



Digital Inverter

**Synthesis**



## Synthesis Inverter

### Bonfiglioli: Specific Solutions for Power Control and Transmission

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## Bonfiglioli: Specific Solutions for Power Transmission and Motion Control

**P**roduct diversification, process automation, and quality have enabled Bonfiglioli to play a leading role in the industry. Bonfiglioli's policy focuses on integrated solutions, competence and innovative technology as key factors, indispensable to ensure customer satisfaction, while production is aimed at achieving the highest standards.

Bonfiglioli product portfolio aims at meeting the toughest and most sophisticated requirement for Industrial Process and Automation Solution and for Mobile Equipment Solutions.



Such market areas are covered through the following Product Lines:

 **BONFIGLIOLI RIDUTTORI** representing Helical, Bevel and Worm Gearmotors and Gear Units

 **BONFIGLIOLI TRASMITAL** representing Planetary Gearmotors and Gear Units

 **BONFIGLIOLI VECTRON** representing AC drives

# 2 Synthesis

## Inverter



Synthesis combines the best features of price effectiveness, compactness and versatility currently available on stand alone inverters. Easy to install and program, in a limited number of parameters it features the most important functions required from this type of AC drive.

Especially suitable for APPLICATIONS such as CONVEYOR BELTS, PUMPS, SCREW CONVEYORS, MIXERS, STIRRERS, it is also available in the IP65 (NEMA 4) version for installation off the cabinet and on board the machine.

Synthesis drives are available with ratings up to 2.2 kW. Power supplies are either single phase 220 V and 110 V or three phase 220 V and 400 V. As standard, the drive come complete with built-in class A EMI filter and meets all major world standards.



### Model SYN10

	S115 03	S115 05
Suitable Motor Power Rating (kW)	0.4	0.75
Rated Output Current (A) <sup>1</sup>	2.3	4.2
Capacity (kVA)	0.9	1.6
Input Voltage Max.	Single phase 100V-120V, 50/60Hz	
Allowable versions	Voltage +10%, -15%, frequency +/-5%	
Output Voltage Max. <sup>2</sup>	Three phase 200V - 240V	
EMC Specification	Class A (Single Phase Filter built in)	
Available versions	IP20	

### Model SYN10

	S220 01 AF	S220 03 AF	S220 05 AF	S220 07 AF	S220 09 AF
Suitable Motor Power Rating (kW)	0.2	0.4	0.75	1.5	2.2
Rated Output Current (A) <sup>1</sup>	1.4	2.3	4.2	7.5	10.5
Capacity (kVA)	0.53	0.88	1.6	2.9	4.0
Input Voltage Max.	Single phase 200V - 240V, 50/60 Hz			Single/Three phase 200V - 240V, 50/60 Hz	
Allowable versions	Voltage +10%, -15%, frequency +/-5%				
Output Voltage Max. <sup>2</sup>	Three phase 200V - 240V				
EMC Specification	Class A (Single Phase Filter built in)				
Available versions	IP20, IP65, IP65 S			IP20, IP65 S	

### Model SYN10

	T400 05 AF	T400 07 AF	T400 09 AF
Suitable Motor Power Rating (kW)	0.75	1.5	2.2
Rated Output Current (A) <sup>1</sup>	2.3	3.8	5.2
Capacity (kVA)	1.7	2.9	4.0
Input Voltage Max.	Single phase 380V-460V, 50/60Hz		
Allowable versions	Voltage +10%, -15%, frequency +/-5%		
Output Voltage Max. <sup>2</sup>	Three phase 380V - 460V		
EMC Specification	Classe A (Three Phase Filter built in)		
Available versions	IP20, IP65 S		

Note<sup>1</sup>: Rated output current value when the PWM carrier frequency (parameter F12=5) is 8 kHz or less.

Note<sup>2</sup>: Maximum output voltage is the same as the input voltage. The maximum output voltage of single phase 115 V model is proportional to the supply voltage.



