



Siemens Energy & Automation White Paper

**Short Circuit Current Ratings (SCCR) for Industrial Control
Panels**

NEC®¹ Article 409 and Changes to UL 508A

Updated: May 10, 2006

¹ NEC is a registered trademark of the National Fire Protection Association

Introduction

Article 409 on Industrial Control Panels was added to the NEC in the 2005 edition. This Article requires all Industrial Control Panels to be marked with a Short Circuit Current Rating. The Short Circuit Current Rating (SCCR) requirements for UL 508A took effect in April 2006. These changes impact control panel builders, OEMs and end users in numerous ways:

- How customers select power circuit components for a control panel.
- How customers specify preferred manufacturers.
- How control panel manufacturers design and mark their panels.
- How customers install and modify control panels.

Siemens is committed to supplying our customers best in class products and services. Siemens has put together a comprehensive list of our device ratings and combination ratings to allow our customers to comply with NEC Article 409 and the changes in the UL 508A standard.

This document will provide the following:

- **Overview of Code Changes in NEC Article 409**
- **Overview of Supplement SB from UL 508A**
- **SCCR Control Panel Calculation Examples**
- **Process Flow Charts**
 - **Determination of the SCCR of a Component**
 - **Determination of the SCCR with Current Limiting Feeder Components**
 - **Determination of the SCCR of the Control Panel**

Overview of Code Changes in NEC Article 409

The **NFPA 70: National Electrical Code**² includes **Article 409** on the Construction of Industrial Control Panels operating at 600 volts or less.

Section 409.2 defines an Industrial Control Panel as:

An assembly of a systematic and standard arrangement of two or more components such as motor controllers, overload relays, fused disconnect switches, and circuit breakers and related control devices such as pushbutton stations, selector switches, timers, switches, control relays, and the like with associated wiring, terminal blocks, pilot lights, and similar components. The industrial control panel does not include the controlled equipment.

Section 409.110 requires a Short Circuit Current Rating (SCCR) to be marked on an Industrial Control Panel. It notes the rating is to be based on the rating of a listed and labeled assembly or using an approved method to establish the rating. It also includes a Fine Print Note (FPN) reference to UL 508A Supplement SB as an example of an approved method for determining the SCCR that can be marked on the panel.

² National Electrical Code is a registered trademark of the National Fire Protection Association

Overview of Supplement SB from UL 508A

UL508A is the safety standard for Industrial Control Panels.

NEC Article 409 references UL508A Supplement SB as an approved method for determining the SCCR of an Industrial Control Panel. The specific method is outlined in Section SB4.

The SCCR of the Control Panel is based on the SCCR of each component in the Power Circuit. Paragraph SB4.2.1 and Table SB4.1 list the following components as part of the Power Circuit:

- disconnect switches
- branch circuit protective devices
- branch circuit fuseholders
- load controllers
- motor overload relays
- meter socket base
- miniature or miscellaneous fuse
- supplementary protectors
- bus bars
- current meters
- current shunt
- switch unit
- receptacles
- terminal or power distribution blocks

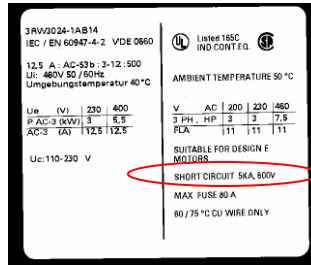
Paragraph SB3.2.1 states that the primary short circuit protective device for the Control Circuit is also included in the calculation for the SCCR for the Power Circuit. Therefore, the SCCR of the overcurrent protective device (ex: Supplementary Protector or set of Fuses) used on the primary side of a Control Power Transformer **are** included in the determination of the SCCR of the Control Panel. Control Circuit Components downstream of these devices would **not** be included in the calculation of the SCCR.

The basic steps for developing a SCCR for the Control Panel are:

SB4.2 – Determine the short circuit current ratings (SCCR) of individual **power circuit components** using three possible methods.

