Reyrolle
Protection
Devices

7SG23 - MSCDN

Capacitor Bank Protection

Answers for energy

SIEMENS

7SG23 - MSCDN

Capacitor Bank Protection

Description

Capacitor banks require a varied range of protection devices to monitor the system. Traditional solutions use many different relay types most of which were designed for other purposes. The MSCDN-MP has a unique range of purpose designed functions to cover all of the protection requirements in three multi-functional boxes:

MSCDN-MP1
MSCDN-MP2a
MSCDN-MP2b

Function Overview

MSCDN-MP*

Analogue Inputs

Current & Voltage signals are sampled at 32 samples per cycle which provides accurate measurements up to 750Hz (15th Harmonic).

Output Relays

All the output relays are capable of handling circuit breaker tripping duty. All relays are fully user configurable and can be programmed to operate from any or all of the control functions. In normal operation output relays remain energised for a minimum of 100ms and a maximum dependent on the energising condition duration. However outputs can be programmed as latching relays.

Status Inputs

The Status Inputs can be programmed to be used for any function, a timer is associated with each input and a pickup time setting may be applied. Each input can also be logically inverted and each input may be mapped to the fascia LED's or any output relay contact. Status inputs can be used to give a trip circuit supervision scheme.

Fascia LED's

There are 32 user programmable LED flag indicators on the front fascia of each relay. The user can customise which LED is used for which purpose as well as being able to program each LED as being latching or self-resetting.

Self Monitoring

The relay incorporates a number of self-monitoring features. Each of these features can initiate a controlled reset recovery sequence, which can be used to generate an alarm output. In addition, the Protection Healthy LED will give visual indication.

A watchdog timer continuously monitors the microprocessor. The voltage rails are also continuously supervised and the microprocessor is reset if any of the rails falls outside of their working ranges. Any failure is detected in sufficient time so that the micro can be shut down in a safe and controlled manner.

Monitoring Functions

RMS capacitor bank currents (primary, secondary and relay)
RMS overall differential currents (secondary and relay)
RMS capacitor spill currents (primary, secondary and relays)
RMS Phase unbalance currents (primary, secondary and relay)
System voltage (Primary, secondary)
Digital input status
Output relay
Time & Date

Application

The MSCDN range represents an integration of the protection elements required to provide a single box Main 1 and Main 2 protection of EHV capacitor banks.
Applications covered include overall differential protection, capacitor unbalance protection additional phase unbalance backup protection, true RMS phase by phase resistor thermal overload protection, resistor open circuit protection, true RMS phase-by-phase reactor thermal overload protection, backup overcurrent and earth faults protection and overvoltage protection.

