



# AGILE SERIES

Advanced Standard Drive

 **Bonfiglioli**



# Advanced technologies for all industrial fields

The Agile series of inverters by Bonfiglioli sets new standards in technology for a broad range of users. Agile inverters are particularly suited for the food & beverage, textile, wood, packaging and ceramic industries, where they can be used in a variety of medium complex automation processes.

Agile inverter implement a sensorless vector control algorithm that offers excellent performance in speed and torque control. A wide range of built-in functions provide significant benefits to users seeking safety, energy savings, diagnostics, reliability and local functional intelligence.

The innovative user-friendliness of these inverters is evident from the word 'go'. Even inexperienced users will find installation and start-up to be quick and easy.

Agile inverters are designed for reliability at component, machine and process levels. Software functions have been specifically developed to inform users of the ideal time to perform maintenance in order to ensure continuous service of the plant.

Transparent control is ensured by Agile inverters' ability to accurately diagnose themselves and surrounding components in order to avoid faults and failures in the system.

While being extremely reliable, Agile inverters also boast special functions designed to reduce programming costs. These functions facilitate the selection and setting of software parameters and provide a speedy and intuitive man-machine interface.

The advanced energy saving functions, adaptability and robustness of Agile inverters reduce impact on the environment, too.

Integrated PLC functions allow Agile inverters to achieve a practical level of autonomy. The CPU not only controls the motor, but also provides the user with a number of programmable logic functions that can be used to complement or replace PLCs and process controllers.

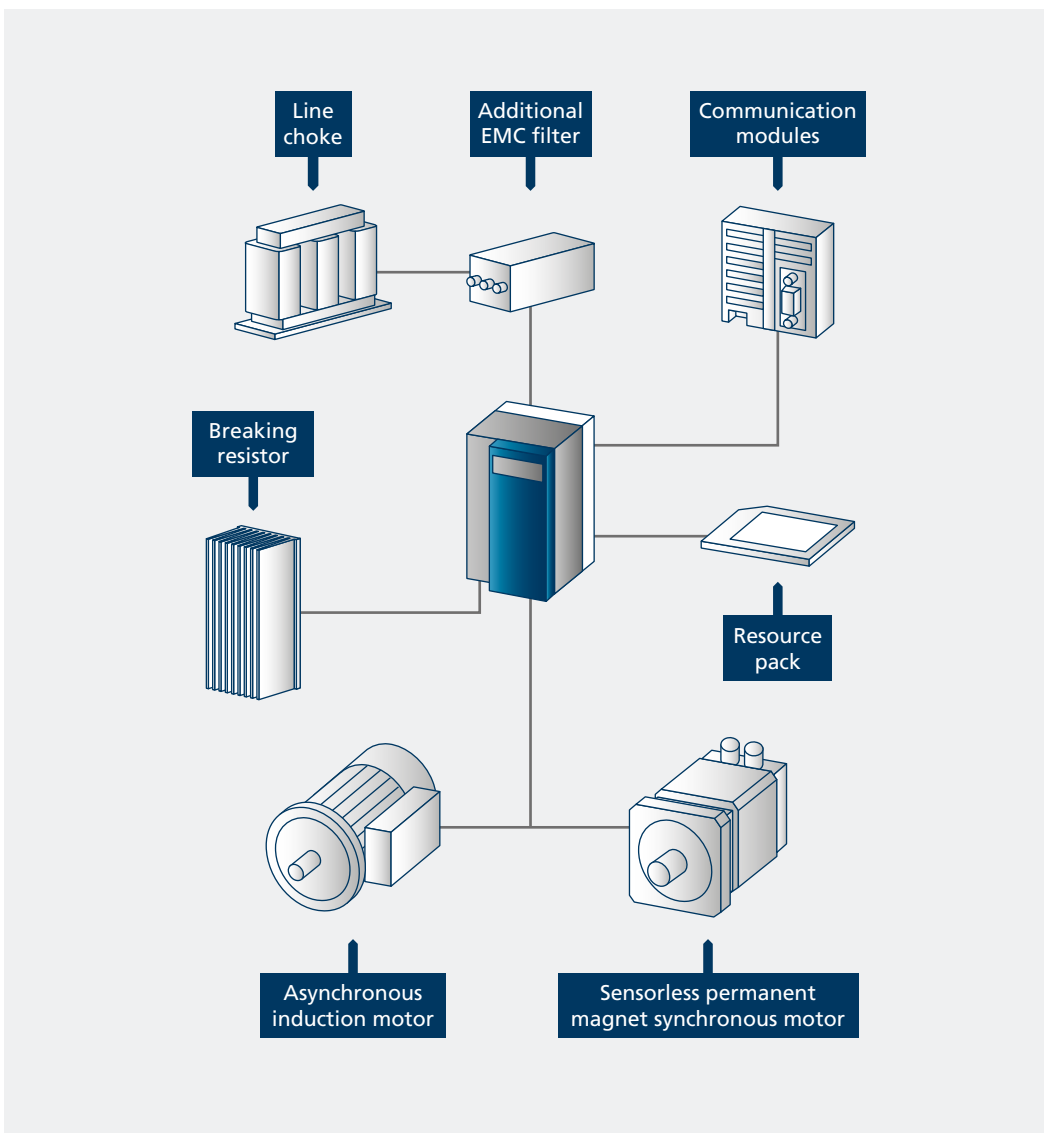


# Overview

Agile inverters are designed to control asynchronous induction motors and permanent magnet synchronous servomotors.

With their sleek, compact cases, Agile inverters have been specially developed for maximum functional integration. With a wide range of hi-tech functions already built in, Agile inverters are complete and fully functional despite their small size.

Thanks to intelligent design, the generous and advanced standard functions can be expanded by accessories and optional modules to extend versatility even further.



The Agile Series comes in three book-size models covering power requirements from 0.25 to 11 kW.

# Areas of application

Agile inverters can be used in all areas of industry, but are particularly suited to the following applications:



FOOD & BEVERAGE



VERTICAL STOCKING SYSTEM



PACKAGING



TEXTILE



WOOD PROCESSING



CERAMICS



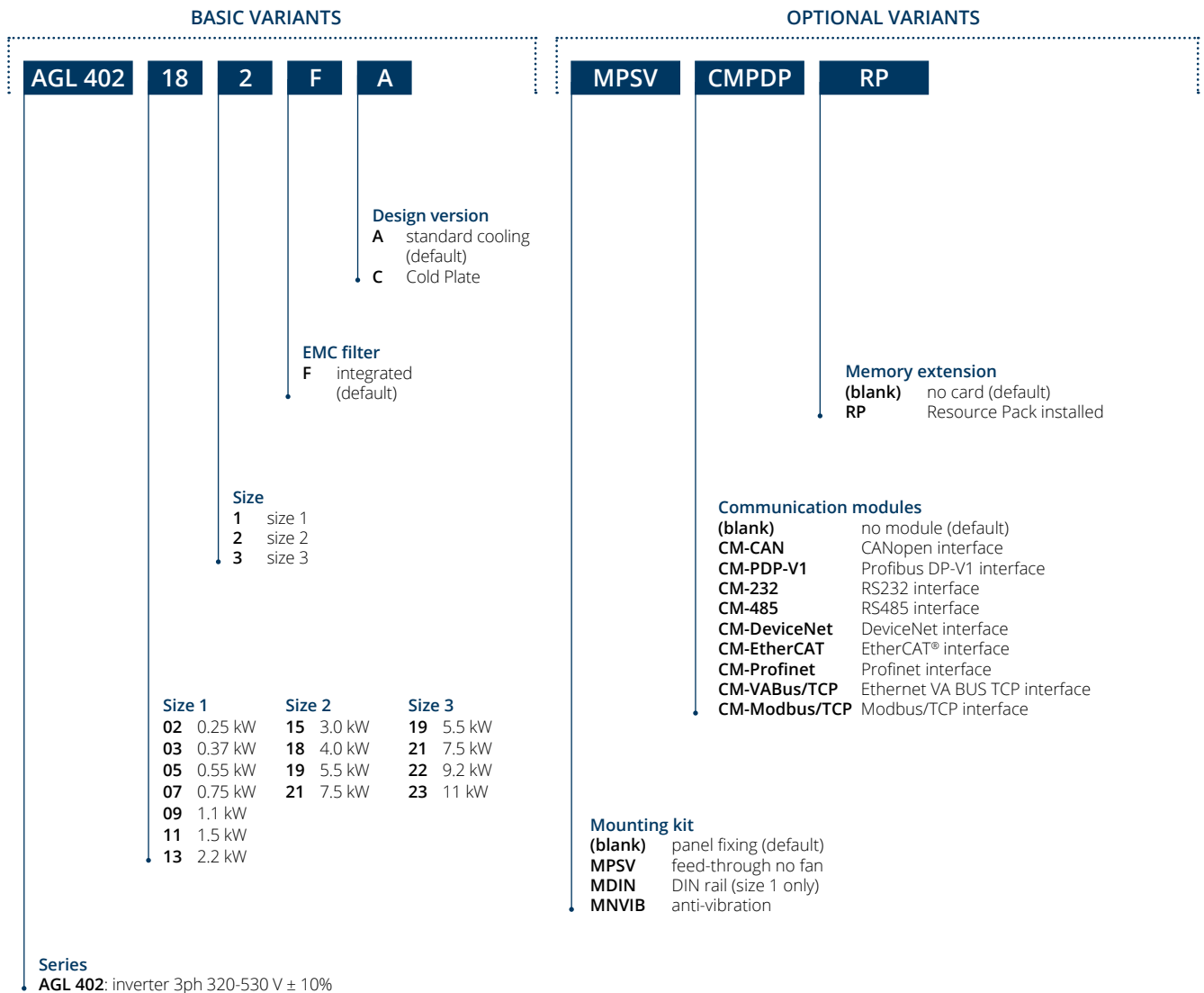
# Agile 402 series

## Selection guide

To order an Agile inverter, you need to specify the designation string corresponding to it. This comprises a series of fields that define exactly and uniquely what drive you need for your particular application. The first five fields identify the inverter and its basic variants. These fields are mandated in your order. You cannot leave any of these fields blank.

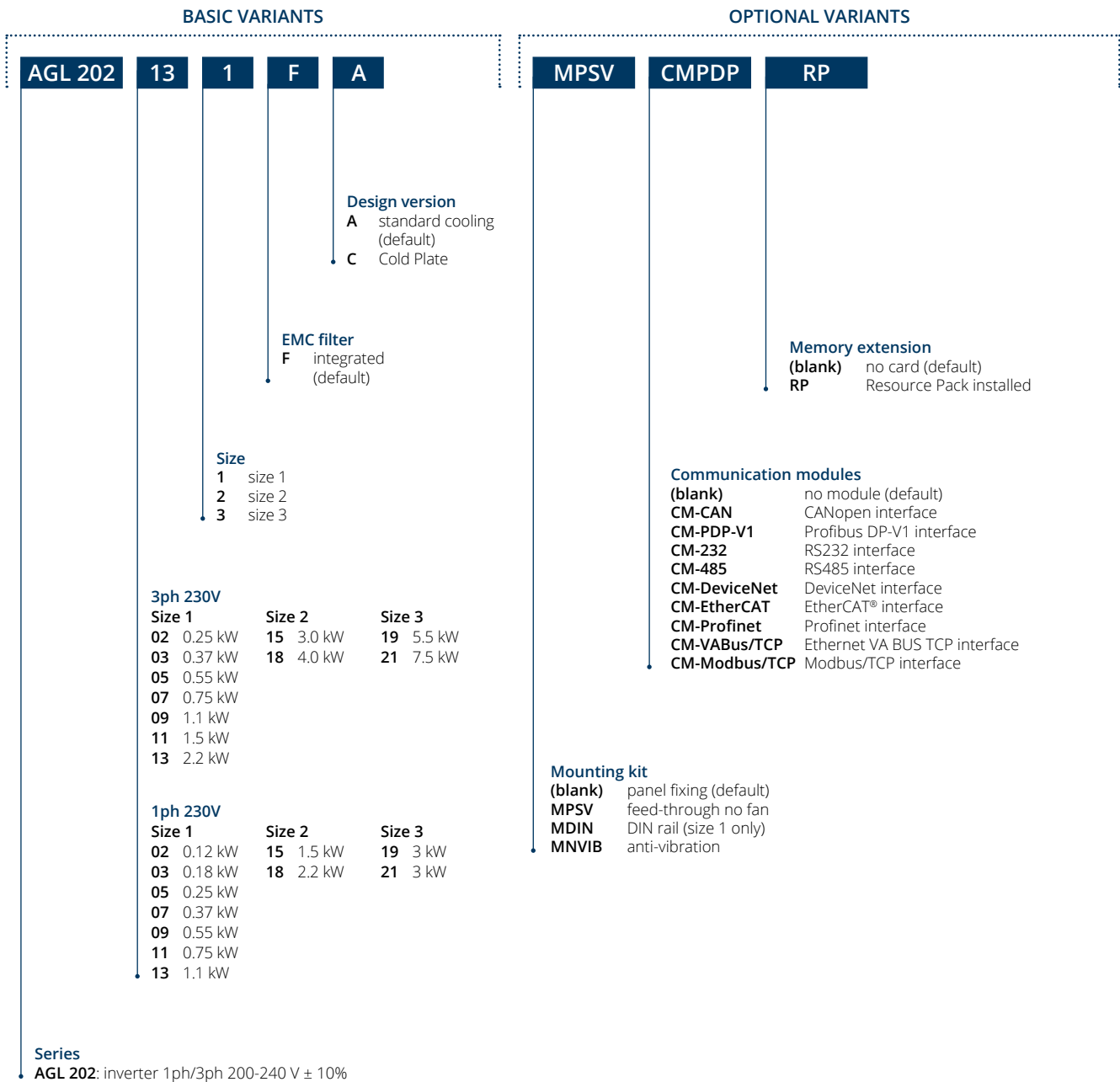
The next three fields define optional configurations for your Agile inverter. Simply leave the corresponding field blank if the option is not required.