- 1) from device markings or component instruction sheets

Most Siemens Power Control and Circuit Protection components include a standard short circuit rating on the front or side label. Example of a 3RW30 Soft Starter label:



SHORT CIRCUIT 5KA, 600V

- 2) or from the assumed short circuit current rating from table SB4.1 titled *Assumed maximum short circuit current rating for unmarked components* (excerpt below)

| Component | Short circuit current rating, kA |
|---------------------------------------|----------------------------------|
| Bus bars | 10 |
| Circuit breaker (including GFCI type) | 5 |
| Current meters | a |
| Current shunt | 10 |
| Fuseholder | 10 |
| Industrial control equipment: | |
| a. Auxiliary devices (overload relay) | 5 |

- 3) or by testing a combination of components per UL508

Siemens has information on our Controls website and the UL 508A website that provides UL508 combination testing for NEMA, IEC and Solid State Soft Starter components used in conjunction with Circuit Breakers and Fuses. This testing provides a higher SCCR than the individual component ratings.

www.sea.siemens.com/Controls/SCCR

<http://www.ul.com/controlsequipment/shortcircuit.html>

Example of IEC Contactor/Overload/Circuit Breaker high short circuit ratings from the available summary tables:

| ID Number | Combination Type | Individual Component | | | | | | | Combination SCCR | | | | | | | | | |
|------------------|------------------|----------------------|--------------|---------------------|----|-------------------------------|--------------------------------|-------|------------------|-----|-------|----|--------|-------------|----------------------------|-----------------------------|----------------------|-----------------------|
| | | Type | Manufacturer | Catalog Designation | kA | Overload Relay Current Rating | Circuit Breaker Current Rating | Volts | Poles | kA | Volts | Ph | MAX HP | MAX NEC FLC | Min. Enclosure Vol (cu ft) | Conditions of Acceptability | Combination UL File | Enclosure Vol (cu in) |
| SE&A TC1R2006100 | D | ICB | Siemens | EDKSA | - | - | See Below | 200 | 3 | 100 | 200 | 3 | 5 | 17.5 | 1.38 | 1, 5 | E43399 Vol. 1 Sec. 6 | 2385 |
| | | MC | Siemens | 3RT1026 | 10 | 25 | 200 | 3 | | | | | | | | | | |
| | | CLR | Siemens | 3RB102, 3RU112 | 5 | na | 30 | 200 | 3 | | | | | | | | | |
| SE&A TC1R2006101 | D | ICB | Siemens | EDKSA | - | - | See Below | 208 | 3 | 100 | 208 | 3 | 5 | 16.7 | 1.38 | 1, 5 | E43399 Vol. 1 Sec. 6 | 2385 |
| | | MC | Siemens | 3RT1026 | 10 | 25 | 208 | 3 | | | | | | | | | | |
| | | CLR | Siemens | 3RB102, 3RU112 | 5 | na | 30 | 208 | 3 | | | | | | | | | |
| SE&A TC1R2006102 | D | ICB | Siemens | EDKSA | - | - | See Below | 240 | 3 | 100 | 240 | 3 | 5 | 15.2 | 1.38 | 1, 5 | E43399 Vol. 1 Sec. 6 | 2385 |
| | | MC | Siemens | 3RT1026 | 10 | 22 | 240 | 3 | | | | | | | | | | |
| | | CLR | Siemens | 3RB102, 3RU112 | 5 | na | 30 | 240 | 3 | | | | | | | | | |

SB4.3 – modify the available short circuit current based on let-through values when using current limiting devices in the feeder circuit

Siemens offers a full line of Current Limiting Circuit Breakers. Refer to the Circuit Protection web page for links to Information and Instruction Guides that provide specific let-through current values for Siemens Type CED6, CFD6, CJD6, CLD6, CMD6, CND6, and CPD6 Current Limiting Circuit Breakers.

http://automation.usa.siemens.com/power/product/circuit_breakers.html

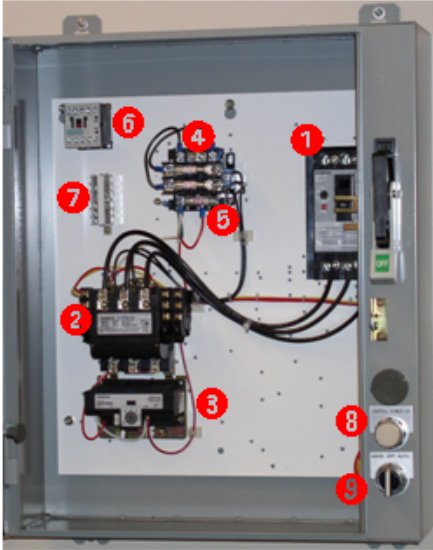
For **fuse** information, reference Table SB4.2 titled *Peak let through currents, I_p , and clearing, I_2t , for fuses.*

SB4.4 – Determine the SCCR for the control panel which is limited to the lowest value of a component or circuit from SB4.2 or SB4.3.

