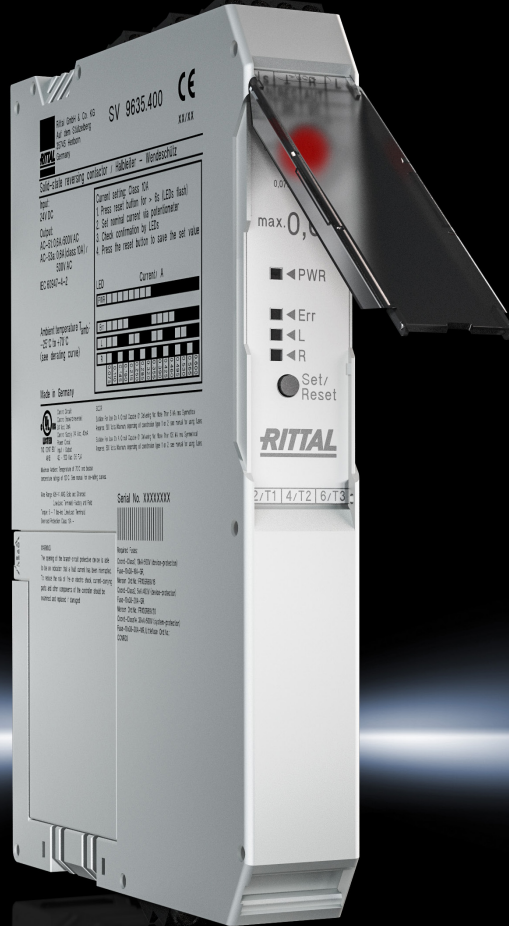


Rittal – The System.

Faster – better – everywhere.



RiLine Compact Motor Controller

SV 9635.400

SV 9635.410

SV 9635.420

Assembly and operating instructions

ENCLOSURES

POWER DISTRIBUTION

CLIMATE CONTROL

IT INFRASTRUCTURE

SOFTWARE & SERVICES

FRIEDHELM LOH GROUP





Contents

	Page
1. Technical specifications, overview	3
2. Notes on documentation	4
2.1 CE labelling	4
2.2 Storing the documents	4
2.3 Symbols used	4
2.4 Associated documents	4
3. Safety provisions / set-up instructions	4–5
4. Brief description	5
5. Assembly / dismantling	6–8
6. Protection of the load circuit from short circuits	9–10
6.1 Protection to IEC	9
6.2 Protection to UL (SCCR)	10
7. Function	10–13
7.1 Status and diagnosis display	10
7.2 Diagnosis function	11–12
7.3 Parameterisation – Setting the rated current	12–13
8. Application instructions	14
8.1 Motor with brake	14
8.2 Connection of auxiliary relays	14
9. Technical specifications	14–16
10. Appendix	17–18
11. Servicing	18
12. Storage	18
13. Warranty	19
14. Customer service addresses	19



1. Technical specifications, overview

Model No.	9635.400	9635.410	9635.420
Max. rated current A	0.6	2.4	9
Rated operating voltage V AC	500	500	500
Rated frequency Hz	50/60	50/60	50/60
Heat loss W	2.8	5.5	12
Adjustable current monitoring A	0.075 – 0.6	0.18 – 2.4	1.5 – 9
Number of poles	3-pole	3-pole	3-pole
Height mm	160	160	160
Width mm	22.5	22.5	22.5
Depth mm	114	114	114
Application area	IEC/UL ¹	IEC/UL ¹	IEC/UL ¹

¹ The technical specifications provided may vary for UL applications. See 9. Technical specifications.



2. Notes on documentation

The **assembly instructions** are aimed at personnel who are suitably trained and qualified to configure enclosures with electrical, electronic, mechanical and pneumatic equipment in accordance with applicable standards and to erect, assemble and connect such enclosures at the place of use.

The **operating instructions** are aimed at operating personnel and suitably trained electrical and mechanical maintenance specialists.

2.1 CE labelling

The declaration of conformity is available for downloading at www.rittal.com.

2.2 Storing the documents

The safety instructions constitute part of the product, and must be handed to the plant operator. The operator is responsible for suitable storage of the documents so they are readily available when needed.

2.3 Symbols used

Please observe the following safety instructions and other notes in these instructions:



Danger!

Immediate danger to life and limb.



Caution!

Potential threat to the product and the environment.



Note!

Useful information and special features.

2.4. Associated documents

These installation and operating instructions for the busbar components described here can be downloaded from www.rittal.com. Rittal cannot accept any liability for damages associated with the failure to observe these instructions. The instructions for any accessories used also apply.



3. Safety provisions / set-up instructions

- The national safety and accident prevention regulations must be observed whenever working on the device. Failure to observe these regulations may result in death, serious injury or considerable material damage.
- The product documentation / instructions for use must be kept in a safe place.
- If using "automatic RESET" mode, the drive will be reactivated once the cooldown period has elapsed, provided a control signal is still present. The cooldown period is 20 minutes.
- Installation should be performed in accordance with the operating instructions provided. Access to the circuits inside the appliance is inadmissible.
- Opening or modifying the appliance and carrying out repairs yourself will invalidate the warranty. The device will be replaced under warranty with an equivalent appliance. Repairs may only be carried out by the manufacturer. The manufacturer will not be liable for any damages caused by a contravention of this provision.
- The safety data can be taken from this documentation and the certificates.
- When the drive is switched on and/or in the deactivated state, the device performs a function diagnosis. Additionally, an electrician or specialist who is familiar with the relevant standards may carry out a test of the "motor protection" safety function. For this test, the drive must be operated in counter-clockwise or clockwise mode and the flow of electricity interrupted in one conductor (e.g. by removing a fuse in phase L1 or L3). The motor controller will then switch off the drive within 1.5 .. 2 s. The LEDs for counter-clockwise or clockwise rotation will be extinguished and the ERR-LED and checkback output will be set.
- Only power packs with reliable disconnection with SELV/PELV voltage to EN50178/ VDE 0160 (SELV/ PELV) should be used.