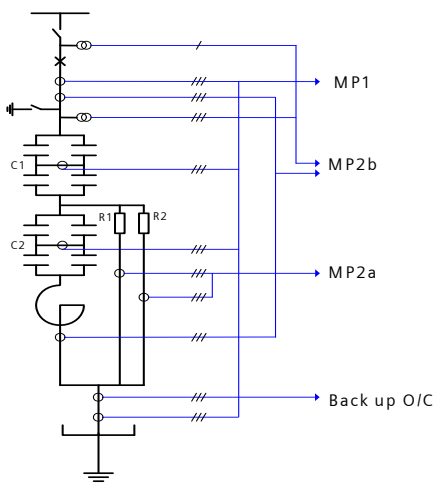


Fig 1. Typical application for the MSCDN range

Function Diagram – 7SG231

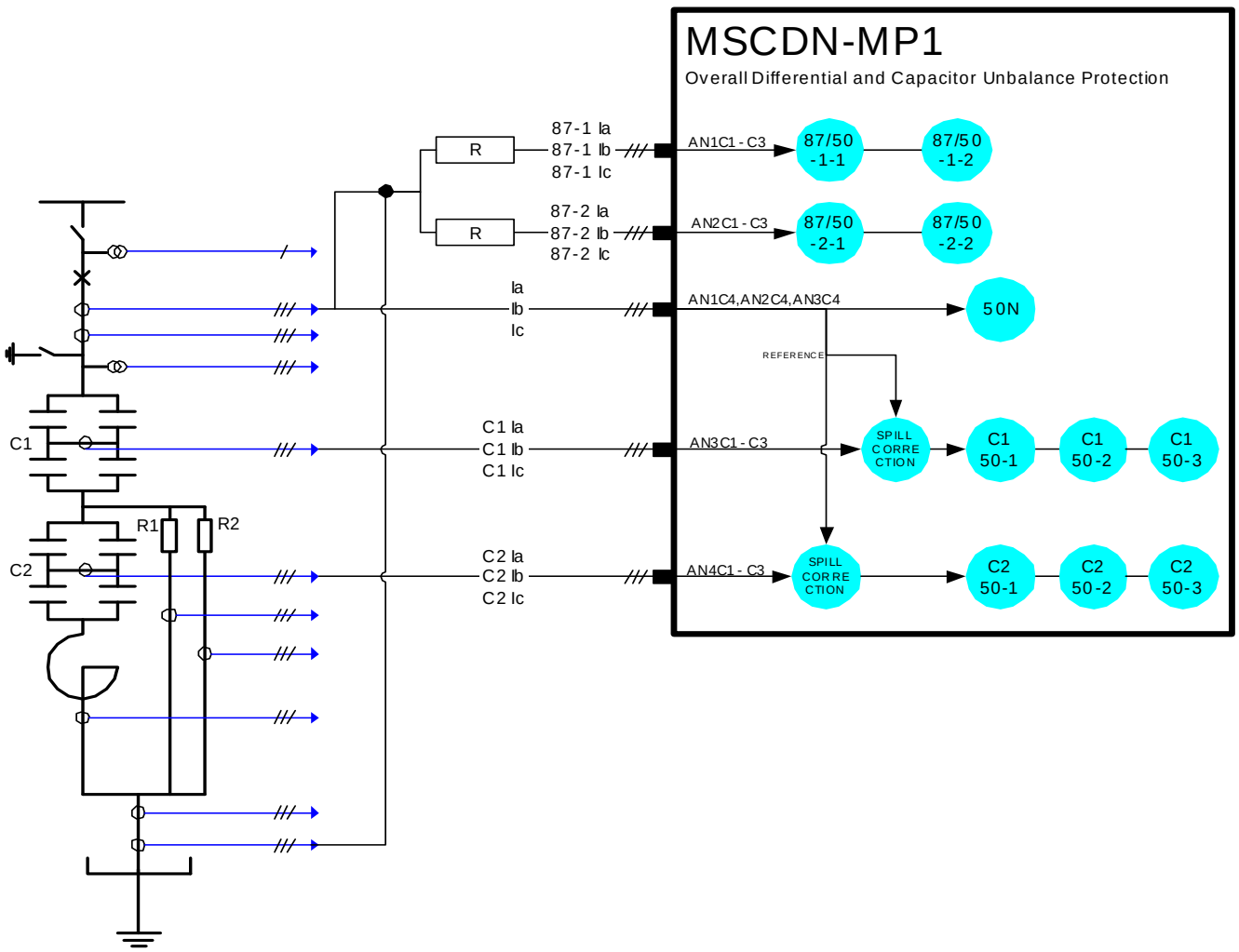


Fig 2. MSCDN MP1 Overview

Overall Differential (87/50)

The overall differential protection uses the high impedance circulating principle. The protection consists of two DTL over-current 87/50-1 and CT-1, 87/50-1 is set for tripping and the CT-1 element is utilised for CT supervision. The protection is duplicated for dependability, with elements 87/50-2 and CT-2 available for this purpose.

Capacitor Unbalance Protection (C1 50 and C2 50)

The relay contains two identical Capacitor Unbalance protection units, which are primarily designed to protect phase segregated capacitor stacks, with a central 'H' connection, although application to alternative stack arrangements is possible. Thus providing complete capacitor unbalance protection for main and auxiliary capacitor stacks.

For each unit, expected capacitive spill current for each phase is calculated, based on a proportion of the overall Capacitor bank current. This expected spill current is then compared with the measured phase spill current and this difference is the operating quantity for the two DTL elements available per unit.

Each DTL element is phase segregated, but utilises a common operate setting.

Phase Unbalance Protection (50N)

The operating quantity for the 50N element, is calculated from the RMS residual of the three phase currents, which is then connected to a DTL overcurrent element.

Trip circuit supervision

Status inputs on the relay can be used to supervise trip circuits while the associated circuit breakers (CB) are either open or closed. Since the status inputs can be programmed to operate output contacts and LED's alarm can be also generated from this feature