This will be reviewed through the series of examples that follow.

The manufacturer of the Control Panel also has the option of submitting their completed panel to UL for testing at a higher short circuit rating than provided by the component manufacturers.

SCCR Control Panel Calculation Examples



This panel includes the following components

| <u>Power Circuit</u> | | <u>Catalog #</u> |
|------------------------|---------------------------------|------------------|
| ① | Circuit Breaker | ED63B050 |
| ② | Contactor | 40FP32AA |
| ③ | Overload Relay | 48BSH3M10 |
| ④ | Fuses on primary of the CPT | CC Fuses |
| <u>Control Circuit</u> | | <u>Catalog #</u> |
| ⑤ | Control Power Transformer (CPT) | MT0050A |
| ⑥ | Control Relay | 3RH1122-1AK61 |
| ⑦ | Terminal Blocks | 8WA1011-0DF21 |
| ⑧ | Pilot Light | 52PC4E2 |
| ⑨ | Hand-Off-Auto | 52SA2CABA1 |

The components listed under Control Circuit do not need to be included in the calculation of the SCCR of the Control Panel.

Example 1: The first calculation will be based on SB4.2 and reviewing the individual SCCR values marked on the components or found in the list for unmarked components.

The individual SC ratings for each of the Power Circuit Components are as follows:

| | <u>Power Circuit</u> | <u>Catalog #</u> | <u>SCCR @ 480V</u> |
|---|-----------------------------|------------------|--------------------|
| ① | Circuit Breaker | ED63B050 | 25 kA |
| ② | Contactor | 40FP32AA | 5 kA |
| ③ | Overload Relay | 48BSH3M10 | 5 kA |
| ④ | Fuses on primary of the CPT | CC Fuses | 200 kA |

Both the contactor and the overload relay have a 5 kA rating @ 480V. If no additional information is available, this Control Panel would be marked with a SCCR of 5 kA @ 480VAC.

Example 2: The second calculation will be based on SB4.2 and reviewing manufacturer information for tested combinations with higher short circuit current ratings.

A review of the Siemens UL508 Combination Testing Tables shows that Siemens has tested this Circuit Breaker/Contactor/Overload Relay combination to 100 kA @ 480V. This UL testing can be referenced when determining the SCCR of the panel.

NOTE A: For Combinations using current transformers, the current transformer must be provided as specified on the installation instructions for the overload relay.

