MANUFACTURER DOCUMENT PACKAGE

Manufacturer's Manual

Amikon cover with selected ABB reference pages; not the complete manuals

SPACOM / SPTU 240 R2

SPTU 240 R2

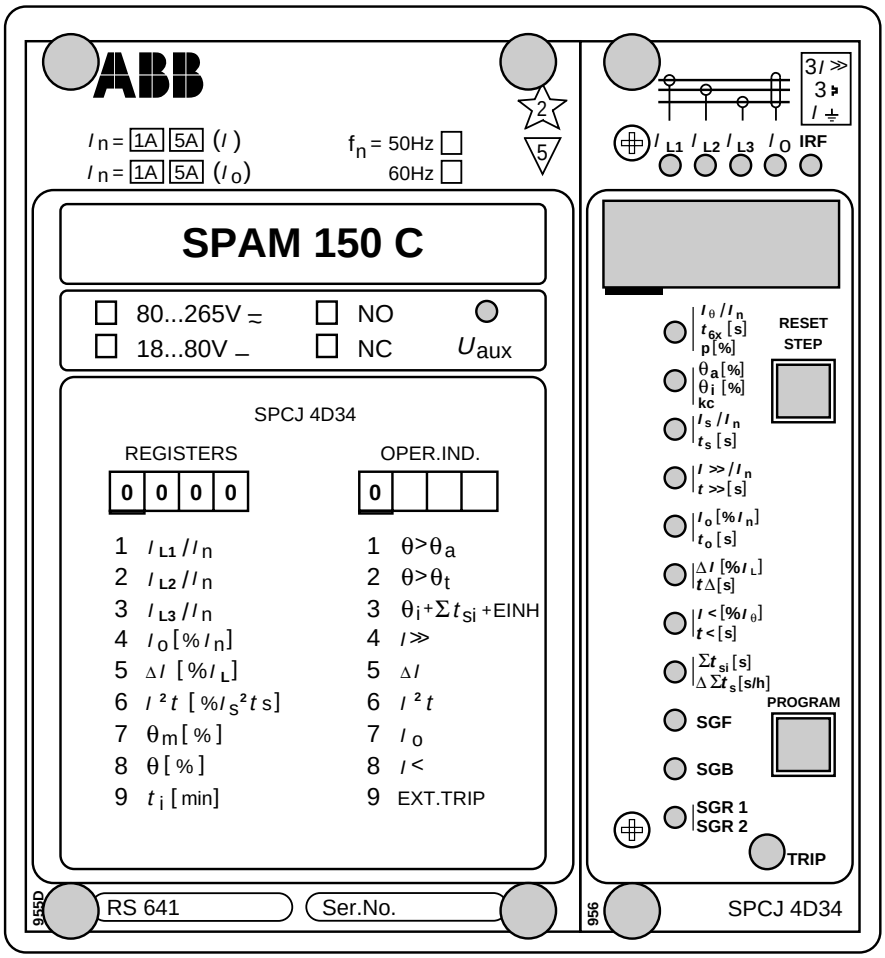
POWER-SUPPLY AND OUTPUT-RELAY MODULE

OFFICIAL SOURCES

ABB SPAM 150 C and SPAJ 160 C: selected module, contact and maintenance references. Original pages remain unchanged.

SPAM 150 C
Motor protection relay

User´s manual and Technical description



1MRS 750637-MUM EN

Issued 1997-03-05
Modified 2002-04-24
Version B (replaces 34 SPAM 8 EN1)
Checked MK
Approved OL

SPAM 150 C
Motor protection relay

Data subject to change without notice

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The complete user´s manual includes the following separate manuals:

Motor protection relay, general description	1MRS 750637-MUM EN
General characteristics of D type relay modules	1MRS 750066-MUM EN
Motor protection relay module type SPCJ 4D34	1MRS 750476-MUM EN

Characteristics

Versatile multifunction relay for the protection of circuit breaker or contactor controlled a.c. motors

Flexible single, two or three phase protection relay for feeders etc.

Thermal overload protection, monitoring all three phases, the thermal replica is adjustable both for protected objects with or protected objects without hot-spots

High-set overcurrent protection operating instantaneously or with definite time characteristic

Phase unbalance & single-phasing protection with inverse time characteristic

Fast operating incorrect phase sequence protection

Sensitive definite time or instantaneous earth-fault protection with tripping or only signalling function

Undercurrent protection with wide start current and operate time setting ranges

Start-up supervision with I_s^2 x t_s-characteristic, with a low-set overcurrent unit or as a start-up time counter. The start-up supervision can also cooperate with a speed switch on the motor shaft of an ExE-type motor

Continuous self-supervision of hardware and software

Current range handled meets the requirements for ExE motor drives of Zone 1

Two versions; one with a normally open trip contact for circuit-breaker controlled drives and another with a normally closed trip contact for contactor controlled drives

Fibre-optic serial communication over the SPA bus provides access to any relay data

Powerful support software for parametrization of the relay and for recording of measured and recorded values, events, etc.

