



Bock Semi-hermetic Compressors

Electronic Controls

Intelligent Compressor Solutions



GEA Bock - More than a compressor

Over 75 years ago, when the refrigeration and air-conditioning industry was still in its infancy, our company's founder, Wilhelm Bock, had a vision: he wanted to build first-class and reliable refrigeration machines. In the following decades Bock developed into one of the world's leading manufacturers of refrigeration and air-conditioning compressors.

Today, GEA Bock offers as part of GEA Refrigeration Technologies the right compressor for all fields of commercial-, industrial-, rail-, bus- and transport refrigeration.

That GEA Bock places the highest demands on compressors for energy efficiency shows our EFC system. For many years we offer with the EFC system a solution to reduce the energy consumption by 25 %.

In this brochure we present you our current program of intelligent accessories for compressor monitoring and energy saving.

Be inspired. By our new products, our established product series and the entire passion that goes into each of our products.



Disclaimer

This brochure has been produced for you with the greatest of care. Nevertheless it is not possible to rule out mistakes completely. In such cases we cannot assume any liability. The contents correspond to the status on going to print. Deviations cannot be ruled out because of the ongoing development process for our products.

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Semi-hermetic compressors HG (HA)

The Bock HG (Hermetic Gas-cooled) range of semi-hermetic compressors offers traditional suction gas-cooled compressor state of the art technology. These compressors of the highest quality standard excel in their running comfort, easy maintenance, efficiency and reliability. Suitable as standard for conventional or chlorine-free HFC refrigerants.

The HA (Hermetic Air-cooled) range, specially engineered by GEA Bock, is available for deep-freezing applications, in particular for use with the refrigerants R22 and R404A.

- ° Single-stage
- ° CO₂ compressors subcritical
- ° CO₂ compressors transcritical
- ° R134a compressors
- ° R407C compressors
- ° R410A compressors
- ° ATEX compressors
- ° HC compressors
- ° Aluminium compressors
- ° 2-pole compressors
- ° Two-stage compressors
- ° Duplex compressors
- ° Compressor units with receiver
- ° Condenser units air-cooled



Vehicle compressors FK

Bock vehicle compressors of the FK range are the result of many years of experience in the domain of mobile cooling systems.

The unsurpassed light, compact, robust design and wide r.p.m. range are only some of the outstanding features of this unique product range of two, four and six cylinder compressors.

A wide variety of designs can be tailored to suit individual requirements.

The so-called K version is a special innovation with a unique valve plate system for maximum requirements in bus and coach air-conditioning systems.

- ° Compressors for bus and train air-conditioning
- ° Compressors for transport refrigeration and other applications



Open type compressors F

The F model series provides modern open type compressors for separate drive systems (using V belts or direct couplings). Load transfer through a V pair.

Virtually all drive capacity requirements can be met.

Very compact compressor design, robust and easy to handle. Oil pump lubrication as standard.

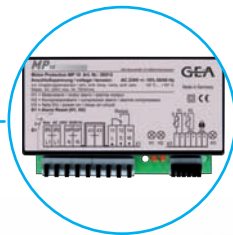
- ° Single-stage compressors
- ° NH₃ compressors
- ° Compressor units for direct drive
- ° NH₃ Compressor units for direct drive



Progressive technology in and around the compressor

GEA Bock has been the pioneer under this motto in developing technical solutions which set the benchmark for energy and efficiency, operating safety and reliability, not only for compressors but for the whole refrigeration plant.

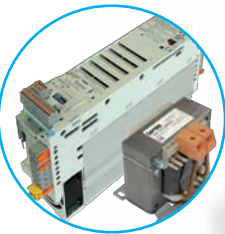
MP10
Motor Protection
Activate motor protection
Information see page 5



BCM2000 Bock
Compressor Management
The multifunctional
management system
Information on page 6



ESP Electronic Single Phase
Phase converter from single
to three phase AC
Information on page 16



ESS Electronic Soft Start
Start electronic for compressors
Information on page 14



EFC Electronic
Frequency Control
Continuously variable
speed control directly
mounted on the compressor
Information on page 8



EFCe Electronic
Frequency Control external
Continuously variable speed
control for individual set-up
Information on page 8



Availability

Compressor	MP10	BCM2000	EFC	EFCe	ESS	ESP
HG(HA)12P	●		○			○
HG22e, HA22P	●		○		○	
HG34e, HA34P	●		○		○	
HG(HA)4	●	○		○ ¹⁾	○	
HG(HA)5	●	○		○ ¹⁾	○	
HG(HA)6	●	○		○ ¹⁾	○	
HG7	●	○		○	○	
HG8	○	●		○		