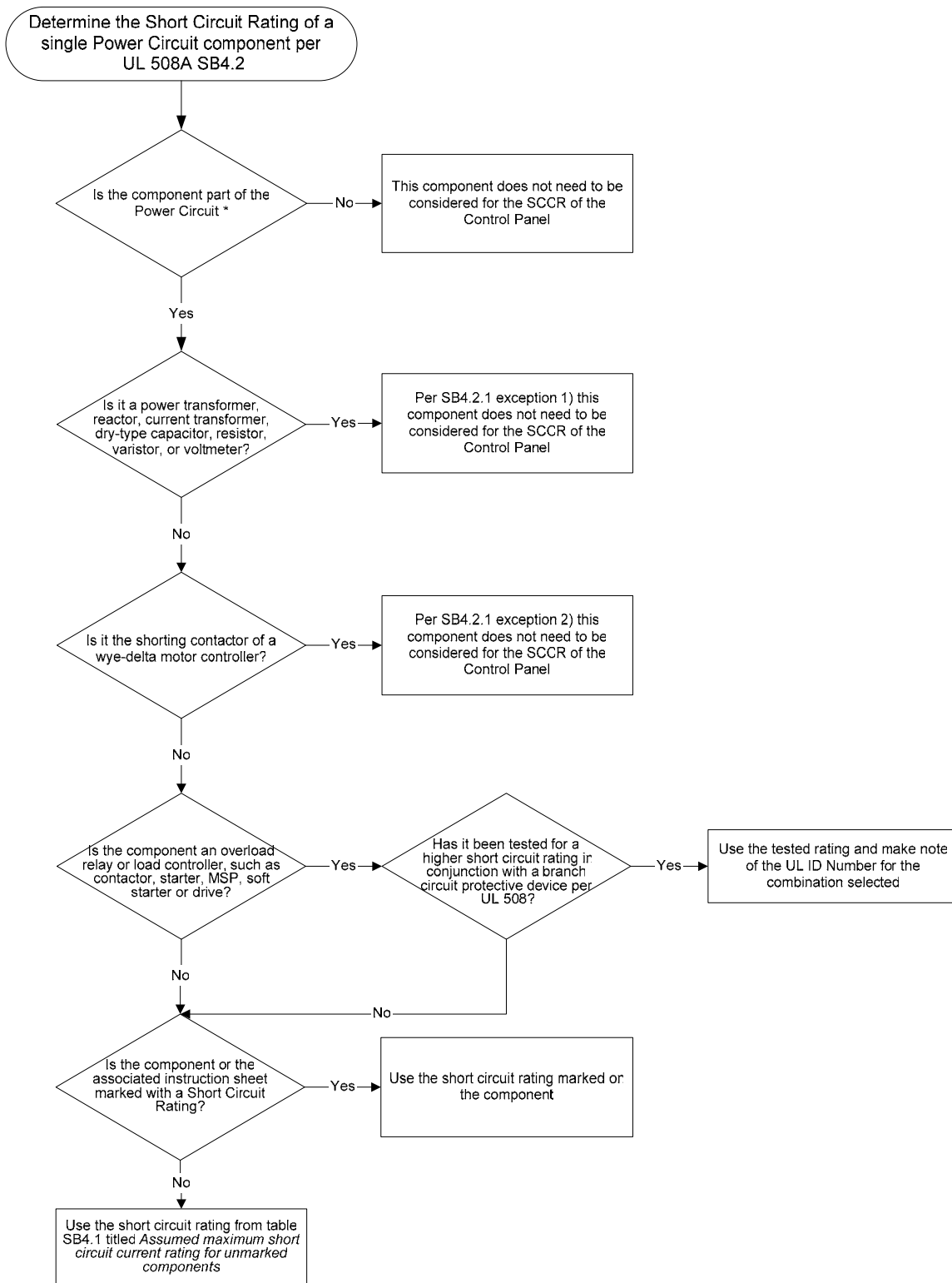
| ID Number | Combination Type | Individual Component | | | | Ratings | | Combination SCCR | | | | | | | | | | |
|--------------------|------------------|----------------------|--------------|---------------------|----|---------|-----------|------------------|-------|-----|--------|-------------|----------------------------|-----------------------------|---------------------|-----------------------|-------------------------|------|
| | | Type | Manufacturer | Catalog Designation | kA | Volts | Poles | kA | Volts | Ph | MAX HP | MAX NEC FLC | Min. Enclosure Vol (cu ft) | Conditions of Acceptability | Combination UL File | Enclosure Vol (cu in) | | |
| SE&A CTR2006055 | C | CB | Siemens | ED63B | 25 | - | See Below | 480 | 3 | 100 | 480 | 3 | 25 | 34 | 1.38 | 1, 3 (For 480C3) | E43399 Vol. 1 Sec. 6 | 2385 |
| | | MC | Siemens | 40FP32A | 5 | 50 | - | 480 | 3 | | | | | | | | | |
| | | OLR | Siemens | 4BARE, 4BASE | 5 | 9 - 18 | 20 | 480 | 3 | | | | | | | | | |
| | | OLR | Siemens | 4BARF, 4BASF | 5 | 13 - 27 | 30 | 480 | 3 | | | | | | | | | |
| | | OLR | Siemens | 4BARG, 4BASG | 5 | 20 - 40 | 40 | 480 | 3 | | | | | | | | | |
| | | OLR | Siemens | 4BRH, 4BESH | 5 | 22 - 45 | 50 | 480 | 3 | | | | | | | | | |
| OLR | Siemens | 4BGC3 | 5 | 60 | 90 | 480 | 3 | | | | | | | | | | | |