Function Diagram – 7SG232

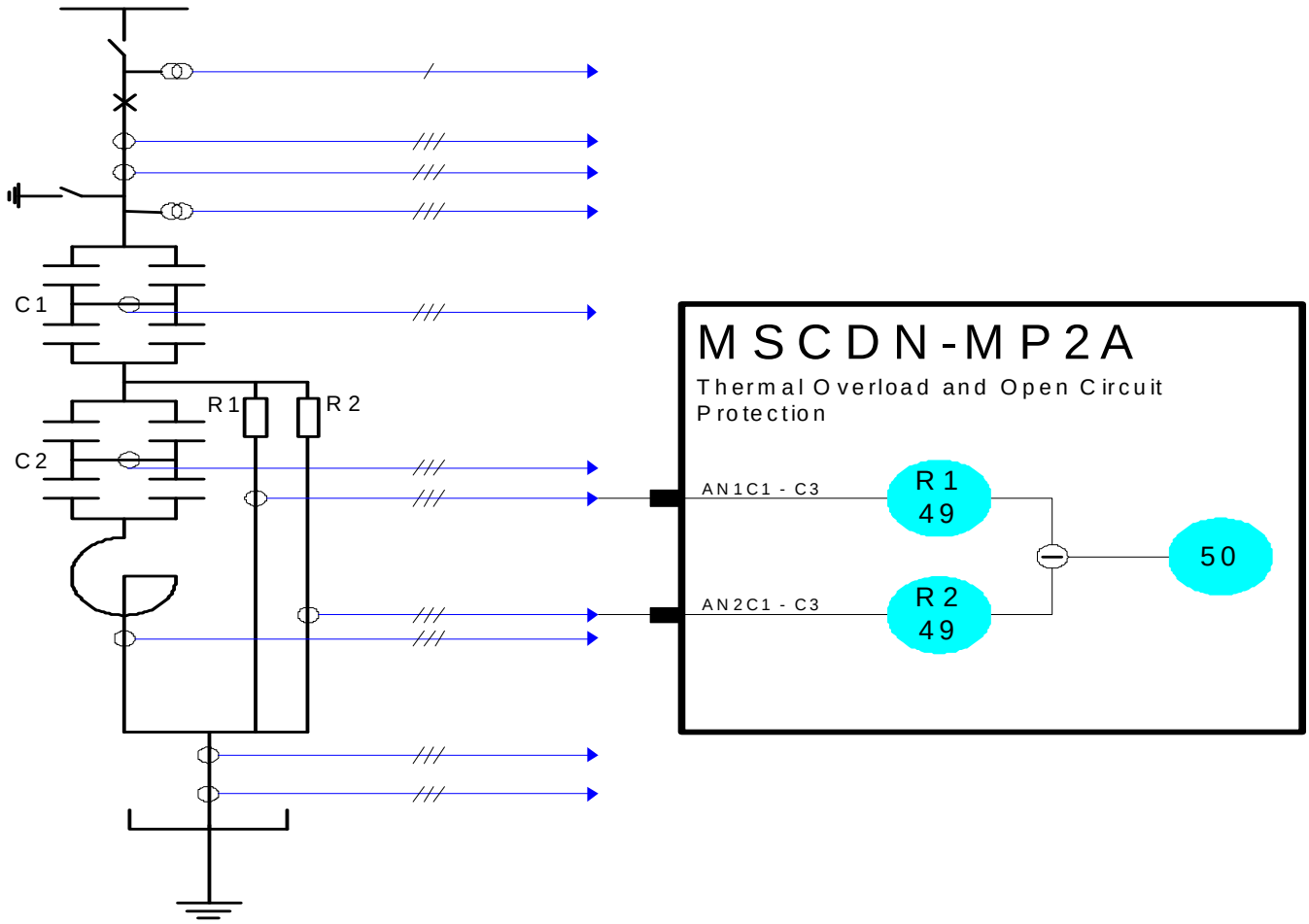


Fig 3. MSCDN MP2A Overview

Resistor R1 and R2 Thermal Overload (R1 49, R2 49)

The relay provides thermal overload protection for R1 and R2. The elements, one per phase, use 32 samples/cycle to provide a flat frequency response up to 550Hz and beyond.

The temperature of the protected equipment is not measured directly. Instead, thermal overload condition are detected by calculating the RMS of the current flowing in each phase of the resistor.

Should the RMS current rise above a defined level (the overload setting) for a defined time (the operating time t), the system will be tripped to prevent damage.

$$t = \tau * In\left\{\frac{I^2 - I_P^2}{I^2 - (k * I_B)}\right\}$$

Where

I_P = Previous steady state current level

I_B = Basic current of resistor, typically the same as I_n

k = Multiplier resulting in the overload pickup setting $k.I_B$

I = The measured resistor current

τ = Thermal time constant

Additionally, an alarm can be given if the thermal state of the system exceeds a specified percentage of the protected equipment's thermal capacity (Capacity alarm)

Resistor R1 and R2 Open Circuit 50OC

The resistor open circuit protection works by comparing the current in resistor R1 and resistor R2 on a phase-by-phase basis. Because the resistors are the same value then the current through each resistor should be equal. An instantaneous/time delayed overcurrent element monitors the difference between the currents on a phase-by-phase basis. If the element operates then the resistor, which has the lowest current, is indicated on the Fascia LEDs. For an open circuit condition then this will be the faulty resistor. However if there has been a short circuit in a resistor then this will not be true. The waveform records should be downloaded to confirm the actual fault condition that has occurred.