Functional specifications

Item	Specifications	
Input signal type	PNP type (SOURCE) input (External 24VDC Input is allowed)	
Control method	Sinusoidal wave PWM control	
Frequency Control	Frequency range	1~200 Hz
	Resolution setting	Digital: 0.1 Hz (1 ~ 99.9 Hz); 1 Hz (100 ~ 200 Hz) Analog: 1Hz/ 60 Hz
	Keyboard setting	Directly setup by ▲ and ▼ buttons
	External signal setting	0~10 V, 4 ~ 20 mA, 0 ~ 20 mA
	Other function	Frequency upper and lower limit
	Carrier frequency	4~16 kHz
General Control	Accelerate / Decelerate time	0.1~ 999 Sec
	V/f Pattern	6 patterns
	Torque control	Torque boost level adjustable (manual torque boost)
	Multi-Functional input	2 point, to be used as multi-speed 1 (Sp.1) / multi-speed 2 (Sp.2) / Jog / External quickstop / External bb / Reset
	Multi-Functional output	1a Relay terminal, to be setup as Fault / Running / Frequency
	Braking Torque	S115, S220 01 03 and 05: about 20% S220 07, 09 and T400: 20%~100% built-in braking transistor
Other function	Decelerate or free run stop, Auto reset, DC braking frequency / Voltage / Time can be setup by constants	
Display	Three digital LED display frequency / inverter parameter / fault record / program version	
Operating temperature	-10 ~ +40°C (with cover removed: -10°C ~ +50°C)	
Humidity	0~95% RH non - condensing	
Vibration	Under 1 G (9.8 m/s <sup>2</sup> )	
EMC specification	EN50081-1, EN50081-2, EN50082-2, EN50178, EN61800-3+A11	
UL	UL508C	
Protection Function	Overload protection	150% for 1 min.
	Over voltage	DC voltage > 410V (200 series); > 800V (400 series)
	Under voltage	DC voltage < 200V(200 series); < 400V(400 series)
	Momentary Power-loss	0 ~ 2 sec: the inverter can be restarted u sign speed search feature
	Stall prevention	During Acceleration / Deceleration / Constant speed
	Output short-circuit	Electronic circuitry protection
	Grounding fault	Electronic circuitry protection
	Other function	Heat sink overheat protection, current limit
	Installation	Mounting screw or DIN rail (Option)

Sample Model Identification

SYN10	S	220	05	AF	IP65	S
	Input phases	Input voltage	Size / Power	EMC Filter	Protection degree	Switch
Series	S = single phase	115 = 115V 220 = 220V	01 = 0.2 kW 03 = 0.4 kW 05 = 0.75 kW 07 = 1.5 kW 09 = 2.2 kW	AF = integrated class "A" filter not available for S115	_ = IP20 IP65 = IP65	_ = no switch S = integrated switch (only for IP65)
	T = three phases	400 = 400V				

### Parameter list

Function	F_	Function description	Unit	Range	Factory setting
	00	Factory Adjustment			0
Acceleration	01	Acceleration time	0.1 sec	0.1 ~ 999 s	5.0
	02	Deceleration time	0.1 sec	0.1 ~ 999 s	5.0
Operation mode	03	0: Forward/Stop, Reverse/Stop 1: Run/Stop, Forward/Reverse	1	0 ~ 1	0
Motor rotation direction	04	0: Forward 1: Reverse	1	0 ~ 1	0
V/f pattern	05	V/f pattern setting	1	1 ~ 6	1/4
Frequency upper/lower limit	06	Frequency upper limit	0.1 Hz	1.0 ~ 200 Hz	50/60 Hz
	07	Frequency lower limit	0.1 Hz	0.0 ~ 200 Hz	0.0 Hz
SP1 frequency	08	SP1 frequency	0.1 Hz	1.0 ~ 200 Hz	10 Hz
JOG frequency	09	JOG frequency	0.1 Hz	1.0 ~ 200 Hz	6 Hz
Start / Stop control	10	0: Keypad 1: Terminal (TM2)	1	0 ~ 1	0
Frequency control	11	0: Keypad 1: Terminal (0~10v / 0~20mA) 2: Terminal (4~20mA)	1	0 ~ 2	0
Carrier frequency control	12	Carrier frequency control	1	1 ~ 10	5
Torque compensation	13	Torque compensation gain	0.1%	0.0 ~ 10.0%	0.0%
Stop method	14	0: controlled deceleration stop 1: free run stop	1	0 ~ 1	0
DC braking setting	15	DC braking time	0.1 s	0.0 ~ 25.5 s	0.5 s
	16	DC braking injection frequency	0.1 Hz	1 ~ 10 Hz	1.5 Hz
	17	DC braking level	0.1%	0.0 ~ 20.0%	8.0%
Electric thermal Overload protection	18	Protection base on motor rated current	1%	0 ~ 200%	100%
Multifunction input connection point	19	Multifunction input terminal 1 (SP1) function	1: Jog 2: SP1		2
	20	Multifunction input terminal 2 (RESET) function	3: Quick stop 4: External Base Block 5: Reset 6: SP2		5
Multi-function output	21	Multifunction output terminal	1: Operating 2: Reached frequency 3: Fault		3
Reverse Lock-Out	22	0: REV run 1: REV run Lock-Out	1	0 ~ 1	0
Momentary power loss	23	0: enabled 1: disable	1	0 ~ 1	0
Auto restart	24	Number of Auto-restart times	1	0 ~ 5	0
Factory setting	25	010: Constants initialization to 50 Hz system 020: Constants initialization to 60 Hz system			
SP2 frequency	26	SP2 frequency	0.1 Hz	1.0~200 Hz	20
SP3 frequency	27	SP3 frequency	0.1 Hz	1.0~200 Hz	30
Direct start	28	0: enable 1: disable	1	0 ~ 1	1
Software version	29	CPU program version			
Fault Log	30	Fault log for three faults			

