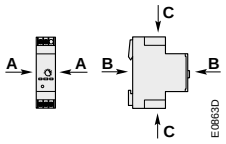
Electronic timer for star-delta starters

Technical data

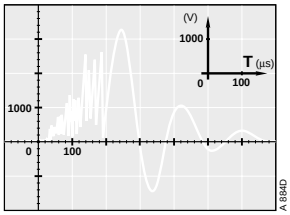
Types			TE5S-24	TE5S-120	TE5S-240	TE5S-440
Utilization characteristics according to IEC						
Standards			IEC 60947-5-1 and EN 60947-5-1			
Rated insulation voltage Ui						
acc. to IEC 60947-5-1			440 V			
Rated operational voltage Ue max.			24 V DC			–
			24…240 V AC			440 V AC
Conventional free air thermal current Ith			10 A			
Ie / Rated operational current AC-15						
acc. to IEC 60947-5-1		24-120 V 50/60 Hz	5 A			–
		220-240 V 50/60 Hz	4 A			–
		380-440 V 50/60 Hz	–			3 A
Ie / Rated operational current DC-13						
acc. to IEC 60947-5-1		24 V DC	4 A			–
Short-circuit protection device - gG type fuse			10 A			
Control circuit voltage						
AC control voltage	Rated supply voltage Uc		24 V AC	110…120 V AC	220…240 V AC	380…440 V AC
50/60 Hz	Average consumption		1.5 VA	3.5 VA	6.5 VA	12.5 VA
DC control voltage	Rated supply voltage Uc		24 V DC	–	–	–
	Average consumption		0.7 W	–	–	–
Rated frequency limits			48…63 Hz			
Supply voltage range			0.85…1.1 x Uc			
Overvoltage protection			Built-in varistor			
Load factor			100 %			
Time delay range (t1) selected by switch			0.8…8 s and 6…60 s			
Temperature drift			-0.2 % per °C			
Mechanical setting accuracy			±15 % of the setting range			
On-load reiteration accuracy under constant conditions			±2 % after 1 million operating cycles			
Minimum time lapse (t2)			50 ms			
Minimum time lapse after 1 million of operating cycles			40 ms			
Resetting time (max.)			250 ms			
Front panel display		green indicator light	Energization			
		yellow indicator light	Output relay activated			
Ambient air temperature						
Operation			-25…+60 °C			
Storage			-40…+85 °C			
Shock withstand						
acc. to IEC 60068-2-27 and EN 6006-2-27						
		Shock direction				
		A	20 g / 11 ms			
		B	15 g / 11 ms			
		C	20 g / 11 ms			
Vibration withstand			10 to 300 Hz in the 3 directions			
acc. to IEC 60068-2-6 and EN 60068-2-6			3 g			
Mechanical durability			5 millions operating cycles			
Electrical durability			1 million operating cycles			
On-load maximum switching frequency			720 cycles/h			600 cycles/h
Fixing						
On rail according to IEC 60715, EN 60715			35 x 7.5 mm or 35 x 15 mm			

Connecting characteristics

Connection capacity (min. ... max.)			
Rigid solid		1 x	1...2.5 mm²
		2 x	1...2.5 mm²
Flexible with ferrule		1 x	0.75...2.5 mm²
		2 x	0.75...2.5 mm²
Tightening torque	Recommended		0.6 Nm
	Max.		0.8 Nm
Degree of protection			
acc. to IEC 60947-1 / EN 60947-1 and IEC 60529 / EN 60529			IP20
Screw terminals			Delivered in open position, screws of unused terminals must be tightened
All terminals			M2.5
Screwdriver type			Flat Ø 4 / Pozidriv 1

1SBC101326S0201 - Rev. A

Surge suppressors for contactor coils



3

Description

The operation of inductive circuits causes overvoltages, in particular on opening of the contactor coil.

The electromagnetic energy stored in the coil during contactor closing is restored on opening in the form of surges, the slope and amplitude of which may rise to several kilovolts. A number of drawbacks are observed ranging from interference on the electronic devices to breakdown of insulators and even destruction of eer tain sensitive components.
The graph opposite reproduces the oscillogram showing voltage discharges at the terminals of a 42 V / 50 Hz coil without peak clipping. The coil was switched by 8 series-connected poles of a contactor relay.

