protection to personnel in close proximity to the equipment in the event of an internal arcing event while the equipment is operating under normal conditions.

With SIMOVAC, we offer several types of controllers to meet your specific needs. Typical motor and feeder applications:

- Squirrel-cage induction motors (non reversing, reversing, multi-speed or soft start)
- Transformer feeders
- Power bus feeders (tie).
- Typical controller types:
- Full-voltage non-reversing (FVNR)
- Full-voltage reversing (FVR)
- Two-speed two winding (2S2W)
- Two-speed one winding (2S1W)
- Reduced-voltage autotransformer (RVAT)[1]
- Solid-state reduced-voltage (or soft start) starter (SSRVS)[2].

Controller ratings:

- 400 A fixed-mounted (plug-in optional) - type 12SVC400
- 720 A fixed-mounted - type 12SVC800.

Footnotes:
1. RVAT available up to 5 kV only.
2. UL/cUL listing not available for 720 A SSRVS controller.

Product ratings

The Siemens SIMOVAC controller delivers some of the highest performance in the industry starting with a maximum voltage rating of 7.65 kV (refer to Controller assembly ratings table). Also, two 12SVC400 (400 A) controllers in a single vertical section can be loaded up to 740 A (refer to Controller maximum current capability table).

Controller maximum current capability			
Controller type	Type 1 non-arc-resistant; type 2 non-arc-resistant; type 3 outdoor non-arc-resistant	Type 1 arc-resistant	Type 12 non-arc-resistant
Two-high compartment with 12SVC400 controller	340 A top	340 A top	340 A top
	400 A bottom	400 A bottom	380 A bottom
One-high compartment with 12SVC400 controller	400 A top or bottom	400 A top or bottom	380 A top or bottom
One-high compartment with 12SVC800 controller	720 A	720 A	630 A

Controller assembly ratings					
Maximum voltage kV	Short-circuit current class E2[2] kA	Insulation level (impulse)[3] kV	Main bus continuous current[1] A	Short-time current duration (main bus)	Internal arc resistance (SIMOVAC-AR only)
5.0	63[4]	60	1,200, 2,000, 3,000, 4,000[5]	10 cycles (2-seconds optional)	Accessibility type 2B 0.5 seconds
7.65	63[4]	60	1,200, 2,000, 3,000, 4,000[5]	10 cycles (2-seconds optional)	Accessibility type 2B 0.5 seconds

Footnotes:
1. All main bus ratings are on a self-cooled, ventilated basis.
2. Short-time duration for controllers without main bus is limited to contactor capability (with fuses).
3. Insulation level is for the controller, with inductive transformers disconnected for testing (per UL 347).
4. 50 kA with certain contactor/fuse combinations.
5. Type 12 up to 2,000 A. Type 3R up to 3,000 A.

Contactor/controller ratings										
System voltage	Vacuum contactor	Enclosed continuous ampere rating[1]	Interrupting capacity		Motor horsepower rating (three phase)				Transformer loads[2]	
			Unfused class E1	Fused class E2	Synchronous motors		Induction motors	Maximum motor fuse rating	Maxiumum three phase	Maximum fuse rating
kV	Type	A	kA	kA	0.8 PF	1.0 PF	HP		kVA	
2.3	12SVC400	400	4.8	63[3]	1,500	1,750	1,500[7]	24R[3]	1,500	450E[6]
2.3	12SVC800	720	7.2	63[4]	3,000	3,500	3,000	57X[4]	2,500	900E
4.0	12SVC400	400	4.8	63[3]	2,500	3,000	2,500[8]	24R[3]	2,500	450E[6]
4.0	12SVC800	720	7.2	63[4]	5,500	6,000	5,500	57X[4]	5,000	900E
4.6	12SVC400	400	4.8	63[3]	3,000	3,500	2,500[8]	24R[3]	3,000	450E
4.6	12SVC800	720	7.2	63[4]	6,000	7,000	6,000	57X[4]	5,000	900E
6.9	12SVC400	400	4.8	63[5]	4,000	5,000	4,000	18R[5]	3,750	400E[6]-18R
6.9	12SVC800	720	7.2	63[4]	8,000	10,000	8,000	57X[4]	4,000-6,000	750E[6]-57X[4]

Footnotes:
1. Refer to Controller maximum current capability table for further detail.
2. Based on self-cooled transformer rating.
3. With 24R fuse, interrupting capacity is 50 kA.
4. With 48X or 57X fuse, interrupting capacity is 50 kA.
5. Maximum fuse is 18R.
6. Fuse shown will not permit transformer forced-cooling rating of 133 percent of self-cooled rating.
7. For horsepower greater than 1,500, please consult factory.
8. For horsepower greather than 2,500, please consult factory.