## DESIGNATION



# Agile 202 series

## DESIGNATION



## Basic offer Agile 402 series

INVERTER	POWER SUPPLY	POWER	FILTER	DIMENSIONS	
	[V]	[kW]		[HxDxW]	
AGL402-02 1 F A	3ph 400	0.25	Integrated	200 x 170 x 60	
AGL402-03 1 F A	3ph 400	0.37	Integrated		
AGL402-05 1 F A	3ph 400	0.55	Integrated		
AGL402-07 1 F A	3ph 400	0.75	Integrated		
AGL402-09 1 F A	3ph 400	1.1	Integrated		
AGL402-11 1 F A	3ph 400	1.5	Integrated		
AGL402-13 1 F A	3ph 400	2.2	Integrated		
AGL402-15 2 F A	3ph 400	3.0	Integrated	200 x 196 x 80	
AGL402-18 2 F A	3ph 400	4.0	Integrated		
AGL402-19 2 F A	3ph 400	5.5	Integrated		
AGL402-21 2 F A	3ph 400	7.5	Integrated		
AGL402-19 3 F A	3ph 400	5.5	Integrated	200 x 205 x 125	
AGL402-21 3 F A	3ph 400	7.5	Integrated		
AGL402-22 3 F A	3ph 400	9.2	Integrated		
AGL402-23 3 F A	3ph 400	11	Integrated		



## Basic offer Agile 202 series

INVERTER	POWER SUPPLY	POWER	FILTER	DIMENSIONS	
	[V]	[kW]		[HxDxW]	
AGL202-02 1 FA	3ph 230	0.25	Integrated	200 x 170 x 60	
	1ph 230	0.12			
AGL202-03 1 FA	3ph 230	0.37	Integrated		
	1ph 230	0.18			
AGL202-05 1 FA	3ph 230	0.55	Integrated		
	1ph 230	0.25			
AGL202-07 1 FA	3ph 230	0.75	Integrated		
	1ph 230	0.37			
AGL202-09 1 FA	3ph 230	1.1	Integrated		
	1ph 230	0.55			
AGL202-11 1 FA	3ph 230	1.5	Integrated		
	1ph 230	0.75			
AGL202-13 1 FA	3ph 230	2.2	Integrated		
	1ph 230	1.1			
AGL202-15 2 FA	3ph 230	3.0	Integrated	200 x 196 x 80	
	1ph 230	1.5			
AGL202-18 2 FA	3ph 230	4.0	Integrated		
	1ph 230	2.2			
AGL202-19 3 FA	3ph 230	5.5	Integrated	200 x 205 x 125	
	1ph 230	3			
AGL202-21 3 FA	3ph 230	7.5	Integrated		
	1ph 230	3			

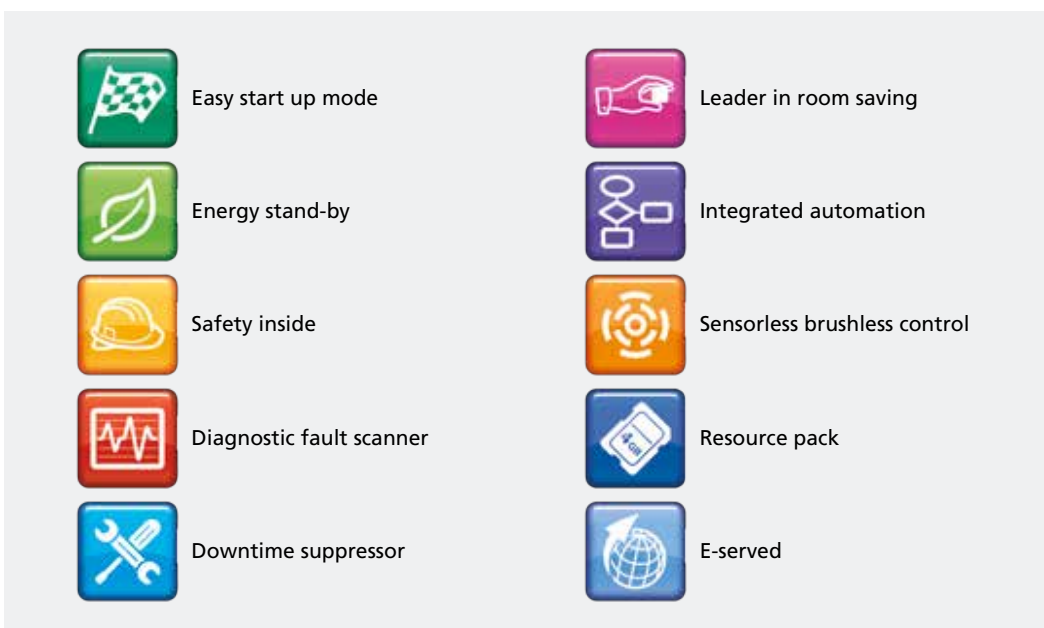
# Innovation at the service of people

Agile inverters help bridge the gap between user and process by providing software and hardware functions that simplify the management of complete systems.



Agile inverters provide accurate sensorless vector control of asynchronous induction motors and permanent magnet synchronous motors, and also help manage the complete automation system by contributing to **energy saving, safety, maintenance and logic control**.

Agile inverters are Bonfiglioli's solution to the needs of the standard inverter market, and boast a special "all-in-one" formula that delivers exceptional versatility.



# Innovation at the service of people



## Rapidity

It only takes a few minutes to install and set up an Agile inverter. Users will find everything quick and easy, from control rack installation to software configuration, and will have the motor up and running in next to no time.

- Drilling template
- DIN rail mounting
- Clearly identified power terminals
- Pre-calibrated for Bonfiglioli motors
- Automatic and permanent adaptive tuning
- Pre-selection of application masks
- Customisable units of measure
- On-line help



## Energy saving

Agile helps reduce system energy requirements by minimising its own losses and those of the motor.

- Sensorless control of permanent magnet synchronous motors
- Automatic suspension of power stage with motor stopped
- Adaptation of voltage to suit the load applied to the motor shaft
- Minimum earth leakage



## Functional safety

Agile inverters respect all the safety standards applicable to electronic variable speed control.

In particular, Agile inverters provide functional safety according to EN61508 SIL2 and electrical safety according to EN13849-1 PL d (Cat.3), in conformity to EN61800-5-2 product standards for torque elimination through the physical disconnection of the motor inside the inverter.

- Safe Torque Off
- Foolproof wiring



## Diagnostic analysis

Agile inverters provide valuable support for the analysis of critical events affecting the inverter itself and the system in which it is installed. They also incorporate a tool for monitoring, reconstructing and interpreting system dynamics.

- Alarm log
- Inverter and motor status recovery
- Autodiagnosics after critical events
- Built-in multi-trace oscilloscope



## Failure prevention

Agile inverters keep themselves and the system they are installed in under control, and make a generous contribution to maintenance efficiency by preventing unexpected machine stoppages.

- Estimation of capacitor maintenance intervals
- Estimation of cooling fan maintenance intervals

# Innovation at the service of people

## Space saving

The compact book size of Agile inverters means significant space saving and great manoeuvrability inside the control cabinet.

- High power concentration
- Space saving in the control panel
- Book size
- Side by side installation
- Same height for all sizes



## Built-in PLC

Agile inverters can perform simple and complex programmable logic operations on physical signals to their terminals and on internal software variables, and can combine these operations to create a functional program that can complement or replace a control panel PLC.

- Programmable logic functions
- Graphic block programming
- Cyclical operating system
- Accessible inverter variables
- Input/output buffers



## Sensorless brushless

Agile vector inverters can control even sensorless permanent magnet synchronous motors thanks to an innovative algorithm which provides full starting torque.



## Resource pack

Agile inverters can be fitted with an MMC standard non-volatile flash memory expansion.

- MMC standard memory expansion card
- Any capacity cards supported
- Parameter copy function
- Integrated application documentation
- Integrated application software



## E-served management

Agile can be fully managed through Bonfiglioli's MOSAICO e-business platform that lets you select drives, order them and monitor delivery over the internet.



# Synergy with Bonfiglioli motors

To set up a modern microprocessor inverter, the electrical data of the motor have to be known for the inverter's speed and torque control to use the right mathematical model for calculating control values.

To facilitate start-up and avoid the user having to find and then manually enter all the necessary data, Agile inverters come with all the characteristics of equivalent Bonfiglioli motors pre-programmed. The pre-programmed parameters accelerate the motor setup process. When switching on the inverter the first time, these values are already ready to operate for the equivalent Bonfiglioli motor. To use the inverter with another motor, simply modify these parameters as required during the start-up procedure.



Bonfiglioli default motor data

Parameter	Data Set 0	Data Set 1	Data Set 2	Data Set 3	Data Set 4
369 Motor Type	1 - Asincrono				
370 Rated Voltage		400,0 V	400,0 V	400,0 V	400,0 V
371 Rated Current		5,4 A	5,4 A	5,4 A	5,4 A
372 Rated Speed		1410 U/min	1410 U/min	1410 U/min	1410 U/min
373 No. of Pole Pairs		2	2	2	2
374 Rated Cosinus Phi		0,76	0,76	0,76	0,76
375 Rated Frequency		50,00 Hz	50,00 Hz	50,00 Hz	50,00 Hz
376 Rated Mech. Power		2,2 kW	2,2 kW	2,2 kW	2,2 kW

A table of correspondence can be defined between each Agile inverter size and the Bonfiglioli 4-pole asynchronous or permanent magnet synchronous motor for which the inverter is ready for use.

INVERTER	POWER SUPPLY	ASYNCHRONOUS MOTOR	NOMINAL POWER
	[V]		[kW]
AGL202-02 1 F A	1ph 230V	BN63B4 / M05A4	0.12
	3ph 230V	BN71A / M05B4	0.25
AGL202-03 1 F A	1ph 230V	BN63B4 / M05B4	0.18
	3ph 230V	BN71B4 / M1SD4	0.37
AGL202-05 1 F A	1ph 230V	BN63C4 / M05B4	0.25
	3ph 230V	BN80A4 / M1LA4	0.55
AGL202-07 1 F A	1ph 230V	BN71B4 / M1SD4	0.37
	3ph 230V	BN80B4 / M2SA4	0.75
AGL202-09 1 F A	1ph 230V	BN80A4 / M1LA4	0.55
	3ph 230V	BN90S4 / M2SB4	1.1
AGL202-11 1 F A	1ph 230V	BN80B4 / M2SA4	0.75
	3ph 230V	BN90LA / M3SA4	1.5
AGL202-13 1 F A	1ph 230V	BN90S4 / M2SB4	1.1
	3ph 230V	BN100LA4 / M3LA4	2.2
AGL202-15 2 F A	1ph 230V	BN90LA4 / M3SA4	1.5
	3ph 230V	BN100LB4 / M3LB4	3.0
AGL202-18 2 F A	1ph 230V	BN100LA4 / M3LA4	2.2
	3ph 230V	BN112M4 / M3LC4	4.0
AGL202-19 3 F A	1ph 230V	BN100LB4 / M3LB4	3.0
	3ph 230V	BN132S4 / M4SA4	5.5
AGL202-21 3 F A	1ph 230V	BN100LB4 / M3LB4	3.0
	3ph 230V	BN132MA4 / M4LA4	7.5

INVERTER	ASYNCHRONOUS MOTOR	NOMINAL POWER
		[kW]
AGL402-02 1 F A	BN63C4 / M05B4	0.25
AGL402-03 1 F A	BN71B4 / M1SD4	0.37
AGL402-05 1 F A	BN80A4 / M1LA4	0.55
AGL402-07 1 F A	BN80B4 / M2SA4	0.75
AGL402-09 1 F A	BN90S4 / M2SB4	1.1
AGL402-11 1 F A	BN90LA4 / M3SA4	1.5
AGL402-13 1 F A	BN100LA4 / M3LA4	2.2
AGL402-15 2 F A	BN100LB4 / M3LB4	3.0
AGL402-18 2 F A	BN112M4 / M3LC4	4.0
AGL402-19 2 F A AGL402-19 3 F A	BN132S4 / M4SA4	5.5
AGL402-21 2 F A AGL402-21 3 F A	BN132MA4 / M4LA4	7.5
AGL402-22 3 F A	BN132MB4 / M4LB4	9.2
AGL402-23 3 F A	BN160MR4 / M4LC4	11

# VPlus engineering software



VPlus software provides a common programming and monitoring platform for all Bonfiglioli inverters.

Now in version 8, VPlus provides an effective aid to configuring, diagnosing and controlling your drive from a PC, and also provides a range of practical tools to manage the resources of your AgilE inverter completely and efficiently.

Just connect the computer to the inverter via the ASK-USB accessory cable and launch VPlus. Serial communications are quickly established and entire inverter setup is displayed on the computer monitor along with a toolbar containing inverter control functions.

VPlus supports multiple and simultaneous communication instances between the same number of inverters as there are USB ports on the computer, as well as a connection to the Bonfiglioli inverter field bus.

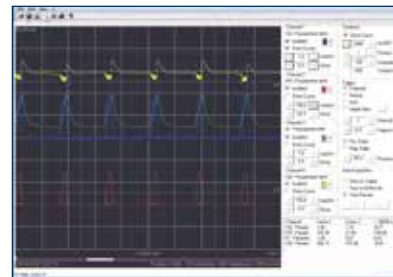


## VPlus functions

Simply click on the relevant icons to:

- Upload parameter files to the inverter
- Configure inverter parameters
- Read current parameters values
- Run the motor setup
- Open the inverter monitoring window
- Display the 4-trace oscilloscope
- Open the inverter status window
- Program the inverter's built-in PLC

Each of the above functions opens a new window that remains visible along with all the others to permit a global view of inverter functions.



## Built-in oscilloscope

VPlus software incorporates a digital oscilloscope with the following functions:

- 4 programmable traces
- 1 ms sampling rate for AGL series
- manual/automatic X-Y axis scaling
- programmable threshold triggers
- auxiliary cursors
- print function
- data export in CSV format
- image saving

The oscilloscope enhances the functionality of the AgilE inverter's own diagnostics by permitting the run-time display of any physical or virtual variable handled by the inverter and the real time analysis of the entire process driven by the motor shaft.



## Graphic control panel

Current inverter functioning values can be displayed numerically or graphically, as the user wishes.



## IO monitoring

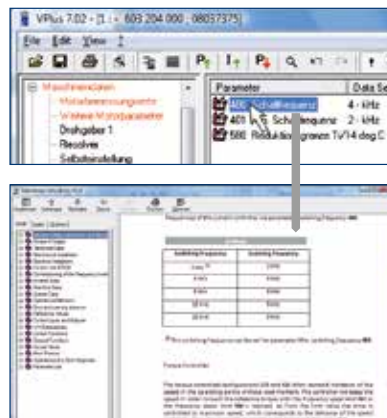
The IO monitor window lets you view the inverter's digital inputs and outputs and motor status.

# VPlus engineering software



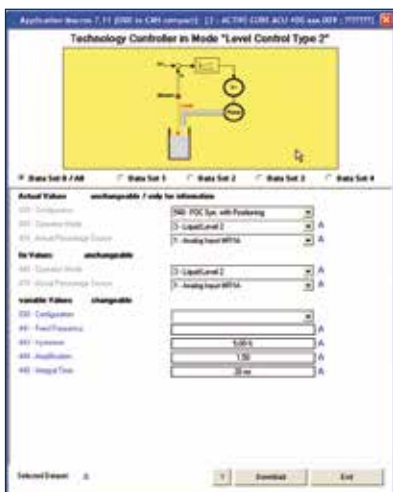
## Comparative analysis

To make it easier for users to analyse application parameters off-line, VPlus also provides a file compare function that identifies differences and similarities.



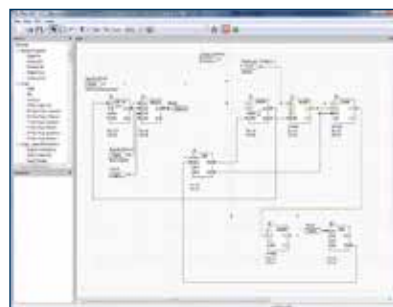
## On-line help

To guide users in programming the inverter, VPlus also features an on-line help that explains the meaning and the effect of each inverter parameter. Simply right click on the desired parameter to access help on it.