● standard ○ option ¹⁾ not available for HA-version

MP10 Motor Protection

Temperature safety drive for the drive motor

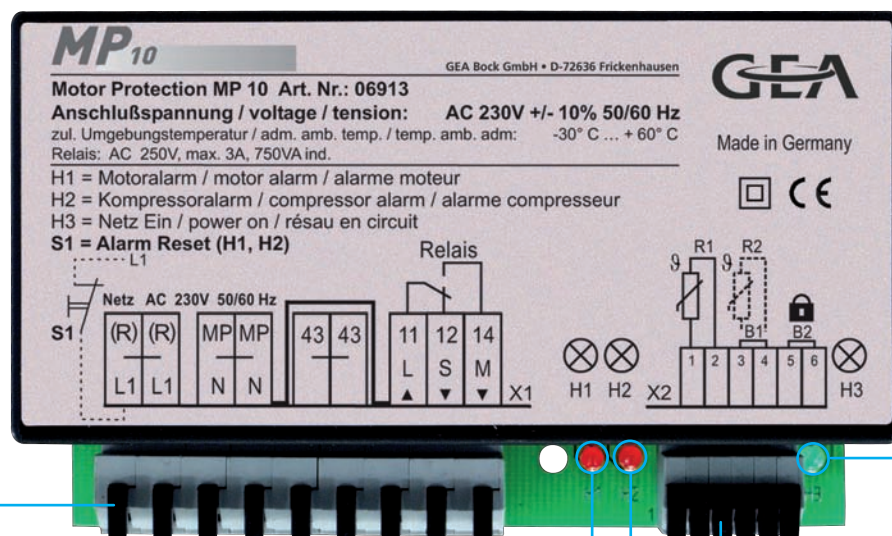
Technical data

Standard in all compressors

The exceptional feature is that the monitoring function and mains availability are shown by coloured LED's. There are no complicated or time-consuming defect locating processes.

The MP10 also provides the usual functions as standard, e.g. a reconnection preventing device, a reset, free terminals for PTC temperature sensors (e.g. heat protection thermostat) and other useful items.

Unit designation	MP10
Connection voltage	AC 230 V - 1 - 50/60 Hz
Relay	AC 250 V, 3 A, 750 VA ind.
Dimensions L/W/H	100 x 60 x 52 mm



Supply section
Cable connections with screwless terminals

Red LED
Temperature fault in motor

Red LED
Temperature fault (random e.g. heat protection thermostat)

Green LED
Mains supply available

Drive section
Cable connections by screwless terminals

BCM2000

Bock Compressor Management

Multifunctional management system

Included as standard in HG8.

Available as an option for HG(HA)4, 5, 6 and HG7.

With the BCM2000, GEA Bock ist the first compressor manufacturer who offers a complete management system providing all the main functions for safe compressor operation in a practical compact assembly, user-friendly and economical.

Two central functions

- Protection against liquid slugging during start-up through the start-up identification system
- Oil service recommendations (calculation is based on operating data)

Other important functions

Monitoring of discharge gas temperature, motor winding temperature, oil temperature as well as oil pressure and cycle protection.

Simple and logical operation

- Self-explanatory symbols
- Status is indicated by LED's
- Clearly designed control unit

Simple electrical connection

- All monitoring functions are wired ready for operation
- Simple integration of the BCM2000 into the control circuit
- All cable connections have screwless terminals

Practical and easily accessible

positioning in the compressor connection box

- Installed in place of the usual motor protection unit MP10 (same dimensions)
- Optimal visibility by inspection window in the cover of the connection box (HG8)

