



# Motion Control

**ETEL**



## ABOUT ETEL

ETEL is the world's leading supplier for direct drive and advanced motion systems. It supports high-tech industries with a comprehensive range of products. Linear and torque motors, positioning systems, motion control hardware and software help customers get the most out of ETEL's direct drive solutions as quickly as possible.

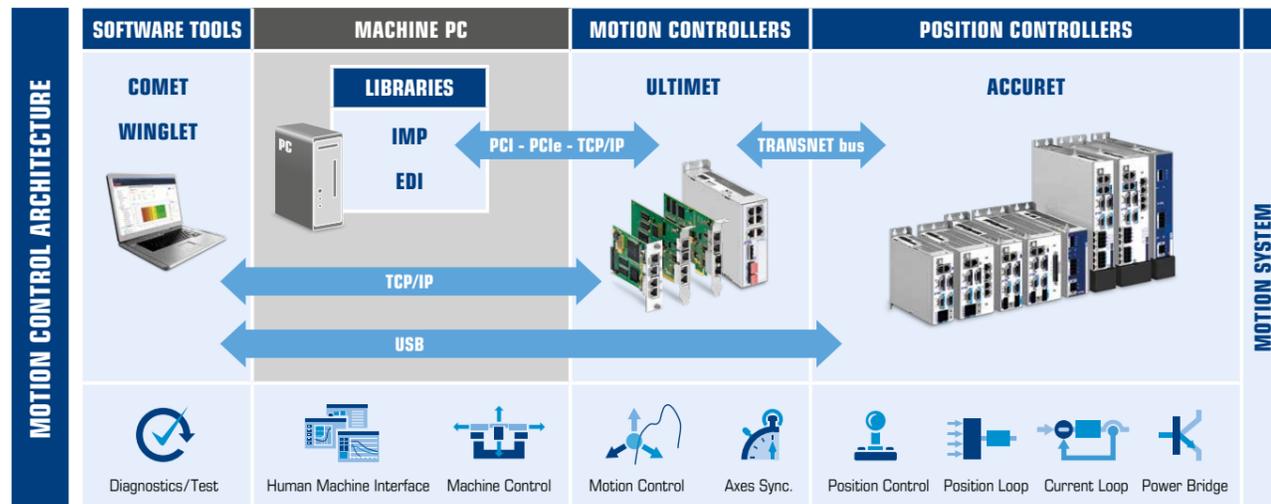
The full ETEL solution allows machine builders to simplify integration in their machine thanks to a very consistent design. It also gives customers the opportunity to focus on their core competence and technology while ETEL takes care of motion systems development.

## MOTION CONTROL RANGE

ETEL's motion control solutions have been integrated into leading edge machines of various high-tech industries for more than 20 years.

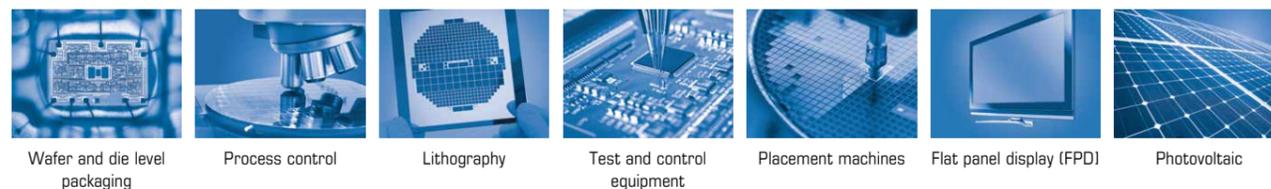
ETEL's range of motion and position controllers allows machine builders to control direct drive axes with the highest performance while maintaining a compact footprint.

Its decentralized architecture ensures the same level of performance and speed regardless of the number of axes driven in the machine. Distributed architecture also makes cabling easier to manage and to maintain in the field. The software environment simplifies embedded programming, machine commissioning and maintenance.



## INDUSTRY SECTORS

ETEL is a leading supplier of components and motion systems to the following industries:



## ULTIMET MULTI-AXIS MOTION CONTROLLERS

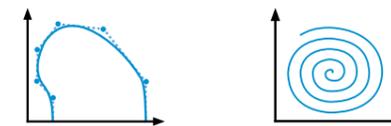
The ULTIMET motion controller is the master on the TRANSNET bus and can manage up to 63 axes. To provide the best price/performance solution to its customers, ETEL has designed two versions of the motion controller: the ULTIMET LIGHT and the ULTIMET ADVANCED.