## Application masks

To help users set up the inverter for frequently used applications quickly and easily, VPlus includes a library of application masks showing only those software parameters that are strictly necessary for application start-up. Users benefit from a schematic description of the functionalities provided by the selected mask as well as the parameters needed to configure it.



## Built-in graphic PLC

The internal PLC of Agile inverters can be programmed using VPlus software. The various functional blocks processed by the PLC's operating system can be programmed in VPlus simply by selecting the corresponding page. A graphic editor in VPlus lets you load and drag all the logic blocks recognised by the inverter to form the functional program that the PLC needs to implement in RUN mode.

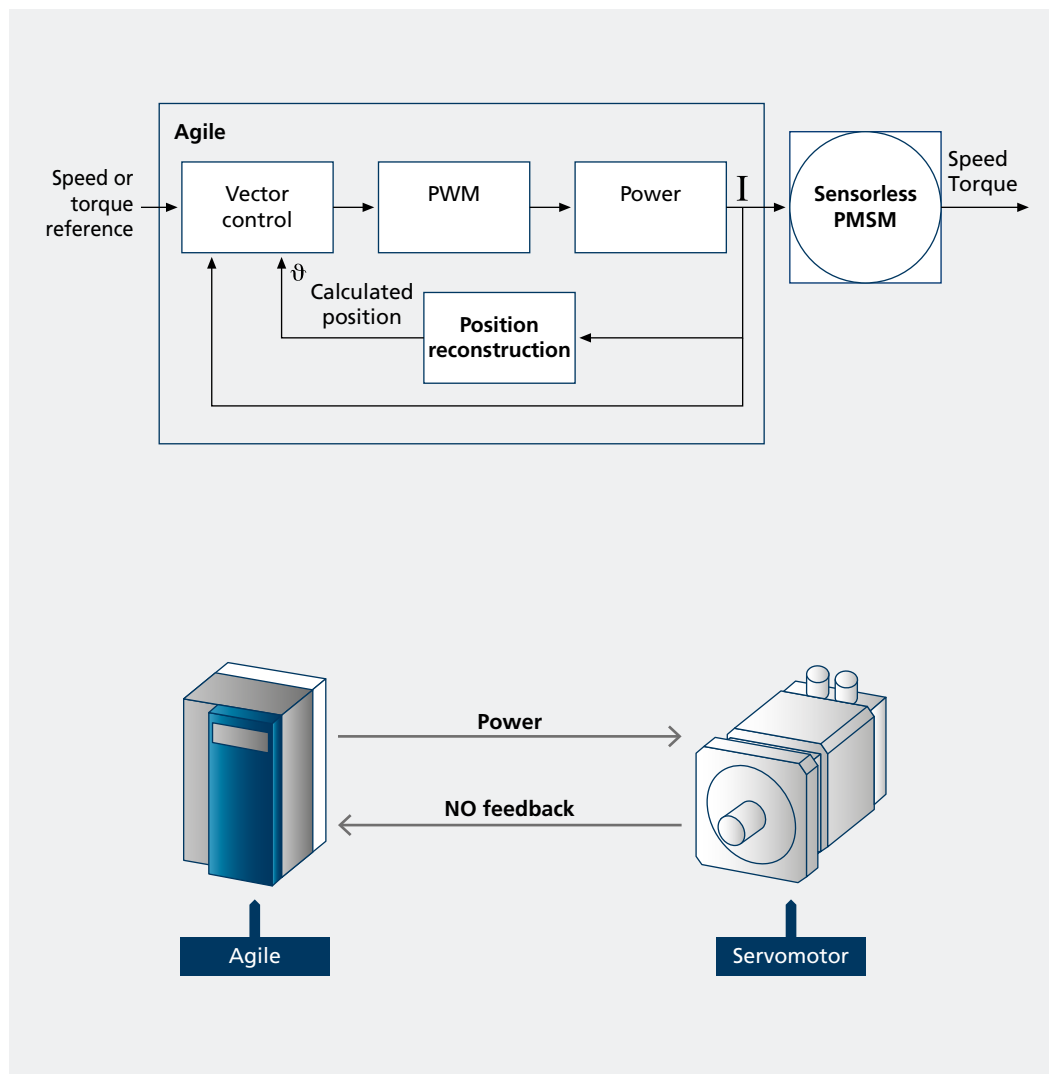
# Sensorless control of permanent magnet synchronous motors

In brushless motor control, the exact angular position of the rotor must be known at all times for the inverter to commutate the inverter phases.

The conventional method for tracking rotor position is to incorporate an encoder or resolver inside the servomotor to provide the inverter with the necessary electrical signals. This, however, requires extra cabling, data interfaces and controls.

Thanks to innovative technology, Agile inverters can control brushless servomotors without the need for sensors, eliminating the cost of additional components, wiring, interfaces and controls. Agile inverters use efficient algorithms to calculate the instantaneous angular position of the motor shaft from measurements of the current absorbed by the motor. This gives significant savings in costs, eliminates the criticalities inherent in sensors, simplifies the control system and reduces energy consumption by permitting a more efficient motor architecture to be used.

By combining analytic techniques to reconstruct the electrical status of the motor and functional analyses of its magnetic circuit, Agile inverters provide effective vector control of torque.





# Energy saving



Energy saving is a common objective in all areas of manufacturing. No company is exempt from the need to save money and help the environment at the same time. If energy saving is your aim, Agile is the inverter to help you achieve it. Agile inverters incorporate numerous functions for reducing the electrical energy needed to power motors and can make a major contribution to energy saving in any plant. Bonfiglioli knows exactly what factors determine an inverter's energy efficiency and how to achieve major energy savings. Now all this know-how has been concentrated into a single product.

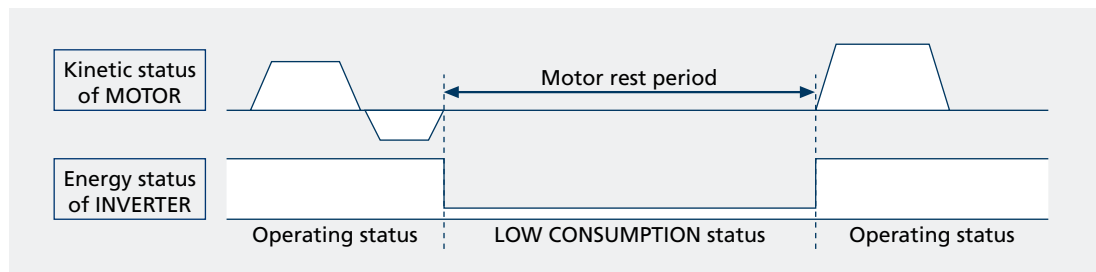


## Sensorless control of permanent magnet synchronous motors

Modern brushless motors are extremely efficient thanks to a design that favours excellent electromechanical energy conversion and minimises heat loss through the rotor. Agile inverters are designed to bring the benefits of brushless motor technology within the reach of all users. Agile inverters do not need encoders or resolvers on board the motors to control them. They can therefore save money by eliminating additional components, without any loss of dynamic motor performance.

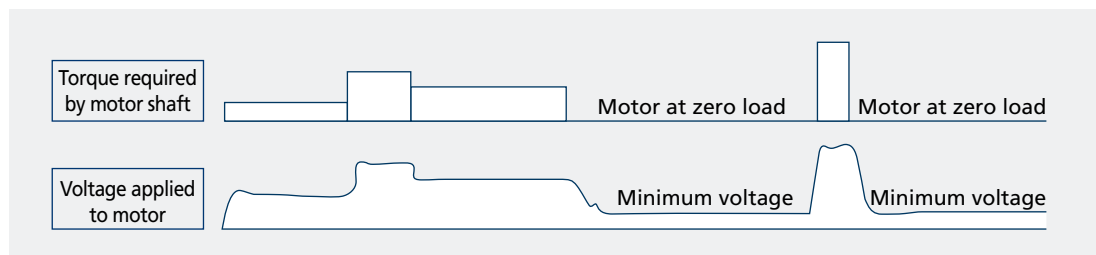
## Standby mode

Motors are often used in applications involving intermittent functioning cycles characterised by alternating run and rest phases. Under conditions like these, the inverter itself has to remain powered on in order to be ready to start the motor as soon as the application demands. To avoid unnecessary energy consumption during motor rest periods without actually disconnecting power to the inverter, Agile inverters use a special auto-standby function, which leaves the inverter in a "sleep" condition with only its control circuits active, a condition in which energy consumption is minimal. A programmable delay can be adjusted by users in order to extend the standby mode even to keypad display. As soon as a start command is received, the inverter "wakes up" immediately to power the motor.



## Power managing

Motor efficiency is significantly conditioned by the quality of the power supply. Agile inverters use control to reduce motor voltage to suit applied loads without compromising performance. This reduces motor losses, consumption and maintenance requirements and helps extend motor life. For example, if the motor is run up to rated speed at zero load, there is no need to apply full rated voltage. The minimum voltage compatible with the needs of motor magnetisation is all that is needed.



## Minimum earth leakage

Agile inverters are equipped with a built-in, low leakage current EMC filter that conforms to all applicable standards. By significantly reducing earth leakage, this filter also maximises energy savings under all operating conditions.



# An inverter with a PLC built in

Modern PLCs are extremely evolved devices with high calculation and interface capacities. To reduce the necessity for qualified, expert PLC programming personnel the AGL device series offers the possibility of internal PLC programming offering a wide range of customization. The inverter is becoming one type of actuator to which PLCs can delegate the dynamic control of an axis in synchronisation with other parts of the machine.

Agile inverters guarantee efficient motor control and incorporate a programmable logic controller that can be used to complement or replace a conventional control panel PLC.

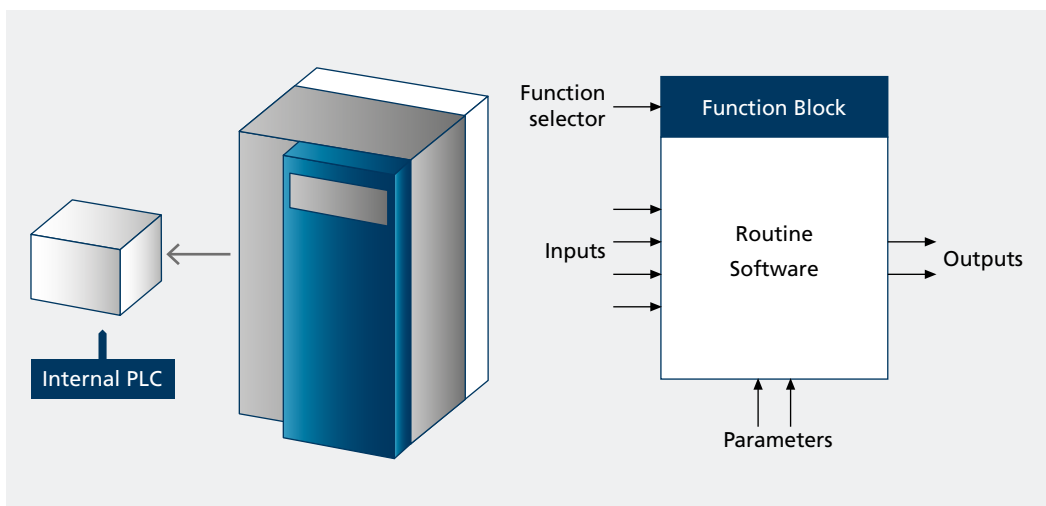
In the heart of every Agile inverter there is a PLC capable of performing multiple logic operations (AND, OR, XOR) and functions (counters, timers, comparators, multiplexers, decoders, oscillators, etc.). These can be combined using a graphic editor to create complex functions. The result is an intelligent local controller capable of handling the inverter's own internal variables (currents, frequencies, machine statuses, etc.), I/O signals to and from the terminals, and multiplexed data exchanged over a field bus.

The intuitive graphic editor allows even non-expert users to program the PLC of an Agile inverter without having to learn complicated programming languages that very few can master. Agile users do not have to rely on others to program their inverters.

Agile inverters are powerful and intelligent and, by relieving the main control panel PLC of local tasks, conform perfectly to the concept of distributed logic.

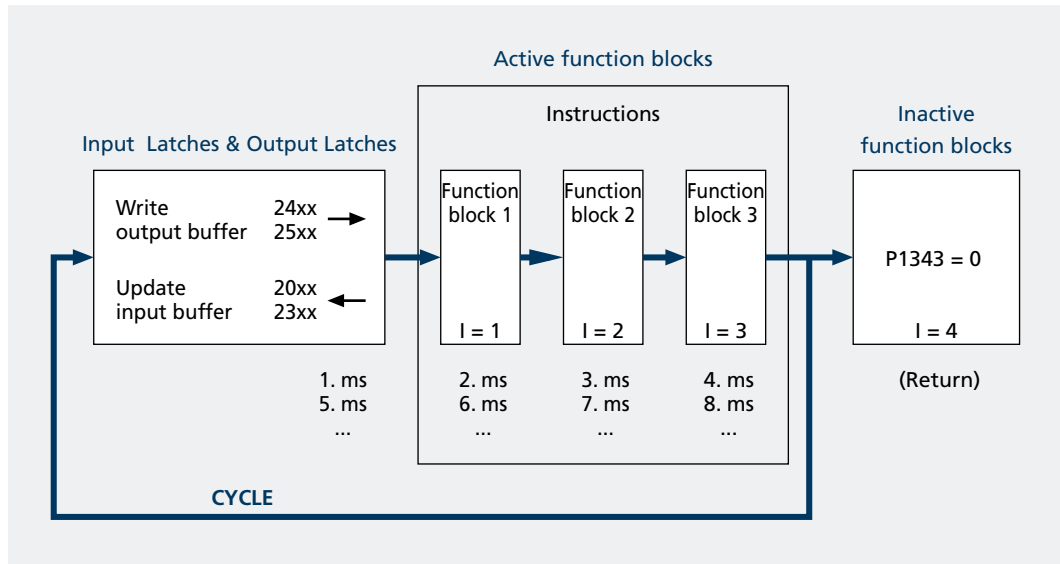
The Agile PLC recognises and handles 120 different functions, which can be used within 32 programmable functional modules (indexes).

Each module has a maximum of 4 inputs, 2 outputs and 2 configuration parameters. When the inverter is switched on, its operating system indexes all the active modules in sequence, taking only 1 ms per module. Each module is implemented by running all its instructions in sequence. When one module has been completed, the OS moves on to the next, and so on.



# An inverter with a PLC built in

The OS scans input and output buffers, samples input signals and executes output signals before it indexes the sequence of active modules.