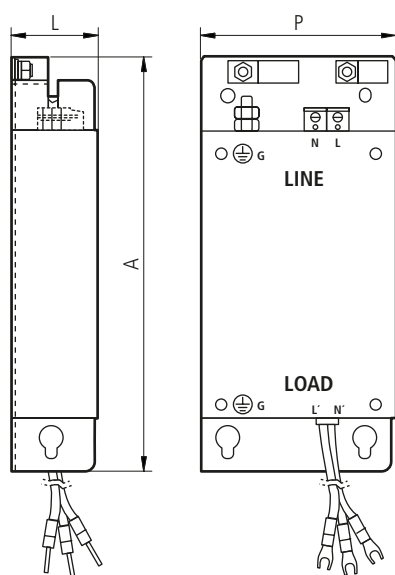
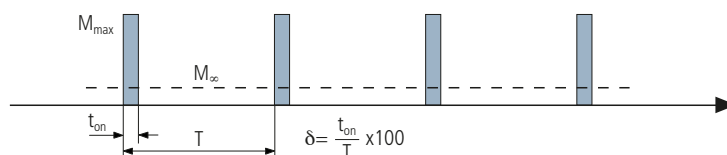
### Braking resistor selection

Inverter model	Braking module	Braking resistor	Resistor model
SYN10 S 220 01 AF	—	—	—
SYN10 S 220 03 AF	—	—	—
SYN10 S 220 05 AF	—	—	—
SYN10 S 220 07 AF	built-in	external	SR-0.75-S
SYN10 S 220 09 AF	built-in	external	SR-0.75-S
SYN10 T 400 05 AF	built-in	external	SR-0.75-T
SYN10 T 400 07 AF	built-in	external	SR-1.5-T
SYN10 T 400 09 AF	built-in	external	SR-2.2-T

Note: braking torque without resistor is about 20% of motor rated torque

### SYN10 braking resistor features

Inverter model	Resistor type	Rated data	Maximum braking torque (Mmax)
SYN10 S 220 07 AF	SR-0.75-S	100 Ω - 150 W	85% $t_{on}=10s$ $\delta=10\%$
SYN10 S 220 09 AF	SR-0.75-S	100 Ω - 150 W	60% $t_{on}=10s$ $\delta=10\%$
SYN10 T 400 05 AF	SR-0.75-T	300 Ω - 150 W	150% $t_{on}=11.5s$ $\delta=11.5\%$
SYN10 T 400 07 AF	SR-1.5-T	100 Ω - 150 W	150% $t_{on}=10.7s$ $\delta=10.7\%$
SYN10 T 400 09 AF	SR-2.2-T	150 Ω - 300 W	150% $t_{on}=8s$ $\delta=8\%$



### Class B EMI filters

Filter model	Inverter model	Dimensions (mm) WxHxD	Current (A)
FT1000-0.4-S	SYN10 S 220 01 AF	36x189x71	6.5
	SYN10 S 220 03 AF		
FT1000-0.75-S	SYN10 S 220 05 AF	36x191x110	18
	SYN10 S 220 07 AF		
FT1000-2.2-S	SYN10 S 220 09 AF	41x191x174	29
	SYN10 T 400 05 AF		
FT1000-2.2-T	SYN10 T 400 07 AF	41x191x110	10
	SYN10 T 400 091 AF		

Book type mounting class B EMI filter upon the main plate

### DIN RAIL Specification

Model	Inverter model	Dimension (mm) WxHxD
DIN E2-201	All SYN10 models	130x72x7.5







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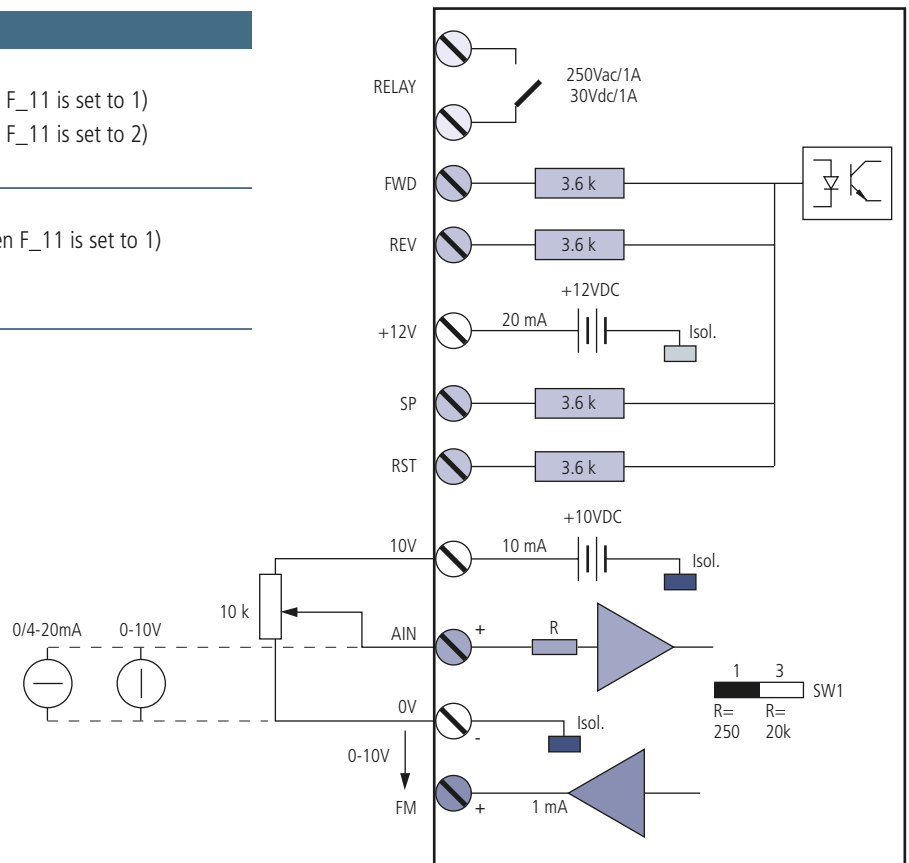
## Inverter