Connection diagram

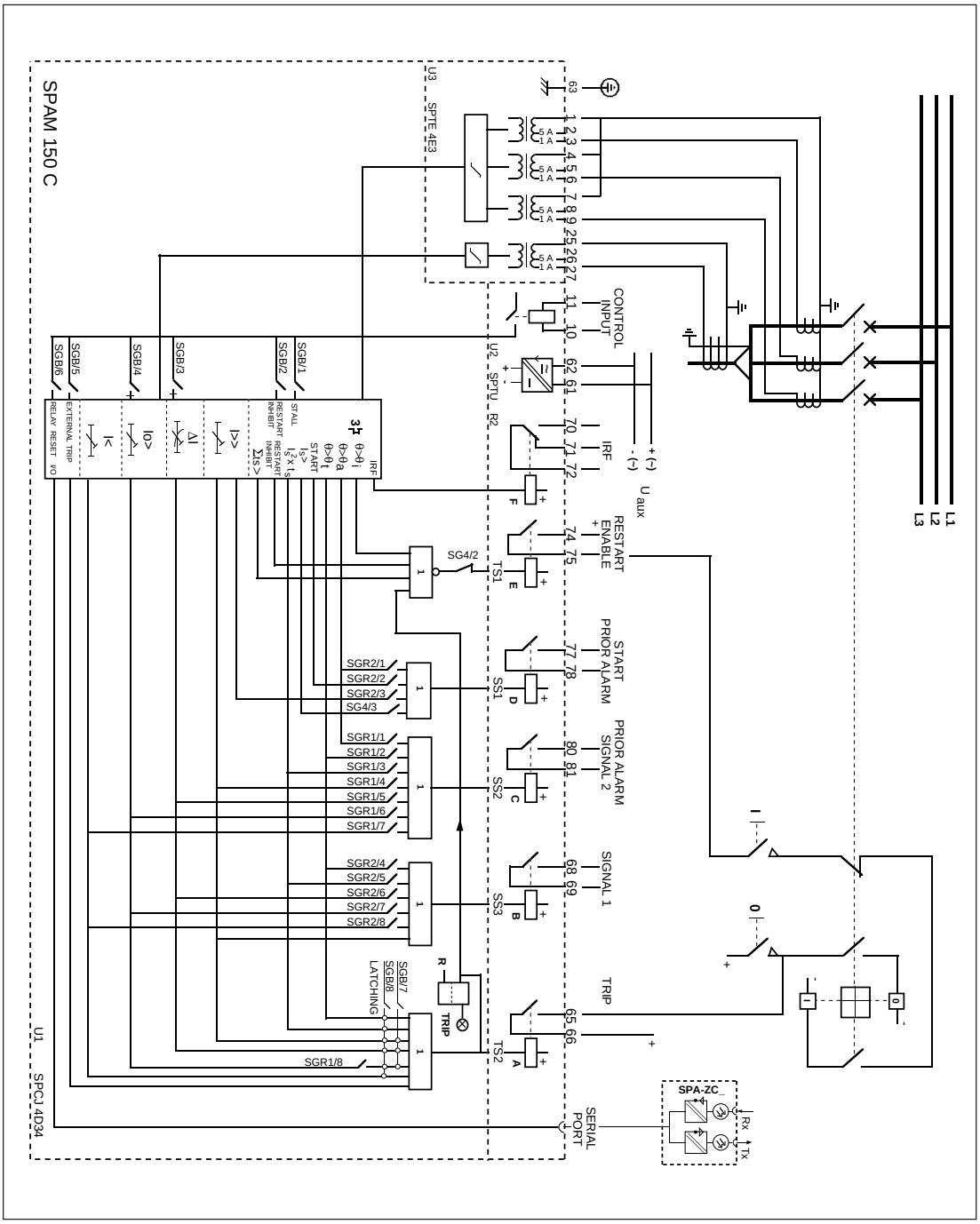


Fig. 2. Connection diagram of the motor protection relay SPAM 150 C. The version shown is the one with the normally open trip contact, i.e. with an auxiliary supply and output relay module type SPTU 240R2 or SPTU 48R2.