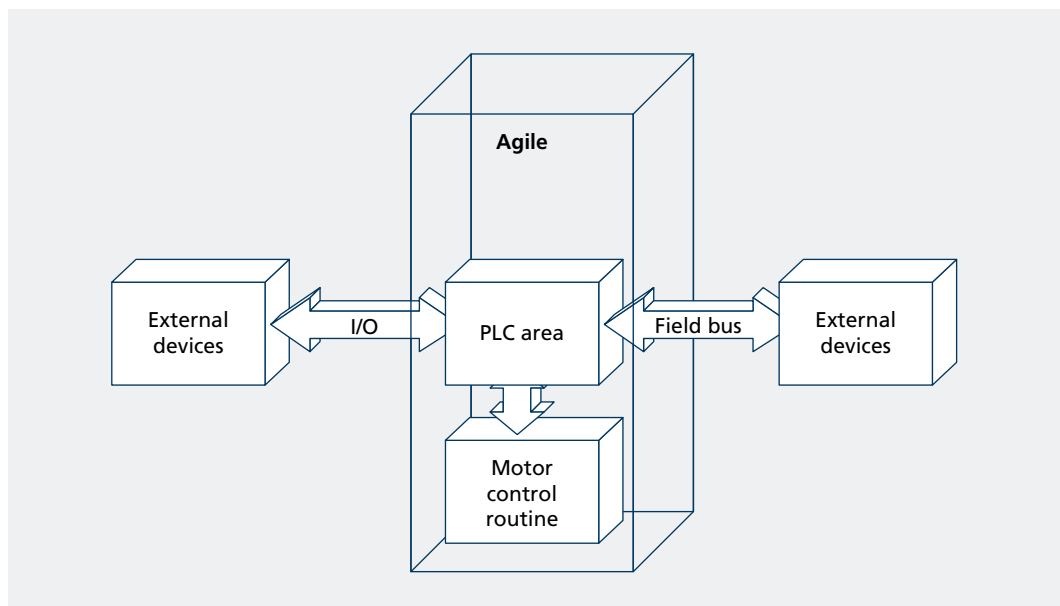
As in any control panel PLC, cycle management is entrusted to the operating system and is independent of all other processes managed by the CPU.

The program is therefore deterministic and scan time proportional to the number of active function blocks. In any automation process, the cycle period can be calculated by summing the 1-ms delays introduced by each function block.

Agile PLC functions can be programmed using VPlus software, which graphically displays the program to which the inverter's memory corresponds in real time.

VPlus software also provides a page that can be used to load graphic function blocks and link them together to create complex logic networks for use by the inverter.

The Agile PLC supports and processes all the variables used by the inverter software, including I/O variables, strings exchanged over the field bus and numeric motor control values. The PLC is therefore perfectly able to exchange signals with external devices like sensors, actuators, inverters, PLCs, PC's, etc. as well as with the inverter itself.



# Integrated safety thanks to Safe Torque Off

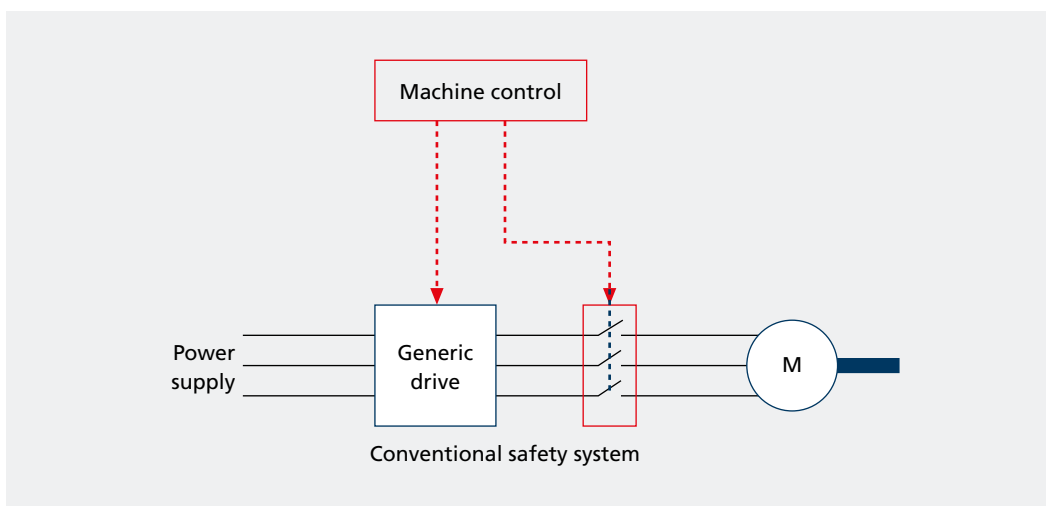
The Machinery Directive establishes the **safety requirements** that all machines must conform to before they can carry the CE mark and be manufactured and sold within the European Community.

In particular, all machine movements must be monitored by a safety system capable of intervening in an emergency to stop motors and **disconnect power** until normal operating conditions can be restored.

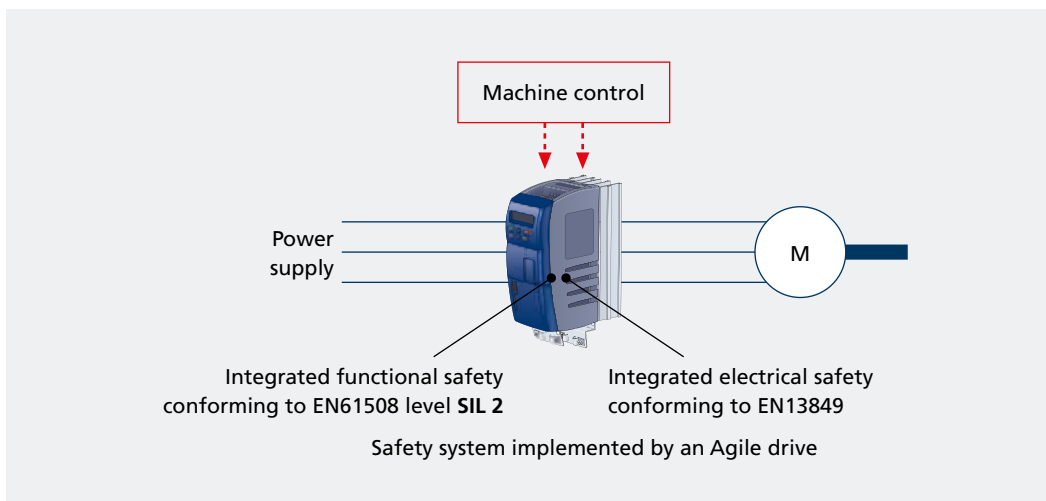
Safety systems must intervene effectively and guarantee physical disconnection between motor and power source. They must also be **reliable**, i.e. never fail to function.

Standards EN13849-1 and EN 61508 regulate Functional Safety system effectiveness and reliability respectively. These standards assign **two distinct value scales** to effectiveness and reliability (Category and Level), ensuring that machine manufacturers design in a degree of safety adequate to the needs of the application.

In a conventional inverter, to guarantee the effective disconnection of the motor and the absence of turning moment at its shaft, the safety system uses remote power switch outside the inverter to insulate the motor electrically.



Bonfiglioli has integrated the Safe-Torque-Off system (STO, EN61800-5-2) in Agile inverters to reduce the size of control panels, minimise the number of operating components, simplify control, and eliminate the mechanical stress caused by the sudden application of the brake while the shaft is still turning. In an emergency this system disconnects the motor in compliance with EN13849-1 PL d and EN61508 SIL2, without the need for external contactor.

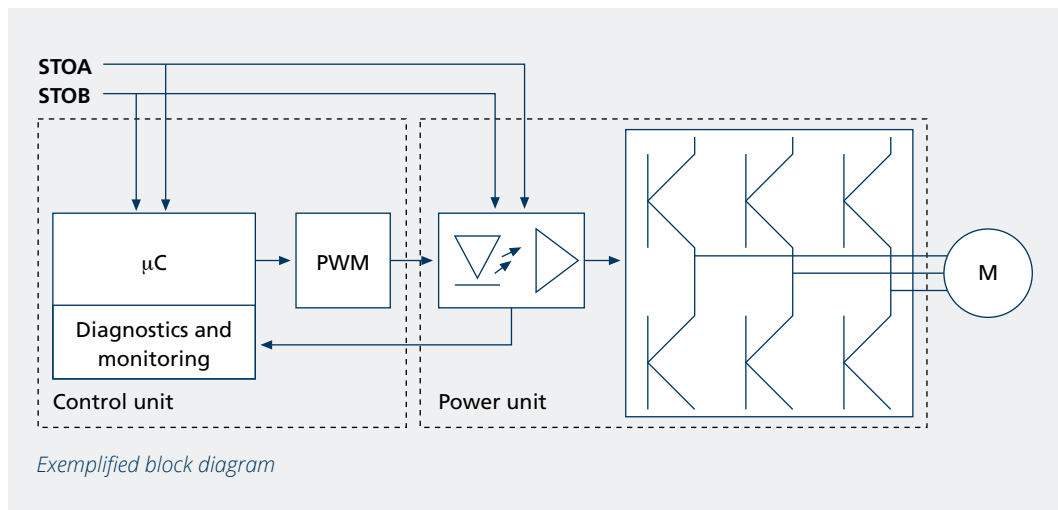


# Integrated safety thanks to Safe Torque Off

Agile inverters incorporate redundant functional logic and hardware architecture to disconnect the motor safely and stop it in the minimum time possible.

The simultaneous activation of two digital inputs, STOA and STOB, corresponding to two identical but distinct electrical paths, causes the software to recognise an external emergency condition, suspend the generation of PWM pulses and physically disable the optoisolators that transmit signals to the IGBT inverters, all in less than 10ms. This can bring the motor to a controlled stop, followed by total isolation from the inverter.

Any alarm condition arising inside the inverter also generates an emergency stop in the same way, irrespective of STOA and STOB signals.



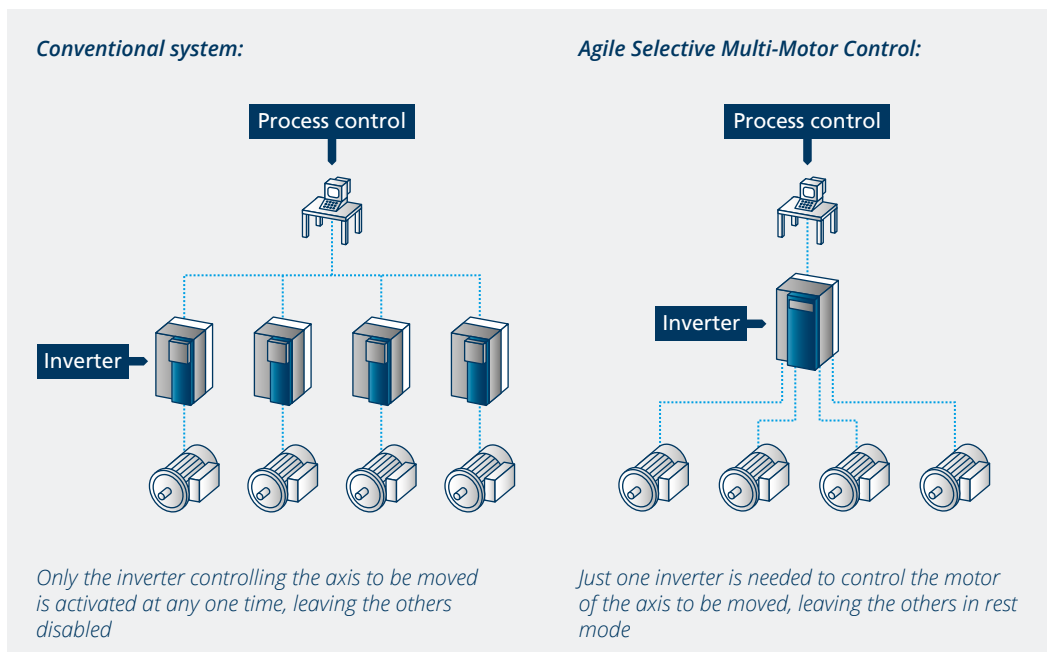
STOA	STOB	EFFECT
0	0	Safe Torque Off active; motor stopped and isolated
0	1	Safe Torque Off in stand-by; the software awaits a second signal: after 5-s wait time with no signal, the inverter generates an alarm
1	0	
1	1	Safe Torque Off not activated; the motor functions conventionally

# Selective Multi-Motor Control (SMMC)

Industrial applications often require a number of axes to be controlled separately and driven one at a time in a predefined sequence in which no two motors operate simultaneously.

In conventional systems of this type, each individual axis has to be controlled by its own inverter, configured to power its motor for a set time and then to remain inactive while the control sequence passes on to the next axes. The process controller must therefore send each inverter its own set of commands and must also transmit the necessary reference signals over a corresponding number of analog ports or network addresses. This requires a high level of redundancy in system components, cabling and control software and results in significant energy consumption.

Agile inverters are specially designed to provide efficient control of complex systems comprising multiple but non-simultaneous motors. Agile inverters can handle four separate motors even with different electrical characteristics, reserving a dedicated area of memory to the control of each. The architecture of Agile inverters lets you store simultaneous configurations for all four motors and control them independently at separate times according to independent criteria and strategies, but using the same power hardware.

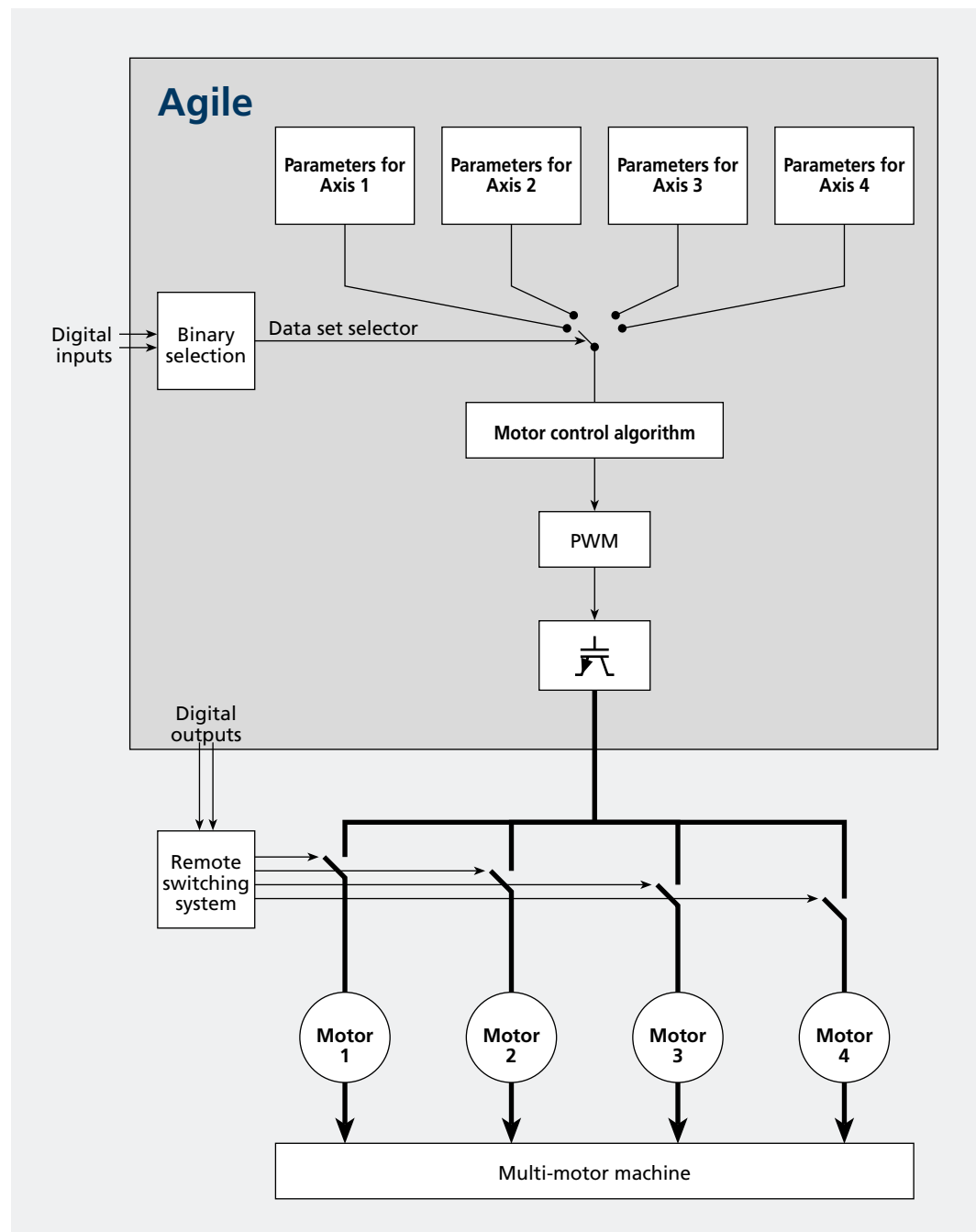


By using two digital inputs in binary combination mode, users can activate the inverter's parameter configuration corresponding to just one of the four motors, thus excluding the other three. The currently active control algorithm (V/f, sensorless vector control, sensorless brushless motor control) controls the selected motor and drives it according to the parameter settings in the corresponding dataset.