Safety

Arc-resistant

SIMOVAC-AR arc-resistant (minimum two vertical sections per lineup) has been tested to IEEE C37.20.7, accessibility type 2B, up to 63 kA rated arcing current for 0.5 second duration. Accessibility type 2B means protection is provided against an internal arcing fault at the front, sides, and rear of a lineup, and with the low-voltage compartment door open. During an internal arcing event, SIMOVAC-AR is designed and tested to redirect hot gases to the top-mounted pressure relief channel (PRC) and through a compact exhaust duct (plenum) to an area away from the user personnel. The main bus is fully-insulated as standard to reduce the risk of bus faults.

Safe design

SIMOVAC is available in non-arc resistant (SIMOVAC) and arc-resistant (SIMOVAC-AR) construction that complies with UL 347 6th Edition (CSA C22.2 No. 253-09)[1].

Insulated main bus

To reduce risk of arcing faults and provide excellent protection in adverse environments, the top-mounted isolated main power bus and the vertical bus bars are insulated with fluidized-epoxy insulation material. The bus bars are isolated from controller compartments by metal barriers and insulating shutters. Optionally, bus joints may be insulated with preformed insulating boots.

Footnote:
1. UL/cUL listing not available for 720 A SSRVS controller.

Safety during operation and maintenance

Safety during operation of the equipment is enabled by the advanced interlock system that prohibits the user from opening the door of the medium-voltage controller compartment when the isolation switch is closed or the vacuum contactor is in the closed position. The interlock system also prevents the user from operating the isolation switch and the vacuum contactor when the medium-voltage compartment door is open.

When the isolating switch is open, the load side of the switch is grounded.

Isolating switch operating mechanism



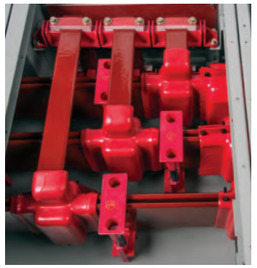
A unique important feature is the plug-in option for the 12SVC400 (400 A) contactor. It is designed to be removed or inserted without the need of special tools or extra steps.

Of course, working with electrical equipment is an inherently dangerous activity and should only be performed by qualified individuals following and using appropriate safety procedures.

For personnel safety, what should you look for in a controller?

- Safety in event of an arcing fault - tested to IEEE C37.20.7
- Tested to UL347 standard
- Safer operation and maintenance.

Main bus with optional insulating boots



Easy to operate

For ease of use, what should you look for in a controller?

- Easy to specify and order
- Easy to install
- Easy to operate and maintain.

SIMOVAC is designed from ground up to be easy to specify, install, operate, and maintain. The installation of a SIMOVAC lineup offers significant time savings.

Specify and order

To specify a SIMOVAC controller, refer to the selection and application guide.

Installation

Pressure relief channel (PRC)

For SIMOVAC-AR, the top-mounted pressure relief channel (PRC) is shipped assembled and installed on each shipping group. The PRC does not have to be erected at the job site. The PRC only needs to be connected at the shipped splits and the exhaust duct (plenum) installed.

Load cable routing

The SIMOVAC controller is equipped with features to help ease the installation process starting with removable cable guards to allow for easy access for cable installation and extra space to pull power cables. The load terminals are located to allow space to connect up to one 500 kcmil or two 4/0 cables per phase for the 12SVC400 (400 A) controller. Snap-in phase barriers are provided to provide extra convenience during the installation process.

Visible disconnect

The 2" (51 mm) x 10" (254 mm) viewing window located in the compartment door allows for quick verification of the open and closed positions of the isolating switch. The user does not have to open an enclosure door to view the isolating switch position.