Function Diagram – 7SG233

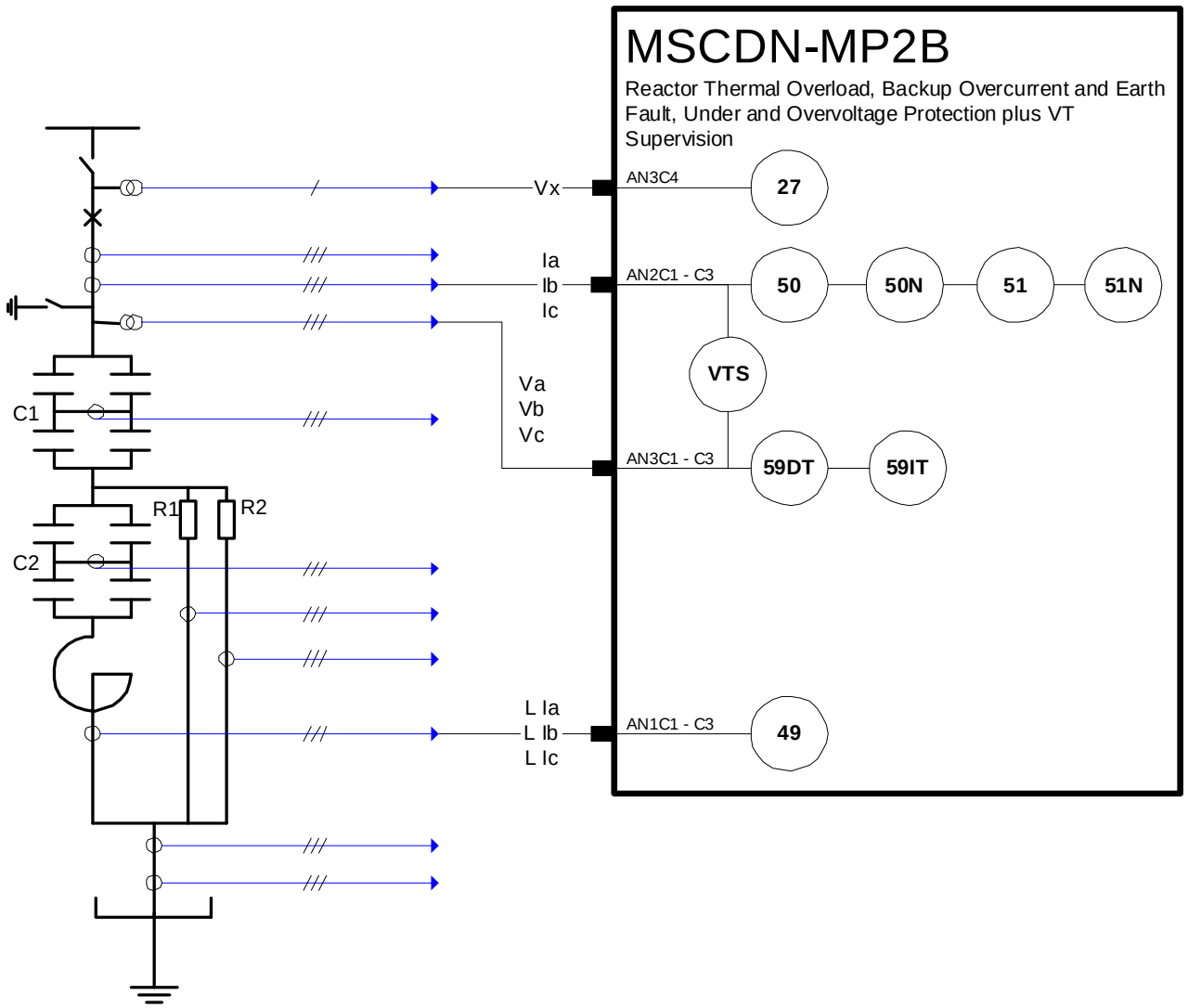


Fig 4. MSCDN MP2B Overview

Backup Overcurrent and Derived earth fault Protections 50/50N/51/51N

The relay provide true RMS backup overcurrent and earth fault protection for the capacitor bank. The elements, one per phase, use 32 samples/cycle to provide a flat frequency response up to 550Hz and beyond.

Undervoltage Detector 27

The relay provides true RMS measuring single-phase definite time under voltage detector. A guard element may be enabled to prevent the under voltage element from operating when there is a complete loss of voltage.

Definite Time Overvoltage Protection 59DT

The relay provides true RMS measuring three-phase definite time over voltage protection. The elements one per phase, use 32 samples per cycle to provide a flat frequency response up to 550Hz and beyond.

Inverse Time Overvoltage Protection

The relay provides true RMS measuring three-phase definite time over voltage protection. The inverse curve is specified using a 7 point user defined curve. The elements one per phase, use 32 samples per cycle to provide a flat frequency response up to 550Hz and beyond.

VT Supervision

The VTS function is performed using an undervoltage element (27VTS) and a current check element (50VTS) on a phase by phase basis. Each element is usually set instantaneous. Fuse failure operates if both the current check element (50VTS) and the undervoltage element (27VTS) is picked up for the VTS delay setting period, which indicates the capacitor bank is energised, and operates, which is set to 10 seconds by default i.e. A sustained condition of rated current without rated volts indicates a fuse failure on a per phase basis

Function Overview

Measurements and indication

Analogue values can be displayed on the LCD screen. In addition most values can be obtained via the IEC60870-5-103 communications.

System data

Sequence of event records

Up to 500 events are stored and time tagged to 1ms resolution. These are available via the communications.

Fault records

The last 10 fault records are available from the fascia with time and date of trip, measured quantities and type of fault.

Disturbance recorder

10 seconds of waveform storage is available and is user configurable as 10*1s, 5*2s or 1*10s records. Within the record the amount of per-fault storage is also configurable. The recorder is triggered from a protection operation, or status input.

The records contain the analogue waveforms of the line currents, the relay currents after vector group correction and the digital input and output signals.