### Control circuitry terminal block electric features

Terminal number	Terminal name	Default function	Electrical features	Parameter
1	Trip	Relay output	250VAC/1A 30VDC/1A	F_21
2	Relay			
3	FWD	Forward run	12/24VDC, 4.5mA, 3.6k $\Omega$	F_3
4	REV	Reverse run		F_10
5	DC12V	Output power supply +12VDC	12VDC, 20mA	–
6	SP1			F_19
7	RST	Multifunction digital input	12/24VDC, 4.5mA, 3.6k $\Omega$	F_20
8	DC10V	Output power supply +10VDC	10VDC, 10mA	
9	V/I in	Analog input (+)	DC 0~10V 20k $\Omega$	F_6
		Voltage/Current	DC 0~20/4~20mA 250 $\Omega$	F_7
		(Potentiometer 10k $\Omega$ )	10 bits resolution	F_11
10	0V	Common analog (-)	0V	Switch1
11	FM+	Analog output (+)	DC 0~10V, 1mA	F_6
				F_7

### SW1 function description

SWITCH 1	External signal type
 1	0~20mA analog signal (when F_11 is set to 1)
 2	4~20mA analog signal (when F_11 is set to 2)
 3	
 1	0~10 VDC analog signal (when F_11 is set to 1)
 2	(default)
 3	



**Precautions:** for safety reasons, read carefully the "Operations Manual", in particular those paragraphs marked with "Warning" or "Caution" symbols, before installing and operating the inverter.

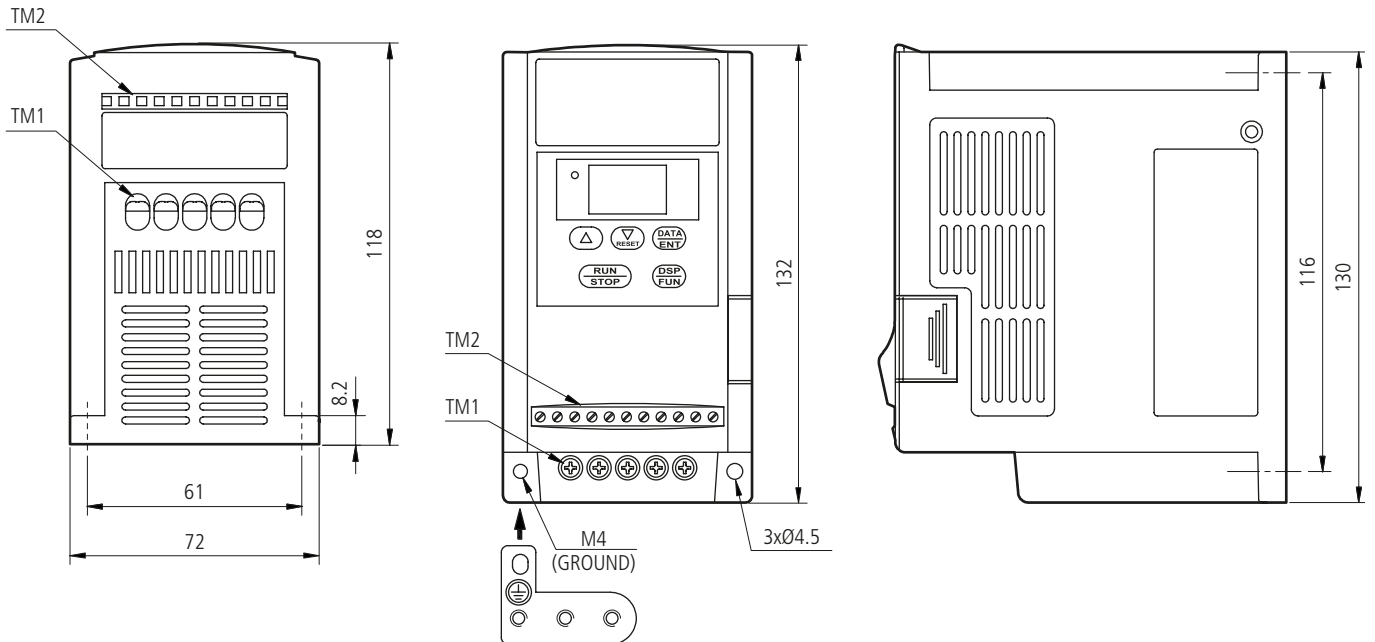
For further information, please contact our technical service or the nearest Bonfiglioli dealer.