Viewing window for isolating switch position

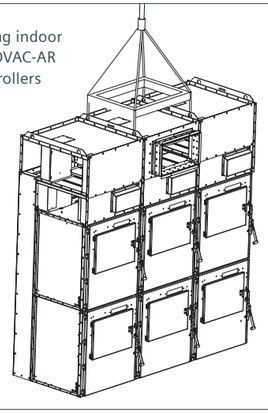


Operate and maintain

Fixed-mounted contactor (plug-in type optional)

The rugged 12SVC400 vacuum contactor is available in both a standard fixed-mounted design and an optional plug-in contactor design. The removal and installation of the vacuum contactor for maintenance, routine inspection, and emergency repair or replacement is fast and easy.

Lifting indoor SIMOVAC-AR controllers



Removing type 12SVC400 (400 A) plug-in contactor



Cost effective

Because we understand the cost of major electrical equipment does not end with the initial purchase cost.

We have designed SIMOVAC to reduce the user's cost for installation, operation and maintenance.

Installation

PRC shipped installed to save time and money

The installation of a SIMOVAC-AR lineup is easy and fast – saving you time and money. The pressure relief channel (PRC) for a SIMOVAC-AR lineup is shipped assembled on each shipping group. The PRC need only be connected at the shipping splits and the exhaust duct (plenum) installed and vented outside the equipment room.

To illustrate the savings due to shipping the SIMOVAC-AR units with the PRC factory-assembled, consider a three-unit assembly shipped as one shipping group. Since the PRC is factory-assembled, field labor for PRC assembly is zero hours.

For a representative competitor's product, the PRC must be assembled at site, estimated to require two persons and seven hours (total fourteen labor hours) for field assembly.

Further, exhaust duct (plenum) sections ship assembled in 36" (914 mm) sections, requiring only installation site labor to connect sections together, providing additional savings in site labor.

Integral transition to GM-SG-AR metal-clad arc-resistant switchgear

When SIMOVAC-AR is close-coupled connected to Siemens medium-voltage GM-SG-AR metal-clad switchgear, the exhaust duct will be provided and connected to the PRC in the GM-SG-AR switchgear, and the SIMOVAC-AR PRC connected to the GM-SG-AR PRC saving time and money.

Maintenance

Universal components

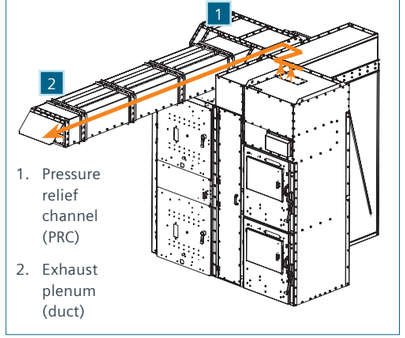
In a SIMOVAC controller many of the parts are common and are used in multiple places. This provides many advantages including reduced need for spare parts, reduced downtime and reduced maintenance and training. For example, the isolating switch used in a controller is also used as the primary disconnect for auxiliary devices, such as control power transformers or voltage transformers. The molded glass-polyester bus supports are used across various bus continuous ratings and used throughout a lineup in various areas.

SIMOVAC-AR arc-resistant requires a minimum of two vertical sections, or alternatively, one vertical section of SIMOVAC-AR with common PRC connected to type GM-SG-AR arc-resistant switchgear.

For cost effectiveness, what should you look for in a controller?

- Cost effective for installation
- Cost effective for service
- Cost effective for maintenance.

Arc venting for standard transition section from SIMOVAC-AR to GM-SG-AR



1. Pressure relief channel (PRC)
2. Exhaust plenum (duct)

Reliable

For reliability, what should you look for in a controller?

- Reliable components
- Reliable construction
- Reliable supplier.

The SIMOVAC controllers have been type-tested to ensure the highest level of reliability of a SIMOVAC controller. The isolating switch, the vacuum contactor, the enclosure integrity, and functionality of the system are verified to meet and exceed the industry standards.

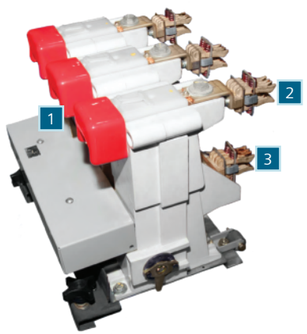
Components

Isolating switch

Siemens 400 A and 720 A isolation switches are ruggedly constructed for reliable operation and use. The switch is tested to exceed the industry standard for endurance. The welded steel gear drive provides long-life operation. The switch is easily removed from the controller if the need arises.