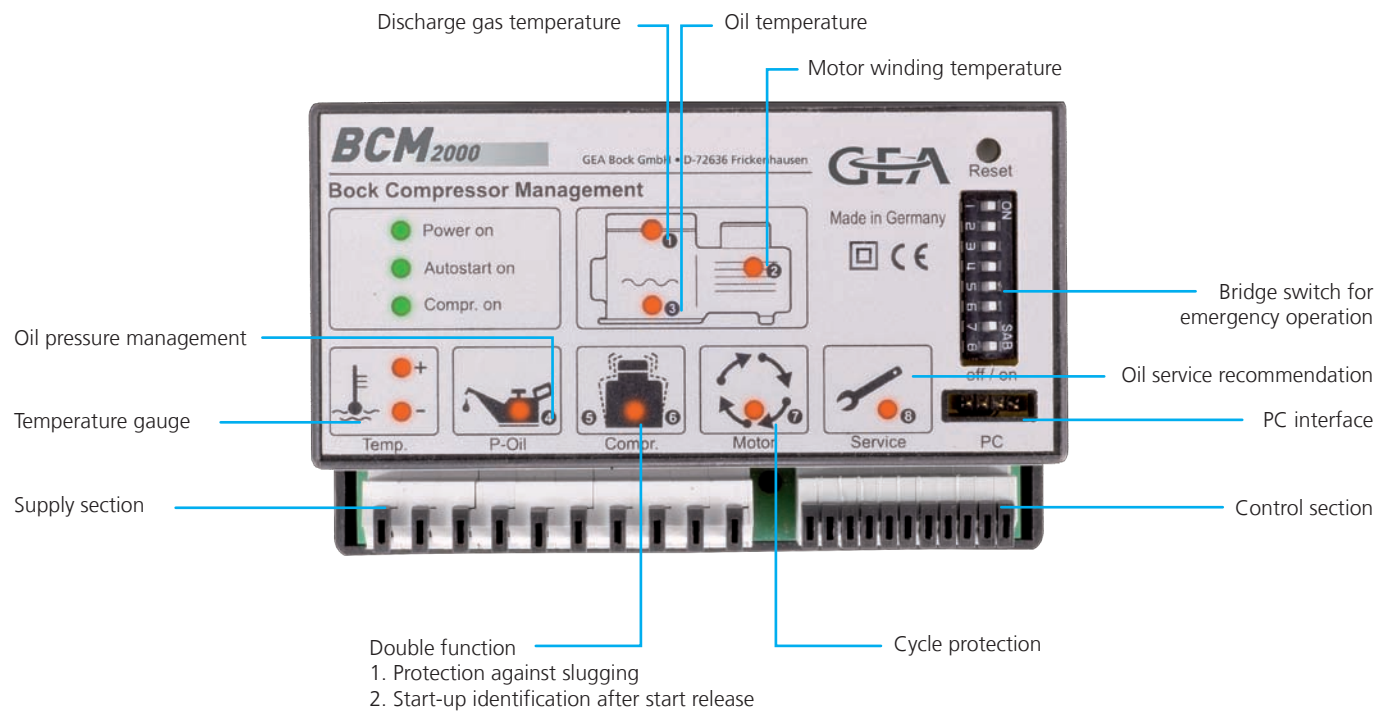
Reliable and economical

- Eight monitoring functions in one central unit
- Intelligent monitoring of the various functions including operating hour metering
- Simple recognition of the current status using an optical display
- Each function can be short cut for emergency operation
- Read facility for stored messages for fast and safe error analysis in the event of a fault or breakdown
- Loss-proof error memory even after power failure
- Self-monitoring sensor technology
- Connection facility for external error messages

Technical data

Unit designation	BCM2000
Connection voltage	AC 230 V - 1 - 50/60 Hz
Relay	AC 250 V, 3 A, 750 VA ind.
Dimensions L/W/H	100 x 60 x 52 mm

BCM2000 Bock Compressor Management



EFC, EFCe Systeme – Electronic Frequency Control

Continuously variable speed control using frequency converter technology.

With the EFC and EFCe system GEA Bock offers the most efficient means of adapting the capacity of the compressor to current refrigeration plant requirements: "Continuously variable speed control using frequency converter technology".

25 % or more energy saving potential!

The **EFC system** is optionally available for the compressors HG(HA)12P, HG22e, HA22P, HG34e and HA34P.

EFC systems are compactly mounted on the compressor, wired and connected ready for use.

It is activated by a pressure transducer mounted on the suction side. The adjustment range can be set individually.

In December 2009, the Bock EFC system received the BMU (German Environment Ministry) Climate Protection Innovation Award in Refrigeration Technology from the German Minister for Environment.



NEW: The EFCe systems are optionally available for the compressors of the series HG4 to HG8.

EFCe systems are also optimally adjusted to the compressor at the factory and programmed with the necessary control settings.

Due to their size, however, they are not directly built on the compressor but are instead intended to be set up individually. The device is controlled via a pressure sensor arranged on the intake side, or via an external control signal.

The trigger for the system (start/stop) is via a pump down pressostat. The control range can be adjusted on an individual basis. The device is designed for mounting on the wall or switch cabinet.

Thanks to the oil pump lubrication all Bock compressors are ideal for speed control, in particular for low frequencies.

EFC



EFCe



EFC, EFCe Systeme – Electronic Frequency Control Versions

EFC versions

Single compressors



HG12P, HA12P
HG22e, HA22P
HG34e, HA34P

Duplex compressors



DHG12P, DHA12P
DHG22e, DHA22P
DHG34e, DHA34P

EFCe versions

Single compressors



HG4, HG5, HG6, HG7, HG8

Duplex compressors



DHG4, DHG5, DHG6, DHG7

Possible configurations only ex-works

Software versions see page 11, 2)

EFC - Electronic Frequency Control

The advantages of frequency-converter operation:

- Set for immediate connection and optimally programmed with data for the relevant compressor
- Fully variable adjustment of the refrigerating capacity on demand
- No high-energy, high-wear start/stop operation
- **25 % or more energy saving potential!**
- Reduced mechanical compressor load for longer service life
- Always optimum machine pressures and operating conditions
- Lower pressure losses in the heat exchangers
- Lower cooling down and heating up losses throughout the system
- Reduced start-up current at full torque
- Part windings and star-delta circuits no longer required
- Including motor monitoring

