FRIWO

WE ACCELERATE ELECTROMOBILITY

Innovative power supply units and drive systems for limitless mobility



ABOUT US

As an international manufacturer of technically leading power supply units and drive solutions, FRIWO provides a whole host of applications with tailored systems from a single source. Innovative system supplier of smart power supply units and drive solutions

Since the discovery of the first plugin power supply unit in the world, our demanding customers have been able to fully rely on FRIWO for their power supply needs. Since 1971, we have produced well over a billion power supply solutions and this has given us leading technological expertise throughout the whole industry.



50 years of full performance

As an international system supplier, FRIWO develops and produces digitally controllable power supply units and drive solutions from a single source. The product portfolio includes smart components for electric drives as well as premium technological chargers, battery packs, and power supplies. All components of a modern electric drive are also provided: from the display, motor control unit and drive unit to the control software.

FRIWO

With modern development centers, manufacturing facilities and sales locations in Europe, Asia and the US, FRIWO is present in all of the world's key markets. The FRIWO brand stands for innovative strength, security, safety, quality, and efficiency around the world.

As proof of this, we are certified according to DIN ISO 9001 (Quality management), DIN ISO 14001 (Environmental management), and DIN ISO 13485 (Quality management for medical devices).

FRIWO EXPERTS IN MOTOR CONTROLLER



COMPONENTS

Battery Management System V1 Battery Management System V2 Battery Management System V3 Batterie Pack LEV500 Enable Tool SDK Back-2-Back Motor Control Unit 2500 Motor Control Unit 6000 Motor Control Unit 8000 VCU

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DRIVE SYSTEM SOLUTIONS

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BMS

Since as far back as 2013, our battery technology can be found in the large electric scooter rental fleets of European cities such as Berlin, Munich, Paris, and Bordeaux. This is where our battery packs have already proven their safe continuous operation and long durability over more than 5,000,000 km and more than 150,000 hours of charging.

Battery Management System - V1

Our high-end Battery Management System (BMS) not only offers reliable protection for your battery but also a number of convenience and communication functions. Thanks to its UL certification, the BMS can be safely used and sold in more than 50 countries worldwide, including the US.

In practice, battery packs for the widest range of applications have already been tested and successfully certified with this BMS according to UN38.3.

The programming and adjustment of the BMS is done on site through our Enable Tool development and diagnostic software. You can also use this software to safely and reliably carry out firmware updates on battery packs already delivered.

Overview

Cell config (seriell)	10 - 14 S
Cell config (parallel)	20 P
Continious current	65 A
Peak current	70 A
Communication	CAN, USB
Input signals	Keylock/Buttons, Charger

DRIVE SYSTEM SOLUTIONS









Battery Management System - V2

The next generation of BMS comes with several optimizations in output performance, size and costs. Keeping main functionality and configuration possibilities, it gives the pack designer more flexibility to fit BMS in system application.

The higher peak performance leads to much more dynamic system power and driving emotion. The programming and adjustment now can be done over CAN BUS communication with our Enable Tool development and diagnostic software.

Overview

Cell config (seriell)	10 - 15 5
Cell config (parallel)	20 P
Continious current	70 A
Peak current	150 A
Communication	CAN, USB
Input signals	Keylock/Buttons, Charger





Visit the product webpage for more details and downloads!



Battery Management System - V3

The newest BMS - actually in final development phase - will enhance output performance to new dimension. Flexibility in cell count and voltage robustness will provide a solution in many different applications.

New functionalities like HV-Interlock will give the chance for safe series connection and use of higher voltage application.

Optimized cell monitoring and balancing together with new safety features increases life span of cells.

Overview

Cell config (seriell)	10 - 16 S	
Cell config (parallel)	20 P	
Continious current	120 A	
Peak current	300 A	
Communication	CAN, USB, HV-Interlock	
Input signals	Keylock/Buttons, Charger	

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BATTERY

With our market-leading charging technology, we supply numerous global companies from ambitious sectors such as mobile tools and gardening equipment, medical technology and electromobility, making us one of the key players on the global market.

Our 14S12P Li-lon high-power battery pack has been developed for maximum performance and durability.

The next generation

This new design features our Second Generation BMS, capable of delivering more power for longer!

Encapsulated in our new watertight IP65 housing with built in heat sink, not only the aesthetics are an upgrade, the durability outperforms the previous generation, perfect for those demanding environments!

Overview

Cell Config	14 Series + 12 Parallel	
Nominal voltage	50.4 V	
Nominal energy	2026 Wh	
Max. charging voltage	58.8 V	
Max. charging current	20 A	
	412 mm x 269 mm x 79.4 mm	
Dimensions	412 mm x 269 mm x 79.4 mm	
Dimensions Weight	412 mm x 269 mm x 79.4 mm 11 kg	

DRIVE SYSTEM SOLUTIONS











CHARGER

A standard product that sets new standards.

With the launch of the LEV500 Li-Ion charger, FRIWO is redefining charging technology for electric mobility in terms of robustness, efficiency and customizing.