3. Safety provisions / set-up instructions

These are designed to prevent short-circuits between the primary and secondary side.

- The motor controller is a product designed for Environment A (industry). In Environment B (households), this device may cause unwanted malfunctions. In such cases, the operator may be required to take appropriate action.

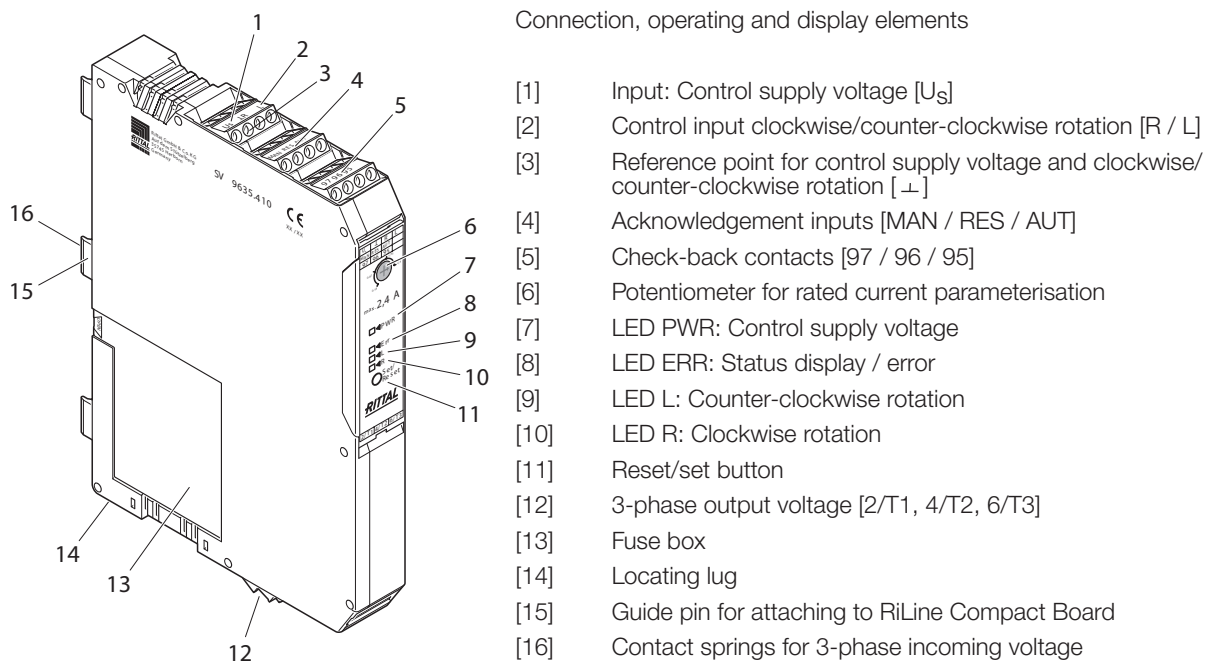


4. Brief description

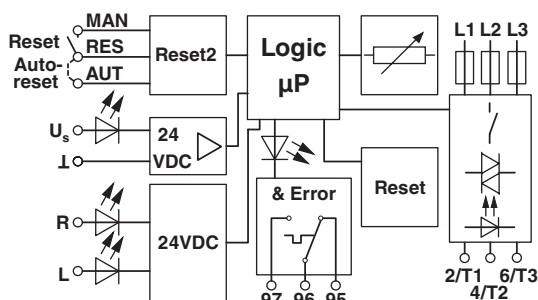
The three-phase motor controller with reversing function and current monitoring combines four functions in one:

- Contactor, clockwise rotation
- Contactor, counter-clockwise rotation
- Motor protection relay
- Short-circuit protection

The internal load and interlock circuit reduces wiring effort to a minimum. The device may only be operated in combination with 3-phase motors.



