Synch-Check Relay

SCM21 Synch-Check Relay

The SCM21 is a member of the of Cooper Power Systems' Edison® line of micro-processor based protective relays. The SCM21 offers the following functions:

- Control of one or two lines against a common bus.
- Check of voltage, frequency, and phase displacement between each of the lines and the bus.
- Programmable dead line and dead bus operation.
- Definite time bus over- and under- voltage inhibit functions.
- Definite time bus over- and under- frequency inhibit functions.

The SCM21 relay also shares the following features common to all Edison® relays:

- Simple five button man machine interface (MMI) allows access to all functions, settings, and stored data without the need for a computer.
- Bright electroluminescent display easily visible even in brightly lit environments.
- Draw-out design permits relay testing without disturbing connections to case.
- Modbus communication protocol and RS485 terminal on rear.
- Modular design allows the draw-out module to be fitted to a variety of space saving cabinet styles.
- Three fully programmable Form C (SPDT) output contacts, and one Form A/B contact set.
- Pick-up (start-time) elements.
- Programmable reset characteristics.
- Dedicated power supply/relay fail output contacts.

Figure 1.
Front View of the SCM21 Synch-Check Relay

- Event records.
- Cumulative trip counters.
- Auto-ranging power supplies.

Applications

The SCM21 is ideally suited as a supervisory relay on lines subject to reclosing where the possibility that the open line or lines may be out of synchronism with the com-mon bus. Reclosing the lines on to the bus under this condition may possibly cause equipment damage or exacerbate system stability concerns.

The SCM21 may also be used as a supervisory relay for industrial or co-gen operations to ensure that the plant generators are in synchronism with the local utility before closing the tie breaker. Note, the SCM21 does not provide synchronizing functions. If this is required, please refer to synch-ronizing relay SPM21 described in Catalog Section 150-55.

The SCM21 also provides for dead bus and dead line operation, whereby the ability to re-energize a line or bus may be controlled.

Operation

When a valid operating condition exists (one or two lines open and the bus voltage and frequency are within programmed limits) the relay continuously compares the bus' and line(s)' voltage and frequency against the programmed difference limits. After the voltage and frequency have been within the limits for a programmable period of time, the relay begins to check phase angle displacement.

When the phase angle displacement is within limits and decreasing for a programmable period of time, the breaker close signal is enabled. The breaker closing time is able to be input as a setting, and the relay will automatically adjust the output contact closing time to take into account this breaker closing time.

After the relay has issued a close command, the issuance of another close command is blocked for the duration of an internal timer.

Dead Line Operation

In addition to normal conditions where both line and bus voltages are within limits, this mode of operation, when selected, also allows closing when the following conditions are met:

- The line voltage is less than 5% of nominal bus voltage;
- Bus voltage and frequency within programmed limits.

Dead Bus Operation

In addition to normal conditions where both line and bus voltages are within limits, this mode of operation, when selected, also allows closing when the following conditions are met:

- The bus voltage is less than 5% of nominal bus voltage;
- Line voltage and frequency limits are within programmed limits.

Both dead bus and dead line operation modes may be activated simultaneously. If both modes are selected, closing is blocked in the case that both lines and the bus are dead.

Targets

Eight bright LED targets are provided as follows:

- One red LED (VBUS RANGE) which monitors the bus voltage against the acceptable range defined by the bus over- and under- voltage inhibit elements. When both lines are isolated from the bus, the LED flashes if the bus voltage is within the set limits. This signifies a permissive condition.

  If one or both of the lines are connected to the bus, the LED remains dark if the bus voltage is within the set limits. The LED will flash if the bus voltage exceeds either the bus under- or over- voltage inhibit elements (i.e. pickup).