# Selective Multi-Motor Control (SMMC)

The inverter's digital outputs can be used to switch the cabling upstream from the motors to ensure that only one motor is ever connected to the inverter at any one time.



# Resource pack

As with all microprocessor systems, the inverter firmware, all the motor control routines and all the inverter functions are contained in the internal memory of Agile inverters.

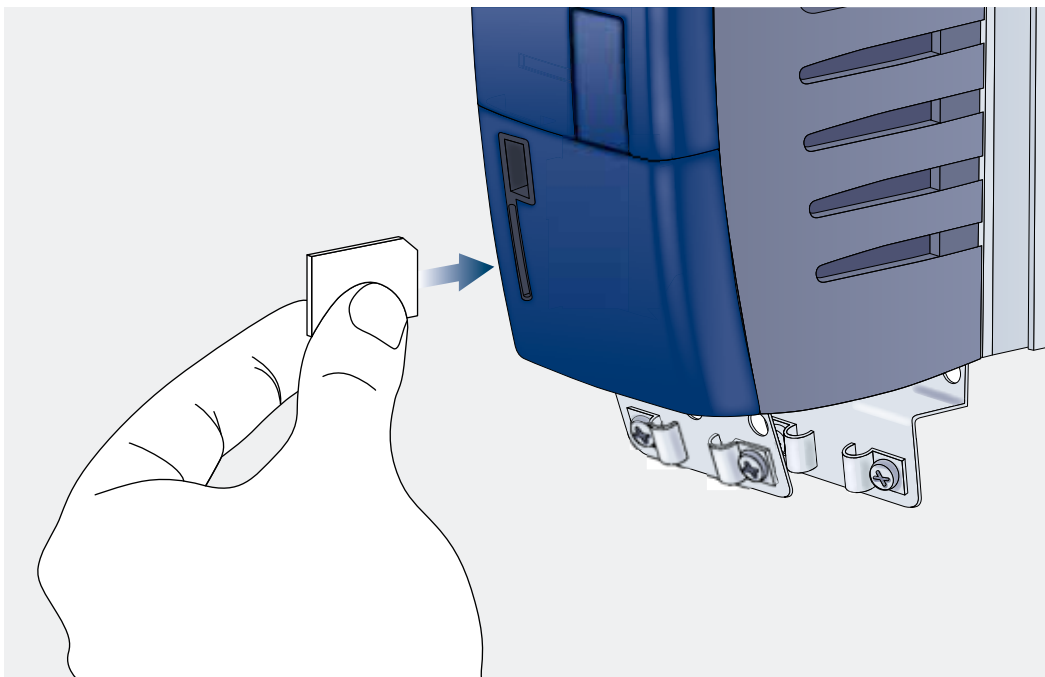
This main memory is strictly reserved for the inverter's operating system. Agile inverters, however, also support a removable MMC memory card or Resource Pack that conforms to SPI protocol and can be used to save and organise data as the user wishes.

A slot is provided in the front panel of the Agile inverter for inserting the MMC card.

Cards can be used for any of the following purposes:

- data exchange with the inverter
- storage of operator manuals, catalogues and technical documentation
- saving configuration files to and from the inverter
- saving oscilloscope traces
- storing any other data relevant to the application

Bonfiglioli offers resource pack for maximum compatibility with AGL devices.





# Functional layout

The terminals, connectors and push-buttons of the Agile user interface are located where they are easily accessible.

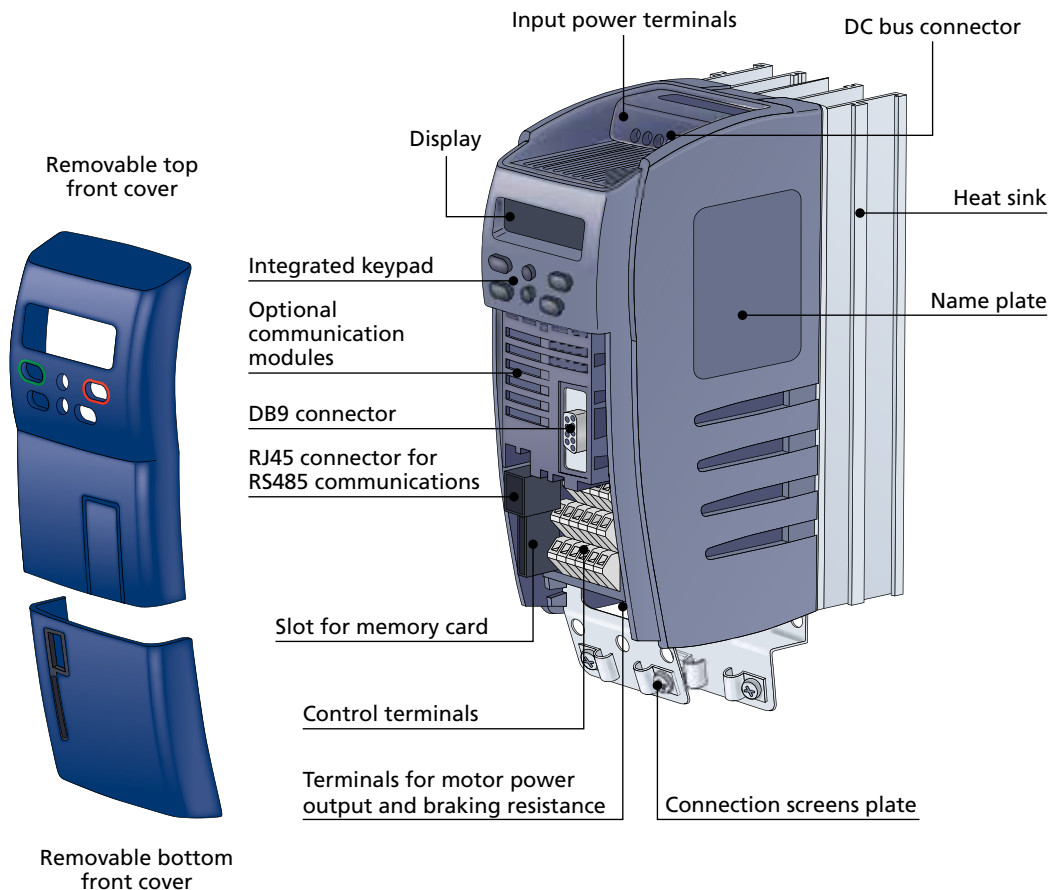
The power terminals (inverter power input and motor power output) are located at the top and bottom of the inverter and are individually marked with clearly visible symbols to ensure correct wiring.

Control terminals are located at the front of the unit and are easily accessible simply by removing the blue push-on protective cover.

A keypad, elegantly integrated in the inverter body, provides six function keys for inverter programming, monitoring and control.

The inverter is also equipped with an RJ45 connector for the RS485 Modbus serial interface as well VABus and a slot for an MMC memory card that can be used to copy inverter parameters.

An RS232 port, Profibus DP-V1, CANopen, Devicenet, Modbus, EtherCAT, Profinet or Modbus/TCP communication port can be fitted as optionals. If one of these ports is required, installation is quick and easy and only requires the protective cover to be removed to access the slots beneath the operator panel in the front of the inverter. The installation of these optional modules does not alter the overall dimensions of the inverter.



# General technical data

## Environment

- Transport and storage temperature -25°C ... 55°C
- Operation temperature: 0°C - 40°C (40°C-55°C with derating)
- Environment class: 3K3 (EN60721-3-3)
- Relative humidity 5%...95%, no condensation
- Altitude of installation: up to 3000m (over 1000m with derating)
- Storage conditions: according to EN50178
- Degree of protection: IP20

## Electrical

- Rated mains voltage 3ph: in the range 323 .... 528 V
- Rated mains voltage 1ph: in the range 200 .... 240 V
- Rated mains frequency: in the range 45 ... 69 Hz
- Overload current: 150% nominal current
- Peak current: 200% nominal current
- Electric protections: short circuit / earth
- Braking transistor: built-in on standard device

## Standards

- CE conformity: Low voltage directive 2014/35/EU and EN50178 / DIN VDE 0160 and EN61800
- Interference immunity: according to EN61800-3
- UL approval: according to UL508c
- STO: EN61508 / EN61800-5-2 / EN13849

## Connections

The Agile inverter is fitted with power input terminals for connection to the mains, power output terminals for driving the motor and signal terminals for inverter control, subdivided into four sections.

## Power terminals

The power terminals are located at the top and bottom of the unit.

Mains input power is connected to the top of the inverter where a DC-bus connection is also provided. The power output cables to the motor are connected to the bottom of the inverter where there is also a connection for a braking resistance if required.

This separation of input and output power terminals helps preventing effectively accidental mis-wiring.

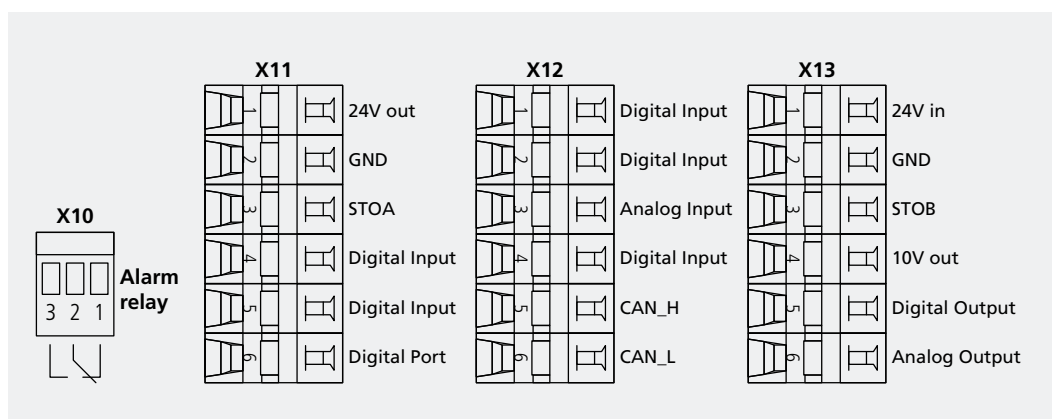


# General technical data

## Control terminals

Control signals are distributed over three separate terminal strips, located under the inverter's removable front cover and one additional terminal strip with a relay on top of the device. Terminals include:

- 6 digital inputs
- 1 configurable digital I/O port
- 2 configurable multifunctional A/D inputs
- 1 digital output
- 1 configurable multifunctional A/D/pulse output
- 1 auxiliary voltage supply input
- 2 voltage supply outputs
- 1 Systembus/CAN communication interface



TERMINAL	DEFAULT FUNCTION
X13.1	Auxiliary 24 VDC input
X13.2	GND for X13.1
X13.3	Digital input for Safe Torque Off B
X13.4	10 VDC output
X13.5	Multifunction Digital Output (default = RUN state)
X13.6	Multifunction Analog Output (default = Actual speed)
X12.1	Multifunction Digital Input (default = data set change-over bit 1)
X12.2	Multifunction Digital Input (default = fixed frequency change-over)
X12.3	Voltage Configurable Analog/Digital Multifunction Input (default = frequency reference)
X12.4	Voltage Configurable Analog/Digital Multifunction Input (default = motor thermal contact)
X12.5	Systembus/CAN signal +
X12.6	Systembus/CAN signal -
X11.1	24VDC output
X11.2	GND for X11.1
X11.3	Digital input for Safe Torque Off A
X11.4	Multifunction Digital Input (default = start clockwise)
X11.5	Multifunction Digital Input (default = start anticlockwise)
X11.6	Digital Configurable Input/Output (default = data set change-over bit 2)
X10.1	Normally closed Alarm Relay contact
X10.2	Alarm relay switching contact
X10.3	Normally open Alarm Relay contact

## General technical data

The Agile Series covers a power range of 0.12 to 11 kW, divided into three sub-ranges, each covered by one physical inverter size. Each size can therefore satisfy the needs of different power ratings to offer a suitable solution for all applications.

The three physical inverter sizes are identical in height and depth but differ in width because of the different power modules combined with them. The sizes are easily identifiable for the same reason.