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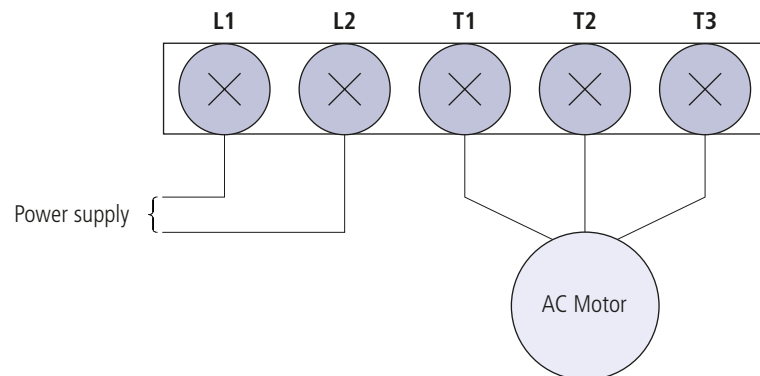


Dimension & location of terminal block

SYN10 S 115 03/05, S 220 01/03/05



SYN10 case A



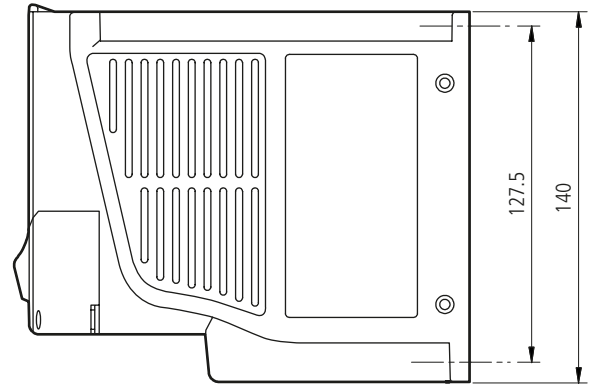
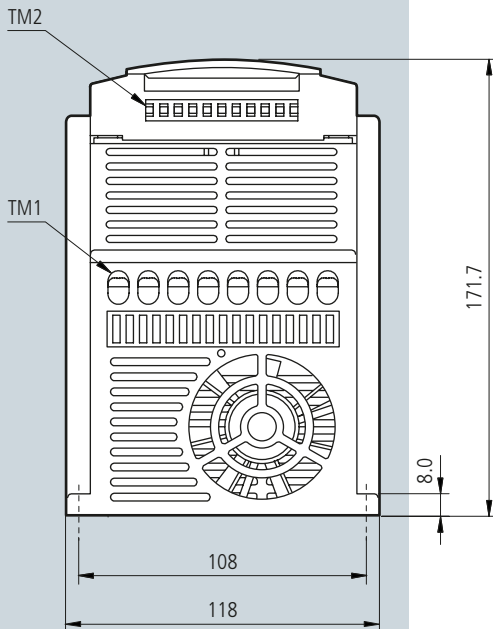
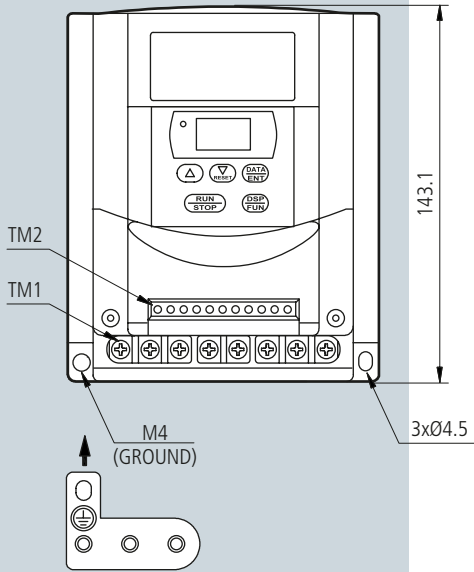
Mains supply:

SYN10 S 115 03/05: 1 ph 100-120V 50/60Hz

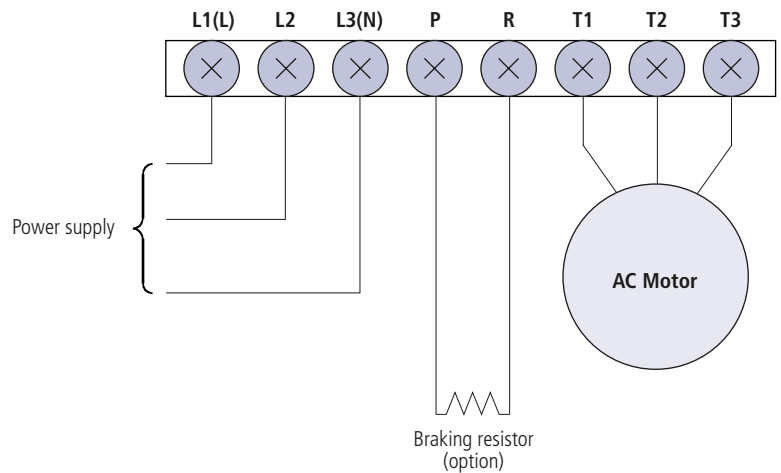
SYN10 S 220 01/03/05: 1 ph 200-240V 50/60Hz