  The LED will illuminate continuously after the set time delay (i.e. trip).
- One red LED (V) which compares the difference between the bus and line voltages against the predefined limits to permit closing. The LED is off if both line breakers are closed. The LED flashes if the delta voltage between the bus and an open line or lines is low, and illuminates constantly if high.
- One red LED (f) which compares the difference between the bus and line frequencies against the predefined limits to permit closing. The LED is off if both line breakers are closed. The LED flashes if the delta frequency between the bus and an open line or lines is low, and illuminates constantly if high.
- One red LED (fBUS RANGE) which monitors the bus voltage against the acceptable range defined by the bus over- and under- voltage inhibit elements. When both lines are isolated from the bus, the LED flashes if the bus voltage is within the set limits. This signifies a permissive condition. The flashing or constant illumination pattern of the LEDs follows the same logic as the VBUS RANGE LED.
- Two red LEDs which indicates the condition of the phase angle displacement between the bus and the lines and the breakers (CLOSED/SYNCH LINE 1 and CLOSED/SYNCH LINE 2). When the breaker for the respective line is closed, the LED are constantly illuminated. When the breakers are open, the LEDs flash of the phase angle displacement is within limits, and are dark if out of limits.
- In addition, one yellow LED is provided which illuminates when any function has been disabled via programming.

  A second yellow LED flashes when the relay is in programming mode, and illuminates constantly upon relay or power supply failure.

Blocking Inputs

One opto-isolated blocking input is provided and is dedicated to blocking the operation of the relay's output contacts. Note, this does not block operation of the relay logic.

Output Functions

The following output functions are available which may be assigned to any or all of the programmable output contacts. Note that pick-up and time delayed elements may not be assigned to the operate the same output contact(s).

- Closing command of line 1 breaker (all synch conditions are met).
- Closing command of line 2 circuit breaker (all synch conditions are met).
- Time delayed bus.
- Time delayed bus overvoltage.
- Time delayed underfrequency.
- Time delayed overfrequency.

Reset Characteristics

Each of the four programmable output relays except those assigned to close the line 1 or line 2 circuit breakers may be programmed to reset in one of three manners.

- Instantaneously upon the input or calculated quantities dropping below the pickup value.
- Automatically, but with a time delay adjustable between 0.1 and 9.9 seconds in 0.1 second steps.
- Manual reset (by front panel or computer command) only.

Output relays assigned to close the circuit breakers automatically reset 100 msec after the circuit breaker's close signal is detected.

Measurements

The following measurements are available for display on the relay and are accessible by software:

- Line and bus voltages and frequencies.
- Voltage and frequency differences between each line and the common bus.
- Phase angle difference between each line and the common bus.

Last Trip Record

At the time of any pick-up event, the measured values described above are stored in non-volatile memory, providing details of the last event. A record is kept of the initiating event.

In addition, the relay keeps a set of counters associated with the operation of each protective element.

Diagnostics

Complete memory and circuit diagnostics are run upon powering the relay. The revision level of the firmware is displayed at this time.

During normal operation the relay suspends operation every 15 minutes for 10 msec and runs a comprehensive set of diagnostics that includes memory checksum, test of the A/D converters by injection of an internally generated reference voltage, and a check of the ALU.

The relay provides two manual test routines which may be run at any time. The first routine performs the same 15 minute test an in addition checks the target LEDs and the control circuitry to the output relays without operating the output relays. The second test is identical but also operates the output relays.

TABLE 2
Catalog Numbers

Description	Catalog Number
Base Relay	SCM21
To the above add one each of the following applicable suffixes	
Modbus Protocol	J
Power Supply[1]	
24-110V AC/DC	L
90-220V AC/DC	H
Case Style[2]	
Draw out relay only, no cabinet supplied	D
Single relay case	S
Double relay case	T
19" Rack mount cabinet	N
Mounting Position	
Denotes mounting position in either a double case or 19" Rack along with other relays ordered at the same time.	C2 C3 C4

[1] The power supplies are user replaceable and interchangeable. See Catalog section 150-99.

[2] The relay itself may be drawn out of any of the listed cases and plugged into any of the other case styles. The catalog number specified during ordering denotes the type of cabinet in which the relay will be shipped.

Dimensional and Electrical Specifications

See Catalog Section 150-05 for electrical specifications and dimensional information on all Edison® relays.

Ordering Information

Construct catalog number from Table 2.

Example: A SCM21JxN and an IM30AJxxC2 consist of a SCM21 relay in the leftmost bay of a 19” rack case, with an IM30A relay in the second bay from the left. The third and fourth bays will be empty and will be covered with blank faceplates.