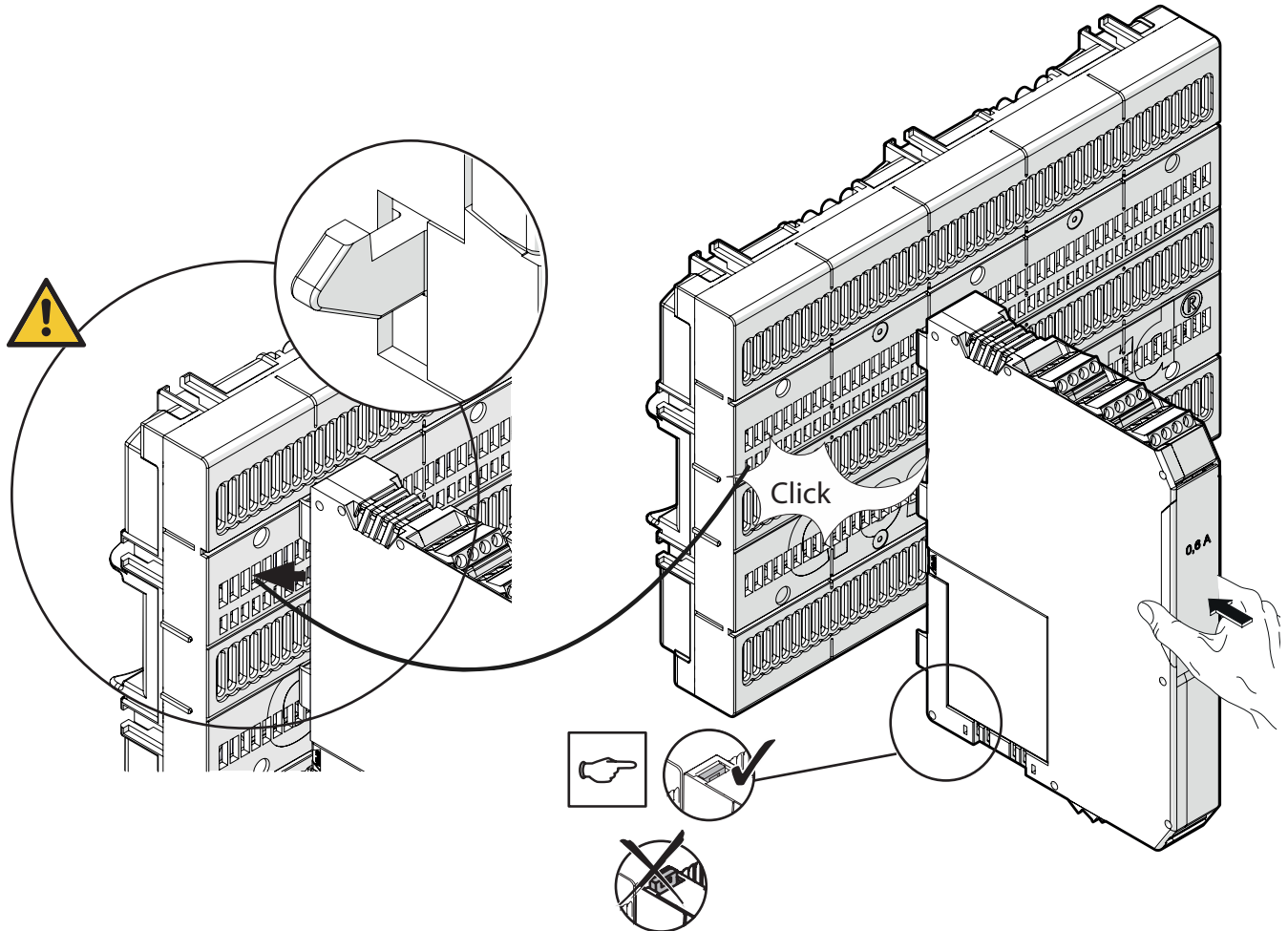
Block diagram





5. Assembly / dismantling

Assembly



Caution!

Never work with live current!
Danger to life!

- The hybrid motor controller snaps onto the RILine Compact Board. It is automatically connected to the 3-phase network via the integral device contacts.



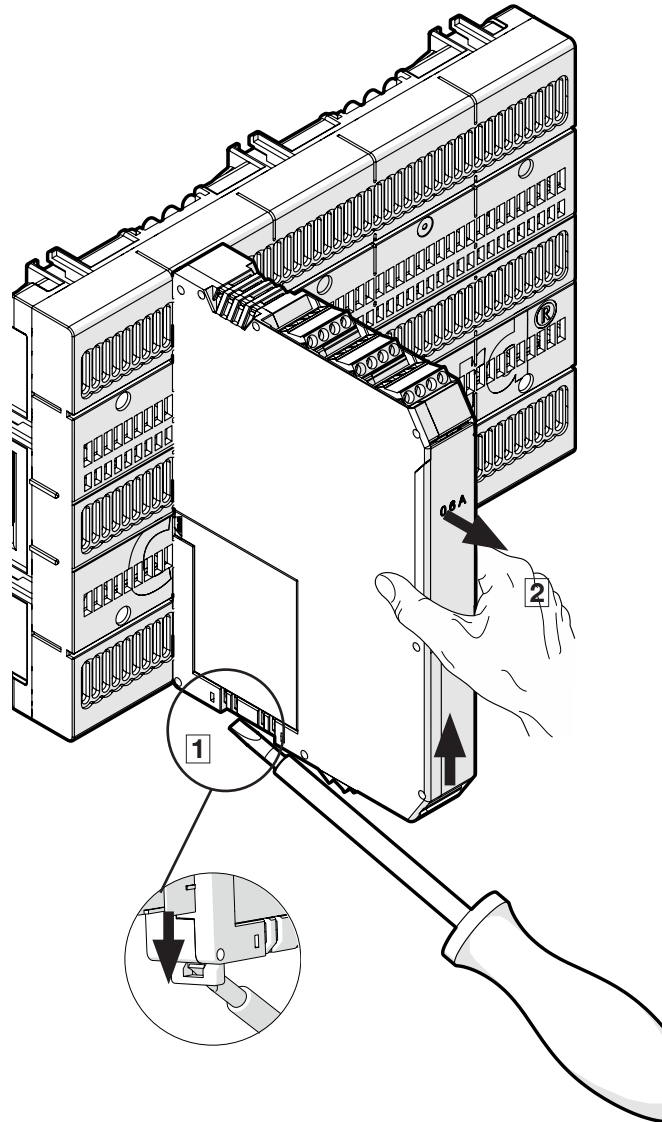
Note!