Vacuum contactor

The proven vacuum contactors used in the SIMOVAC family lineups are compact in size and lightweight for easy removal and installation. The low maintenance and long-life contactor is of robust construction. The contactor complies with NEMA, NEC, UL, and CSA standards[1].



1. Insulation boot
2. Line connection
3. Load connection

Type 12SVC400 (400 A) contactors (plug-in shown)

Construction

Door latching mechanism

The rugged door handle and latching system provides a six-point latching of the medium-voltage compartment door of 12SVC400 (400 A) controllers. The robust door latching provides reliable fastening of the compartment door.

Enclosure

The rugged enclosure is constructed with 11-gauge sheet metal, bolted-construction and with zinc-plated, dichromate treated hardware. The external finish is ANSI 61 light gray polyester, electrostatically applied. Special colors and finishes are available.

For SIMOVAC-AR, the enclosure withstands the extreme pressure associated with an internal arcing event and exhausts the arcing gases into the integral top-mounted pressure relief channel, and thence to the exhaust plenum for release outside the building. SIMOVAC-AR is classified for type 2B accessibility to IEEE C37.20.7.

Supplier

Siemens experience gained in over 50 years of supplying medium-voltage controllers in the U.S. has been captured in the SIMOVAC and SIMOVAC-AR designs. The objective has been to incorporate features designed to provide safety, while simplifying operation and maintenance, and reducing installation cost. Siemens is committed to providing products that are reliable and high quality.

Footnote:
1. UL/cUL listing not available for 720 A SSRVS controller.

Innovative

SIMOVAC controllers provide innovative features for increased safety and ease of operation - making the product more reliable and cost-effective. SIMOVAC controllers are provided with innovative features that make it easy to operate, more reliable and cost effective, and provides increased safety.

Safety

Door pressure flange - SIMOVAC-AR

Siemens patented door pressure flange design for SIMOVAC-AR significantly helps to contain the pressure and the escape of hot gases around the compartment doors. Under the extreme pressure inside the enclosure during an arcing event, the pressure flanges provide extra sealing capability for hot gases. This design is just another example of the measures Siemens has taken to improve the safety of a SIMOVAC-AR controller.

Easy to use

Self-adjusting door interlock

The load-interrupter switch is equipped with our self-locating adjustable door interlock design. This feature enables the easy closing of the access door as the interlock on the door automatically adjusts to the fixed interlock on the load-interrupter switch frame.

Door pressure flange



Load-interrupter switch self-adjusting door interlock



Door - self-locating interlock



Cubicle portion of door interlock

For innovation, what should you look for in a controller?

- Innovation for increased safety
- Innovation for ease of use.

Flexible



PRC integrated into transition between GM-SG-AR and SIMOVAC-AR





Fused load-interrupter switch unit (600 A)

Application

Flexibility means the ability to use a product in different applications, for different purposes, and different configurations to meet the specific needs of users. SIMOVAC is available in many starter types for a wide range of motor types and horsepower ratings. Using the available latched contactor, SIMOVAC can also be applied for distribution transformer feeder applications.

Applications

Incoming line section

Incoming line sections can accommodate top or bottom entry cables or bus connections and are available in 18" (457 mm) or 36" (914 mm) widths. They can contain auxiliary medium-voltage devices, such as voltage transformers, ground sensors, or surge devices. In SIMOVAC-AR lineups, they are classified as arc-resistant, to IEEE C37.20.7, and have been qualified to carry a type 2B accessibility rating.

Load-interrupter switch

SIMOVAC is available with fused or non-fused 600 A and 1,200 A load-interrupter switches (LIS) in a full height section. Provisions are available for mounting load- or line-side connected current transformers and voltage transformers. The LIS is available with a low-voltage compartment with space for mounting low-voltage devices including protective relays, meters, terminal blocks, controls and control wiring. For improved visibility, the entire low-voltage compartment is painted white.

Installation

Pressure relief channel

The top-mounted compact pressure relief channel (PRC) is designed to allow the exhaust duct (plenum) to be connected in the front, rear, top or either side for increased installation flexibility. The PRC must be connected together at shipping splits and the exhaust duct must be installed, but the PRC and exhaust duct sections are assembled at the factory.