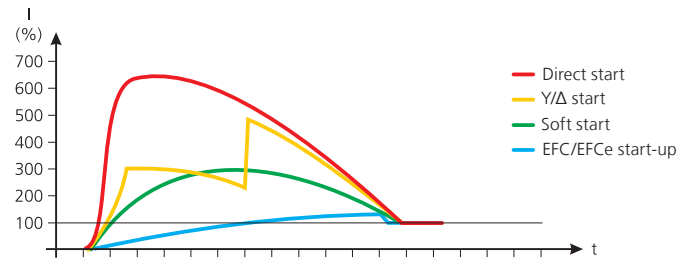
Further advantages of the EFC system:

- Wired for immediate connection and compactly mounted on the compressor
- No additional wiring required
- Takes up no space in the switchboard
- Needs no screened supply lines to the compressor
- Control module also included for simple adjustment of the EFC system

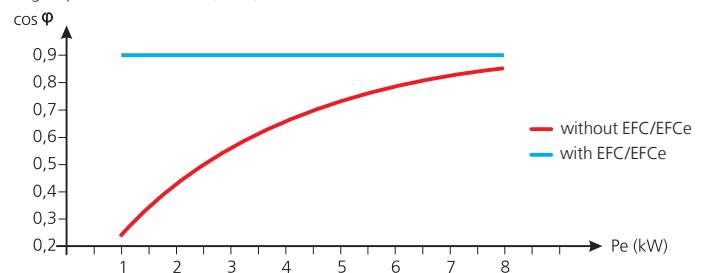
Further advantages of the EFCe system:

- No power contactor and/or soft start necessary to trigger controlled compressors
- Easy adjustment of the EFCe system by means of full graphic display (operating unit)
- EFCe system fulfills the requirements of safety category 3 in EN 954-1 (safe stop function)

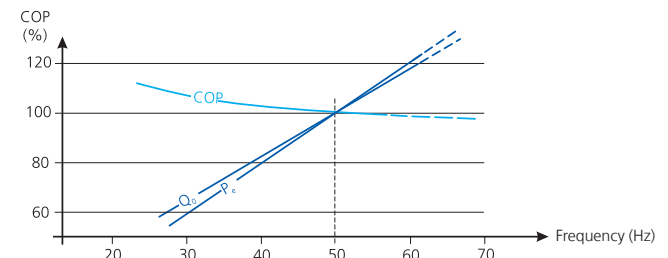
Start-up current with and without EFC/EFCe



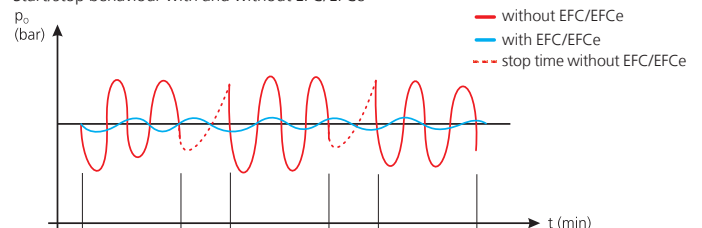
Engine performance factor ($\cos \Phi$) with and without EFC/EFCe



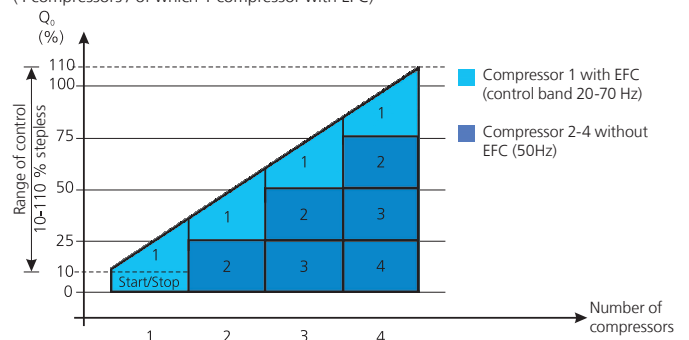
COP behaviour with EFC/EFC



Start/stop behaviour with and without EFC/EFCe



Capacity control in rack operation (4 compressors / of which 1 compressor with EFC)



Type key - EFC / EFCe systems

EFC e 15,0 / A1

Software version 2)

Capacity 1)

Installation variant

Electronic Frequency Control

e = from 11 kW for individual external installation (not mounted on the compressor)