U_{aux}	Auxiliary voltage
A, B, C, D, E, F	Output relays
IRF	Self-supervision
SGB	Switchgroup for the configuration of the blocking or control signal
TRIP	Trip output relay, output 65-66
SIGNAL	Signal on tripping
PRIOR ALARM	Prewarning for a beginning overload condition
START	Start information from the motor
RESTART ENABLE	Starting of motor inhibited in fault conditions
U1	Motor protection module SPCJ 4D34
U2	Power supply and output relay module SPTU 240 R2 or SPTU 48 R2 with a normally open trip contact, SPTU 240 R3 or SPTU 48 R3 with a normally closed trip contact
U3	Input module SPTE 4E3
SPA-ZC—	Bus connection module
SERIAL PORT	Serial communication port
Rx, Tx	Receiver bus terminal (Rx) and the transmitter bus terminal (Tx) of the bus connection module
STALL	External stall control input
RESTART INHIBIT	External restart inhibit control signal
LATCHING	Latching function of the trip relay

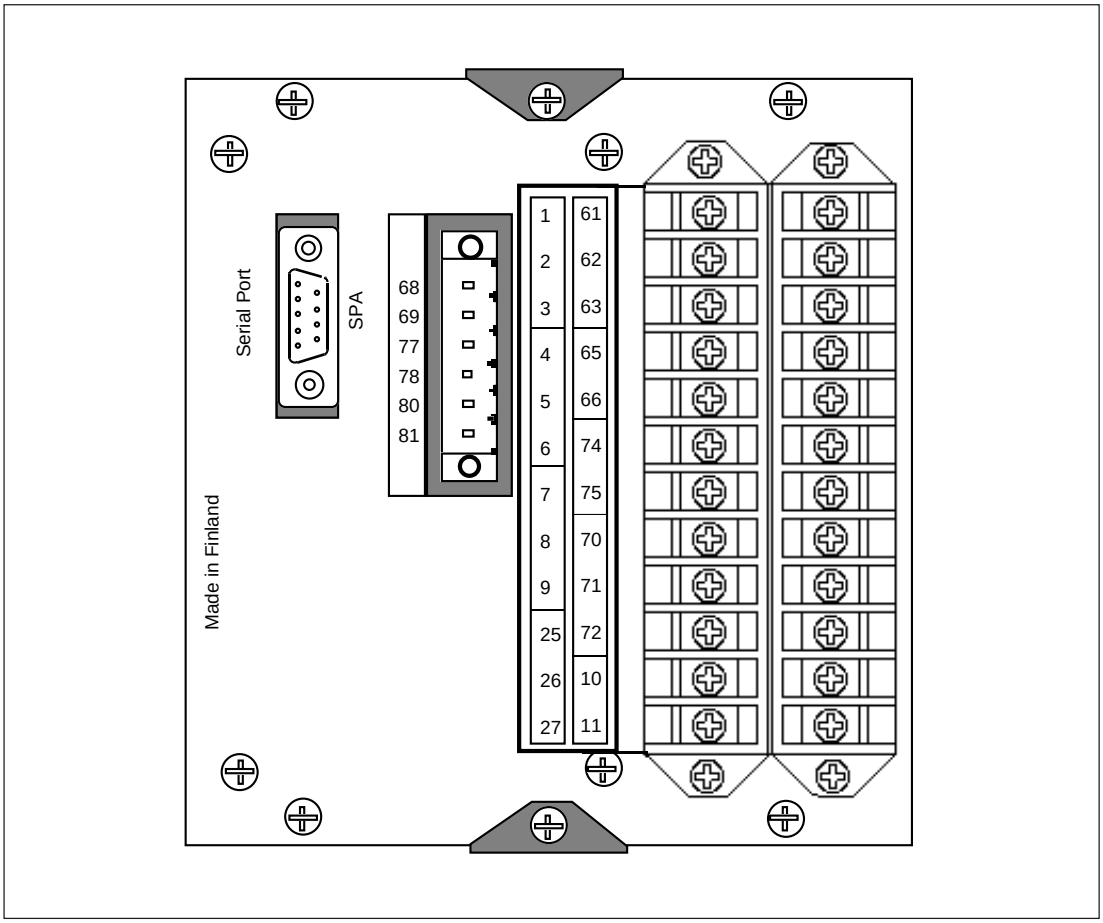


Fig. 3. Rear view of relay SPAM 150 C.

Connections

The three phase currents are connected to terminals 1-2, 4-5 and 7-8, when the rated current of the secondary circuits is I_n = 5 A. When using current transformers with a rated current of 1 A, terminals 1-3, 4-6 and 7-9 are used. The thermal overload protection may also be used in single-phase or two-phase applications, in this case inputs not used may be left unconnected.

To get a proper operation of the unbalance and incorrect phase sequence protection in a two-phase application, the two phase currents should be summed in the third phase current input. In single-phase applications, wiring the phase current through two or three current inputs in series may slightly increase the operating speed of the relay and stabilize operation of the thermal unit.

The neutral current of the earth-fault protection is connected to terminals 25-26 when the rated current is 5 A and to terminals 25-27 when the rated current is 1 A.