SERIES	POWER SUPPLY	
AGL 402	3ph 400V	
AGL 202	3ph 230V	1ph 230V

	AGL402- ... 1 F A	AGL402- ... 2 F A	AGL402- ... 3 F A
	Size 1	Size 2	Size 3
Rating	0.25 kW	3.0 kW	5.5 kW
	0.37 kW	4.0 kW	7.5 kW
	0.55 kW	5.5 kW	9.2 kW
	0.75 kW	7.5 kW	11 kW
	1.1 kW	-	-
	1.5 kW	-	-
	2.2 kW	-	-

	AGL202- ... 1 F A		AGL202- ... 2 F A		AGL202- ... 3 F A	
	Size 1 3ph 230V	Size 1 1ph 230V	Size 2 3ph 230V	Size 2 1ph 230V	Size 3 3ph 230V	Size 3 1ph 230V
Rating	0.25 kW	0.12 kW	3.0 kW	1.5 kW	5.5 kW	3 kW
	0.37 kW	0.18 kW	4.0 kW	2.2 kW	7.5 kW	3 kW
	0.55 kW	0.25 kW	-	-	-	-
	0.75 kW	0.37 kW	-	-	-	-
	1.1 kW	0.55 kW	-	-	-	-
	1.5 kW	0.75 kW	-	-	-	-
	2.2 kW	1.1 kW	-	-	-	-

# AGL402 - Technical data (from 0.25 to 2.2 kW)

AGL402-	02	03	05	07	09	11	13
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Size 1

## OUTPUT, MOTOR SIDE

Recommended motor power	$P_n$	kW	0.25	0.37	0.55	0.75	1.1	1.5	2.2
Max. continuous output current	$I_n$	A	0.8	1.2	1.5	2.1	3.0	4.0	5.5
Current overload 60 s	$I_{OL}$	A	1.2	1.8	2.3	3.2	4.5	6.0	8.2
Current overload 1 s	$I_{pk}$	A	1.6	2.4	3.0	4.2	6.0	8.0	11.0
Output voltage	$U_n$	V	3 x (0...U)						
Output frequency	$f_n$	Hz	From 0 to 599						
Switching frequency	$f_c$	kHz	From 2 to 16						
Protections	-	-	Short circuit phase to phase / phase to earth						

## INPUT, MAINS SIDE

Mains configuration	-	-	TT, TN, IT						
Mains rated voltage	U	V	323 ... 528						
Mains rated frequency	f	Hz	45 ... 69						
Input rated current	I	A	0.8	1.2	1.8	2.4	2.8	3.3	5.8
Fuses 3ph/PE	I	A	6	6	6	6	6	6	10
DC-bus rated voltage	$U_{DC}$	V	U x 1.41						
Overvoltage category	-	-	DIN EN 61800-5-1 300V CAT 3						

## GENERAL

Short circuit / earth protection	-	-	Yes, unlimited							
Mounting position	-	-	Vertical							
Degree of protection	-	-	IP 20 (EN 60529)							
Dimensions	HxWxD	mm	200 x 60 x 170							
Fan cooling	-	-	No				Yes			

## ENVIRONMENT

Coolant temperature	$T_n$	°C	From 0 to 40 (40 ... 55 with derating)						
Humidity	-	%	5 ... 85, no condensing						
Power dissipation	-	W	19	29	42	53	70	89	122

## OPTIONS & ACCESSORIES

Brake-chopper	-	-	Integrated						
Line choke	-	-	Option						
EMI filter	-	-	class A (EN 61800-3) integrated / class B option						
Braking resistor	-	-	Option						
Operator panel	-	-	Integrated						
Communication interfaces	-	-	RS485 Modbus integrated / Systembus integrated / CANopen integrated RS232 option / Profibus DP V1 option / DeviceNet option / EtherCAT® option / Profinet option / VABus/TCP option						



# AGL402 - Technical data (from 3 to 7.5 kW)

AGL402-	15	18	19	21		
Size 2						
<b>OUTPUT, MOTOR SIDE</b>						
Recommended motor power	$P_n$	kW	3.0	4.0	5.5	7.5
Max. continuous output current	$I_n$	A	7.5	9.5	13	17
Current overload 60 s	$I_{OL}$	A	11.2	14.2	19.5	25.5
Current overload 1 s	$I_{pk}$	A	15.0	19.0	26.0	34.0
Output voltage	$U_n$	V	3 x (0...U)			
Output frequency	$f_n$	Hz	From 0 to 599			
Switching frequency	$f_c$	kHz	From 2 to 16			
Protections	-	-	Short circuit phase to phase / phase to earth			
<b>INPUT, MAINS SIDE</b>						
Mains configuration	-	-	TT, TN, IT			
Mains rated voltage	U	V	323 ... 528			
Mains rated frequency	f	Hz	45 ... 69			
Input rated current	I	A	6.8	7.8	14.2	15.8
Fuses 3ph/PE	I	A	10	10	16	25
DC-bus rated voltage	$U_{DC}$	V	U x 1.41			
Overvoltage category	-	-	DIN EN 61800-5-1 300V CAT 3			
<b>GENERAL</b>						
Short circuit / earth protection	-	-	Yes, unlimited			
Mounting position	-	-	Vertical			
Degree of protection	-	-	IP 20 (EN 60529)			
Dimensions	HxWxD	mm	200 x 80 x 196			
Fan cooling	-	-	Yes			
<b>ENVIRONMENT</b>						
Coolant temperature	$T_n$	°C	From 0 to 40 (40 ... 55 with derating)			
Humidity	-	%	5 ... 85, no condensing			
Power dissipation	-	W	133	167	235	321
<b>OPTIONS &amp; ACCESSORIES</b>						
Brake-chopper	-	-	Integrated			
Line choke	-	-	Option			
EMI filter	-	-	class A (EN 61800-3) integrated / class B option			
Braking resistor	-	-	Option			
Operator panel	-	-	Integrated			
Communication interfaces	-	-	RS485 Modbus integrated / Systembus integrated / CANopen integrated RS232 option / Profibus DP V1 option / DeviceNet option / EtherCAT® option / Profinet option / VABus/TCP option			



# AGL402 - Technical data (from 5.5 to 11 kW)

AGL402-	19	21	22	23		
Size 3						
<b>OUTPUT, MOTOR SIDE</b>						
Recommended motor power	$P_n$	kW	5.5	7.5	9.2	11
Max. continuous output current	$I_n$	A	13.0	17.0	20.0	23.0
Current overload 60 s	$I_{OL}$	A	19.5	25.5	30.0	34.5
Current overload 1 s	$I_{pk}$	A	26.0	34.0	38.0	46.0
Output voltage	$U_n$	V	3 x (0...U)			
Output frequency	$f_n$	Hz	From 0 to 599			
Switching frequency	$f_c$	kHz	From 2 to 16			
Protections	-	-	Short circuit phase to phase / phase to earth			
<b>INPUT, MAINS SIDE</b>						
Mains configuration	-	-	TT, TN, IT			
Mains rated voltage	U	V	323 ... 528			
Mains rated frequency	f	Hz	45 ... 69			
Input rated current	I	A	14.2	15.8	20.0	26.0
Fuses 3ph/PE	I	A	25	25	35	35
DC-bus rated voltage	$U_{DC}$	V	U x 1.41			
Overvoltage category	-	-	DIN EN 61800-5-1 300V CAT 3			
<b>GENERAL</b>						
Short circuit / earth protection	-	-	Yes, unlimited			
Mounting position	-	-	Vertical			
Degree of protection	-	-	IP 20 (EN 60529)			
Dimensions	HxWxD	mm	200 x 125 x 205			
Fan cooling	-	-	Yes			
<b>ENVIRONMENT</b>						
Coolant temperature	$T_n$	°C	From 0 to 40 (40 ... 55 with derating)			
Humidity	-	%	5 ... 85, no condensing			
Power dissipation	-	W	235	321	393	470
<b>OPTIONS &amp; ACCESSORIES</b>						
Brake-chopper	-	-	Integrated			
Line choke	-	-	Option			
EMI filter	-	-	class A (EN 61800-3) integrated / class B (external) option			
Braking resistor	-	-	Option			
Operator panel	-	-	Integrated			
Communication interfaces	-	-	RS485 Modbus integrated / Systembus integrated / CANopen integrated RS232 option / Profibus DP V1 option / DeviceNet option / EtherCAT® option / Profinet option / VABus/TCP option			

# AGL202 - Technical data (from 0.12 to 2.2 kW)

AGL202-	02	03	05	07	09	11	13
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Size 1

## OUTPUT, MOTOR SIDE

Recommended motor power 3ph	$P_n$	kW	0.25	0.37	0.55	0.75	1.1	1.5	2.2
Recommended motor power 1ph	$P_n$	kW	0.12	0.18	0.25	0.37	0.55	0.75	1.1
Max. continuous output current 3ph	$I_n$	A	1.5	2.0	3.0	3.5	5.0	6.0	9.0
Max. continuous output current 1ph	$I_n$	A	1.0	1.3	1.5	2.0	3.0	3.5	5.0
Current overload 60 s	$I_{OL}$	A	2.25	3.0	4.5	5.25	7.5	9.0	13.5
Current overload 1 s	$I_{pk}$	A	3.0	4.0	6.0	7.0	10.0	12.0	18.0
Output voltage	$U_n$	V	Max input voltage						
Output frequency	$f_n$	Hz	From 0 to 599						
Switching frequency	$f_c$	kHz	From 2 to 16						
Protections	-	-	Short circuit phase to phase / phase to earth						

## INPUT, MAINS SIDE

Mains configuration	-	-	TT, TN, IT						
Mains rated voltage	U	V	200 ... 240						
Mains rated frequency	f	Hz	50 ... 60						
Overvoltage category	-	-	DIN EN 61800-5-1 300V CAT 3						

## GENERAL

Short circuit / earth protection	-	-	Yes, unlimited						
Mounting position	-	-	Vertical						
Degree of protection	-	-	IP 20 (EN 60529)						
Dimensions	HxWxD	mm	200 x 60 x 170						

## ENVIRONMENT

Coolant temperature	$T_n$	°C	From 0 to 40 (40 ... 55 with derating)						
Humidity	-	%	5 ... 85, no condensing						

## OPTIONS & ACCESSORIES

Brake-chopper	-	-	Integrated					No	
Line choke	-	-	Option						
EMI filter	-	-	class A (EN 61800-3) integrated / class B option						
Braking resistor	-	-	Option						
Operator panel	-	-	Integrated						
Communication interfaces	-	-	RS485 Modbus integrated / Systembus integrated / CANopen integrated / RS232 option / Profibus DP V1 option / DeviceNet option / EtherCAT® option / Profinet option / VABus/TCP option						



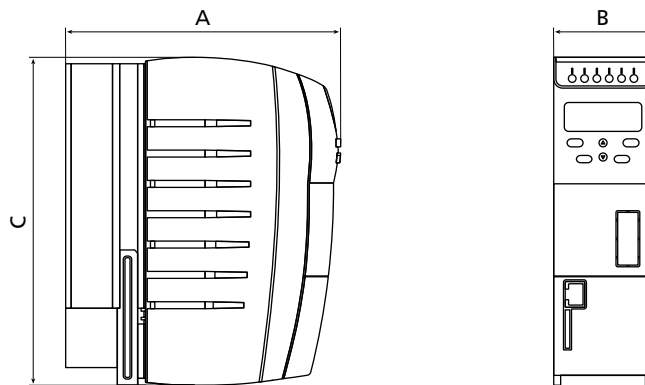
# AGL202 - Technical data (from 1.5 to 7.5 kW)

AGL202-			15	18	19	21
			Size 2		Size 3	
<b>OUTPUT, MOTOR SIDE</b>						
Recommended motor power 3ph	$P_n$	kW	3.0	4.0	5.5	7.5
Recommended motor power 1ph	$P_n$	kW	1.5	2.2	3	3
Max. continuous output current 3ph	$I_n$	A	12.0	15.0	21.0	26.0
Max. continuous output current 1ph	$I_n$	A	6.0	9.0	12.0	12.0
Current overload 60 s	$I_{OL}$	A	18.0	22.5	31.5	39.0
Current overload 1 s	$I_{pk}$	A	24.0	30.0	42.0	44.0
Output voltage	$U_n$	V	Max input voltage			
Output frequency	$f_n$	Hz	From 0 to 599			
Switching frequency	$f_c$	kHz	From 2 to 16			
Protections	-	-	Short circuit phase to phase / phase to earth			
<b>INPUT, MAINS SIDE</b>						
Mains configuration	-	-	TT, TN, IT			
Mains rated voltage	U	V	200 ... 240			
Mains rated frequency	f	Hz	50 ... 60			
Overvoltage category	-	-	DIN EN 61800-5-1 300V CAT 3			
<b>GENERAL</b>						
Short circuit / earth protection	-	-	Yes, unlimited			
Mounting position	-	-	Vertical			
Degree of protection	-	-	IP 20 (EN 60529)			
Dimensions	HxWxD	mm	200 x 80 x 196		200 x 125 x 205	
<b>ENVIRONMENT</b>						
Coolant temperature	$T_n$	°C	From 0 to 40 (40 ... 55 with derating)			
Humidity	-	%	5 ... 85, no condensing			
<b>OPTIONS &amp; ACCESSORIES</b>						
Brake-chopper	-	-	No			
Line choke	-	-	Option			
EMI filter	-	-	class A (EN 61800-3) integrated / class B (external) option			
Braking resistor	-	-	Option			
Operator panel	-	-	Integrated			
Communication interfaces	-	-	RS485 Modbus integrated / Systembus integrated / CANopen integrated RS232 option / Profibus DP V1 option / DeviceNet option / EtherCAT® option / Profinet option / VABus/TCP option			

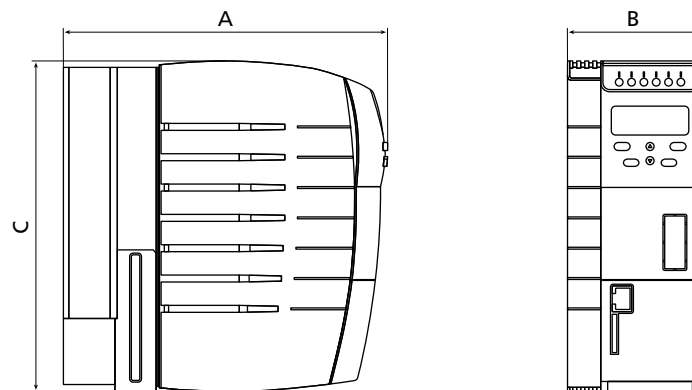
# Dimensions

	SIZE 1	SIZE 2	SIZE 3
	[mm]		
A	170	196	205
B	60	80	125
C	200	200	200

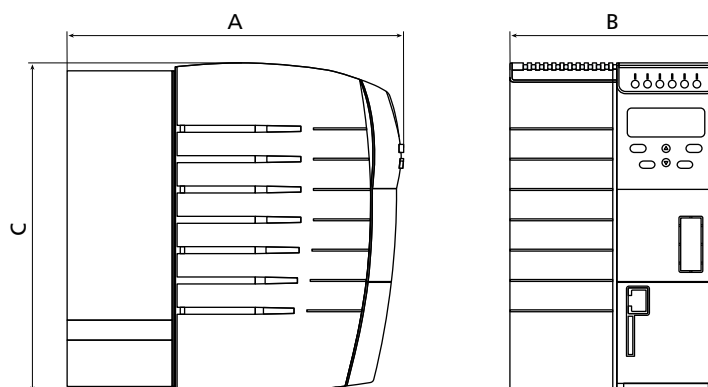
## Size 1



## Size 2



## Size 3



# Standards and Regulations

## Obligatory compliance:

<b>DIN EN 61800-1</b> 1999-08	Adjustable Speed Electrical Power Drive System - part 1: - General requirements - Rating specifications for Low Voltage Adjustable Speed d.c. Power Drive Systems (IEC 61800-1:1997) - German version EN 61800-1:1998
<b>DIN EN 61800-2</b> 2016-08	Adjustable Speed Electrical Power Drive System - part 2: - General requirements - Rating specifications for Low Voltage Adjustable Frequency a.c. Power Drive Systems (IEC 61800-2:1998) German version EN 61800-2:1998
<b>DIN EN 61800-3</b> 2012-09	Adjustable Speed Electrical Power Drive System - part 3: - EMC requirements and specific test methods (IEC 61800-3:2004) - German version EN 61800-3:2004
<b>DIN EN 61800-5-1 Amend. 2</b> 2017-11	Adjustable Speed Electrical Power Drive System - part 5-1: - Safety requirements - Electrical thermal and energy (IEC 61800-5-1:2003) German version EN 61800-5-1:2003 Amend. to DIN EN 618000-5-1
<b>DIN EN 50178</b> 1998-04	Electronic equipment for use in power installations German version EN 50178:1997
<b>2014/35/EU</b>	Low Voltage Directive
<b>2014/30/EU</b>	EMC Directive
<b>CE</b>	CE Directive

## Possible certifications:

<b>UL (508c)</b>	
<b>cUL (CSA C22.2 No. 14)</b>	(in preparation)

# Optional modules

Even in their basic configuration, Agile inverters are equipped with an on-board RJ45 connector for use with communications ports.