The device is installed in a vertical position. The coding tab must not be removed to rotate the device.



5. Assembly / dismantling

Dismantling



Danger from electric shock and risk of fire!

An open fuse box [13] may indicate an interrupted fault current. To reduce the risk of fire and electric shock, current-carrying parts and other components in the controller must be checked and replaced if damaged. Failure to observe these instructions can result in death, serious injury or considerable material damage.

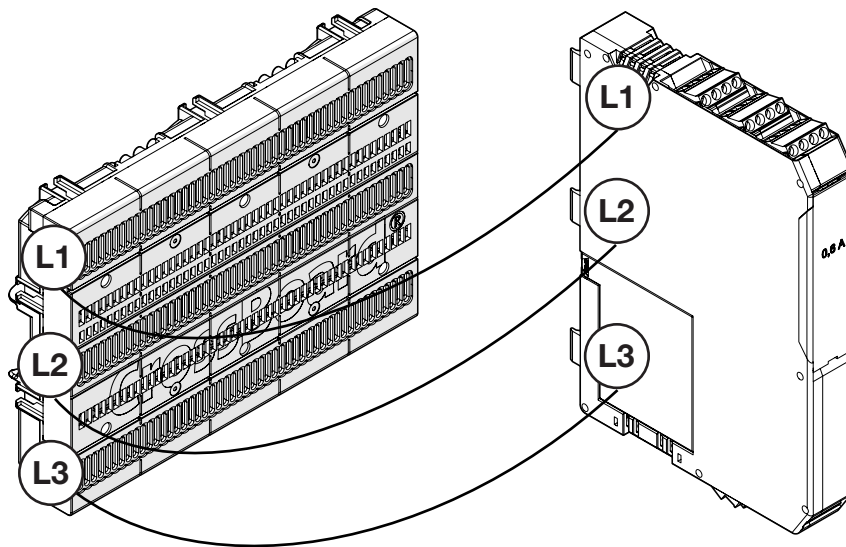


5. Assembly / dismantling



Mains connection and line protection

- When connecting the 3-phase RiLine Compact Board, it is essential to ensure the correct phase position.



- The control supply voltage and control voltage inputs must only be operated with power supply modules that comply with IEC 61131-2 (max. 5% residual ripple).
- With long pilot wires, to avoid the inductive / capacitive coupling of interference pulses, we recommend the use of shielded lines.
- Copper lines with 75 °C approval for use with a low-voltage, limited energy, isolated power supply should be used.



Electrical safety

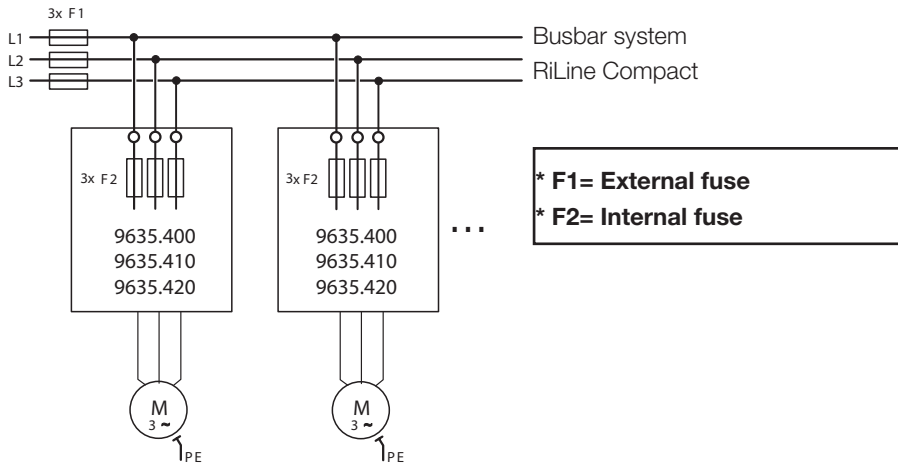
When connecting double conductors, only conductors with an identical conductor cross-section should be connected to the same terminal.

Replacing fuses

- Remove the motor controller from the RiLine Compact Board.
- Remove the outgoing motor cables ► Pull the 3-phase output voltage terminal block from the device [12].
- After opening the cover of the fuse box [13], the fuses can be removed.
- Insert new fuses. Replace all fuses at the same time.
- Only fuses listed in the tables for this device under point 6 should be used.
- After closing the fuse box cover, re-connect the outgoing motor cables (3-phase output voltage terminal block [12]) and snap the device onto the RiLine Compact Board.



6. Protection of the load circuit from short circuits



* F2 in the supplied state		
9635.400	Motor controller 0.6 A	Mersen FR10GR69V16 (16 A)
9635.410	Motor controller 2.4 A	Mersen FR10GR69V16 (16 A)
9635.420	Motor controller 9.0 A	Mersen FR10GR69V20 (20 A)

6.1 Protection to IEC

For device size	Icw	Ue	* F1	* F2	Allocation type 1)
0.6 A/2.4 A/9.0 A	5 kA	400 V	-	20 A gR (10 x 38 mm)	2
	10 kA	500 V	-	16 A gR (10 x 38 mm)	2
	30 kA	500 V	-	30 A gR (10 x 38 mm)	1
	50 kA	500 V	-	16 A gR (10 x 38mm)	1
	50 kA	500 V	-	20 A gR (10 x 38 mm)	1