The ULTIMET LIGHT offers different ways to manage multi-axis movements, depending on the needs: synchronized or interpolated movements, or advanced control feature requiring slave to slave communication between the different position controllers. They are available in three form factors: PCI and PCI Express version integrated into a PC for high speed applications requiring real-time deterministic communication and TCP/IP version directly mounted inside an ACCURET position controller. This configuration is best for stand-alone machines, in which the need for time deterministic data transfer between motion system and machine PC is lower.



The ULTIMET ADVANCED is a powerful and versatile high-end multi-axis motion controller. It brings outstanding intrinsic performance as well as a high level of flexibility in controlling advanced motion systems with strategies that one can shape very precisely to match dedicated needs of various applications. This motion controller is fitted with a quad-processor from which one core is fully dedicated to the user and running with a real-time operating system. The computation power provided by this "user core" can be used for any type of motion control algorithm, enabling the ULTIMET to become a very open and flexible architecture possibly hosting part of the process IP.

From a hardware standpoint, ULTIMET ADVANCED also provides many more interfacing capabilities such as multiple TCP/ IP connections, SPI channels, GPIOs, SD card, etc. to directly bring additional data into the real-time motion control execution.



The ULTIMET ADVANCED brings the most added value when a process requires more computation power, more data processing, more interfacing and free real-time operating system.



For more information, refer to our ULTIMET Overview leaflet.

## COMMUNICATION

TRANSNET is a gigabit ethernet based field bus designed to be the communication channel in ETEL's distributed motion control architecture. TRANSNET manages the real-time commands between the ULTIMET motion controller and the ACCURET position controllers driving up to 63 motors at the same time. It allows for handling of highly reliable deterministic synchronization and interpolation.

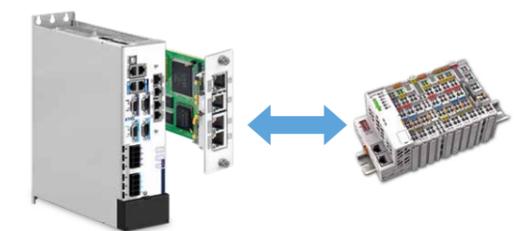
In addition, the TRANSNET nanosecond jitter allows for master to slave, slave to master, or slave to slave communication within the same cycle. This is a major advantage for high-end machines, since most require extensive slave to slave communication to perform at their best performance.

### Input and output interfaces

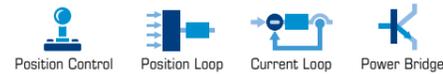
Each ACCURET controller has embedded inputs and outputs to interface external devices or precisely trigger process tasks. On top of the embedded I/Os, ETEL provides an optional I/O board to extend the number of interfaces.



The ULTIMET LIGHT controller can also be used to communicate to external WAGO modules and push the number of I/Os even further.



## ACCURET POSITION CONTROLLERS



ACCURET position controllers cover a wide range of voltage and current levels, making the integration of various axes in a single machine very easy. The modular mounting design makes ACCURET position controllers a very compact solution:

- Each controller can drive two axes and a single power supply can be used for multiple ACCURETs sharing the same DC bus voltage.
- Optional boards can be mounted directly inside the ACCURET, such as the ULTIMET LIGHT TCP/IP motion controller or the I/O board.
- No rack is needed, making the required volume only dependent on the number of driven axes.
- Simplified power and communication cabling as well as modular cooling unit make the machine installation and maintenance easy to perform.

Machine builders will appreciate this cost effective, compact and quickly integrated design.



### Increase the accuracy and throughput of your machine with ACCURET

By using a high quality current loop, parasitic movements can be avoided thanks to extreme low noise. In addition, the regulator architecture makes the overall position loop bandwidth reach outstanding levels. Last but not least, the ACCURET advanced feedforward feature helps in identifying and compensating friction, viscosity, motor ripple and other repeatable behavior.

ACCURET is also optimized to ease and improve the overall machine performance in terms of accuracy.

By providing features such as 3D mapping, nanosecond reaction triggers, trajectory filters, etc., the machine control is drastically improved and any process related action will take place at precisely the right time and the right moment while disturbances are being rejected. In addition, they can run up to 2 embedded programs per axis, so machine builders can manage any process specific tasks at the controller level.

Once these features are brought together, ACCURET minimizes tracking errors during axes movement and therefore dramatically reduces the motion and the settling time. All this is directly translated into an increased machine throughput and better overall accuracy.