For integration into other field networks you can install an optional module with an additional network interface.

Agile inverters can therefore be integrated in existing fieldbus networks simply by adapting inverter communications to the hardware and software of the existing communications standard.

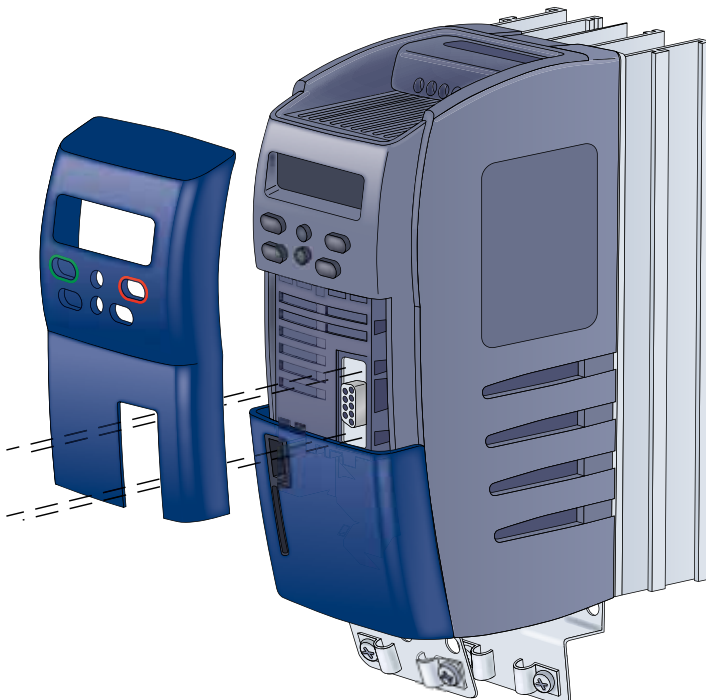
Agile inverters share the same communication module platform with other Bonfiglioli inverter series like Active Cube reducing stock costs when using different Bonfiglioli inverter series. They also profit from the same plug & play functionality, so that the inverter recognises and enables the new module automatically as soon as it is powered on.



Agile inverters support various communication standards. Some of these do not require any optional equipment while others require the corresponding module to be installed. See the table alongside.

All optional modules are identical in shape and size, but differ in electronic functioning according to the standards of the type of field bus they communicate with. Communication modules are installed in slots in the front of the inverter. Simply remove the protective cover to access the slots. A secure push-fit ensures an efficient electrical connection.

With the front panel removed, the connector (typically DB9 or RJ45) for the communication module is also accessible.



Field bus	Optional module
CANopen	CM-CAN
Profibus DP V1	CM-PDP-V1
RS-232	CM-232
RS-485 Modbus	CM-485
DeviceNet	CM-DeviceNet
EtherCAT®	CM-EtherCAT
Profinet	CM-Profinet
VABus/TCP	CM-VABus/TCP
Modbus/TCP	CM-Modbus/TCP

## Logos

RS-232	
RS-485 Modbus	
CANopen	
Profibus DP V1	
DeviceNet	
EtherCAT®	
Profinet	
VABus/TCP	
Modbus/TCP	

# Mounting

## Installation equipment

There are a number of different ways to install Agile inverters inside control cabinets. Inverters can be installed using the metal brackets supplied or using one of the various optional kits.

The following table summarises which installation equipment is available for which inverter sizes.

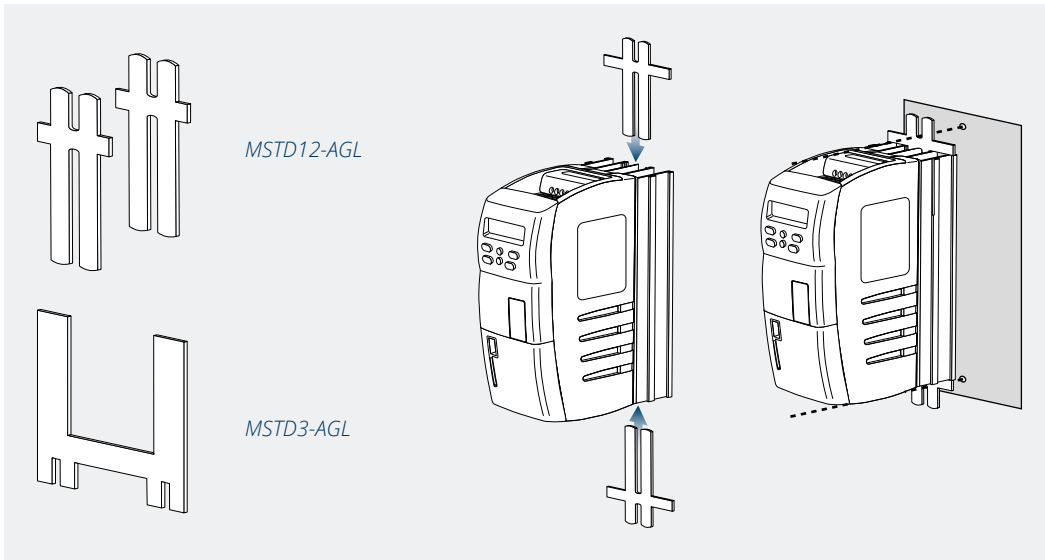
INVERTER		STANDARD MOUNTING (SUPPLIED)	FEED-THROUGH MOUNTING (OPTIONAL)	DIN RAIL MOUNTING (OPTIONAL)	ANTI-VIBRATION MOUNTING (OPTIONAL)
Size	Type	MSTD kit	MPSV kit	MDIN kit	MNVIB kit
1	AGL ...-02 1 FA	MSTD12-AGL	MPSV1-AGL	MDIN1-AGL	MNVIB1-AGL
	AGL ...-03 1 FA				
	AGL ...-05 1 FA				
	AGL ...-07 1 FA				
	AGL ...-09 1 FA				
	AGL ...-11 1 FA				
	AGL ...-13 1 FA				
2	AGL ...-15 2 FA	MSTD3-AGL	MPSV2-AGL	MDIN1-AGL	MNVIB2-AGL
	AGL ...-18 2 FA				
	AGL 402-19 2 FA				
	AGL 402-21 2 FA				
3	AGL ...-19 3 FA	MSTD3-AGL	MPSV3-AGL	MDIN1-AGL	MNVIB3-AGL
	AGL ...-21 3 FA				
	AGL402-22 3 FA				
	AGL402-23 3 FA				



# Mounting

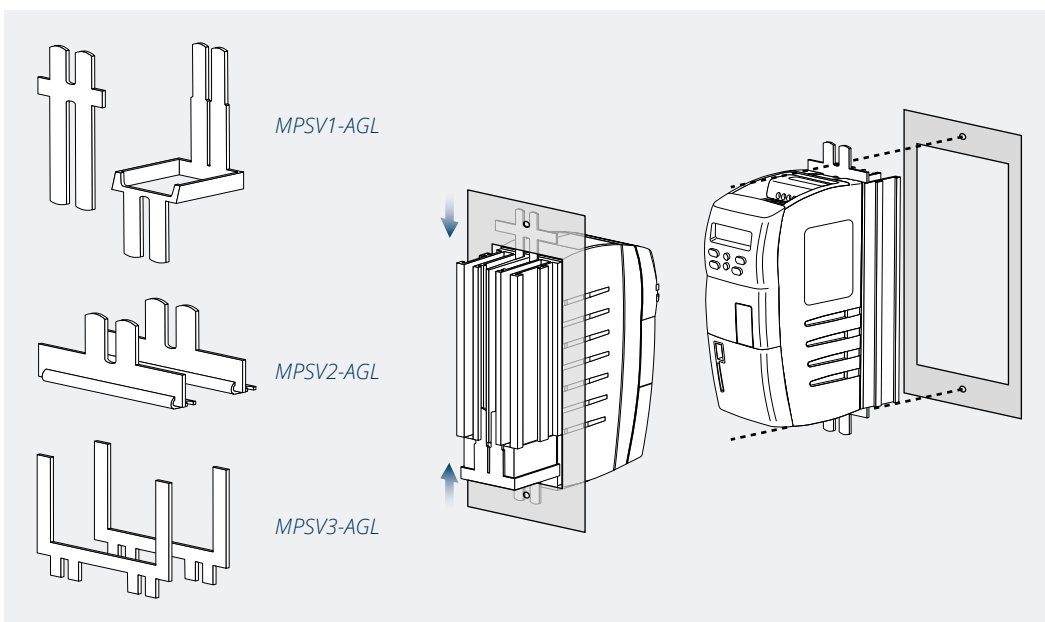
## MSTD kit (standard mounting)

This kit comprises two brackets that engage with slots in the inverter's heat sink fins. The brackets are fixed to the inside wall of the control cabinet with two screws.



## MPSV kit (feed-through mounting)

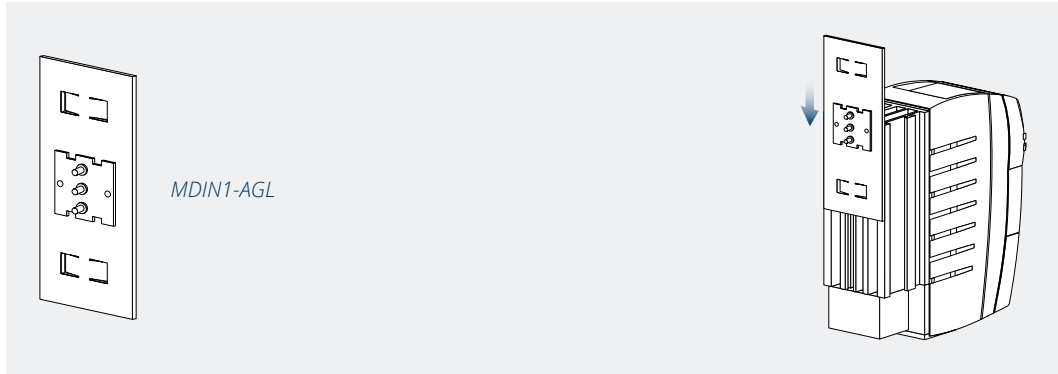
When heat has to be dissipated outside the control panel, or component depth minimised, the feed-through mounting kit lets you install the inverter with the heat sink outside and the rest of the inverter inside the control cabinet.



# Mounting

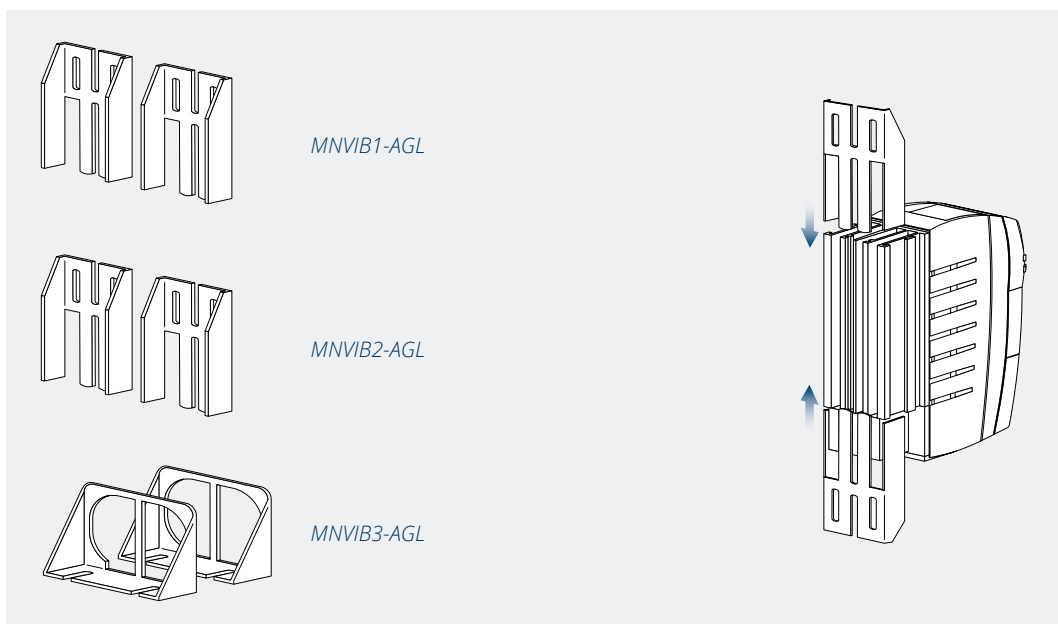
## MDIN kit (DIN mounting)

Only available for Agile size 1 inverters, the MDIN kit comprises a metal plate that engages with slots in the inverter's heat sink fins and allows the inverter to be installed on a DIN rail inside the control cabinet.



## MNVIB kit (vibration proof mounting)

Designed for installation in high vibrations environment, the MNVIB kit consists of two inserts to introduce between the heat sink fins to assure greater strength of attachment.