The control input 10-11 can be used in five different ways:
- as the control input controlled by a motor speed switch in Ex-type applications
- as the control input of an external blocking signal for blocking the operation of the unbalance or earth-fault protection units
- as the control input for an external trip signal
- as the control input for unlatching the trip relay
- as the control input for the restart enable relay.

The designed function is selected by means of switches 1...8 of switchgroup SGB in the main menu of the protection relay module.

The auxiliary supply voltage of the relay is connected to the terminals 61-62. At d.c. auxiliary supply voltage the positive lead is connected to terminal 61. The accepted input voltage range is determined by the type of power supply and output relay module inserted in the relay case. For further details see the description of the power supply module. The accepted auxiliary voltage range of the relay is indicated on the front panel.

Output relay A provides the CB tripping commands when the operate time of a protective unit has elapsed. The earth-fault unit can be made non-tripping, i.e. only signalling, with switch 8 of switchgroup SGR1. On delivery from factory all protective units are selected to perform tripping. A latching function of the output relay A can be selected by means of switches SGB/7 and SGB/8. Switch SGB/7 gives a latching function after a short-circuit, an earth-fault or an unbalance tripping. Switch SGB/8 provides a latching function after any trip operation. After having latched the output relay must be manually reset or reset by remote control.

The trip alarm signals from the relay module are obtained via output relays B and C. The signals to be routed to these relays are selected with switches1...7 of switchgroup SGR1 and switches 4...8 of switchgroup SGR2 of the relay module. Normally the output relays B and C are given such a configuration that a thermal prior alarm is obtained over relay C and the trip signals of the protection units are linked to output relay B to form an auxiliary trip signal. This is also the default setting of the relay on delivery from the factory.

The signals to be routed to the output relay D are selected with switches 1, 2 and 3 of software switchgroup SGR2 in the main menu of the relay module. Switch SGR2/1 routes the thermal prior alarm, switch SGR2/2 routes the startup information for the motor and switch SGR2/3 routes the start signal of the high-set overcurrent stage to output relay D.

Output relay E, terminals 74-75, is a heavy duty output relay capable of controlling a circuit breaker, as the main trip relay A. Relay E is used for controlling the restart of the motor. If the thermal capacity used exceeds the set restart inhibit level of the thermal unit, if the allowed maximum cumulative start-up count is exceeded or if the external restart inhibit signal is active the output relay E prevents a motor restart attempt. This also applies to a condition where the protective relay is out of auxiliary voltage or the relay is faulty.

Output relay F, terminals 70-71-72, operates as the output relay of the integrated self-supervision system. The relay operates on the closed-circuit principle, thus under normal service conditions the contact gap 70-72 is closed. If a fault is detected by the self-supervision system, or if the auxiliary supply fails, the output relay drops off, providing an alarm signal by closing the NO contact 71-72.

The relay is connected to the SPA data bus by means of bus connection module type SPA-ZC 17 or SPA-ZC21. The bus connection module is connected to the D type connector marked SERIAL PORT on the rear panel of the relay. The fibre-optic cables are connected to the connectors Tx and Rx of the bus connection module. The communication mode selector switches on the bus connection module are set in position "SPA".

Control signals between the modules

The figure below schematically illustrates how the starting, tripping, control and blocking signals can be programmed to obtain the required function of the protection relay.