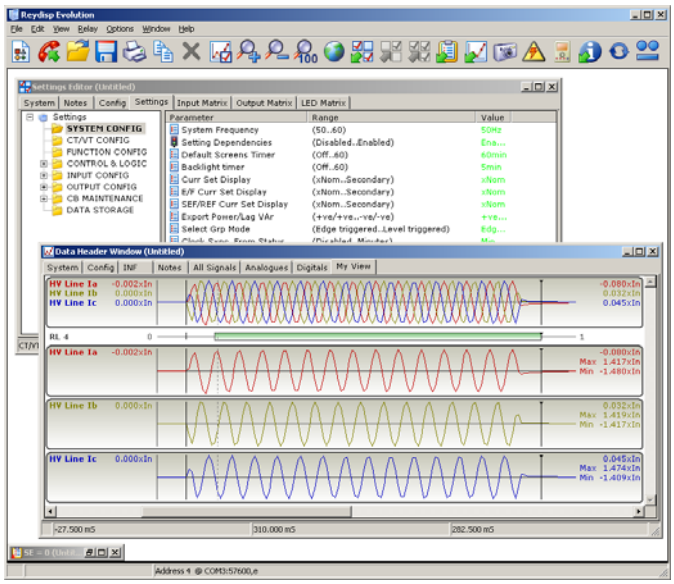
Communications

Two Fibre-optic communications ports are provided on the rear of the relay. They are optimised for 62.5/125µm glass-fibre, with BFOC/2.5(ST®) bayonet style connectors.

In addition users may interrogate the MSCDN locally with a laptop PC and the RS232 port on the front of the relay.

The MSCDN uses IEC 60870-5-103 as its communications standard

Reydisp Evolution



Reydisp Evolution is common to the entire range of Reyrolle numeric products. It provides a means for the user to apply settings to the MSCDN, interrogate settings and retrieve disturbance waveforms from the MSCDN

Figure (of screen shot of disturbance records in Reydisp Evolution

Technical Information

Accuracy Reference Conditions

General	IEC60255 Parts 6, 6A & 13
Auxiliary Supply	Nominal
Frequency	50 Hz
Ambient Temperature	20°C

Modular II Specification

Mechanical

Vibration (Sinusoidal) –IEC 60255-21-1 Class 1

		Variation
Vibration response	0.5gn	≤ 5%
Vibration endurance	1.0gn	≤ 5%

Shock and Bump–IEC 60255-21-2 Class 1

		Variation
Shock response	5 gn 11ms	≤ 5%
Shock withstand	15 gn 11ms	≤ 5%
Bump test	10 gn 16ms	≤ 5%

Seismic – IEC 60255-21-3 Class 1

		Variation
Seismic Response	1gn	≤ 5%

Durability	In excess of 10^6 operations

Auxiliary Energizing Quantity DC Power Supply

Nominal	Operating Range
30V	24V to 37.5V dc
48/110V	37.5V to 137.5V dc
220/250V	175V to 286V dc

Auxiliary DC Supply – IEC 60255-11

Allowable superimposed ac component	≤ 12% of DC voltage
Allowable breaks/dips in supply (collapse to zero from nominal voltage)	≤ 20ms

D.C. Burden

Quiescent (Typical)	15 Watts
Max	27 Watts

A.C Current Inputs

1 Amp and 5 Amp current inputs are both available on the rear terminal blocks for most functions except Capacitor Unbalance.

Electrical

Insulation - IEC 60255-5

Between all terminals and earth	2.0kV rms for 1 min
Between independent circuits	2.0kV rms for 1 min
Across normally open contacts	1.0kV rms for 1 min

High Frequency Disturbance - IEC 60255-22-1 Class III

	Variation
2.5kV Common (Longitudinal) Mode	≤ 5%
1.0kV Series (Transverse) Mode	≤ 5%

Electrostatic Discharge - IEC 60255-22-2 Class IV

	Variation
8kV contact discharge	≤ 5%

Conducted & Radiated Emissions - EN 55022 Class A (IEC 60255-25)

Conducted 0.15MHz – 30MHz Radiated 30MHz – 1GHz

Conducted Immunity - (IEC 61000-4-6; IEC 60255-22-6)

	Variation
0.15MHz – 80MHz 10V rms 80% modulation	≤ 5%

Radiated Immunity - IEC60255-22-3 Class III

	Variation
80MHz to 1000MHz, 10V/m 80% modulated	≤ 5%

Fast Transient – IEC 60255-22-4 Class IV

	Variation
4kV 5/50ns 2.5kHz repetitive	≤ 5%

Surge Impulse - IEC 61000-4-5 Class IV; (IEC 60255-22-5)

	Variation
4KV Line-Earth (O/C Test voltage ±10%) 2KV Line-Line	≤ 10

Environmental Withstand

Temperature - IEC 60068-2-1/2

Operating range	-10°C to +55°C
Storage range	-25°C to +70°C

Humidity - IEC 60068-2-3

Operational test	56 days at 40°C and 93% RH

Transient Overvoltage –IEC 60255-5

Between all terminals and earth or between any two independent circuits without damage or flash-over	5kV 1.2/50µs 0.5J

Thermal Withstand

Continuous and Limited Period Overload AC Current Inputs

3.0 x In	Continuous
3.5 x In	for 10 minutes
4.0 x In	for 5 minutes
5.0 x In	for 3 minutes
6.0 x In	for 2 minutes
250A	for 1 second
625A peak	for 1 cycle

A.C. Burden

1A tap	≤0.1 VA
5A tap	≤0.3 VA

NB. Burdens are measured at nominal rating.