- 1) Allocation type 1 = System protection
Allocation type 2 = Device protection



6. Protection of the load circuit from short circuits

6.2 Protection to UL (SCCR)

For device size	SCCR	Ue	* F1	* F2	Allocation type 1)
0.6 A/2.4 A	5 kA	500 V	20 A RK5	Mersen FR10GR69V16 (16 A)	1
	100 kA	500 V	30 A Class J / Class CC	Mersen FR10GR69V16 (16 A)	1
	100 kA	500 V	-	Littlefuse CCMR30	1
6.5 A	5 kA	500 V	20 A RK5	Mersen FR10GR69V20 (20 A)	1
	100 kA	500 V	30 A Class J / Class CC	Mersen FR10GR69V20 (20 A)	1
	100 kA	500 V	-	Littlefuse CCMR30	1

1) Allocation type 1 = System protection Allocation type 2 = Device protection



WARNING: Danger from electric shock and risk of fire

Opening the safety device in the branch circuit may indicate an interrupted fault current.

To reduce the risk of fire and electric shock, current-carrying parts and other components in the controller must be checked and replaced if damaged.

Failure to observe these instructions can result in death, serious injury or considerable material damage.



NOTE: Please use copper lines approved for use with at least 75 °C and a low-voltage, limited energy, isolated power supply.

The device is designed for use with a low-voltage, limited energy, isolated power supply.

SCCR (individual and group installation)	
Suitable for use in circuits with maximum 5 kA eff. symmetrical current and ≤ 500 V, with 20 A, class RK5 fuses (allocation type 1).	
Suitable for use in circuits with maximum 100 kA eff. symmetrical current and ≤ 500 V, with 30 A, class J or class CC fuses (allocation type 1).	
FLA	0.6 A (500 V AC) / 2.4 A (500 V AC) / 6.5 A (500 V AC)



7. Function

7.1 Status and diagnosis display

The device visualises operating statuses with a total of 4 LEDs.

After applying the control supply voltage, all LEDs are initially illuminated as an LED test.

LED PWR	Green	Device status
LED L	Yellow	Counter-clockwise rotation
LED R	Yellow	Clockwise rotation
LED ERR	Red	Internal or external error
		Process error: Overcurrent, asymmetry, phase failure



7. Function

7.2 Diagnosis function

Explanation:

A	▶	LED deactivated	Aut	▶	Automatic
E	▶	LED permanently illuminated	Man	▶	Manual
B	▶	LED flashing approx. (2 Hz)	Nm	▶	Not possible

Status	Description	PWR	ERR	L	R	96 97	95 96	Error acknowl- edgement
		Green	Red	Yellow				
Off	No supply voltage present	A	A	A	A	0	1	-
Operational	Supply voltage present	E	A	A	A	0	1	-
Drive activated	Counter-clockwise rotation (L)	E	A	E	A	0	1	-
	Clockwise rotation (R)	E	A	A	E	0	1	-
Internal error	Internal device error - Replacement unit required	E	E	A	A	1	0	Nm
External fault in the actuator or peripherals (servic- ing required, power transmission path deactivated)	Motor protection function: Motor current > rated motor current requirement: Cool-down time in progress (20 min) Trip class: 10 A					1	0	
	Fault with counter-clockwise rotation	E	B	E	A	1	0	Aut
	Fault with clockwise rotation	E	B	A	E	1	0	Aut
	After 2 minutes have expired "L" or "R" will flash: manual reset possible					1	0	
	Fault with counter-clockwise rotation	E	B	B	A	1	0	Man
	Fault with clockwise rotation	E	B	A	B	1	0	Man
	Fault restoring the system status: Manual acknowledge- ment possible after 2 min	E	B	B	B	1	0	Man
	Symmetry: The two motor cur- rents deviate from one another by more than 33%	E	B	A	A	1	0	Man
	Blockage: The maximum meas- urable motor current is exceeded for more than 2 s.					1	0	
	Fault with counter-clockwise rotation	E	B	B	A	1	0	Man
Fault with clockwise rotation	E	B	A	B	1	0	Man	
Message (power transmission path remains connected)	Message with control signal applied: - 2 or more phases missing - No motor connected - Motor current on at least 2 phases below the minimum cur- rent value setting for > 2 s					1	0	
	Message with counter-clockwise rotation	B	B	E	A	1	0	Aut
	Message with clockwise rotation	B	B	A	E	1	0	Aut



7. Function



- Various diagnosis functions allow the motor controller to detect internal and external errors (error in the peripherals). When a fault is detected, the device is in a safely deactivated state.
- Flashing or steady illumination of the ERR-LED indicates an error.
- Internal errors cannot be acknowledged. They are stored in the device. The device will need to be replaced.
- External errors can be acknowledged once the cause has been rectified.
- With external errors, an error acknowledgement is needed in order to be able to exit the safely deactivated state.
- Flashing of the PWR LED indicates a message. With a message, the power transmission path remains connected. An acknowledgement is not required.
- Symmetry detection: The motor currents are measured at phases L1 and L3 and monitored for symmetry. If there is a deviation in the motor currents of $\geq 33\%$, the motor will switch off within 2 minutes. If there is a deviation in the motor currents of $\geq 67\%$, the motor will switch off within 2 seconds.

Error acknowledgement

- The RES terminal provides the voltage for the reset. At the rated control supply voltage of 24 V DC, this is 24 V DC.
- Maximum 30 m long cables may be connected to the MAN, RES and AUT terminals.

Manual reset button

Manual reset occurs by pressing the reset button (< 2 s) on the front of the device.