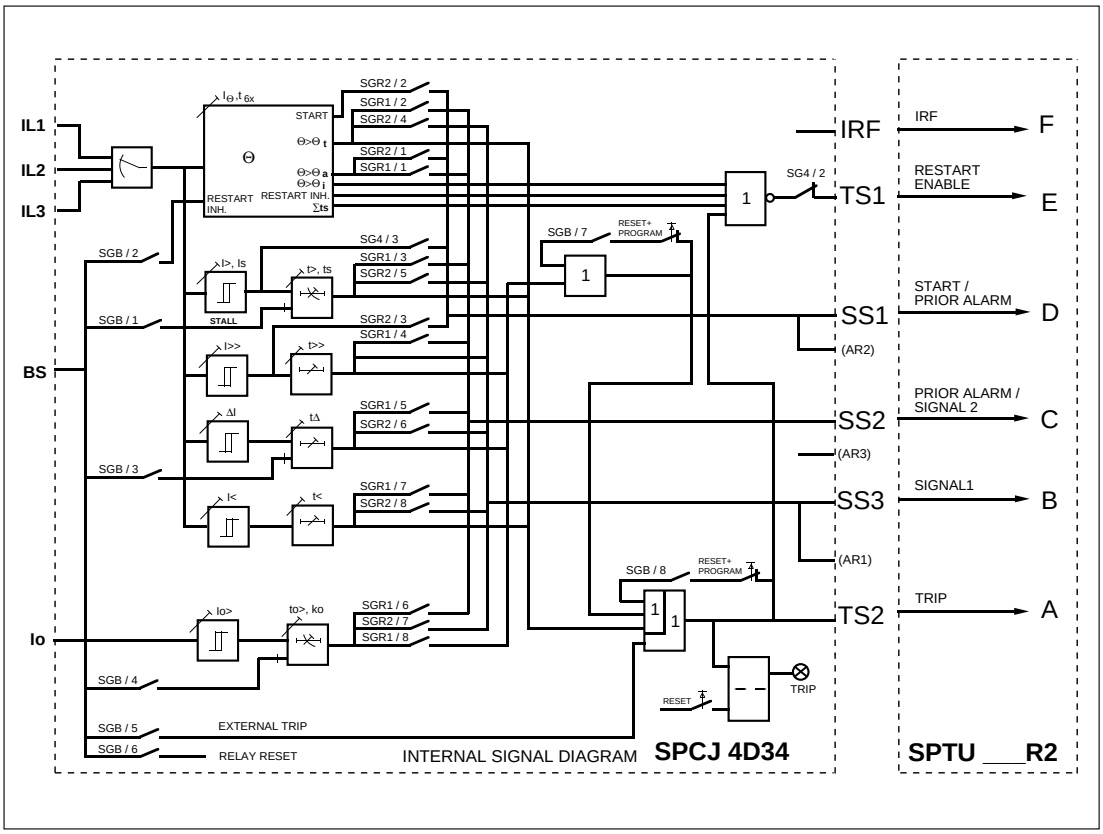


Fig. 4. Control signals between the modules of the motor protection relay SPAM 150 C.

The functions of the blocking and starting signals are selected with the switches of switchgroups SGF, SGB and SGR. The checksums of the switchgroups are found in the setting menu of the measuring relay module. The functions of the different switches are explained in the user´s manual of the measuring module SPCJ 4D34.

Abbreviations of signal names

I_{L1}, I_{L2}, I_{L3}	Phase currents
I_0	Neutral current
BS	Blocking or control Signal
SS1	Start Signal 1
SS2	Start Signal 2
SS3	Start Signal 3
TS1	Trip Signal 1
TS2	Trip Signal 2
AR1...3	Auto-Reclose start signals (not in use in SPAM 150 C)
IRF	Internal Relay Fault signal
SGF	Switch Group for Functions
SGB	Switch Group for Blockings
SGR1...2	Switch Groups for Relay configuration

Power supply and output relay module

To be able to operate the relay needs a secured auxiliary voltage supply. The power supply module forms the voltages required by the measuring relay module and the auxiliary relays. The withdrawable power supply and output relay module is located behind the system front panel, which is fixed by means of four cross-slotted screws. The power supply and output relay module contains the power supply unit, all output relays, the control circuits of the output relays and the electronic circuitry of the external control inputs.

The power supply and output relay module can be withdrawn after removing the system front panel. The primary side of the power supply module is protected with a fuse, F1, located on the PCB of the module. The fuse size is 1 A (slow).

The power supply unit is a transformer connected, i.e. galvanically isolated primary and secondary side, flyback-type dc/dc converter. It forms the dc secondary voltages required by the measuring relay module; that is +24 V, ±12 V and +8 V. The output voltages ±12 V and +24 V are stabilized in the power supply module, while the +5 V logic voltage required by the measuring relay module is formed by the stabilizer of the relay module.

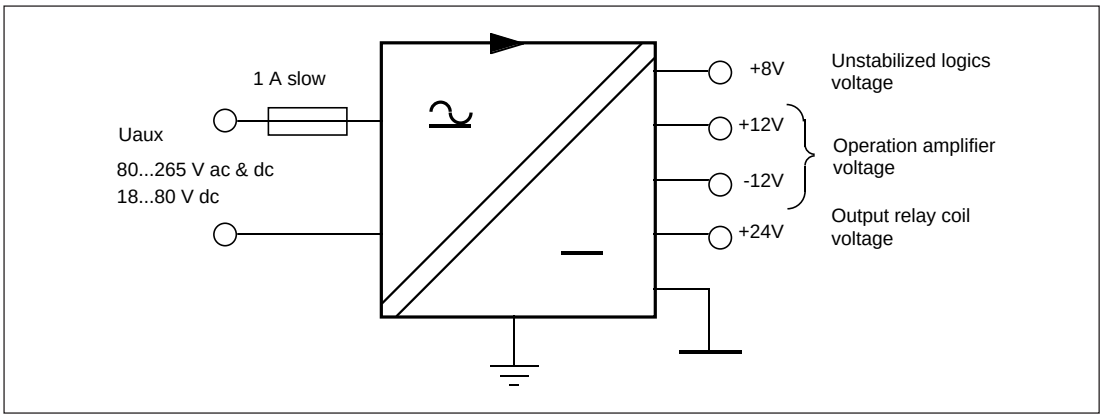


Fig. 5. Voltage levels of the power supply module.