Continuous Overload A.C Voltage Inputs

AC Voltage	320Vrms (452Vpk)

A.C. Burden

110Vrms	0.05 VA
63.5Vrms	0.01 VA

Rated Frequency

Operating Frequency: 50Hz

Frequency

Range	47Hz to 52Hz
Setting variation	≤ 5%
Operating time variation	≤ 5% or 5ms

Accuracy Influencing Factors

Temperature

Ambient range	-10°C to +55°C
Variation over range	≤ 5%

Output Contacts

Output contacts functionality is fully programmable. The basic I/O module has 5 output contacts three of which are change over. Additional modules can be added with consequential increase in case size, to provide more contacts. These are added in-groups of eight up to a maximum of 29

Output Contact Performance

Contact rating to IEC 60255-0-2.

Carry continuously

5A ac or dc

Make and Carry

(limit L/R ≤ 40ms and V ≤ 300 volts)

for 0.5 sec	20A ac or dc
for 0.2 sec	30A ac or dc

Break

(limit ≤ 5A or ≤ 300 volts)

Ac resistive	1250VA
Ac inductive	250VA @ PF ≤ 0.4
Dc resistive	75W
Dc inductive	30W @ L/R ≤ 40 ms 50W @ L/R ≤ 10 ms
Minimum number of operations	1000 at maximum load
Minimum recommended load	0.5W, limits 10mA or 5V

Status inputs

Status Inputs functionality is fully programmable. The basic I/O module has 3 status inputs these can be set to high speed for signalling. Additional modules can be added to provide more inputs. Additional inputs are added in-groups of eight up to a maximum of 27. A pickup timer is associated with each input and each input may be individually inverted where necessary.

Nominal Voltage	Operating Range
30	18V to 37.5V
48	37.5V to 60V
110	87.5V to 137.5V
220	175 to 280V

NB: the status input operating voltage does not have to be the same as the power supply voltage.

Status Input Performance

Minimum DC current for operation	48V 10mA 110V 2.25mA 220V 2.16mA
Reset/Operate Voltage Ratio	≥ 90%
Typical response time	< 5ms
Typical response time when programmed to energise an output relay contact	< 15ms
Minimum pulse duration	40ms

250V RMS 50/60Hz applied for two seconds through a 0.1µF capacitor.
500V RMS 50/60Hz applied between each terminal and earth.
Discharge of a 10µF capacitor charged to maximum DC auxiliary supply voltage.

Auxiliary Timer Accuracy

Auxiliary Timers are those timers created in Reylogic, whose delay settings appear in the reylogic elements menu

Accuracy

Timing	< +1% or +10ms

Accuracy Influencing Factors

Common Performance Disengaging Time

Disengaging Time	30ms

Note: Output contacts have a minimum dwell time of 100ms, after which the disengaging time is as above.

87/50-x-x Overall Differential

Phase segregated High impedance Overall Differential scheme using external stabilizing resistors. Function is insensitive to third harmonic currents.

Accuracy

Pickup	100% of setting ± 5% or ± 0.01 I_n
Reset	80% of I_s
Repeatability	± 2%
Transient Over-reach	5%

Operating Time

Current Applied	Typical
2 x setting	≤ 1.5 cycle
4 x setting	≤ 1 cycle

C1/2 50-x Capacitor Unbalance

Phase segregated Capacitor Unbalance element, whose operate quantity is calculated from the ratio of capacitor load current and the measured spill current, followed by three identical instantaneous Overcurrent elements with following time delay

Accuracy

Pickup	100% of setting ± 5% or ± 0.02 I_n
Reset	80% of I_s
Repeatability	± 2%
Operate Time	± 1% or ± 10ms

Operating Time

Current Applied	Typical
2 x setting	1.5 cycles
4 x setting	1 cycle

50N Cap Bank Phase Unbalance

Derived phase unbalance quantity, from the sum of phase currents, applied to an instantaneous overcurrent element with following time delay.

Accuracy

Pickup	100% of setting ± 5% or ± 0.01 I_n
Reset	80% of I_s
Repeatability	± 2%
Operate Time	± 1% or ± 10ms

Operating Time

Current Applied	Typical
2 x setting	1.5 cycles
4 x setting	1 cycle

R1/2 49 Resistor Thermal Overload

Pickup	100% of setting ± 5% or ± 0.02 I_n
Reset	95% of I_s
Repeatability	± 2%
Operate Time	± 5% or ± 0.1s
Frequency Range	1st, 2nd ...15th Harmonic

Operating Time

Characteristic	Ranges
Thermal IEC 60255-8	Operate times are calculated from: $t = \tau \times \ln\left\{\frac{I^2 - I_p^2}{I^2 - (k \times I_B)^2}\right\}$ τ = thermal time constant I = measured current I_P = prior current I_B = basic current k = constant

50 Resistor Open Circuit

An instantaneous/delayed overcurrent element measures the difference in currents on each resistor on a phase-by-phase basis.