LEV500 Li-Ion Charger - charges what moves us

The LEV 500 can be used in a wide range of applications in different environments. As with all our tailor-made products for electromobility, it goes without saying that the LEV 500 also features extremely energy-efficient charging technology with minimal standby losses. The handle of the compact housing can be removed and mounted directly on the end application to use the charger as an onboard device. The charger is very quiet and can be customized according to customer requirements.

Overview

Input voltage	220 – 240 V
Frequency	50 – 60 Hz
Charging voltage range	28 - 58.8 Vdc
Output current	0 - 8.5 A
Output power	500 W
Efficiency	93 %
Connectors	AC input: 3 pole, 1 m length
Protection class	IP65
Safety design according	IEC60335-1, IEC60335-2 -29

DRIVE SYSTEM SOLUTIONS









SOFTWARE

The ENABLE TOOL Application

FRIWO Enable Tool is a measurement and calibration software for parameterization of motor controls and battery management systems. The software establishes an encrypted connection to an ECU via the USB or CAN interface, and allows read and write access to parameters and measured values.

Service power

A lot happens during the life of an electric vehicle. Everything starts with the development process. In order to provide the best possible support for your R&D, we supply the software to make settings on our control units, manage different versions of this data and safely carry out assembly from the prototype to the larger vehicle fleet. During series production, the Enable Tool supports the calibration of control units, the commissioning of electrical systems and supports logging of vehicle operation. Even an electric vehicle has to be serviced. We have already developed the infrastructure to set up your dealer network.

Our control units are equipped with a USB diagnostic interface and CAN to give service staff access to the fault memory or to carry out firmware updates. We currently offer the Enable Tool Application exclusively as an annual fleet licence, which can be variably distributed among the developer and service user roles.

In our webshop you have the possibility to choose between these variants:

- 1 User, 1 Month, 1 Project code (trail month)
- 1 User, 1 Year, 1 Project code
- 10 Users, 1 Year, 1 Project code
- 100 Users, 1 Year, 1 Project code

DRIVE SYSTEM SOLUTIONS







SOFTWARE

The Software Development Kit

Create individual software modules for FRIWO control devices.

Sometimes it is necessary to have some software modules tailored to specific applications. Our software development kit gives you the exclusive freedom to rapidly modify wellchoosen modules of our control device firmware.

For even more possibilities

FRIWO SDK is an all-in-one tool that bundles developer software and provides an end-to-end development environment setup solution for FRIWO E-Mobility Products. It enables you to focus on your specific application and provides all the bullet-proof basic software. In combination with the FRIWO Enable Tool, the self-developed parameters can be directly displayed or modified.

Due to the use of ANSI C as common programming language, the creation and implementation of new functionalities are made easy. This way you can develop a hill assist, your own driving modes or turn your engine control into a fan or pump control. In addition, you get access to new modules and our GitHub repository, where we provide detailed code samples.

In our webshop you have the possibility to choose between these variants:

- 1 User, 1 Month
- 1 User, 1 Year







B2B

With the help of our new Back-to-Back test bench, you can massively shorten your time-to-market for new powertrain software and hardware components through Rapid Control Prototyping. Thanks to the compact setup with flexible configuration possibilities, you can quickly implement adaptations of your own components.

Benefits

Massively reduce time to market of new powertrain soft- and hardware components through Rapid Control Prototyping.



01

Create education labs demonstrating next generation developers the newest technology in a tangible way.



Compact setup with flexible configuration possibilities to adapt own components quickly.



Extend the setup by battery packs to build up a complete powertrain system and monitor energy flow.

05

Optionally add a torque sensor to get mechanical output power in high precision.

DRIVE SYSTEM SOLUTIONS





MCU

Our intelligent Motor Control Unit has enjoyed great success in electric scooter sharing and motor sports since 2014.

In Europe more than 4000 rental vehicles are on the road that gathered millions of kilometers and a huge amount of experience!

The controller has proven its durability and special robustness.

Motor Control Unit 2500

This motor control unit delivers a continuous power of 1.5 kW and was developed especially for the high demands of the Asian 2- and 3-wheel market. The enormous robustness of the motor control unit allows it to be used under adverse conditions and high ambient temperature.

Due to the enormous flexibility of our motor control unit and the specially developed firmware, the MC2500 is also interesting for other target markets. The large number of interfaces allows easy integration into any end application.

Overview

Supply voltage	30 - 60 V
Phase current	100 A rms
Motor types	Permanent magnet synchronous motor (PMSM)
Control algorithm	Field-oriented control with field weakening
Analog inputs	2
Digital inputs	9
Outputs (digital/analog)	1/1
Communication	CAN

DRIVE SYSTEM SOLUTIONS







^{21.} Motor Control Unit 6000

The motor control unit for 48 V drives was specially developed for use in light electric vehicles. With a continuous output of 6 kW and a peak power of up to 12 kW, the Emerge 6000 accelerates confidently through everyday life.

Thanks to the automatic teach-in function, the controller forms a powerful unit with the motor within a very short time. Our field-oriented control system with highly efficient control algorithms then ensures a unique driving experience.