Following a burst of discharges with a very steep slope a damped oscillation emerges with a peak value of 3500 V.

Overvoltage Factor
The overvoltage factor k is de ned as the ratio of the maximum overvoltage peak value Ûs to the peak value Ûc of the coil rated control voltage Uc:

$$k = \frac{\hat{U}s\ max.}{\hat{U}c} \qquad \text{in DC: } k = \frac{\hat{U}s\ max.}{Uc} \qquad \text{or in AC: } k = \frac{\hat{U}s\ max.}{Uc\ 2}$$

1SBC574001F0301

RV5/50

For example the following is obtained for the above graph: $k = \frac{3500}{42\ \ 2}$ 60

To reduce the harmful effects of these overvoltages, ABB has developed a range of surge suppressors designed to reduce the k factor de ned above and to limit or even completely eliminate the high pre-damping voltage frequencies.

Each case is different, but the technical data tolerances and the generous sizing of parts have enabled us to reduce the number of variants.

We have chosen the following solutions: transil diodes, varistors and RC blocks.

Note: A varistor is a resistor whose value decreases to a very large extent when a certain voltage is applied at its terminals.

1SBC573891F0301

RC5-1/50

Ordering details

For contactors	Rated control circuit voltage Uc V	AC	DC	Type	Order code		Pkg qty	Weight (1 pce) kg
A9 ... A110	24...50			RV5/50	1SBN050010R1000		2	0.015
	50...133			RV5/133	1SBN050010R1001		2	0.015
	110...250			RV5/250	1SBN050010R1002		2	0.015
	250...440			RV5/440	1SBN050010R1003		2	0.015
A9 ... A40	24...50		–	RC5-1/50	1SBN050100R1000		2	0.012
	50...133		–	RC5-1/133	1SBN050100R1001		2	0.012
	110...250		–	RC5-1/250	1SBN050100R1002		2	0.012
	250...440		–	RC5-1/440	1SBN050100R1003		2	0.012
A45 ... A110	24...50		–	RC5-2/50	1SBN050200R1000		2	0.015
	50...133		–	RC5-2/133	1SBN050200R1001		2	0.015
	110...250		–	RC5-2/250	1SBN050200R1002		2	0.015
	250...440		–	RC5-2/440	1SBN050200R1003		2	0.015
A145 ... A300	250...440		–	RC5-3/440	1SFN050300R1003		2	0.028

1SBC101899S0201

Surge suppressors for contactor coils

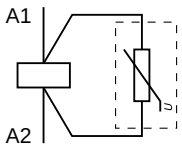
Technical data

Varistor	RV5/50	RV5/133	RV5/250	RV5/440
Rated control circuit voltage Uc	24...50 V AC	50...133 V AC	110...250 V AC	250...440 V AC
	24...50 V DC	50...133 V DC	110...250 V DC	250...440 V DC
Residual overvoltage (clipping voltage)	132 V AC	270 V AC	480 V AC	825 V AC
	132 V DC	270 V DC	480 V DC	825 V DC
Opening time growth factor	1.1...1.5			
Operating temperature	-20...+70 °C			
Connection to the coil terminals (parallel mounting)	Clip-on for both fixing and connection.			
Fixing	Clipped onto the top part of the contactor base without change in contactor overall dimensions.			
Advantages	High energy absorption: good damping - Unpolarized system.			
Drawback	Clipping as from Uvdr (1), thus voltage front up to this point.			

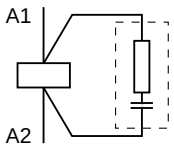
(1) Uvdr = Varistor operating voltage (voltage dependent resistor), tolerance ±10 %.