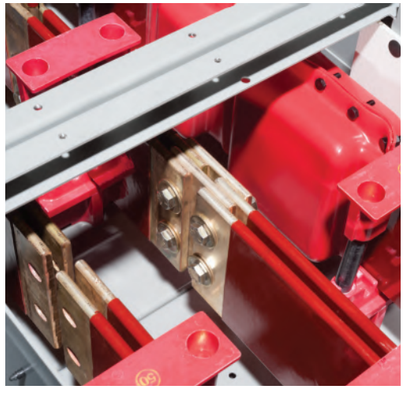
Configuration

Bus transition section

In cases where close-coupled connection to Siemens type GM-SG or GM-SG-AR medium-voltage switchgear is required, a 22.5" (572 mm) wide bus transition is available in 1,200 A, 2,000 A, 3,000 A and 4,000 A with integrated PRC section for GM-SG-AR and SIMOVAC-AR.

Sectionalized (unitized) main bus

Each vertical section has a main bus compartment for a section of horizontal bus which extends the length of the vertical section. In situations where only the single section can fit through the entry way during installation, a lineup can be delivered in single sections for easy reconnecting in the field or extension of the lineup in the future.



Shipping split main bus joints (phase 1 - as shipped; phase 2 - joint connected; phase 3 optional insulating boot installed)



Pressure relief channel with connection flange for exhaust duct

Enclosures

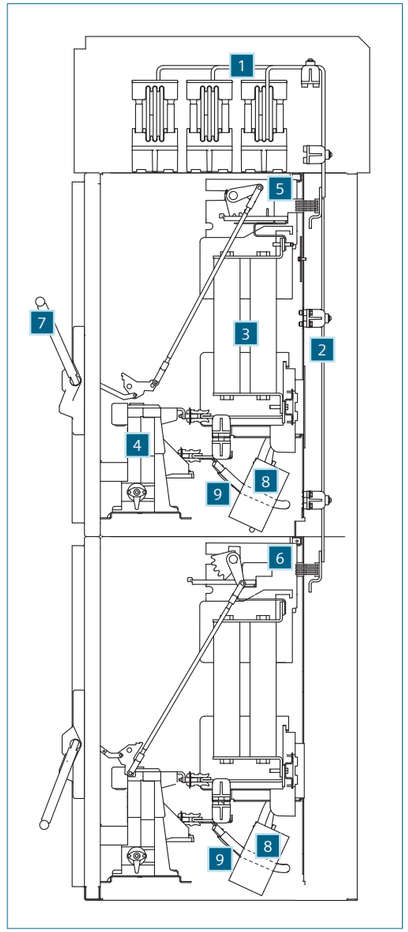
The Siemens SIMOVAC controller is an integrated system of contactors and components arranged for convenient access within a common enclosure consisting of one or more free-standing structural sections.

Available in the following enclosure types to meet the specific needs:

- Type 1 non-arc-resistant
- Type 2 non-arc-resistant
- Type 3 non-arc-resistant
- Type 1 arc-resistant
- Type 12 non-arc-resistant.

External finish is ANSI 61 light gray polyester, electrostatically applied.

Controller arrangement



Low-voltage compartment

All starter compartment front panels are provided with a "door-in-door" for access to the controller low-voltage area. Devices normally mounted in this section can include such devices as a Siemens 9350 power meter, overload relay, ammeter, control relays, timing relays, push buttons, indicating lights, etc. Location within this section isolates the devices from any source of high voltage and allows access to these control devices without interrupting service. Terminal blocks for control circuit wiring terminations are also accessible in this compartment.

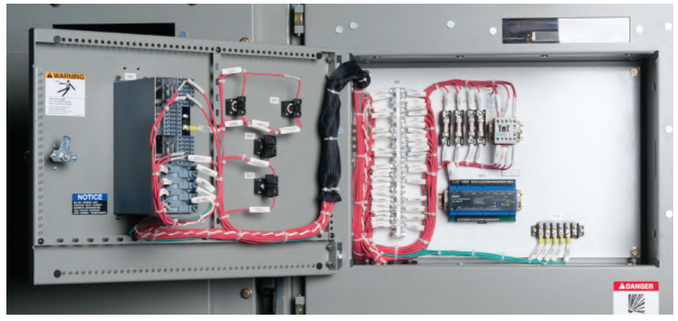
For SIMOVAC-AR arc-resistant controller, this compartment has been qualified as accessibility type 2B with low-voltage compartment door open.