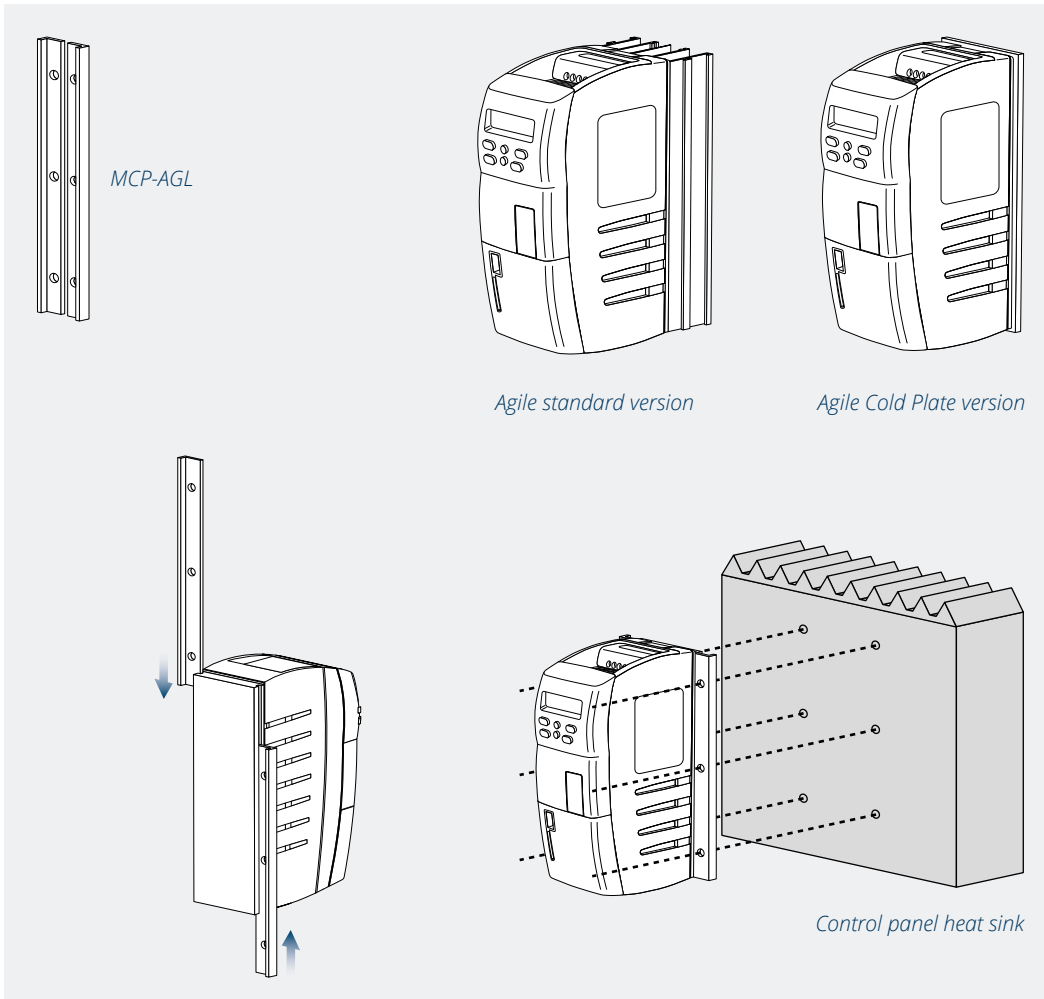
# Mounting

## Cold Plate design form

The Agile' s standard version is executed with integrated heat-sink which contributes to define the inverter overall dimensions allowing optimal performances by means of suitable heat disposal.

For special applications requiring space saving or compliance with certain environmental conditions, Agile offers the alternative design form "Cold plate version" available for purchasing.

The cold plate version is realized without built-in cooling ribs which instead must be prepared by the user according to parameters reported on the relevant technical manual. In that configuration the inverter back ends with smooth metal plate able to be fixed to an auxiliary heat-sink by means of specific mounting kit.





## ASK-USB serial connection kit

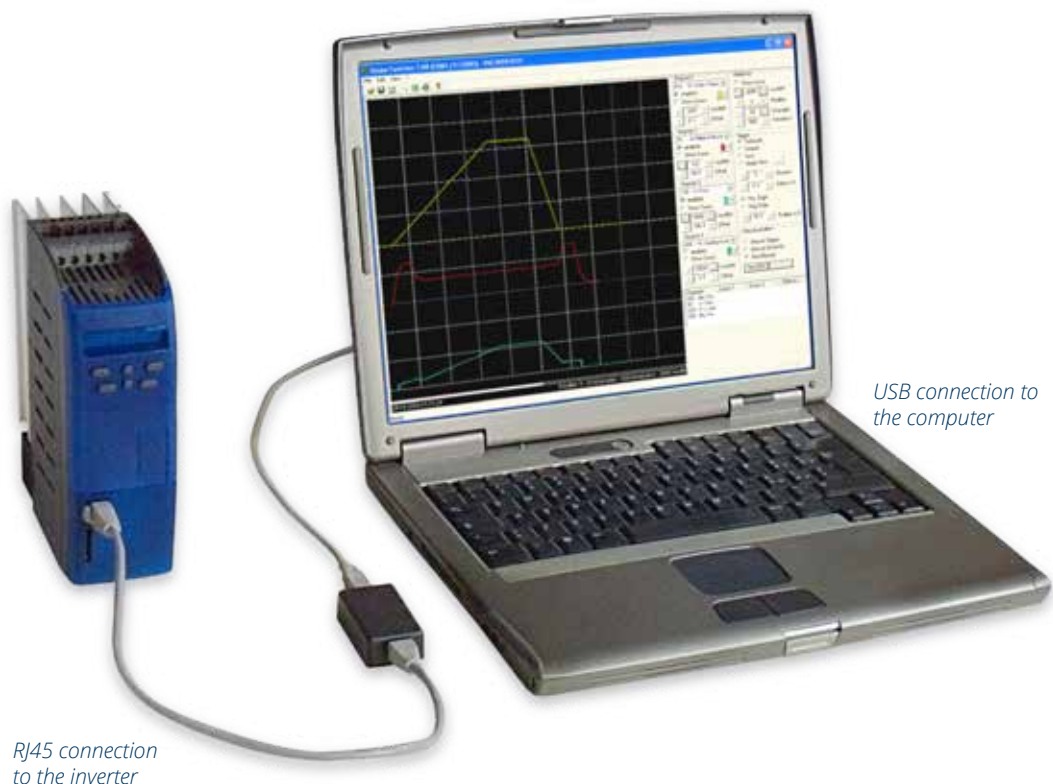
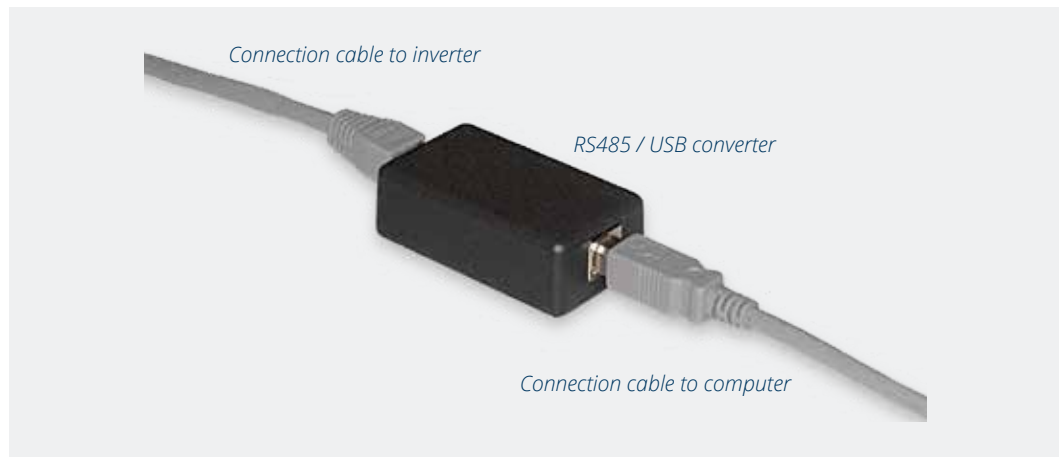
Agile inverters are equipped with a number of different communication interfaces.

Some of these (RS485, CAN-Systembus) are integrated in the basic product, while others (RS232, CAN, Profibus, DeviceNet, EtherCAT®, Profinet, VABus/TCP) are only available if the corresponding CM optional module is installed in the inverter.

The RS485 port is integrated and accessible via the RJ45 connector on the front panel. This port is able to communicate using Modbus RTU, Modbus ASCII and VABus (Bonfiglioli Vectron's own proprietary and open to public protocol).

The ASK-USB connection kit allows you to connect your Agile inverter to your computer's USB port. The kit comprises three components:

- an RS485 / USB converter
- a connection cable to the inverter
- a connection cable to the computer



# Braking resistors

## Regenerative mode

When an inverter-controlled electric motor is braking, it becomes regenerative and returns electrical energy to the inverter.

This causes voltage in the inverter's DC-link circuit to rise to a value at which it becomes necessary to dispose of excess energy through a recovery system or through external dissipative components.

Agile inverters support both methods of regenerative energy management and provide a DC-bus power connection to other inverters capable of using the excess energy, and a connection to a braking resistor for the thermal dissipation of energy.



## Braking Resistor

All Agile inverters have a built-in braking chopper for use with a range of Bonfiglioli braking resistors, selected to suit the duty cycle of the application.

BR Series braking resistors are safe and compact, offer an index of protection of IP20 and above, are suitable for panel mounting and feature integrated thermal protection.

Each resistor is identified by a power rating and a resistance value, which form the criteria for combination with different inverter ratings. The following table shows the recommended combination for each AGL model with a braking resistor and the corresponding duty cycle.

INVERTER	RECOMMENDED RESISTOR		DUTY CYCLE*		
	kW (1ph)	kW (3ph)	Type	% (1ph)	% (3ph)
AGL202					
-02	0.12	0.25	BR 160/100	100	64
-03	0.18	0.37	BR 160/100	89	43
-05	0.25	0.55	BR 160/100	64	29
-07	0.37	0.75	BR 160/100	43	21
-09	0.55	1.1	BR 160/100	29	15
-11	0.75	1.5	BR 432/37	57	29
-13	1.1	2.2	BR 432/37	39	20
-15	1.5	3.0	BR 432/37	29	14
-18	2.2	4.0	BR 432/37	20	11
-19	3.0	5.5	BR 667/24	22	12
-21	3.0	-	BR 667/24	22	-
	-	7.5	2x BR 423/37*	-	11

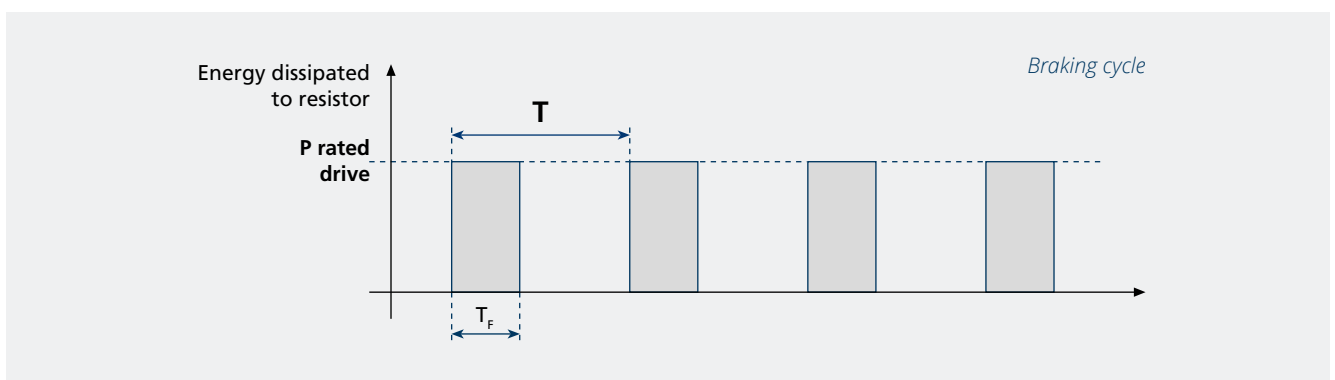
\* 2x BR 423/37 parallel

INVERTER	RECOMMENDED RESISTOR		DUTY CYCLE*
	kW	Type	%
AGL402			
-02	0.25	BR 213/300	85
-03	0.37	BR 213/300	58
-05	0.55	BR 213/300	39
-07	0.75	BR 213/300	28
-09	1.1	BR 213/300	19
-11	1.5	BR 213/300	14
-13	2.2	BR 213/300	10
-15	3.0	BR 471/136	16
-18	4.0	BR 471/136	12
-19	5.5	BR 1330/48	24
-21	7.5	BR 1330/48	18
-22	9.2	BR 1330/48	14
-23	11	BR 1330/48	12

\* referred to a period of 120 seconds

Since each resistor has a lower continuous rated power value than the corresponding inverter, it is important to respect the specified dissipation cycle. Though the component will heat up, this duty cycle permits adequate cooling.

The purpose of the duty cycle is to prevent overheating and damaging the resistor. Therefore the maximum 120 seconds duty cycle must be observed.



# Line choke

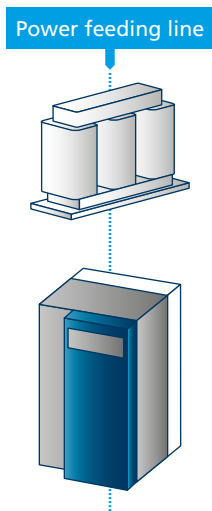
## Harmonic handling

Current harmonics at the inverter's power inputs can attenuate a system's active power. The best solution for dealing with harmonics is to install line chokes in series with each phase.

The mains power supply has its own intrinsic inductance. The addition of line chokes boosts this to offer ever greater impedance to higher harmonic components and act effectively as a low-pass filter.

Line chokes should have a short circuit rating some 20 to 40 times greater than the rated power of the inverter and should produce voltage drops no greater than 4%.

Bonfiglioli can provide a range of line chokes satisfying these criteria for use with different inverter sizes according to the table below.



INVERTER	RECOMMENDED BONFIGLIOLI LINE CHOKE	
	1ph	3ph
AGL202		
AGL202-02	LCVS006	LCVT004
AGL202-03	LCVS006	LCVT004
AGL202-05	LCVS006	LCVT004
AGL202-07	LCVS006	LCVT004
AGL202-09	LCVS006	LCVT006
AGL202-11	LCVS008	LCVT008
AGL202-13	LCVS015	LCVT010
AGL202-15	LCVS015	LCVT015
AGL202-18	LCVS018*	LCVT018
AGL202-19	on request	LCVT025
AGL402-21	on request	LCVT034
AGL402		
AGL402-02		LCVT004
AGL402-03		LCVT004
AGL402-05		LCVT004
AGL402-07		LCVT004
AGL402-09		LCVT004
AGL402-11		LCVT004
AGL402-13		LCVT006
AGL402-15		LCVT008
AGL402-18		LCVT010
AGL402-19		LCVT015
AGL402-21		LCVT018
AGL402-22		LCVT025
AGL402-23		LCVT034

\* Use permitted at maximum continuous power of 18A.



# Sharing the value of our work with you.

The development of effective, tailored solutions for a wide range of applications is a fundamental aspect of our work.

We succeed in this because we co-operate closely with our customers, listen to their requests and work with them to improve our own performance.

Bonfiglioli is determined to deliver the best service possible – before, during and after the sale of any of our products – by applying all our know-how, experience, technology, and advanced communication tools. Bonfiglioli works to the strictest standards of quality and safety, as certified by seven different internationally recognised institutes.

We believe in innovation, and back up this belief by dedicating 100 of our people and 5 activity centres to research and development, and by working hand in hand with some of the world's most prestigious universities.

Our work increasingly brings us into contact with other nations and cultures, for which we have the greatest respect and with whom we share a vision of sustainable development based on renewable energy.

This bond of commitment allows us to be an authoritative and reliable global partner for the present and the future.





# OUR GLOBAL PRESENCE

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Thanks to an international network of closely interconnected commercial and production sites, we can guarantee the same high standards of Bonfiglioli quality anywhere at any given time. We know that our direct presence in local markets is the key to long-lasting success, so our family includes 18 production sites, 23 commercial sites and more than 550 distributors around the world.

Our organization is always close by, offering complete and efficient solutions and supporting our customers with dedicated services, co-engineering and after-sales assistance.



**18**

PRODUCTION SITES



**23**

COMMERCIAL SITES



**80**

COUNTRIES



**550**

DISTRIBUTORS



**~4,700**

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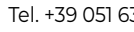
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We have a relentless commitment to excellence, innovation & sustainability. Our team creates, distributes and services world-class power transmission & drive solutions to keep the world in motion.

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