1) Capacity - Product selection

Compressor	EFC			EFCe								
	2,2 kW	4,0 kW	7,5 kW	11,0 kW	15,0 kW	18,5 kW	30,0 kW	37,0 kW	45,0 kW	55,0 kW	75,0 kW	90,0 kW
HG12P, HA12P	•											
HG22e, HA22P		•										
HG34e, HA34P			•									
HG4/465-4				•	•							
HG4/465-4 S					•							
HG4/555-4					•	•						
HG4/555-4 S						•						
HG4/650-4					•	•						
HG4/650-4 S						•						
HG5/725-4					•	•						
HG5/725-4 S						•						
HG5/830-4					•		•					
HG5/830-4 S							•					
HG5/945-4						•						
HG5/945-4 S							•					
HG6/1080-4							•					
HG6/1080-4 S							•					
HG6/1240-4							•					
HG6/1240-4 S								•				
HG6/1410-4							•					
HG6/1410-4 S								•				
HG7/1620-4									•			
HG7/1620-4 S									•			
HG7/1860-4									•			
HG7/1860-4 S										•		
HG7/2110-4										•		
HG7/2110-4 S											•	
HG8/2470-4												•
HG8/2470-4 S												•
HG8/2830-4												•
HG8/2830-4 S												•
HG8/3220-4												•
HG8/3220-4 S												•

2) Software version

- A1 Control signal 4-20 mA with pressure transducer
- A2 Control signal 4-20 mA external (without pressure transducer)
- A3 Control signal 0-10 V external (without pressure transducer)
- A4 for duplex compressors, control signal 4-20 mA with pressure transducer
- A5 for duplex compressors, control signal 4-20 mA external (without pressure transducer)
- A6 for duplex compressors, control signal 1-10 V external (without pressure transducer)

Calculations

Calculating the maximum possible frequency of the compressor under specific operating conditions:

The following calculation is used to obtain the maximum possible frequency at the selected operating point:

$$f_{\max} = \frac{P_{\max} \times 50 \text{ Hz}}{P_e}$$

f_{\max} = Maximum permissible frequency [Hz]

P_{\max} = Maximum power consumption [kW] (see technical data)

P_e = Power consumption at the operating point at 50 Hz [kW] (see performance data, compressors)

Calculating the corresponding refrigerating capacity:

Refrigeration capacity can be determined as a function of frequency from the following calculation:

$$\dot{Q}_{0 \text{ operation}} = \frac{f_{\text{operation}} \times \dot{Q}_{0 \text{ 50 Hz}}}{50 \text{ Hz}}$$

$\dot{Q}_{0 \text{ operation}}$ = Refrigerating capacity at the chosen operating point [W]

$f_{\text{operation}}$ = Frequency at the chosen operating point [Hz]

$\dot{Q}_{0 \text{ 50 Hz}}$ = Refrigerating capacity at the operating point at Hz [W] (see performance data, compressors)



As a rule, the maximum permissible power consumption of the compressor P_{\max} must not be exceeded. The maximum permissible frequency is always restricted in case of high evaporation temperatures associated with high condensing pressures with refrigerants R404A, R507, R407C, R22, ...
For the compressors HG12P/110-4 S, HG22e/190-4 S and HG34e/380-4 S you have to reduce the performance by about 5 Hz.

Technical data

EFC

Unit designation	EFC 2,2	EFC 4,0	EFC 7,5
Protection	IP 65	IP 54	IP 54
Max. output current under continuous load	6 A	9,5 A	19 A
Max. output power	2,2 kW	4 kW	7,5 kW
Input	AC 400/500 V -3- PE 50/60 Hz		
	5,5/4,5 A	12,3/9,8 A	21,5/17,3 A
Output	AC 400/500 V -3- PE 0/650 Hz		
Permissible control range ¹⁾	30 - 70 Hz	30 - 70 Hz	25 - 70 Hz

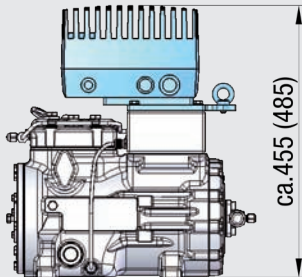
EFCE

Unit designation	EFCE 11	EFCE 15	EFCE 18,5	EFCE 30	EFCE 37	EFCE 45	EFCE 55	EFCE 75	EFCE 90
Protection	IP 54								
Max. output current under continuous load	24 A	32 A	37,5 A	61 A	73 A	90 A	106 A	147 A	177 A
Max. output power	11 kW	15 kW	18,5 kW	30 kW	37 kW	45 kW	55 kW	75 kW	90 kW
Input	AC 380/500 V (+/- 10%) -3- PE 50/60 Hz								
Output	AC 0- 380/500 V -3- PE 0/300 Hz								
Permissible control range ¹⁾	25 - 70 Hz								
Weight	23 kg		27 kg	45 kg			65 kg		104 kg

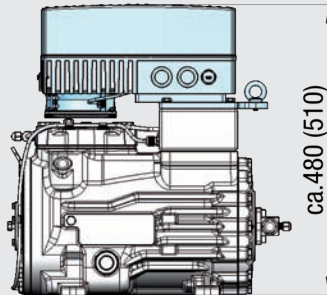
¹⁾ The specified control ranges may vary depending on the operating condition and system structure.