For improved visibility, the entire low-voltage compartment is painted white.

For flexibility, what should you look for in a controller?

- Flexibility for application
- Flexibility for installation
- Flexibility for configuration.

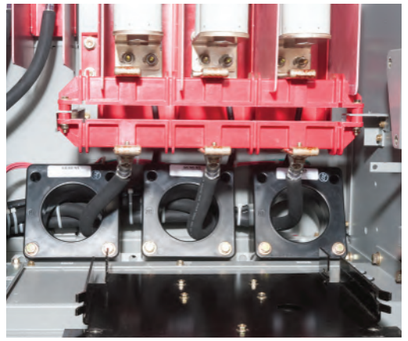
Inside view of low-voltage/control compartment



1. Main bus
2. Vertical bus
3. Bolt-in primary fuses
4. 12SVC400 contactor (plug-in shown)
5. No-load isolating switch (shown closed)
6. No-load isolating switch (shown open)
7. Isolating switch operating handle
8. Phase current transformers
9. Load cables (internal) to user's terminal pads on left side of compartment

Current transformers (CTs)

A SIMOVAC controller can be fitted with up to two standard accuracy CTs per phase in a 12SVC400 (400 A) medium-voltage compartment. Consult with factory for details.



Current transformers (CTs)

Voltage transformers (VTs)

Optional voltage transformers are available, of two general types.

A three-phase voltage transformer (with windings connected open-delta/open-delta) can be provided in a starter or feeder cell. These VTs are connected to the load side of the main power fuses in the cell, and are located in the general vicinity of the outgoing cable termination area, as shown in the VT arrangement in the feeder cell figure.

Since these VTs are connected to the starter or feeder circuit, they are disconnected when the isolating switch is switched to the OPEN position, and in this position the load side of the isolating switch is also grounded. The VTs include primary current limiting fuses, mounted on the top of the transformer assembly as shown in the VT arrangement in the feeder cell figure. The voltage transformers are not accessible until the contactor is switched off, and the isolating switch is OPEN.

Control power transformer (CPTs)

The basic controller includes as a standard, a 0.75 kVA CPT mounted in the medium-voltage compartment. This CPT is used to energize the magnetically-held contactor. It is located in the upper left area of each medium-voltage compartment as shown in the CPT mounted in the cell figure.

Control power transformer mounted in the cell



Voltage transformer arrangement in the feeder cell



Voltage transformer for incoming line or main bus VTs



Motor protection

Overload protection - types 3RU or 3RB

Running overcurrent (overload) protection for the motor must also be provided according to NEMA standards. This overload (or longtime) protection can be provided by the Siemens type 3RU (OLR) bimetallic thermal overload relay. This three-phase adjustable relay provides inherent single-phase protection and phase unbalance protection with NEMA class 10 tripping characteristics, providing optimum protection for motors having acceleration times of six seconds or less and allowable hot locked rotor times of five seconds or more. It is equipped with an isolated normally open contact to actuate a remote alarm in the event of an overload trip.

SIPROTEC protective relays

The SIPROTEC protective relay family includes many of the secondary ANSI functions, allowing the user to use one protective relay for motor protection applications.

SIMOVAC and SIMOVAC-AR can also be equipped with the SIPROTEC 5 arc-protection solution that optically detects arcs reliably as they develop. The SIPROTEC 5 protective relay is then able to initiate a command to open an upstream circuit breaker to quickly clear the arcing fault, reducing potential damage to the equipment, and providing better protection for personnel.

Type SIPROTEC 5 relay



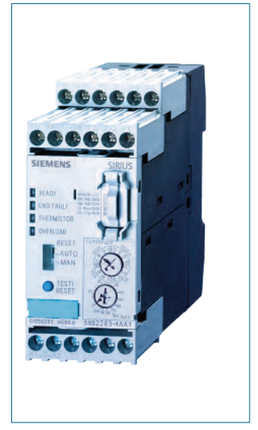
For motor protection, what should you look for in a controller?

- Flexibility for application\
- Flexibility for configuration
- Reliable protection.

Type 3RU overload relay



Type 3RB overload relay



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