If pressed for longer than 2 s, the unit will resume error status. If pressed for longer than 6 s, the unit will switch to "Parameterisation" mode (see point 7.3 Parameterisation, rated current setting).

Manual - remote acknowledgement button

For remote acknowledgement, a button (normally open contact) is connected between the MAN and RES terminals.

Acknowledgement is triggered as soon as a positive edge is detected at the MAN input. If no negative edge is detected after approximately 2 s, the unit will return to error status, because manipulation or a defect in the acknowledgement circuit cannot be excluded.

Automatic

For automatic acknowledgement, an electrical connection is made between the RES and AUT terminals. The unit performs an automatic reset after motor protection monitoring and subsequent cooling has been initiated.

The cooldown period is 20 minutes.

Check-back relay

As soon as the unit detects an error or signals a message, the check-back relay is activated. In other words, the normally open contact is closed or the normally closed contact is opened. This response is equivalent to that of a motor circuit-breaker or motor protection relay.

7.3 Parameterisation – Setting the rated current

- To enter "Parameterisation" mode, press the reset button on the front of the device for more than 6 s. The green LED PWR flashes once.
- The rated current of the drive is set using the 240° potentiometer. There are 16 rated current settings. The four LEDs indicate the set rated current. Refer to the following table under point 7.3 Parameterisation – Setting the rated current.
- The value is set by pressing the reset button again (non-volatile part of the data memory)
- Pressing the reset button for > 2 s (and < 6 s) will display the set current for 3 s. This function is only possible if the device is not being controlled and there is no error on the device.



- To distinguish it from other operating states, in "parameterisation" mode, the LEDs are switched off for 0.3 s at 2 s intervals.
- From a motor current of 45 A, blockage monitoring is activated (see point 10 in the Annex - Tripping characteristic and derating curve).



7. Function

7.3 Parameterisation – Setting the rated current

Explanation:

- A ► LED deactivated
 E ► LED permanently illuminated

Code				Rated current (mA) Variants:		
PWR	ERR	L	R	0.6 A	2.4 A	9 A
A	A	A	A	75	180	1500
A	A	A	E	110	250	2000
A	A	E	A	145	410	2500
A	A	E	E	180	560	3000
A	E	A	A	215	710	3500
A	E	A	E	250	870	4000
A	E	E	A	285	1020	4500
A	E	E	E	320	1170	5000
E	A	A	A	355	1330	5500
E	A	A	E	390	1480	6000
E	A	E	A	425	1630	6500
E	A	E	E	460	1790	7000
E	E	A	A	495	1940	7500
E	E	A	E	530	2090	8000
E	E	E	A	565	2250	8500
E	E	E	E	600	2400	9000



- If the 9 A motor controller is used in UL applications, the maximum admissible rated current is 6500 mA.



8. Application instructions

8.1 Motor with brake

When using a motor with brake (connection to motor terminal board), the 400 V AC brake is connected to 2/T1 and 6/T3. A 230 V AC brake should be connected to 4/T2 and the motor neutral point.



Motor current monitoring should be increased by the rated current of the brake, and set accordingly on the motor controller.

8.2 Connection of auxiliary relays

Auxiliary relays to control external brakes or check-back signals, e.g. to the SPC, are connected to 4/T2 and N of the system.



Switching off the control supply voltage while the motor is being controlled always leads to wear and tear on the motor controller. Consequently, this circuit should only be used if no more than 10,000 deactivations are anticipated over the entire service life of the system.



9. Technical specifications

Model No.	Description	9635.400 9635.410 9635.420	Motor controller 0.6 A Motor controller 2.4 A Motor controller 9.0 A
Incoming data			
Rated control supply voltage U_s	to IEC 60947-1 / UL 508	24 V DC	
Control supply voltage range		19.2 ... 30 V DC	
Rated control supply voltage I_S to IEC 60947-1		≤ 40 mA	
Control input L, R:	Switching level "Low" Switching level "High" Input current	-3 ... 9.6 V DC 19.2 ... 30 V DC 5 mA	
Typical break time		< 30 ms	
Output data, load side		9635.400	9635.410
Switching principle		Safety output stage with bypass, three-phase isolated switch off	
Rated operating voltage U_e	to IEC 60947-1	500 V AC (50/60 Hz)	
Operating voltage range	to IEC 60947-1 to UL 508	42 ... 550 V AC (50/60 Hz) 42 ... 500 V AC (50/60 Hz)	
Load current at 20 °C (see 10. Appendix. Derating curve)		0.075 ... 0.6 A	0.18 ... 2.4 A
Rated operating current I_e AC-51 AC-53a (see 10. Appendix. Derating curve)	to IEC 60947-1 to IEC 60947-4-3 to IEC 60947-4-2 to UL 508	0.6 A 0.6 A 0.6 A	2.4 A 2.4 A 2.4 A
Rated switching capacity	to UL 508 Full Load (power factor = 0.4) Full Load (power factor = 0.8)	0.3 kW (0.4 HP) 0.5 kW (0.6 HP)	0.9 kW (1.2 HP) 1.7 kW (2.2 HP)
			9 A 6.5 A 6.5 A
			2.3 kW (3.0 HP) 4.6 kW (6.1 HP)