Dimensional variations with the EFC system

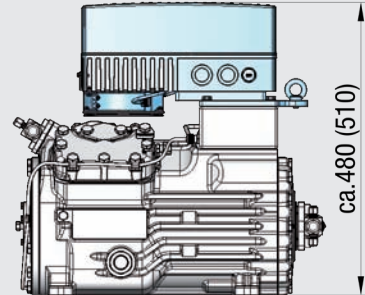
HG(HA)12P



HG22e, HA22P



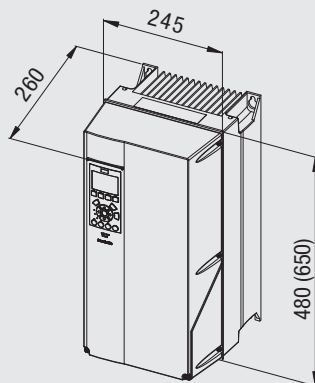
HG34e, HA34P



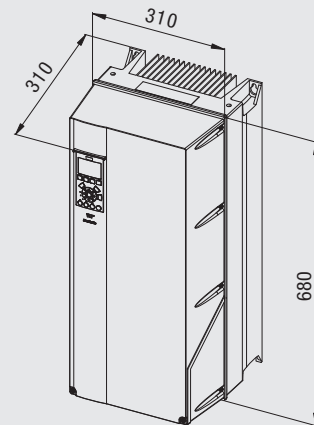
Dimensions in () = HA version

Dimensions EFCe systems

EFCe 11, EFCe 15, EFCe 18,5



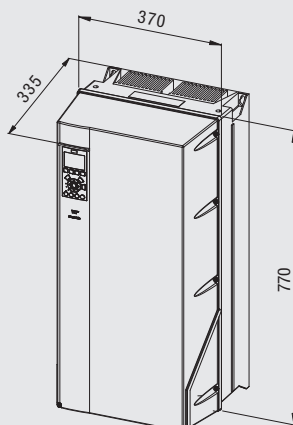
EFCe 30, EFCe 37, EFCe 45



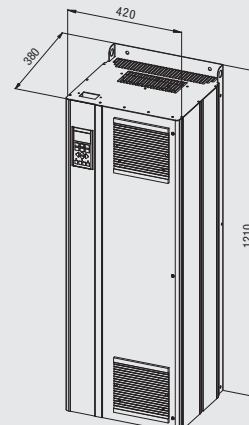
Dimensions in () = EFCe 18,5

Dimensions EFCe systems

EFCe 55, EFCe 75



EFCe 90



Dimensions in mm

EFC, EFCe Systeme – Electronic Frequency Control

Scope of supply EFC

- Basic equipment with intermediate adapter mounted on compressor terminal box, programmed and assembled ready for operation
- Pressure transducer for suction pressure based speed control ¹⁾ mounted on the compressor
- Programming and readout hand-held terminal with connecting cable

¹⁾ Configuration based on design required see table on page 11 for software variant A1 and A4

Scope of supply EFCe

- Basic device for individual set-up, full graphic display, pre-programmed with basic settings for the corresponding compressor
- Pressure sensor for suction-pressure-dependent speed control ¹⁾ enclosed
- Accessories for individual set-up
- Upstream relay to separate input power and control power, including terminal strip component

ESS System Electronic Soft Start

Electronic compressor starter unit

Available as option for:

HG22e, HA22P, HG34e, HA34P

HG(HA)4, 5, 6

HG7

The start process uses an electronic soft start unit, instead of the conventional start unloader through the bypass solenoid valve, non-return valve and star-delta protector combination. This means that the compressor gets up to its nominal speed in a set time and therefore produces much lower power peaks than the classical star-delta start.

The unit is designed to fit into a switch cabinet.

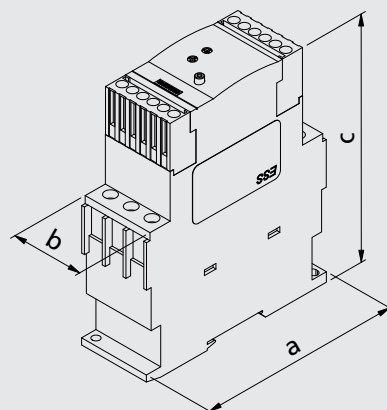
The advantages:

- Soft compressor start from zero to nominal speed, time controlled and monitored
- Up to 40 % lower start-up power consumption than when using star-delta start
- No star-delta protection combination needed, no bypass between pressure and suction side needed. No solenoid valve or non-return valve needed
- No compressor damage resulting from malfunction of the start unloader

Scope of supply:

- Unit programmed ready to operate
- Compressor allotment can be set by the potentiometer
- Unit suitable for fitting into a switch cabinet
- Voltage AC 400 V - 3 - 50/60 Hz
- Control voltage AC 230V - 1 - 50/60 Hz