### Reach outstanding performance with the unique ACCURET VHP

For the most demanding applications, ETEL developed a unique Very High Performance position controller range called ACCURET VHP. This range of product is equipped with both specific hardware and software that maximizes the performance in terms of position stability and speed accuracy.

ACCURET VHP position controllers are compatible with all the other ACCURET controllers and can be dedicated to the most demanding axes of a multi-axis motion system. ETEL's VHP range provides outstanding signal to noise ratio of 100 dB and advanced control features enabling more options and unique algorithms for complex motion systems. For instance, ACCURET VHP provides High Speed Encoder Interfaces (HSEI) to enable extremely high resolution position feedback in combination with high speed motion.

ACCURET VHPs are successfully used in areas such as:

- Process control
- Wafer and die level packaging
- Wafer inspection
- Test and control equipment
- Lithography



## ADVANCED FEATURES

ETEL has always focused on developing advanced control features to make its position controllers unique in the market. From the first prototype commissioning to the serial production of machines, ETEL advanced features provide a simple access to major time savings, throughput enhancement and increased precision.

ETEL advanced features start to bring advantages at a very early stage of a machine design. For instance, **Identification Tools**, are available to allow a one-click evaluation of machine mechanical design, identify resonances and adapt controller settings. While commissioning the machine, other tools like **Friction Compensation** and **Stage Protection** can be used to cancel out repeatable errors and to secure system behavior in case of unexpected events.

In addition, the core of ETEL unique features is designed to bring higher throughput together with the most stringent position accuracy levels. **Trajectory Filters** have the ability to adapt trajectory shapes to minimize settling times. In combination with **Dual Encoder Feedback** capabilities and/or **Gantry Control** functions, outstanding performance can be reached with minimal tuning effort.

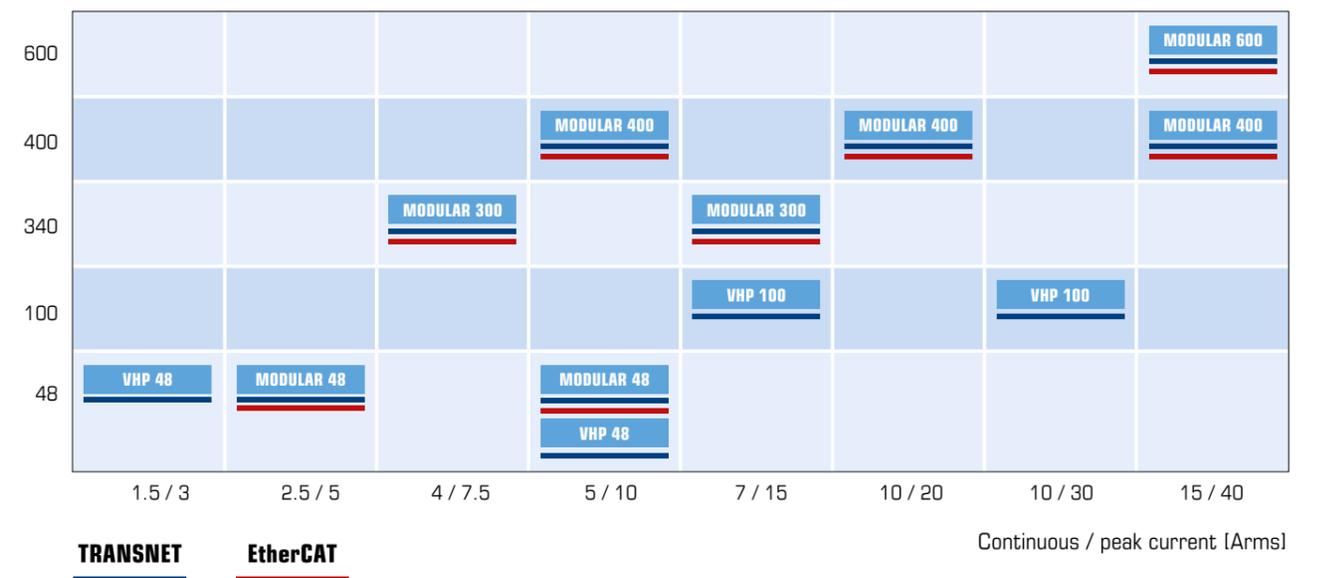
ETEL develops functions that are continuously setting the next milestones in motion control. In fact, with the **Fast Trigger** feature, ACCURET controllers can react to a real position crossing event in 1D or 2D within a few nanoseconds. This opens new possibilities at the machine control level.