A green LED indicator U_{aux} on the system front panel is illuminated when the power supply module is in operation. The supervision of the voltages supplying the electronics is placed in the measuring module. If a secondary voltage deviates from its rated too much, a self-supervision alarm will be established. An alarm is also established when the power supply module is withdrawn from the relay case, or when the auxiliary power supply to the relay is interrupted.

There are two versions of power supply and output relay modules available. For both types, the secondary sides and the relay configurations are identical, but the input voltage ranges differ.

Voltage ranges of the power supply modules:

- SPTU 240R2 or SPTU 240R3 U_{aux} = 80...265 V dc/ac
- SPTU 48R2 or SPTU 48R3 U_{aux} = 18...80 V dc

The modules SPTU 240 R2 or SPTU 240 R3 can be used with both ac and dc voltages. Modules SPTU 48 R2 and SPTU 48 R3 are designed for dc supply only. The auxiliary voltage range of the power supply module of the relay assembly is indicated on the system front panel.

The module SPTU 240R2 and SPTU 48R2 have a normally open trip contact whereas the modules SPTU 240R3 and SPTU 48R3 have a normally closed trip contact.

Technical data
(modified 2002-04)

Energizing inputs

Phase and neutral current inputs, terminals	1-2, 4-5, 7-8, 25-26	1-3, 4-6, 7-9, 25-27
Rated current I_n	5 A	1 A
Thermal withstand capability		
- continuously	20 A	4 A
- for 1 s	500 A	100 A
Dynamic current withstand, half-wave value	1250 A	250 A
Input impedance	< 20 mΩ	< 100 mΩ
Phase current monitoring range	0...63 x I_n	
Neutral current monitoring range	0...210 % I_n	
Rated frequency f_n	50 Hz / 60 Hz	

Output contact ratings

Trip contact and restart enable contact		
Contact type *)	NO (normally open)	NC (normally closed)
Terminals	65-66, 74-75	65-66
- Rated voltage	250 V dc/ac	250 V dc/ac
- Carry continuously	5 A	5 A
- Make and carry for 0.5 s	30 A	10 A
- Make and carry for 3.0 s	15 A	8 A
- Breaking capacity for dc, when the control circuit time-constant L/R ≤ 40 ms, at 48 / 110 / 220 V dc	5 A / 3 A / 1 A	1 A / 0.25 A / 0.15 A
Breaking capacity for ac	5 A	5 A

Signalling contacts	
Terminals	70-71-72, 68-69, 77-78, 80-81
- Rated voltage	250 V dc/ac
- Rated current	5 A
- Make and carry for 0.5 s	10 A
- Make and carry for 3.0 s	8 A
- Breaking capacity for dc, when the control circuit time-constant L/R ≤ 40 ms, at 48 / 110 / 220 V dc control circuit voltage	1 A / 0.25 A / 0.15 A

External control inputs

Blocking, remote reset or remote setting input	10-11
External control voltage level	18...265 V dc or 80...265 V ac
Typical control current of input circuit	2…20 mA

Power supply and output relay module

Supply and relay module, type SPTU 240R2/ - R3	80...265 V dc/ac
Supply and relay module, type SPTU 48R2/ - R3	18...80 V dc
Power consumption under quiescent/operating conditions	~4 W/ ~6 W

Note!

*) The trip contact 65-66 has different contact ratings depending on whether it is a normally open contact (SPTU 240R2 or SPTU 48R2) or a normally closed contact (SPTU 240R3 or SPTU 48R3).

Maintenance and repair

When the protective relay is operating under the conditions specified in the section "Technical data", the relay is practically maintenance-free. The relay modules include no parts or components subject to an abnormal physical or electrical wear under normal operating conditions.

If the environmental conditions at the relay operating site differ from those specified, as to temperature, humidity, or if the atmosphere around the relay contains chemically active gases or dust, the relay ought to be visually inspected in association with the relay secondary test or whenever the relay modules are withdrawn from the case. At the visual inspection the following things should be noted:

- Signs of mechanical damage on relay modules, contacts and relay case
- Accumulation of dust inside the relay cover or case; remove by blowing air carefully
- Rust spots or signs of erugo on terminals, case or inside the relay

On request, the relay can be given a special treatment for the protection of the printed circuit boards against stress on materials, caused by abnormal environmental conditions.

If the relay fails in operation or if the operating values remarkably differ from those of the relay specifications, the relay should be given a proper overhaul. Minor measures can be taken by personnel from the instrument workshop of the customer's company, e.g. replacement of auxiliary relay modules. All major measures involving overhaul of the electronics are to be taken by the manufacturer. Please contact the manufacturer or his nearest representative for further information about checking, overhaul and recalibration of the relay.