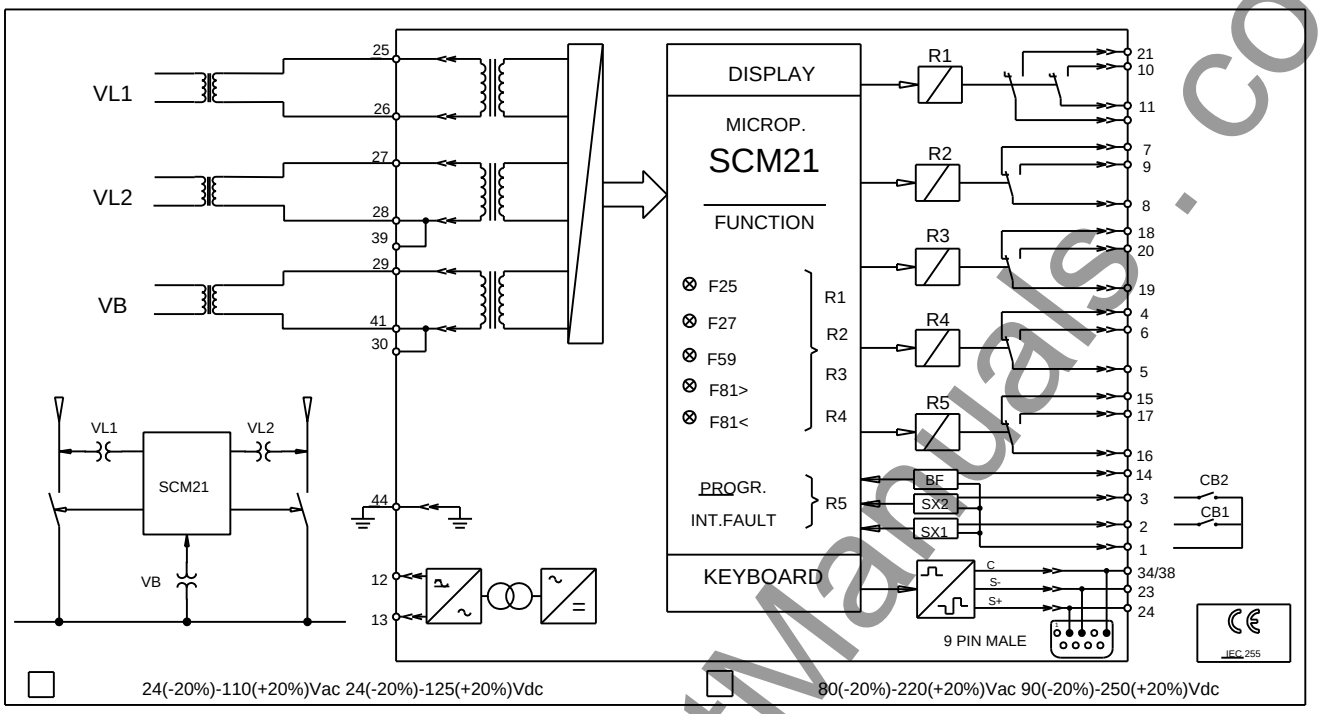

Figure 2.
Wiring Diagram for the SCM21 relay for 2 line Synch-Check Operation

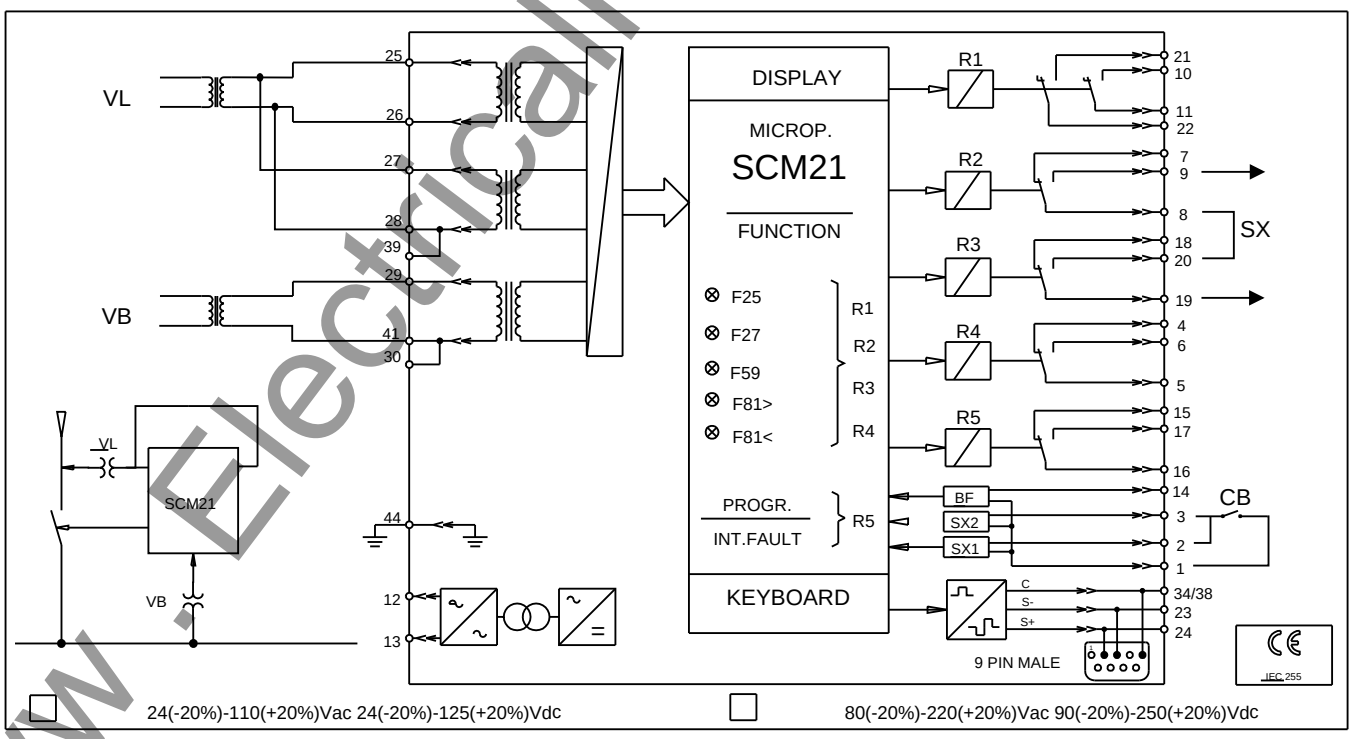

Figure 3.
Wiring Diagram for the SCM21 relay for 1 line Synch-Check Operation

TABLE 1
Functional Specifications

Nominal frequency setting range	50 or 60Hz
Rated input voltage (PT secondary voltage)	100 - 125V in 1V steps
Minimum Bus voltage to allow breaker closure	15 - 120% of rated input voltage in 1% steps
Trip time delay for bus under voltage	0.1 - 30 seconds in 0.1 second steps
Maximum bus voltage to allow breaker closure	20 - 150% of rated input voltage in 1% steps
Trip time delay for bus over voltage	0.1 - 30 seconds in 0.1 second steps
Minimum bus frequency to allow breaker closure	45 - 60Hz in 0.1Hz steps
Trip time delay for bus under frequency	0.1 - 30 seconds in 0.1 second steps
Maximum bus frequency to allow breaker closure	50 - 65Hz in 0.1Hz steps
Trip time delay for bus over frequency	0.1 - 30 seconds in 0.1 second steps
Maximum permissible line/bus voltage difference	1 - 20% in 1% steps
Maximum permissible line/bus frequency difference	0.02 - 0.50Hz in 0.01Hz steps
Maximum permissible line/bus phase angle difference	3 - 30° in 1° steps
Minimum time for voltage and frequency conditions to be met before phase angle is monitored	0 - 60 seconds in 0.1 second steps
Maximum wait time before forcing close if phase angle difference is not decreasing but within limits	0.1 - 30.0 seconds in 0.1 seconds steps
Programmable circuit breaker closing time	0.05 - 0.50 seconds in 0.01 second steps
Reclose time delay	0 - 600 seconds in 1 second steps

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