Last but not least, ETEL **Force Control** algorithm is the flagship of advanced software features. With zero stop time and millinewton accuracy levels, accurate placement with force control can be performed at the highest ever throughput and with a precision never achieved till now.

## POWER RANGE

ACCURET position controllers are available in multiple power ranges to best suit the application requirements and always minimize the required space. The commissioning and programming of the different versions is kept unchanged no matter the ACCURET version. This allows easy upgrade and modularity of the customer's machine variants.

Max. DC bus voltage [V]



## SOFTWARE ENVIRONMENT

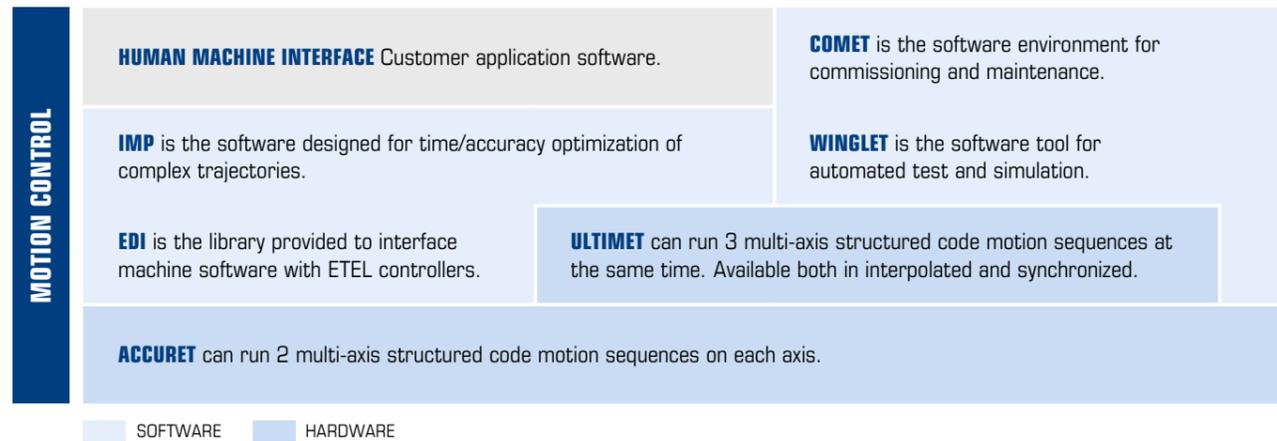


### ETEL motion control architecture: access to various levels for optimal performance

ETEL motion control architecture provides different levels of access, from motion sequences embedded in the controller to EDI (ETEL Device Interface) software library to interact with ETEL controllers from the machine PC. In parallel, ETEL provides:

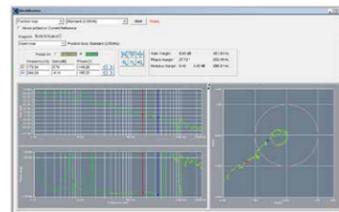
- COMET, a commissioning software to enable a user-friendly access to the controller fine tuning and for monitoring the machine status and performance.
- WINGLET, a powerful software tool for automated test and simulation.
- IMP (Interpolated Motion planning), a trajectory generation and execution library.

A very flexible and powerful structured programming language including mathematical functions (logic, arithmetic, trigonometric, etc.) has been designed so the user can run any kind of motion sequence directly on the ULTIMET or ACCURET controllers.



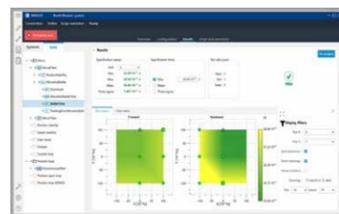
### COMET

COMET is a user friendly interface for commissioning, tuning and maintenance with ETEL controlled equipment. Thanks to COMET, the user can fine tune the extensive set of regulation parameters ETEL controllers provide. Additional tools to observe the overall machine static and dynamic behavior are made available through COMET to help in the development phase. As a result, machine performance and proper robustness can be ensured from day-one.



### WINGLET

WINGLET is a PC based software that brings an additional layer of capabilities in machine fine tuning and qualification of performance. It addresses a wide range of users active anywhere along the path that starts at design phase in R&D and ends at the end-user's equipment. From a pure machine performance enabler, WINGLET also brings significant benefits to automated testing procedures at OEMs' production floor, as well as it helps streamline field services interventions and troubleshooting. WINGLET can benefit each of these parties by shortening design phases and increasing machine performance level, ensuring robustness and repeatability in equipment manufacturing and providing fast and precise machine diagnostics.