Note!
Numerical protection relays contain electronic circuits which are liable to serious damage due to electrostatic discharge. Before removing a module containing electronic circuits, ensure that you are at the same electrostatic potential as the equipment, for instance, by touching the relay case.

Note!
Static protective relays are measuring instruments and should be handled with care and protected against moisture and mechanical stress, especially during transport.

Spare parts

Motor protection relay module	SPCJ 4D34
Power supply and output relay module	
U_{aux} = 80...265 V ac/dc	SPTU 240R2 for NO trip contact
U_{aux} = 18...80 V dc	SPTU 48R2 for NO trip contact
U_{aux} = 80...265 V ac/dc	SPTU 240R3 for NC trip contact
U_{aux} = 18...80 V dc	SPTU 48R3 for NC trip contact
Relay box, complete with input module	SPTK 4E3
Input module as separate part	SPTE 4E3
Bus connection module	SPA-ZC 17 or SPA-ZC 21

Ordering numbers

Motor protection relay with make type tripping contact

SPAM 150 C	RS 641 014 - AA, CA, DA, FA

Motor protection relay with break type tripping contact

SPAM 150 C	RS 641 015 - AB, CB, DB, FB

The last letters of the ordering number indicate the rated frequency f_n and the auxiliary voltage range U_{aux} of the relay as follows:
AA or AB equals f_n = 50Hz and U_{aux} = 80…265 V ac/dc
CA or CB equals f_n = 50Hz and U_{aux} = 18…80 V dc
DA or DB equals f_n = 60Hz and U_{aux} = 80…265 V ac/dc
FA or FB equals f_n = 60Hz and U_{aux} = 18…80 V dc

Power supply and output relay modules with make type tripping contact

SPTU 240R2	RS 941 021 - AA
SPTU 48R2	RS 941 021 - BA

Power supply and output relay modules with break type tripping contact

SPTU 240R3	RS 941 022 - AA
SPTU 48R3	RS 941 022 - BA

1MRS 750064-MUM EN

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SPAJ 160 C
Capacitor protection relay

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The complete user's manual also includes the following documents:

General characteristics of D-type relay module	1MRS 750066-MUM EN
Capacitor bank relay module type SPCJ 4D40	1MRS 750065-MUM EN

Characteristics

One-, two- and three-phase overload stage with definite time charcteristic

One-, two- and three-phase overload stage with inverse (ANSI) time charcteristic

Phase unbalance protection stage with definite time charcteristic

Phase unbalance protection stage with inverse time charcteristic

Undercurrent protection for detection of capacitor disconnection. Reconnection time with wide setting range

Compensation for natural unbalance current

Fully selectable output relay configuration

Easy selection of appropriate operational scheme for various applications

Numerical display of setting values, current measured values, memorized values etc.

Continuous self-supervision of hardware and software

Optical serial communication over the SPA bus provides access from a higher level central unit to all set and measured values and to memorized fault values. Various events can also be selected to be automatically read by a control data communicator and printed out.

Power supply and output relay module

To be able to operate the relay needs a secured auxiliary voltage supply. The power supply module forms the voltages required by the measuring relay module and the auxiliary relays. The withdrawable power supply and output relay module is located behind the system front panel, which is fixed by means of four cross-slotted screws. The power supply and output relay module contains the power supply unit, all output relays, the control circuits of the output relays and the electronic circuitry of the external control signals.

The power supply and output relay unit can be withdrawn after removing the system front panel. The primary side of the power supply module is protected with a fuse, F1, located on the PCB of the module. The fuse size is 1 A (slow).

The power supply unit is a transformer connected, i.e. galvanically isolated primary and secondary side, flyback-type dc/dc converter. It forms the dc secondary voltages required by the measuring relay module; that is +24 V, ±12 V and +8 V. The output voltages ±12V and +24 V are stabilized in the power supply module, while the +5 V logic voltage required by the measuring relay module is formed by the stabilizer of the relay module.