Accuracy

Pickup	100% of setting ± 5% or ± 0.02 I_n
Reset	95% of I_s
Repeatability	± 2%
Operate Time	± 1% or ± 10ms

Operating Time

Current Applied	Typical
2 x setting	2 cycles
4 x setting	1.5 cycle

49 Reactor Thermal Overload

Thermal overload element applied to each phase of the reactor independently.

Accuracy

Pickup	100% of setting ± 5% or ± 0.02 I_n
Reset	≥ 95% of I_s
Repeatability	± 2%
Operate Time	± 5%
Frequency Range	1st, 2nd ...15th Harmonic

Thermal overload element applied to each phase of each resistor independently.

Accuracy

Operating Time

Characteristic	Ranges
THERMAL IEC 60255-8	Operate times are calculated from: $t = \tau \times \ln\left\{\frac{I^2 - I_p^2}{I^2 - (k \times I_B)^2}\right\}$ τ = thermal time constant I = measured current I_P = prior current I_B = basic current k = constant
τ Factor	1 to 1000 Δ 0.5 minutes

50 Backup Overcurrent

Three phase definite time overcurrent element.

Accuracy

Pickup	100% of setting ± 5% or ± 0.02 I_n
Reset	95% of I_s
Repeatability	± 2%
Operate Time	± 1% or ± 10ms
Frequency Range	1st, 2nd ...15th Harmonic

Operating Time

Current Applied	Typical
2 x setting	2 cycles
4 x setting	1.5 cycle

50N Backup Earth Fault

Definite time derived earth fault element.

Accuracy

Pickup	100% of setting ± 5% or ± 0.02 I_n
Reset	≥ 95% of I_s
Repeatability	± 2%
Operate Time	± 1% or ± 10ms
Frequency Range	1st, 2nd ...15th Harmonic

Operating Time

Current Applied	Typical
2 x setting	2 cycles
4 x setting	1.5 cycle

51 Backup Overcurrent

Three phase inverse time overcurrent element.

Accuracy

Pickup	105% of setting ± 5% or ± 0.02 I_n
Reset	95% of I_s
Repeatability	± 2%
Operate Time	± 5% or ± 40ms
Frequency Range	1st, 2nd ...15th Harmonic

Operating Time

Characteristic	Ranges
IEC IDMTL CURVES	Operate times are calculated from: $t = Tm \times \left[\frac{K}{\left[\frac{I}{Is}\right]^{\alpha} - 1} \right]$ I = fault current Is = current setting Tm = time multiplier NI: K = 0.14, α = 0.02 VI: K = 13.5, α = 1.0 EI: K = 80.0, α = 2.0 LTI: K = 120.0, α = 1.0
Time Multiplier	0.025 to 1.600 Δ 0.025 sec
Reset	0.0 to 60.0 Δ 1.0 sec
ANSI IDMTL CURVES	Operate times are calculated from: $t = M \times \left[\frac{A}{\left[\frac{I}{Is}\right]^{P} - 1} + B \right]$ I = fault current Is = current setting M = time multiplier MI: A = 0.0515, B = 0.114, P = 0.02 VI: A = 19.61, B = 0.491, P = 2.0 EI: A = 28.2, B = 0.1217, P = 2.0
ANSI RESET CURVES	Operate times are calculated from: $t = M \times \left[\frac{R}{\left[\frac{I}{Is}\right]^{2} - 1} \right]$ I = fault current Is = current setting M = time multiplier MI: R = 4.85 VI: R = 21.6 EI: R = 29.1

51N Derived Earth Fault

Inverse time derived earth fault element.

Accuracy

Pickup	105% of setting ± 5% or ± 0.02 I_n
Reset	95% of I_s
Repeatability	± 2%
Operate Time	± 5% or ± 40ms
Frequency Range	1st, 2nd ...15th Harmonic

Operating Time

Characteristic	Ranges
IEC IDMTL CURVES	Operate times are calculated from: $t = Tm \times \left[\frac{K}{\left[\frac{I}{Is}\right]^{\alpha} - 1} \right]$ I = fault current Is = current setting Tm = time multiplier NI: K = 0.14, α = 0.02 VI: K = 13.5, α = 1.0 EI: K = 80.0, α = 2.0 LTI: K = 120.0, α = 1.0
Time Multiplier	0.025 to 1.600 Δ 0.025 sec
Reset	0.0 to 60.0 Δ 1.0 sec
ANSI IDMTL CURVES	Operate times are calculated from: $t = M \times \left[\frac{A}{\left[\frac{I}{Is}\right]^{P} - 1} + B \right]$ I = fault current Is = current setting M = time multiplier MI: A = 0.0515, B = 0.114, P = 0.02 VI: A = 19.61, B = 0.491, P = 2.0 EI: A = 28.2, B = 0.1217, P = 2.0
ANSI RESET CURVES	Operate times are calculated from: $t = M \times \left[\frac{R}{\left[\frac{I}{Is}\right]^{2} - 1} \right]$ I = fault current Is = current setting M = time multiplier MI: R = 4.85 VI: R = 21.6 EI: R = 29.1

27 Undervoltage

Single phase definite time undervoltage element. An under voltage guard element may be used to block this elements operation.