RC type	RC5-1/50	RC5-1/133	RC5-1/250	RC5-1/440
	RC5-2/50	RC5-2/133	RC5-2/250	RC5-2/440
	–	–	–	RC5-3/440
Rated control circuit voltage Uc	24...50 V AC	50...133 V AC	110...250 V AC	250...440 V AC
Residual overvoltage (clipping voltage)	2 to 3 x Uc max.			
Opening time growth factor	1.2...1.3			
Operating temperature	-20...+70 °C			
Connection to the coil terminals (parallel mounting)	Clip-on for both fixing and connection.			
Fixing	Clipped onto the top part of the contactor base without change in contactor overall dimensions.			
Advantages	Very fast clipping - Attenuation of steep fronts and thus of high frequencies. No operating delays.			

Wiring diagrams

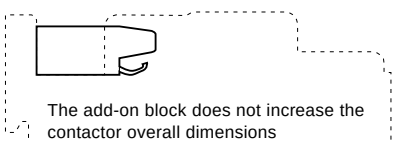


Varistor



RC type

Dimensions



RV5, RC5

1SBC101900S0201

Interface relays

Description

RA5-1 interface relay is designed to receive 24 V DC signals delivered by PLC's or other sources with a low output power and to restore them with suf cient power to operate the coils of the relevant A9 ... A110 contactors.

RA5-1 interface relay is made up of a miniature electromechanical relay equipped with a N.O. contact and with a low consumption 24 V DC coil.

The interface relay coil is controlled by the PLC while the N.O. contact ensures switching of the power contactor.

Coil switching gives rise to overvoltages which have adverse effects on the electronic devices, insulators and, more generally, on component lifetime. The RA5-1 is equipped with surge suppressors:

– on the 24 V DC relay coil via a diode,
– on the power contactor coil via a varistor.

Furthermore, the RA5-1 is protected against relay pole reversal by a diode inserted between the E1 and E2 input terminals.

Ordering details

For contactors	Coil voltages V 50/60 Hz	Rated control circuit voltage Uc V DC	Type	Order code		Pkg qty	Weight (1 pce) kg
A9 ... A110	24...250	24	RA5-1	1SBN060300R1000		1	0.050
			RA5-1	1SBN060300T1000		10	0.050

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Interface relays

Technical data

Type	RA5-1

Utilization characteristics according to IEC

Standards			IEC 60255-5
Rated insulation voltage Ui			
acc. to IEC 60947-4-1			250 V AC
Ambient air temperature			
In free air operation	at Uc = 24 V DC (between E1 and E2)		-25…+70 °C
	from 0.85 to 1.1 x Uc		-25…+55 °C
Storage			-40…+70 °C
Climatic withstand			Complies with that of associated contactors
Maximum operating altitude			3000 m
Mounting positions			No limitation
Fixing			Using the contactor A1 and A2 teminal connecting parts

Connecting characteristics

Connection capacity (min. ... max.)			
Rigid solid		1 x	1...4 mm²
		2 x	1...4 mm²
Flexible with ferrule		1 x	0.75...2.5 mm²
		2 x	0.75...2.5 mm²
Lugs		L <	8 mm
		I >	3.5 mm
Tightening torque	Recommended		1 Nm
	Max.		1.2 Nm
Degree of protection			Protection against direct contact in acc. with EN 50274
acc. to IEC 60947-1 / EN 60947-1 and IEC 60529 / EN 60529			RA5-1 wired and mounted on the associated contactor
Screw terminals			Delivered in open position, screws of unused terminals must be tightened
All terminals			M3.5
Screwdriver type			Flat Ø 5.5 / Pozidriv 2

Working data

Surge suppression		
For contactor coil		Varistor
For interface relay coil		Diode
Protection against polarity reversal between terminals E1 and E2		Diode
Interface relay operating time		Closing and drop-out 10 ms
Total operating time, interface relay + contactor		
Between energization and:	N.O. contact closing	20…37 ms
	N.C. contact opening	17…32 ms
Between de-energization and:	N.O. contact opening	17…25 ms
	N.C. contact closing	20…28 ms