9. Technical specifications

	9635.400	9635.410	9635.420
Leakage current (input, output)	0 mA	0 mA	0 mA
Residual voltage at I _e	< 300 mV	< 400 mV	< 600 mV
Surge current	100 A (t = 10 ms)		
Input protection circuit	Varistors, slow fuses		
Short circuit current rating SCCR to UL 508A	With Littlefuse CCMR 30A fuse, suitable for use in circuits that supply no more than 100 kA _{eff} symmetrical current, max. 500 V. (see 6. Protection of the load circuit from short circuits).		
Checkback output			
Contact version	Single contact, 1 changeover contact		
Switching capacity to IEC 60947 -5-1	3 A (230 V, AC 15) 2 A (24 V, DC 13)		
Measurement system	9635.400	9635.410	9635.420
Two-phase current measurement			
Range	0.075 ... 0.6 A	0.18 ... 2.4 A	1.5 ... 9.0 A
Symmetry monitoring			
Amount I _{max} > I _{rated} => (I _{max} - I _{min} / I _{max}) Amount I _{max} < I _{rated} => (I _{max} - I _{min} / I _{rated})	≥ 33% / ≥ 67% ≥ 33% / ≥ 67%	≥ 33% / ≥ 67% ≥ 33% / ≥ 67%	≥ 33% / ≥ 67% ≥ 33% / ≥ 67%
Response time	2 min / 1.8 s	2 min / 1.8 s	2 min / 1.8 s
Phase failure monitoring			
I(L1), I(L3) (Angle (L1, L3) typ.	> 75 mA 170° ... 190°	> 150 mA 170° ... 190°	> 1200 mA 170° ... 190°
Response time	< 1.8 s	< 1.8 s	< 1.8 s
Blocking protection			
I(L1) or I(L3)	-	-	> 45 A
Response time	-	-	2 s
Trigger characteristic (see 10. Appendix) to IEC 60947-4-2	Class 10 A		
Cool-down time	-	-	20 min



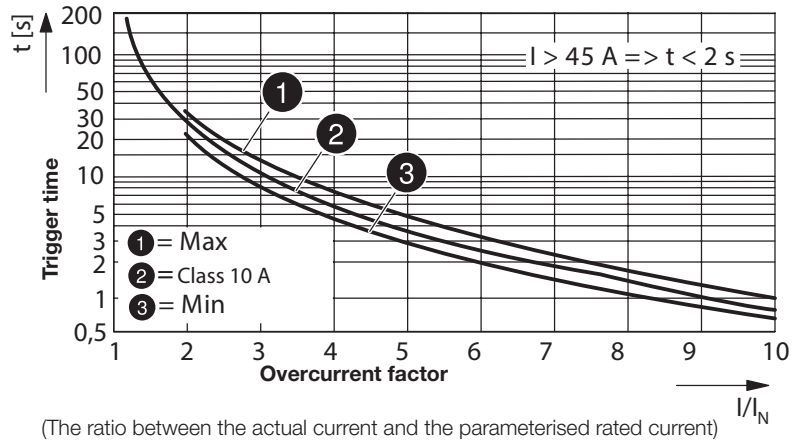
9. Technical specifications

Display and operating elements	9635.400	9635.410	9635.420
Operating voltage display	LED PWR (green)		
Device and process error display	LED ERR (red)		
Control display counter-clockwise/clockwise	LED L (yellow) / LED R (yellow)		
Reset button	Error acknowledgement/parameterisation		
Potentiometer for setting the rated motor current	240°		
General specifications			
Heat loss	0.88 W / 2.8 W	0.88 W / 5.5 W	0.88 W / 12 W
Max. switching frequency (pulse/pause times 50:50)	2 Hz		
Rated surge voltage between control input, control supply and switching voltage - Mains rated voltage (≤ 500 V AC) - Mains rated voltage (≤ 300 V AC, e.g. 230/400 V AC, 277/480 V AC) - Mains rated voltage (300 ... 500 V AC) Control input, control supply voltage and checkback output. Checkback output and switching voltage - Mains rated voltage (≤ 500 V AC) - Mains rated voltage (≤ 300 V AC, e.g. 230/400 V AC, 277/480 V AC) - Mains rated voltage (300 ... 500 V AC)	6 kV Reliable disconnection (EN 50178) Reliable disconnection (IEC 60947-1) Basic insulation (IEC 60947-1) Safe isolation (IEC 60947-1) Safe isolation (EN 50178) Safe isolation (IEC 60947-1) Basic insulation (IEC 60947-1)		
Ambient temperature range Operation Transportation, storage	-25 °C ... +70 °C -40 °C ... +80 °C		
Overvoltage category	III		
Level of contamination	2		
Standards / provisions	IEC 60947-4-2 / IEC 61508-1 / EN 954-1 / ISO 13849-1 / UL 508		
Service life	3 x 10 ⁷ switching cycles		
Protection category	IP20		
Installation position	Vertical		
Installation (see derating curve)	Bayable without or with a distance of ≥ 22.5 mm		
Case: Material Dimensions (W / H / D)	PA 66 (22.5 / 160 / 114.5) mm		
Connection data (conductor cross-section) Screw terminals (rigid / flexible) Thread M3, recommended torque Insulation stripping length	See connection instructions 0.14 ... 2.5 mm ² (AWG 26 ... 14) 0.5 ... 0.6 Nm 8 mm		
Weight Motor controller	approx. 325 g		