| | | | | | |
|--|--|---|--|---|--|
| <ol style="list-style-type: none"> 1 2 3 4 | <p>Power Circuit Circuit Breaker Contactor Overload Relay Fuses on primary of the CPT</p> |) | <p>Catalog # ED63B050 40FP32AA 48BSH3M10 CC Fuses</p> | <p>SCCR @ 480V 100 kA 200 kA</p> | <p>Per UL ID SE&A CTR2006055</p> |
|--|--|---|--|---|--|

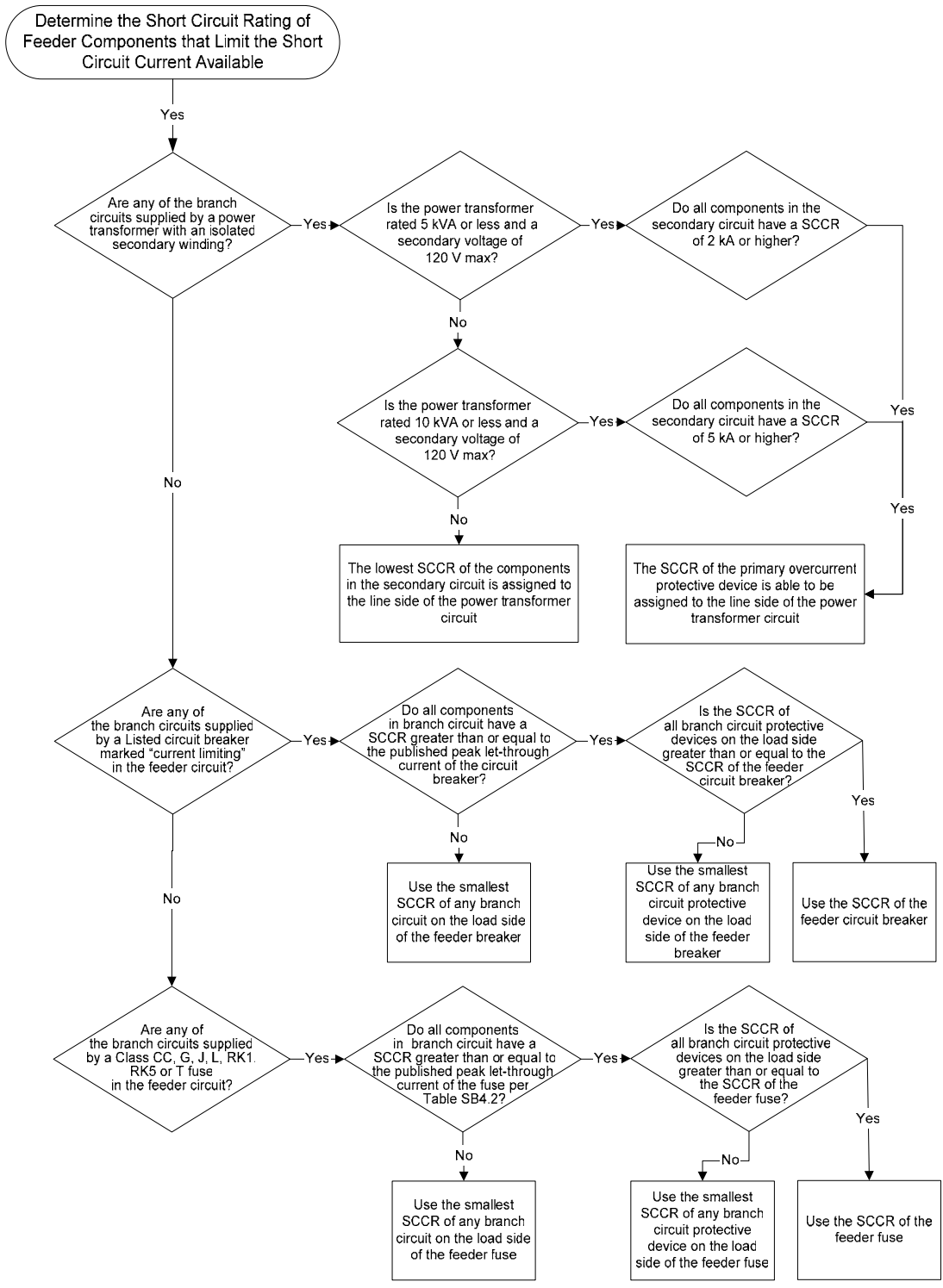
The tested circuit breaker & starter combination has been UL tested for a SCCR of 100 kA @ 480V. The fuses have a SCCR of 200 kA. Since 100 kA is the lowest SCCR rating of any component or combination, this Control Panel would be marked with a SCCR of 100 kA @ 480VAC.