Dimensions



ESS System Electronic Soft Start

Product selection

Compressor	ESS 25	ESS 38	ESS 63	ESS 72	ESS 106
HG22e, HA22P	•				
HG34e, HA34P	•				
HG4/465-4, HA4/465-4 HG4/465-4 S		• •			
HG4/555-4, HA4/555-4 HG4/555-4 S		•	•		
HG4/650-4, HA4/650-4 HG4/650-4 S		•	•		
HG5/725-4, HA5/725-4 HG5/725-4 S		•	•		
HG5/830-4, HA5/830-4 HG5/830-4 S		•	•		
HG5/945-4, HA5/945-4 HG5/945-4 S			• •		
HG6/1080-4, HA6/1080-4 HG6/1080-4 S			•	•	
HG6/1240-4, HA6/1240-4 HG6/1240-4 S				•	•
HG6/1410-4, HA6/1410-4 HG6/1410-4 S				•	•
HG7/1620-4 HG7/1620-4 S					• •
HG7/1860-4 HG7/1860-4 S ¹⁾					• •
HG7/2110-4 ¹⁾					•

¹⁾ up to +40 °C ambient temperature

Technical data

Unit designation	Protection	Max. output current ¹⁾	Input	Lost heat	Dimensions a / b / c
ESS 25	IP 20 Connectors IP00	25 A	AC 400 V -3- 50/60 Hz	8 W	125 x 45 x 150
ESS 38		38 A		19 W	125 x 45 x 150
ESS 63		63 A		12 W	160 x 55 x 170
ESS 72		72 A		15 W	160 x 55 x 170
ESS 106		106 A		21 W	170 x 70 x 190

¹⁾ at +50 °C ambient temperature

ESP System Electronic Single Phase

Phase converter from single to three phase AC

Available as an option for HG(HA)12P

The ESP System consists of a phase converter and a power choke to limit the power. This unit converts single phase input power to three phase output power and therefore enables the compressor model HG(HA)12P to operate with a standard three phase AC motor using a single phase mains supply. The unit is designed to be fitted into a switch cabinet.

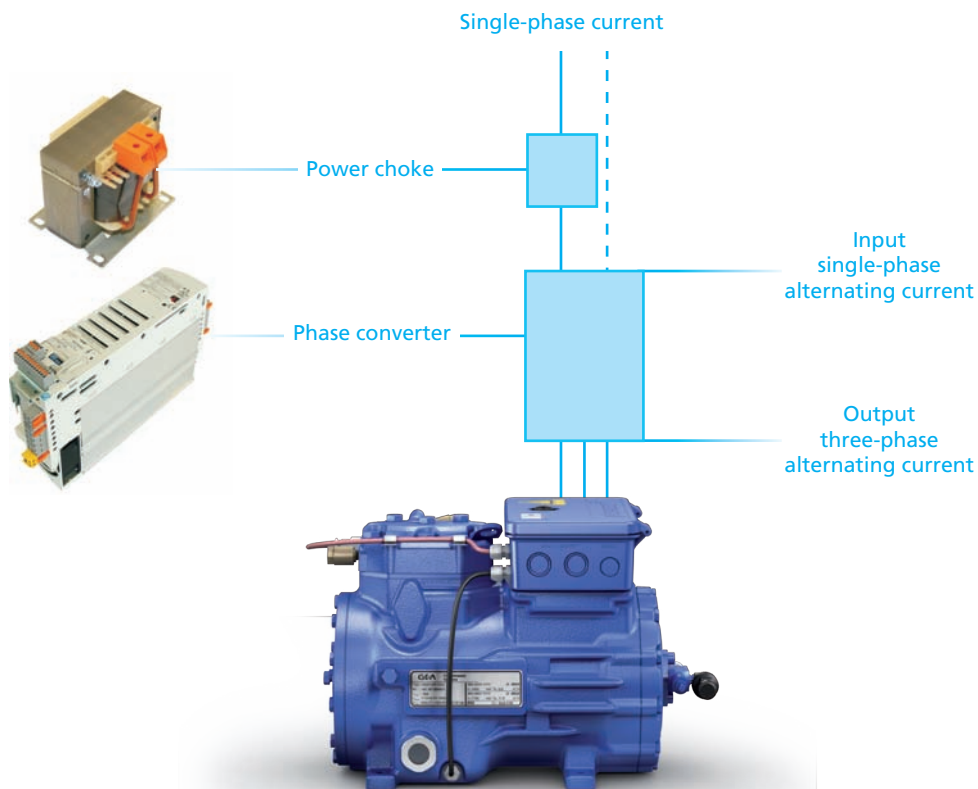
The unit is intended for use in switching cabinets.

Another option is the continuous variable speed control.

The accessories for this are a suction pressure transducer and a programming and readout hand-held terminal.