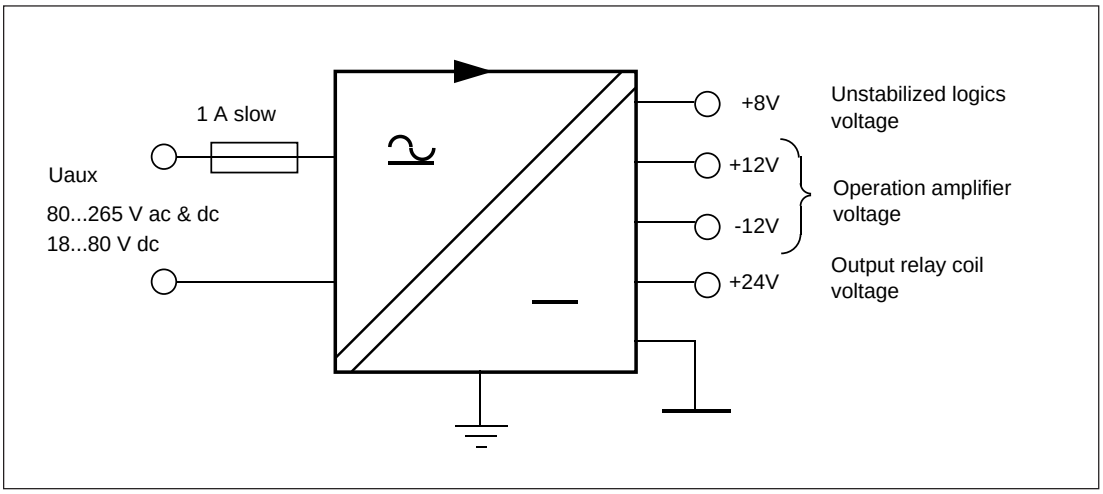


Fig. 11. Voltage levels of the power supply module.

A green LED indicator Uaux on the system front panel is illuminated when the power supply module is in operation. The supervision of the voltages supplying the electronics is placed in the measuring module. If a secondary voltage deviates from its rated value by more than 25 %, a selfsupervision alarm will be established. An alarm is also received when the power supply module is withdrawn from the relay case, or when the auxiliary power supply to the relay is interrupted.

There are two versions of the power supply and output relay modules available. For both types, the secondary sides and the relay configurations are identical, but the input voltage ranges differ.

Insulation test voltage between the primary and the secondary side and the protective earth.
2 kV, 50 Hz, 1min

Rated power P_n 5 W

Voltage ranges of the power supply modules:
- SPTU 240 R2 U_{aux} = 80 ... 265 V ac/dc
- SPTU 48 R2 U_{aux} = 18 ... 80 V dc (on request)

The module SPTU 240 R2 can be used with both ac and dc voltages. Module SPTU 48 R2 is designed for dc supply only. The auxiliary voltage range of the power supply module of the relay assembly is indicated on the system front panel.

Maintenance and repair

When the synchrocheck relay is operating under the conditions specified in the section "Technical data", the relay is practically maintenance-free. The relay modules include no parts or components subject to an abnormal physical or electical wear under normal operating conditions.

If the environmental conditions at the relay operating site differ from those specified, as to temperature, humidity, or if the athmosphere around the relay contains chemically active gases or dust, the relay should to be visually inspected in association with the relay secondary test or whenever the relay modules are withdrawn from the case. At the visual inspection the following things should be noted:

- Signs of mechanical damage on the relay modules, contacts and relay case
- Accumulation of dust inside the relay cover or case; remove by flowing air carefully
- Rust spots or signs of erugo on terminals, case or inside the relay

On request, the relay can be given a special treatment for the protection of the printed circuit boards against stress on materials, caused by abnormal environmental conditions.

If the relay fails in operation or if the operating values remarkable differ from those of the relay specifications, the relay should be given a proper overhaul. Minor measures can be taken by personnel from the instrument work-shop of the customer's company, e.g. replacement of auxiliary relay modules. All major measures involving overhaul of the electronics are to be taken by the manufacturer. Please contact the manufacturer or his nearest representative for further information about checking, overhaul and recalibration of the relay.

Note!
Static relays are measuring instruments and should be handled with care and protected against moisture and mechanical stress, especially during transport.

Spare parts

Capacitor bank protection relay module	SPCJ 4D40
Power and output relay module	
U_{aux} = 80 ... 265 V ac/dc	SPTU 240 R2 for NO trip contact
U_{aux} = 18 ... 80 V dc	SPTU 48 R2 for NO trip contact
Relay box, complete with input module	SPTK 4E3
Input module as separate part	SPTE 4E3
Bus connection module	SPA-ZC 17_ or SPA-ZC 21_

Ordering numbers

Capacitor bank protection without testswitch

SPAJ 160 C	RS 611 051 - AA, CA, DA, FA

Capacitor bank protection with testswitch type RTXP 18

SPAJ 160 C	RS 611 251 - AA, CA, DA, FA

The last letters of the ordering number indicate the rated frequency f_n and the auxiliary voltage range U_{aux} of the relay as follows:
AA equals f_n = 50 Hz and U_{aux} = 80...265 V ac/dc
CA equals f_n = 50 Hz and U_{aux} = 18...80 V ac/dc
DA equals f_n = 60 Hz and U_{aux} = 80...265 V ac/dc
FA equals f_n = 60 Hz and U_{aux} = 18...80 V ac/dc

Power supply and output relay modules:

SPTU 240 R2	RS 911 021 - AA
SPTU 48 R2	RS 911 021 - BA