This example shows that it is critical to review Siemens UL tested combinations when determining the SCCR of the control panel. By knowing the tested combination rating, this panel would be marked with a Short Circuit Current Rating of 100 kA @ 480V, instead of 5 kA as shown in Example 1.

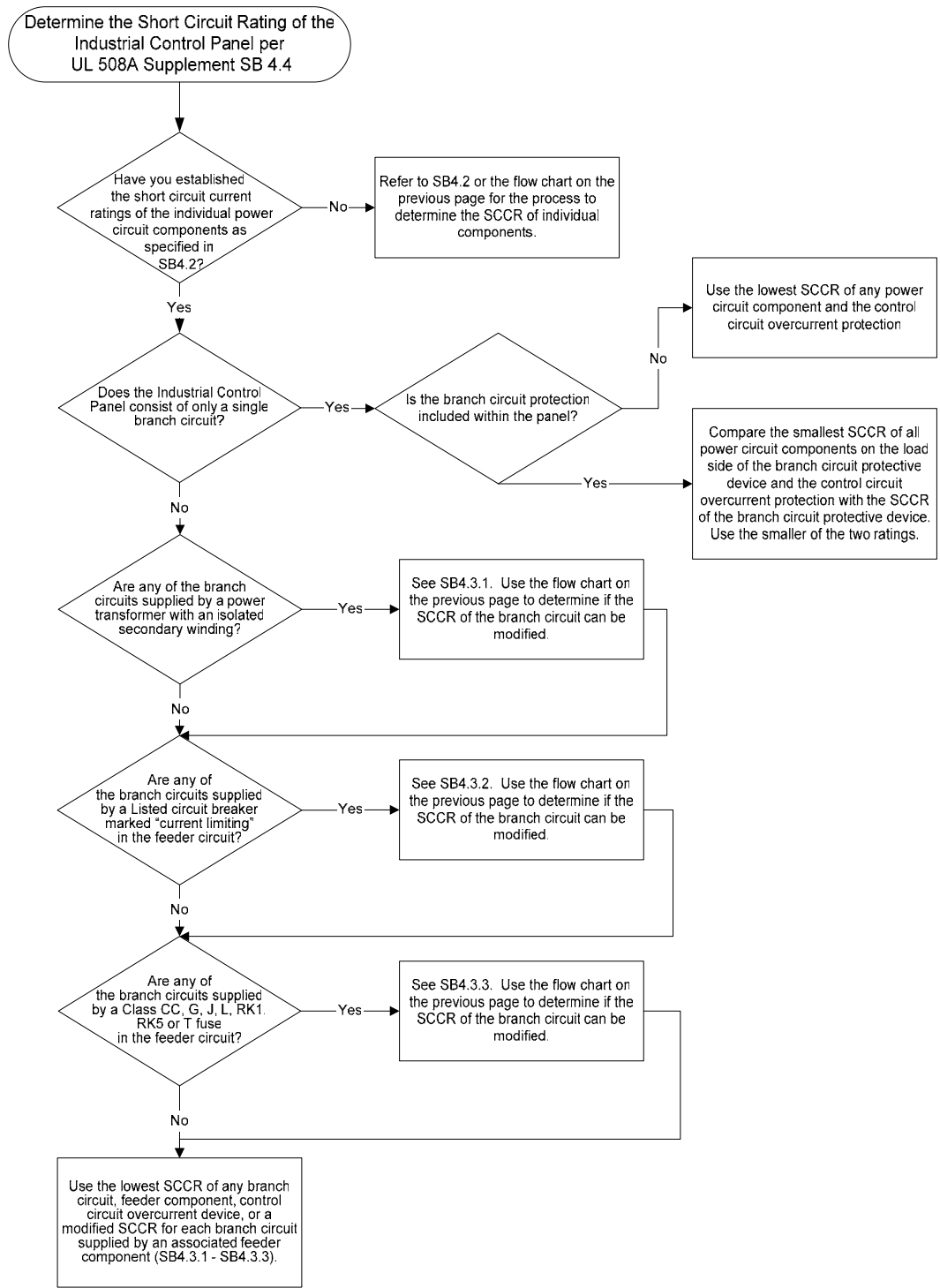
Flow Chart for Determination of the SCCR of a Component (SB4.2)