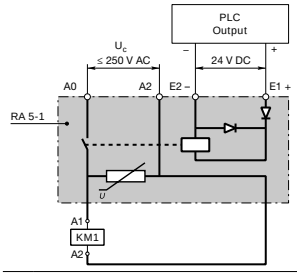
Electrical input data

Control voltage (E1 and E2 terminals) Uc		
Rated value		24 V DC
Max. range at ambient temperature 20 °C		19...30 V DC
Max. consumption for Uc = 24 V DC, = 20 °C		0.3 W
"0" status (relay open)	for Uc	2.4 V DC
	for Ic	< 1 mA
"1" status (relay closed)	for Uc	19 V DC
Max. short supply interruption immunity time		2 ms

Electrical output data

Switching voltage (A0 and A2 terminals)	250 V AC
Electrical durability	
Number of operating cycles	2 millions (600 cycles/h) on A9 ... A75 contactors or N contactor relays
	0.5 million (600 cycles/h) on A95 and A110 contactors

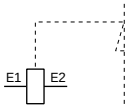
Connection



The "E1+" and "E2-" input terminals must be connected, according to their polarity, to the PLC output.
The RA5-1 is equipped with two terminal pads for connection to the A1 and the A2 terminals of the contactor coil.
This coil is supplied between the A0 and the A2 terminals of the RA 5-1.
Mounting: terminals pads clamped inside the contactor coil terminals.

1SBC101902S0201

Mechanical latching units



Terminal marking

Description

For converting standard contactors into latched contactors.

The WB75-A block contains a mechanical latching device with electromagnetic impulse unlatching (AC or DC) or manual unlatching.

Captive screw type connecting terminals, built-in cable clamps, M3.5 (+,-) pozidriv 2 screw with screwdriver guidance; delivered untightened and protected against accidental direct contact.

Operation

After closing, the contactor continues to be held in the closed position by the latching mechanism should the supply voltage fail at the contactor coil terminals.

Contactor opening can be controlled:

– electrically by an impulse (AC or DC) on the WB75-A block coil.
  (the coil is not designed to be permanently energized)
– manually by pressing the pushbutton on the front face of the WB75-A block.

Mounting

The WB75-A block is clipped onto the front face of the 1-stack contactor where it takes up two slots. The two other slots may accept CA5... single pole auxiliary contacts (1 block on each side of the mechanical latch).

Ordering details

For contactors	Rated control circuit voltage Uc		Type	Order code		Pkg qty	Weight (1 pce)
	V 50 Hz or DC	V 60 Hz					kg
A9 ... A75	24	24...28	WB75-A	FPTN372726R1001		1	0.120
	42	42...48	WB75-A	FPTN372726R1002		1	0.120
	48	48...55	WB75-A	FPTN372726R1003		1	0.120
	110	110...127	WB75-A	FPTN372726R1004		1	0.120
	220...230	220...255	WB75-A	FPTN372726R1006		1	0.120
	230...240	230...277	WB75-A	FPTN372726R1005		1	0.120
	380...415	380...440	WB75-A	FPTN372726R1007		1	0.120
	415...440	440...480	WB75-A	FPTN372726R1008		1	0.120

1SBC565483F0301

1SBC101903S0201

Mechanical latching units

Technical data

Type	WB75-A

Utilization characteristics according to IEC

Rated insulation voltage Ui acc. to IEC 60947-1		690 V
Max. electrical impulse time		
On AC coil (with load factor 5 %)		20 s
On DC coil (with load factor 3 %)		8 s
Min. electrical impulse time		
For latching (energizing of the contactor coil)	AC	50 ms
For pull-out (energizing of the WB block coil)	AC	30 ms
Coil operating limits	AC or DC supply	0.85…1.1 x Uc
AC control voltage 50/60 Hz		
Rated control circuit voltage Uc		24…480 V AC
Coil consumption	Average pull-in value	90 VA
	Average holding value	60 VA
DC control voltage		
Rated control circuit voltage Uc		24…440 V DC
Coil consumption	Average pull-in value	110 W
	Average holding value	110 W
Operating time		
On contactor closing (latching) Between coil energization and:		
	N.O. contact closing	No difference with the operation of a contactor without mechanical latching unit
	N.C. contact opening	No difference with the operation of a contactor without mechanical latching unit
On contactor opening (unlatching) Between WB coil energization and:		
	N.O. contact opening	5…25 ms
	N.C. contact closing	7…28 ms
Mechanical durability		
	Number of operating cycles	1 million operating cycles
Max. switching frequency		3600 cycles/h with on-load factor of 8 %