Type	Weight (kg)
SYN10 S 115 03	0.77
SYN10 S 115 05	0.84
SYN10 S 220 01 AF	0.86
SYN10 S 220 03 AF	0.87
SYN10 S 220 05 AF	0.91

SYN10 S 220 07/09 SYN10 T 400 05/07/09



### SYN10 case B



Mains supply:

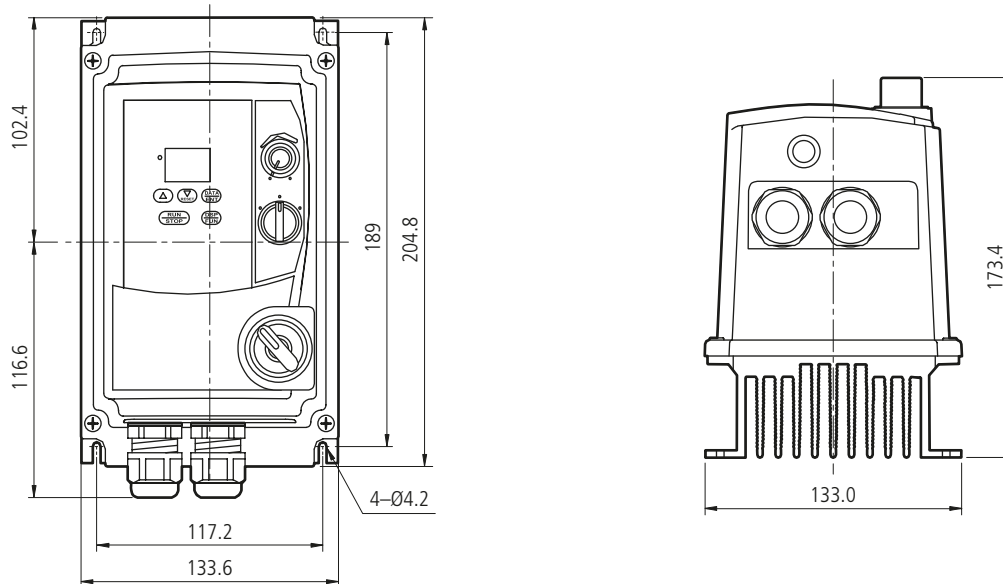
SYN10 S 220 07/09: 1ph 200-240V 50/60Hz: terminals L1(L) e L3(N);

3ph 200-240V 50/60Hz: terminals L1, L2, L3

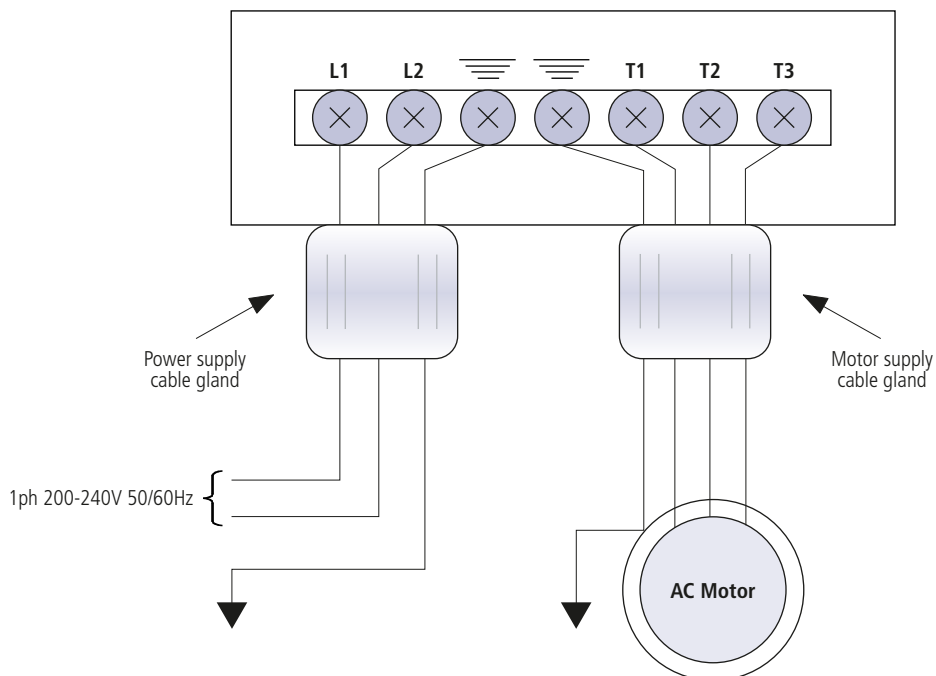
SYN10 T 400 05/07/09: 3ph 380-460V 50/60Hz: terminals L1, L2, L3