Flow Chart for Determination of the SCCR with Current Limiting Feeder Components (SB4.3)



Flow Chart for Determination of the SCCR of the Control Panel (SB4.4)



Go to the Siemens Resource Center for up-to-date information

<http://www.sea.siemens.com/controls/sccr>

UL508A and NEC Article 409 Resource Center

High Short Circuit Current Ratings for Siemens Control Components and Assemblies

These files are dedicated to high short circuit ratings for Control Panels that incorporate combination motor control components.

[Complete Siemens Controls SCCRs all data in one file.xls](#)
[IEC Contactors & Overload Relays with Fuses.xls](#)
[IEC Contactors & Overload Relays with Instantaneous Trip Circuit Breakers.xls](#)
[IEC Contactors & Overload Relays with Thermal Magnetic Circuit Breakers.xls](#)
[NEMA Contactors & Overload Relays with Fuses.xls](#)
[NEMA Contactors & Overload Relays with Instantaneous Trip Circuit Breakers.xls](#)
[NEMA Contactors & Overload Relays with Thermal Magnetic Circuit Breakers.xls](#)
[NEMA Starters with Fuses.xls](#)
[NEMA Starters with Instantaneous Trip Circuit Breakers.xls](#)
[NEMA Starters with Thermal Magnetic Circuit Breakers.xls](#)
[Solid State Soft Starters with Fuses.xls](#)
[Solid State Soft Starters with Instantaneous Trip Circuit Breakers.xls](#)
[Solid State Soft Starters with Thermal Magnetic Circuit Breakers.xls](#)

Additional high short circuit current ratings for IEC Contactors, Overload Relays and Motor Starter Protectors (MSPs) are listed below. Please review the IEC Summary file and use the UL Report files as supporting information.

[IEC Summary for Contactors OLs MSPs.xls](#)
[UL Report for Contactors 3RT101.pdf](#)
[UL Report for Contactors 3RT102.pdf](#)
[UL Report for Contactors 3RT103.pdf](#)
[UL Report for Contactors 3RT104.pdf](#)
[UL Report for MSP 3RV102 Manual and Group.pdf](#)
[UL Report for MSP 3RV1021 Type E Combo.pdf](#)
[UL Report for MSP 3RV103 Manual and Group.pdf](#)
[UL Report for MSP 3RV1031 Type E Combo.pdf](#)
[UL Report for MSP 3RV104 Manual and Group.pdf](#)
[UL Report for MSP 3RV1041 Type E Combo.pdf](#)
[UL Report for MSP Contactor Combinations 3RA.pdf](#)

UL Website for Short Circuit Current Ratings

UL has developed a website dedicated to Short Circuit Current Ratings of Industrial Control Panels Incorporating Combination Motor Controller Components. This site includes the appropriate Siemens SCCR information.

<http://www.ul.com/control/equipment/shortcircuit.html>

Codes and Standards Information Websites

[IEEE \(Institute of Electrical and Electronic Engineers\)](#)
[UL 508A \(Underwriters Laboratories panel builder information\)](#)
[ANSI \(American National Standards Institute\)](#)
[NFPA \(National Fire Protection Association\)](#)
[OSHA \(Occupational Safety and Health Administration\)](#)