Connecting characteristics

Connection capacity (min. ... max.)			
Rigid solid		1 x	1...4 mm²
		2 x	1...4 mm²
Flexible with ferrule		1 x	0.75...2.5 mm²
		2 x	0.75...2.5 mm²
Lugs		L <	8 mm
		l >	3.5 mm
Tightening torque	Recommended		1 Nm
	Max.		1.2 Nm
Screw terminals			Delivered in open position, screws of unused terminals must be tightened
All terminals			M3.5
Screwdriver type			Flat Ø 5.5 / Pozidriv 2

1SBC101333S0201 - Rev. A

Function markers
Impulse contact blocks

BA5-50 function markers

1SBC57587.4F0301

BA5-50

Description

Set of 50 function markers designed to be clipped onto the front face of devices. Details can be added to these markers using a ball point pen, indelible felt-tip pen or pentel white.

Self-adhesive labels (not supplied) can also be added to them.

Marker dimensions: 7 x 19 mm (0.276" x 0.748").

Ordering details

For contactors	Type	Order code		Pkg qty	Weight (1 pce) kg
Contactors, thermal overload relays and accessories	BA5-50	1SBN110000R1000		1	0.017

CB5 impulse contact blocks

1SBC100039V0014

CB5

Description

Impulse contact blocks are designed for use in enclosures, in association with an adjustable mechanical pushbutton. Two types are available:

– CB5-10: N.O. contact with a black actuator ("ON" function)

– CB5-01: N.C. contact with a light grey actuator ("OFF" function).

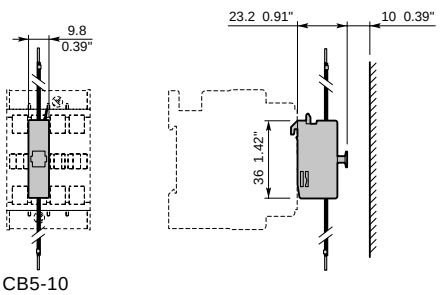
These blocks are equipped with 2 connecting leads 0.5 mm² with end, approximately 18 cm long.

Mounting: Clipped onto the front face of the contactors.

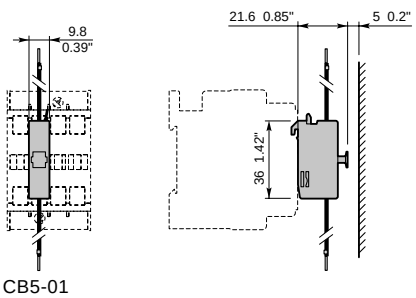
Ordering details

For contactors	Contacts		Type	Order code		Pkg qty	Weight (1 pce) kg
A9 ... A110	1	–	CB5-10	1SBN010013R1010		1	0.012
	–	1	CB5-01	1SBN010013R1001		1	0.012

Main dimensions mm, inches



CB5-10



CB5-01

1SBC101898S0201

Terminal shrouds, terminal enlargements, terminal extensions Connector terminals

1SFT98099-019C3

LT...-AC

1SFT98099-125

LT...-AL

1SFT98000-014

LT...-AY

1SFT98000-011C3

LW...

1SFT98000-012C3

LX...

1SFT98099-00211C1

LZ...

1SFT98099-095C2

LZ...

1SBC580542F0302

LZ...

Terminal shrouds

Description

Main terminal protection for A145 ... A300 contactors.

The auxiliary contact blocks and coils are designed to provide an IP20 degree of protection.

The main terminals, equipped with lugs or connectors, can be protected against accidental direct contact after wiring (EN 50274) by the addition of terminal shrouds (see table below).