For the compressors HGX12P/90-4 S and HGX12P/110-4 with R404A please note:
 $t_o = -5\text{ °C} / t_c = +50\text{ °C}$ may not be exceeded.



ESP System - Electronic Single Phase

The advantages:

- Standard three phase AC compressor can be used on a single phase supply
- Soft compressor start from zero to nominal speed, time controlled and monitored
- **Up to 40 % lower start-up power consumption than using star delta-start**
- No start-up or operating condensers or relays required
- Contact free switching of main phases, no switch protection needed
- Option available for continuous variable speed control

Technical data

Unit designation ESP 1/3 - 2,2

consisting of: phase converter and power choke

Power choke:

Protection	IP 20
Power consumption	AC 230/240 V - 1 - 50/60 Hz 18 A

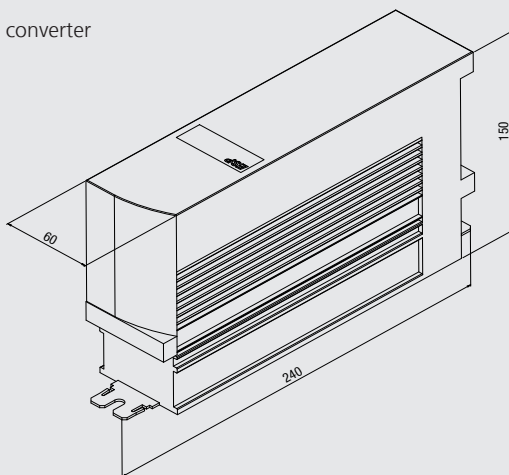
Phase converter:

Protection	IP 20
Max. output current under continuous load	9,5 A
Max. output power	2,2 kW
Input	AC 230/240 V - 1 - 50/60 Hz
Output	AC 230/240 V - 3 - 50/60 Hz
Permissible control range (compressor)*	30 - 60 Hz

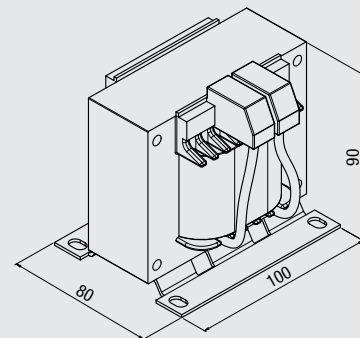
* Only for extension to continuous variable speed control

Dimensions

Phase converter



Power choke



Dimensions in mm

Scope of supply:

- ESP 1/3 - 2,2, comprising phase converter, programmed and tuned to the compressor and also a power choke to control the power. Both units are intended for use in switching cabinets.
- Input: Single phase AC 230/240 V
- Output: Three phase AC 230/240 V

Accessories: (only possible ex-works, not retrofit)

Extension of function to continuous variable speed control 30-60 Hz comprising:

- Suction pressure transducer 4-20 mA
- Programming and readout hand-held terminal

Because you're never done learning - GEA Bock training and workshops on compressors

Many years ago, GEA Bock intensified its commitment in the area of customer training.

And so we offer a comprehensive array of attractive training events, from two-day practitioners' workshops in Frickenhausen to afterwork workshops throughout Germany. Regardless of the type of training you are interested in.

Three things are characteristic of all GEA Bock training:

- The captivating way that the training director Peter Spies carries out the events
- The strong practice orientation of the training events, and
- The fact that all training events from Bock are offered as a free service

Current training dates can be found online at www.bock.de

Overview of training events offered:

- GEA Bock Practitioners' Workshop
- Training tailored to your individual needs
- Training for your entire staff
- Training on your premises

For additional questions or advice, please contact our training director:

Peter Spies

Telephone +49 70 22 / 94 54-157

Fax +49 70 22 / 94 54-137

Email: Peter.Spies@geagroup.com



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- Current company information
- Company film
- Subsidiaries
- History
- References

News

- Company news
- Product news
- Current dates

Toolbocks - The Refrigeration App

- Power Converter
- Length Converter
- Pressure Converter
- Converter Tube Diameter
- Refrigerant Calculator
- Location Finder
- Error Analysis/Troubleshooter

Wordbock - Translation Tool

- Available as an app and
- As an online version on www.bock.de

Know-how

- Error analysis tool
- VAP software
- Comprehensive information





Excellence Passion Integrity Responsibility GEA-versity

GEA Group is a global mechanical engineering company with multi-billion euro sales and operations in more than 50 countries. Founded in 1881, the company is one of the largest providers of innovative equipment and process technology. GEA Group is listed in the STOXX Europe 600 Index.



GEA Refrigeration Technologies

GEA Bock GmbH

Benzstraße 7, 72636 Frickenhausen, Germany
Phone: +49 7022 9454-0, Fax: +49 7022 9454-137
bock@geagroup.com, www.bock.de