### ETEL Device Interface (EDI)

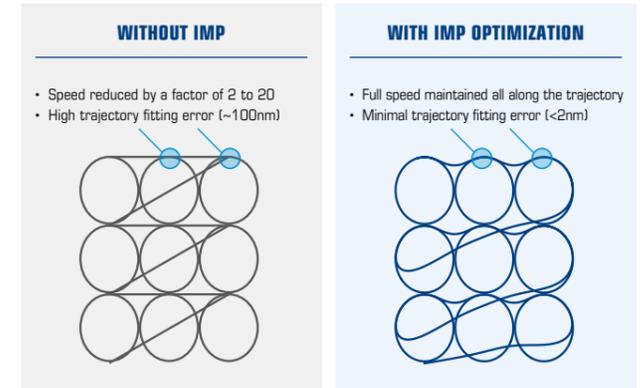
ETEL Device Interface (EDI) is a library which enables the communication between ETEL's motion control system and customer's application. By providing all necessary commands directly into the user's code, the communication to ETEL devices can be fully embedded and time optimized no matter what interface is used to communicate with the devices (USB, TCP/IP, PCIe, etc.).

### IMP

The Interpolated Motion Planning (IMP) is a trajectory optimization library that greatly improves throughput and precision of some specific processes such as laser processes or fast dispensing systems to name but a few.

The gain in time is obtained by pre-processing the optimal trajectory while staying within user defined boundaries and automatically optimizing the transition from one pattern to the next.

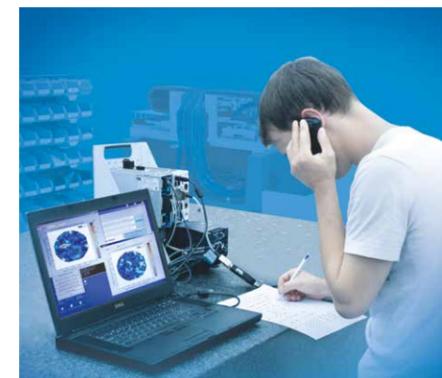
Using IMP for trajectory generation can lead to unprecedented increased throughput without compromise on accuracy.



## TRAINING AND SUPPORT

### High level competences

Customer satisfaction is crucial to us. ETEL not only focuses on supplying reliable products, but also on offering high quality support. In order to better serve its customers, ETEL developed a variety of competences allowing ETEL to propose the appropriate skills depending on machine builders support requirements:



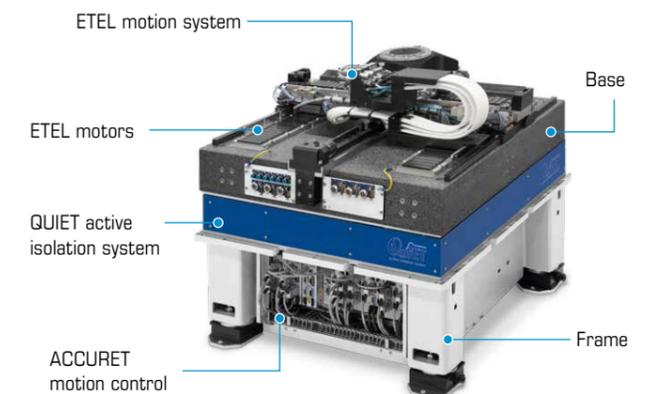
- ETEL's hotline is operated by qualified engineers having detailed product knowledge, not only on motion controllers, but also on direct drive motors and systems, which is critical to provide efficient service. Moreover, on-site support can also be organized whenever it is required.
- ETEL organizes standard or customized training courses on request at its facilities in Switzerland or in regional subsidiaries as ETEL is part of the HEIDENHAIN group. These training courses are conducted by motion control and direct drive specialists.
- OEMs and standard machine builders may require help integrating ETEL products in their machine. Application engineers can specifically focus on their application to get the best outcome.
- We reach nanometer stability on several hundreds of machines a year. Our mechatronic experts can provide valuable help in your machine and motion control optimization.

## INTEGRATED SOLUTION

ETEL is pushing one step further its Integrated Solution strategy.

From now on, an advanced motion platform from ETEL does not only include the advanced motion system and its associated state-of-the-art motion controllers, but can also benefit from ETEL's proprietary active isolation system.

This makes ETEL the only motion system supplier able to cover such a wide scope of supply.





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