Ordering details

For contactors	Type	Order code		Pkg qty	Weight (1 pce) kg
A145 ... A185 with connectors	LT185-AC	1SFN124701R1000		2	0.050
A145 ... A185 with lugs	LT185-AL	1SFN124703R1000		2	0.220
A145 ... A185 with short. bar LY185 or between A145 and TA200DU or between A185 and TA200DU	LT185-AY	1SFN124704R1000		1	0.050
A210 ... A300 with connectors	LT300-AC	1SFN125101R1000		2	0.070
A210 ... A300 with lugs	LT300-AL	1SFN125103R1000		2	0.280
A210 ... A300 with short. bar LY300	LT300-AY	1SFN125104R1000		1	0.075

LW... Terminal enlargements

Description

Enlargement pieces designed to increase the width of the contactor terminal pads in order to allow larger connections to be mounted.

Sets containing 3 tin plated copper bars xed by an isolating spacer.

Ordering details

For contactors	Dimensions		Type	Order code		Pkg qty	Weight (1 pce) kg
	hole Ø mm	bar mm					
A95, A110	6.5	15 x 3	LW110	1SFN074307R1000		1	0.100
A145, A185	10.5	20 x 5	LW185	1SFN074707R1000		1	0.250
A210 ... A300	10.5	25 x 5	LW300	1SFN075107R1000		1	0.450

LX... Terminal extension

Description

Extension pieces designed to extend the main terminals of contactors for combined mounting of contactors and connection sets.

Sets containing 3 tin plated copper bars fixed by an isolating spacer.

Ordering details

For contactors	Dimensions		Type	Order code		Pkg qty	Weight (1 pce) kg
	hole Ø mm	bar mm					
A145, A185	8.5	20 x 5	LX185	1SFN074710R1000		1	0.250
A210 ... A300	10.5	20 x 5	LX300	1SFN075110R1000		1	0.350

Connector terminals

Description

Connection of copper and aluminium cables to the terminal pads of the poles of A contactors.

Ordering details

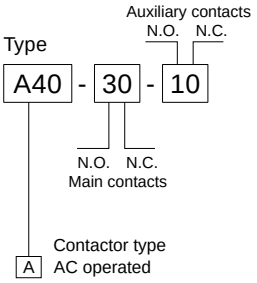
Cables	For contactors	Cable cross section mm²	Type	Order code		Pkg qty	Weight (1 pce) kg
Single Cu	A145, A185	6...185	–	1SDA023354R0001		3	0.200
	A210 ... A300	16...240	–	1SDA023368R0001		3	0.400
Single Al & Cu	A145, A185	35...95	–	1SDA023356R0001		3	0.100
	A145, A185	25...150	–	1SDA023357R0001		3	0.100
	A210 ... A300	120...240	–	1SDA023370R0001		3	0.200
Double Cu	A145, A185	2 x (50...120)	LZ185-2C/120	1SFN074709R1000		3	0.300
Double Al & Cu	A210 ... A300	2 x (95...120)	–	1SDA025766R0001		3	0.400

1SFC101153C0201

Voltage code table

The below tables indicate the available coil voltages and corresponding digits for order codes. When placing an order, please give the order code. Select a standard contactor from ordering detail pages. Change the coil voltage code in the order code according to the table below. Example: for contactor A50-30-00 and coil 48 V 50/60 Hz, the order code is 1SBL351001R8300.

A contactors



Order code

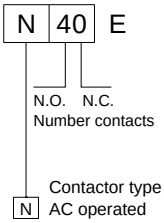
1SBL321001R 80 10

AC coil code
Contactors: A

	50 Hz	60 Hz
81	24 V	24 V
82	42 V	42 V
83	48 V	48 V
84	110 V	110...120 V
36	190 V	220 V
80	220...230 V	230...240 V
88	230...240 V	240...260 V
85	380...400 V	400...415 V
86	400...415 V	415...440 V

Codes in bold for dual frequency coils.

N contactor relays



Order code

1SBH141001R 80 40

AC coil code
Contactors: A

	50 Hz	60 Hz
81	24 V	24 V
82	42 V	42 V
83	48 V	48 V
84	110 V	110...120 V
36	190 V	220 V
80	220...230 V	230...240 V
88	230...240 V	240...260 V
85	380...400 V	400...415 V
86	400...415 V	415...440 V

Codes in bold for dual frequency coils.

1SBC101904S0201