Type	Weight (kg)
SYN10 S 220 07 AF	2.1
SYN10 S 220 09 AF	2.2
SYN10 T 400 05 AF	1.6
SYN10 S 400 07 AF	1.62
SYN10 S 400 09 AF	1.68

SYN10 S 220 01/03/05 IP65 S



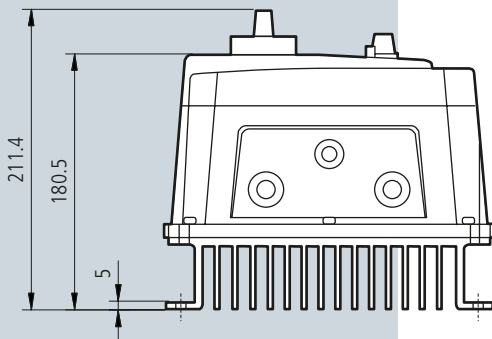
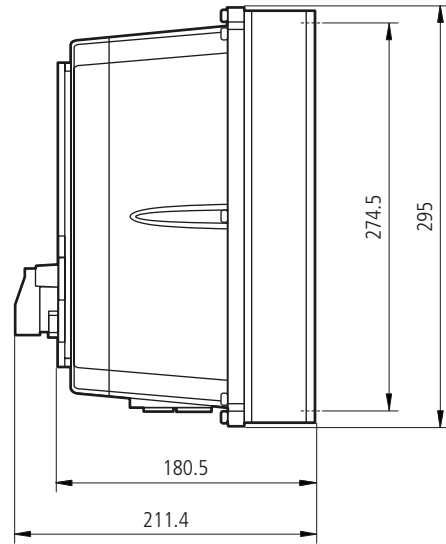
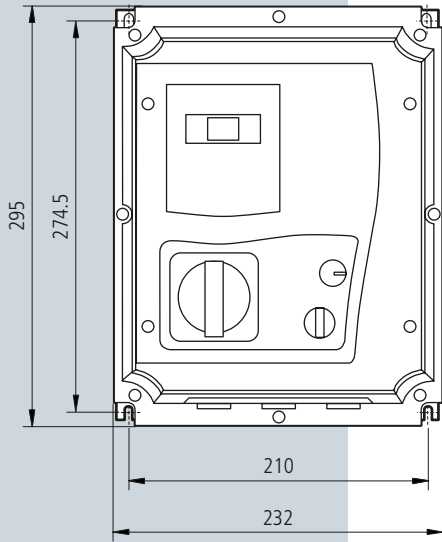
SYN10 case C with switches



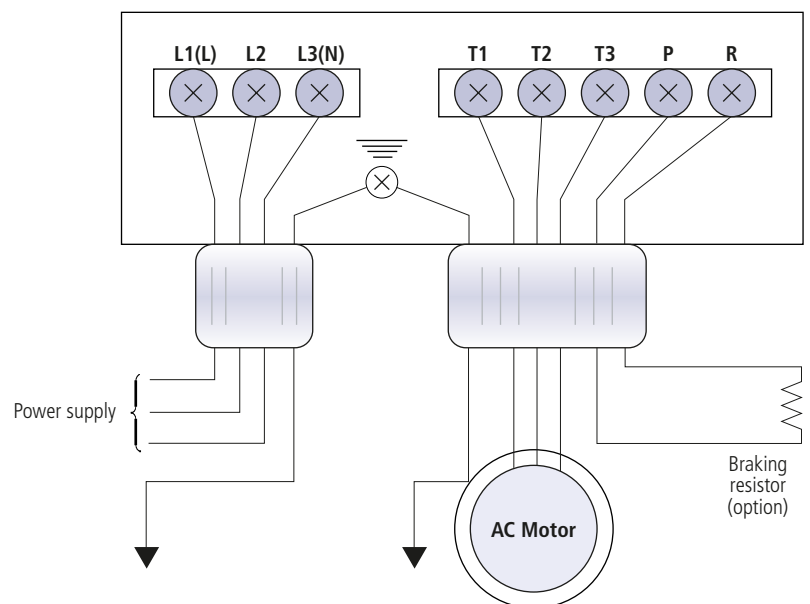
NB: The layout of power terminals is also valid for IP65 models without switches  
SYN10 S 220 01/03/05 AF IP65

Type	Weight (kg)
SYN10 S 220 01/03/05 AF IP65 S	3.4
SYN10 S 220 01/03/05 AF IP65	3.2

SYN10 S 220 07/09 IP65 S SYN10 T 400 05/07/09 IP65 S



SYN10 case D with switches



Mains supply:

SYN10 S 220 07/09: 1ph 200-240V 50/60Hz: terminals L1(L) e L3(N);