Accuracy

Pickup	100% of setting ± 0.1% or ± 0.1 V
Reset	≤ 100.5% of V_s (Adjustable)
Repeatability	± 0.1%
Operate Time	± 1% or ± 20ms
Frequency Range	1st, 2nd ...15th Harmonic

Operating Time

Operate Time	< 3 cycles

59DT Definite Time Overvoltage

Three phase definite time overvoltage element

Accuracy

Pickup	100% of setting ± 0.1% or ± 0.1 V
Reset	≥ 99.5% of V_s
Repeatability	± 0.1%
Frequency Range	1st, 2nd ...15th Harmonic

Operating Time

Operate Time	< 4 cycles

59IT Inverse Time Overvoltage

Three phase inverse time overvoltage element specified using seven user defined points on a curve.

Accuracy

Pickup	± 0.1% of setting or ± 0.1 V
Reset	≥ 99.5% of V_s
Repeatability	± 0.1%
Operate Time	± 5% or ± 0.1s
Frequency Range	1st, 2nd ...15th Harmonic

Operating Time

Characteristic	Ranges
CURVE	7 Point user defined inverse curve X_0,Y_0 : X_6,Y_6 X_i:=1.00xVn ... 2.00xVn Y_i:=0.1 ... 20000s

VT Supervision

The VT supervision element operates when the 27 VTS and the 50 VTS element operate to indicate that the capacitor bank is energised but rated voltage has not been applied to the relay on a phase by phase basis.

27 VTS Undervoltage

Three phase definite time undervoltage element

Accuracy

Pickup	100% of setting ± 0.1% or ± 0.1 V
Reset	≥ 99.5% of V_s
Repeatability	± 0.1%

Operating Time

Operate Time	< 4 cycles

50 VTS Current Check

Three phase definite time overcurrent check element

Accuracy

Pickup	100% of setting ± 5% or ± 0.02 I_n
Reset	≥ 95% of I_s
Repeatability	± 2%
Operate Time	± 1% or ± 10ms

Operating Time

Current Applied	Typical
2 x setting	2 cycles
4 x setting	1.5 cycle

Ordering Information – 7SG23 MSCDN-MP

Product description	Variants	Order No.
MSCDN-MP		**7 S G 2 3 □ 0 - 0 □ □ □ □ - □ □ □ 0**
	Relay type	
	MSCDN-MP1	**1**
	- Two overall unit protection elements	
	- CT supervision	
	- Two capacitor out of balance units	
	- Phase unbalance	
	MSCDN-MP2a	**2**
	- Resistor thermal overload	
	- Resistor open circuit	
	MSCDN-MP2b	**3**
	- Reactor thermal overload	
	- Excessive RMS overcurrent	
	- Capacitor under/overvoltage	
	- Overcurrent and earth-fault	
	- VT supervision	
	Auxiliary supply /binary input voltage	
	30 V DC auxiliary, 30 V DC binary input	**A**
	30 V DC auxiliary, 48 V DC binary input	**B**
	48/110 V DC auxiliary, 30 V DC binary input	**C**
	48/110 V DC auxiliary, 48 V DC binary input [1])	**D**
	48/110 V DC auxiliary, 110 V DC low burden binary input	**E**
	220 V DC auxiliary, 110 V DC low burden binary input	**F**
	220 V DC auxiliary, 220 V DC low burden binary input	**G**
	I/O range	
	11 Binary Inputs / 13 Binary Outputs (incl. 3 changeover)	**B**
	19 Binary Inputs / 21 Binary Outputs (incl. 3 changeover)	**C**
	Frequency	
	50Hz	**1**
	Nominal current	
	1/ 5 A	**0**
	1 A	**1**
	Voltage inputs	
	Not available	**0**
	63/110 V AC	**1**
	Housing size	
	Case size E12 (4U high)	**G**
	Case size E16 (4U high)	**J**
	Communication interface	
	Fibre optic (ST-connector) / IEC 60870-5-103	**A**

[1]) High burden 110/125V binary inputs compliant with ESI48-4 ESI 1 available via external dropper resistors with 48V binary input version
110/125 V application, order combination of the following resistor boxes to suit number of binary inputs
VCE:2512H10064 (9 inputs, 110V)
VCE:2512H10065 (5 inputs, 110V)
VCE:2512H10066 (1 inputs, 110V)
Refer to website for application note about ESI48-4 compliance

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Siemens AG
Energy Sector
Freyeslebenstrasse 1
91058 Erlangen, Germany

Siemens Protection Devices Limited
P.O. Box 8
North Farm Road
Hebburn
Tyne & Wear
NE31 1TZ
United Kingdom
Phone: +44 (0)191 401 7901
Fax: +44 (0)191 401 5575
www.siemens.com/energy

For more information, please contact our
Customer Support Center.
Phone: +49 180/524 70 00
Fax: +49 180/524 24 71(Charges depending on provider)
E-mail: support.energy@siemens.com

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