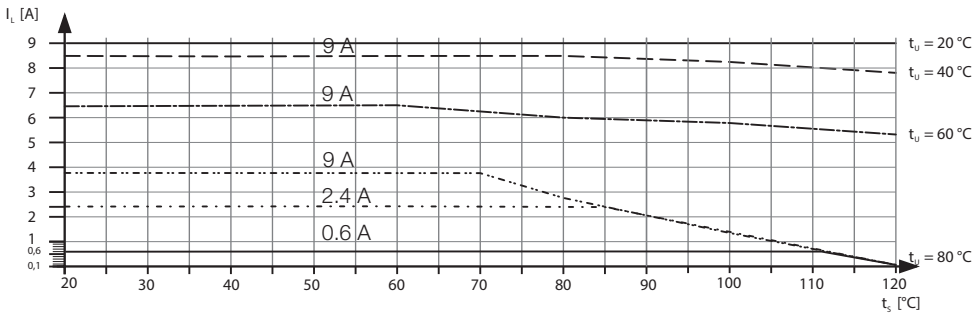
10. Appendix

Trigger characteristic at 20 °C

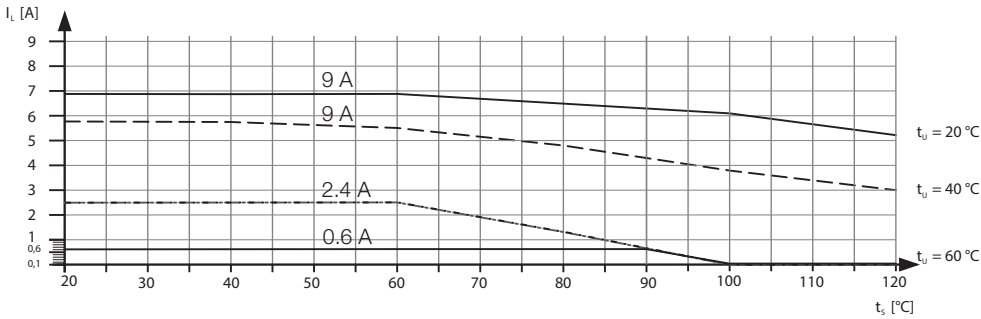


Derating curves at 100% duty cycle

① Bayed at a distance of 22.5 mm



② Bayed with no distance



I_L = Load current [A]
 t_U = Ambient temperature [°C]
 t_S = Temperature of busbar [°C]
 I_A = Start-up current [A]

Derating curve of busbar



The adjustment factors described here refer to motor controllers with a max. load current of 9 A. The max. admissible rated current of the motor can be calculated using the load current, the overcurrent factor (see data sheet for the respective motor) and the 9 A derating curve.

9 A derating curve										
Overcurrent factor I_A/I_N	1	2	3	4	5	6	7	8	9	10
Adjustment factor K	1	1	1	1	1	0.96	0.83	0.72	0.64	0.58
Example 1 (motor controller 9 A)										
Motor with overcurrent factor I_A/I_N (from motor data sheet)	8									
Adjustment factor K	0.72									
Maximum admissible load current I_L at t_S 30 °C and t_U 20 °C, at a distance of 22.5 mm (see derating curve ①)	9 A									
Maximum admissible rating current I_N of motor = $I_L \times K$	6.5 A									



10. Appendix

Example 2 (motor controller 2.4 A)

Motor with overcurrent factor I_A/I_N (from motor data sheet)	-
Adjustment factor	-
Maximum admissible load current I_L at t_s 65 °C and t_U 60 °C, bayed (see derating curve ②)	2.2 A



11. Servicing

As a general principle, manufacturers of electrical plant and equipment must set out, in writing, the required installation, commissioning and maintenance measures, and present these to the operator.

Once commissioned and signed off, all electrical plant and equipment must be re-inspected at suitable intervals. This is the operator's responsibility.

These intervals are generally based on the use, installation and ambient conditions of the electrical plant and equipment. In particular, requirements relating to stationary or mobile use must be observed.

For electrical plant and equipment subject to particular loads and special types of facilities such as:

- Campsites
- Medical environments
- Vehicles
- Wet rooms and outdoors
- Agricultural and horticultural facilities

special conditions apply.

Inspection and testing must normally be carried out by a trained, qualified electrician with suitable knowledge and experience

- of the particular environment
- of the relevant standards and regulations
- of the work involved
- in the identification of risks.

Testing e.g. of RCDs may also be carried out by staff who have received appropriate instruction using suitable measurement and test equipment.

Alongside the relevant standards and regulations, depending on the installation site, the applicable national/regional regulations and laws must also be observed.

For Rittal power distribution components, we recommend inspections at least every year.

Further information on the topic of servicing, testing and personnel requirements may be found in the following standards:

- IEC 60364-7 Group 700, DIN VDE 0100 Group 700, VDE 0100 Group 700
- DIN VDE 0105-100
- VDE 1000-10
- DGU V3



12. Storage

When storing components, please ensure that

- The ambient temperature is no higher than +80 °C
- The ambient temperature is no lower than -40 °C
- The relative humidity is between 10% and 95%, non-condensing.



13. Warranty

The terms of sale and delivery of the individual Rittal sales agencies and subsidiaries apply.



14. Customer service address

Germany headquarters

RITTAL GmbH & Co. KG

Auf dem Stützelberg

35745 Herborn

Germany

Phone +49(0)2772 505-1855

Fax +49(0)2772 505-1850

E-mail: service@rittal.de

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You can find the contact details of all Rittal companies throughout the world here.



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RITTAL GmbH & Co. KG
Postfach 1662 · D-35726 Herborn
Phone +49(0)2772 505-0 · Fax +49(0)2772 505-2319
E-mail: info@rittal.de · www.rittal.com

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