3ph 200-240V 50/60Hz: terminals L1, L2, L3

SYN10 T 400 05/07/09: 3ph 380-460V 50/60Hz: terminals L1, L2, L3

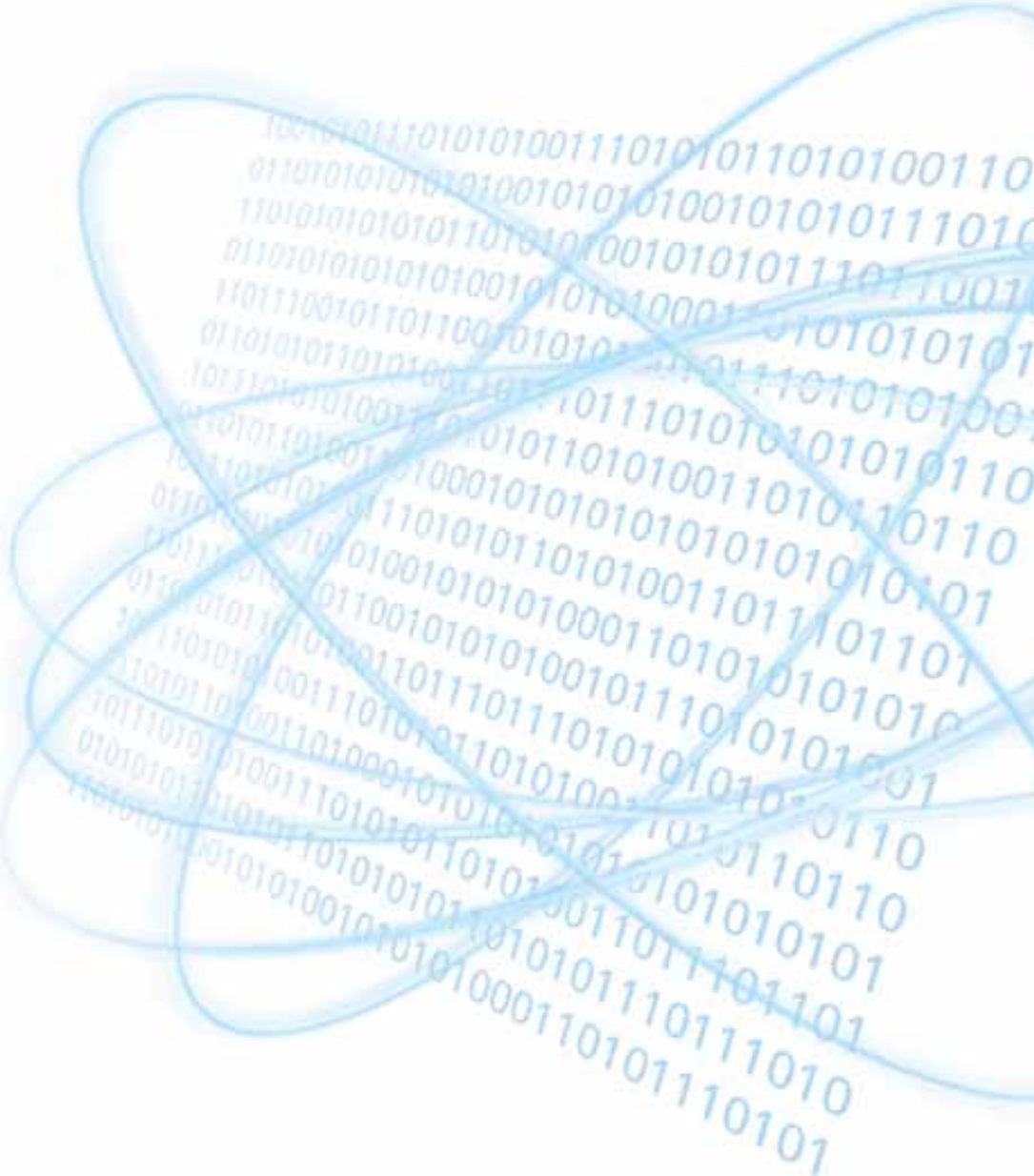
Type	Weight (kg)
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SYN10 S 220 07/09 AF IP65 S	6.2
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SYN10 T 400 05 AF IP65 S	5.8
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SYN10 T 400 07 AF IP65 S	6.0
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SYN10 T 400 09 AF IP65 S	6.1
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## Bonfiglioli is a Partner Worldwide for Power Transmission and Motion Control

The ever-growing export share has led Bonfiglioli into the most far away Countries. With expansion plans entailing a further growth of the sales network Bonfiglioli aims at improving both the competitiveness of its products and the effectiveness of the Customer service. In every market place Bonfiglioli is committed to improve the Customer satisfaction by offering state-of-the-art technology and shorter deliveries. Nowadays branch companies and BEST Partners bearing the Bonfiglioli name are operating in seventeen Countries outside Italy, with sales and service in the other countries managed by appointed dealers. The domestic network is made up of 30 sales office and representatives and 100 dealers operating with their own warehouse and supporting Customers locally. Throughout the World Bonfiglioli's reputed know-how and Service guarantee effective and timely assistance.



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