Overview

Supply voltage	14 - 60 V
Phase current	247 A rms
Motor types	Permanent magnet synchronous motor (PMSM)
Control algorithm	Field-oriented control with field weakening
Analog inputs	2
Digital inputs	2
Communication	CAN, Smartphone connectivity
Diagnostic interface	USB, CAN





Visit the product webpage for more details and downloads!



Motor Control Unit 8000

This motor control unit is intended for customers with higher power demands up to 8 kW. Other key features include support for additional position sensors, the very small form factor thanks to high power density, and extended I/O protection.

As with all other motor controls, we also use our self-developed software here, which has already proven in the field for years.

Overview

Supply voltage	30 - 60 V
Phase current	300 A rms
Motor types	Permanent magnet synchronous motor (PMSM)
Control algorithm	Field-oriented control with field weakening
Analog inputs	2
Digital inputs	2
Communication	CAN, Smartphone connectivity
Diagnostic interface	CAN



DRIVE SYSTEM SOLUTIONS









VCU

With our VCU, we network the entire vehicle with peripheral components. An example: In e-scooter sharing models, the VCU establishes the online connection to rent the vehicle via an app.

Further interfaces are USB, WiFi, Smartphone Connectivity, GPS, GPRS, 3G or 4G, which can be used differently depending on the application.

The Networker

The VCU is used to control vehicle functions in complex vehicle wiring systems, or as a gateway between separate CAN buses.

It handles tasks such as analyzing and controlling the lighting system, or providing the required protection against theft. Optionally the VCU is equipped with Wi-Fi and GPS connections that can be used to upload collected data to the cloud, and to access that data, making it suitable for big-data applications. A simple real-world example: When used in e-scooter sharing, the VCU establishes the online connection required for users to rent the vehicle via an app. The VCU was fully developed in-house, so it can be completely tailored to meet the customer's wishes and requirements.

Overview

Supply voltage	12 V
Interfaces	USB, 2x CAN
Analog inputs	2
Digital inputs	2
Digital outputs	2







FRIWO APPI ICATION FXAMPIES SIORIES



We drive your success!

Unfortunately we cannot show you everything we have worked on due to confidentiality agreements. However, we hope this next section will show you the capabilities and flexibility of the FRIWO powertrain system!

Our mission

To boost electric vehicle development by offering a well designed, highly customisable and efficient electric powertrain solution "offthe-shelf" so innovators can focus on their design!

Before we dive in...

Here are 3 key points that make our Electric Powertrain Solution great!

Battery and charger

We have been in the industry for over 50 years, we specialise in manufacturing high grade power supplies, battery packs and the respective chargers.

Our electric powertrain range featuring a 2 kWh battery pack and 500 W charger is an extension of knowledge and experience formed over the past 5 decades.

Modular components

If you are looking for an 'off-the-shelf' powertrain package, you can take one of each component shown on our website as it has been designed to work together and comes complete with all the mating connectors.

Third party devices are compatible, such as displays and other brushless DC motors.

Programming software

The battery pack and motor controller can be monitored and reprogrammed with the bespoke Enable Tool.

This advanced software has over 1,000 adjustable parameters to tailor the performance to your liking, giving your application that unique edge above the rest!

E-mobility start-up relies on a powerful drive and control system from FRIWO for its electric moped.

looking for an experienced partner for the technical implementation. tems, controllers and motors, FRIWO emerged as Brekr's system partner of choice.



Hard shell, soft interior: Brekr Model B offers maximum E-Mobility driving comfort

The search for technical components took Brekr right across the world – from Europe to North America and Asia. The systems and components that initially appeared to be suitable on paper were built into prototypes to test their functionality, reliability and performance in practice.

Overview

Motor	2,500 – 4,000 watt
- Battery	2.0 kWh Li-Ion
Frame	Aluminium
Operating range with 1 battery	50 – 80 km
Operating range with 2 batteries	100 – 160 km
Speed	25/45 km/h
Weight	78 kg (incl. 1 batter)



Find out more and download the success story now!



FRIWO

Graz University of Technology simulates a manned mission to Mars with E-Mobility

The future of autonomous electric mobility is multifaceted. Graz University of Technology is fulfilling this applicable research vehicle that can sion to Mars and for rescuing people buried in avalanches. FRIWO provides strategic advice and supplies the drive and control technology.



Special Requirement: Autonomous Off-Road Navigation

Autonomous driving in areas for which there are no maps is a complex challenge. Professor Gerald Steinbauer and Richard Halatschek from Graz University of Technology have made it their mission to develop electrically powered vehicles that drive independently in rough terrain. How does an exploration vehicle find its bearing on Mars?

How does a reconnaissance vehicle navigate through avalanche terrain? How does a self-driving robot move in hazardous material situations?

TU Graz has been working for many years on the question of which use cases are possible in the field of autonomous navigation with the help of electrically powered vehicles. In 2017, a research team started developing a research vehicle capable of autonomous off-road driving.





Find out more ar





FRIWO

Have a project in mind?

Please get in touch!

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