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AUTOMATION TECHNOLOGY

**Powerful and Energy Efficient—
The ARATEC® Positioning Solution System**

ARATEC® increases the productivity of existing installations and is an advanced positioning solution for new applications





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A Powerful Replacement for Modernizations

AND AN IDEAL SOLUTION FOR NEW INSTALLATIONS



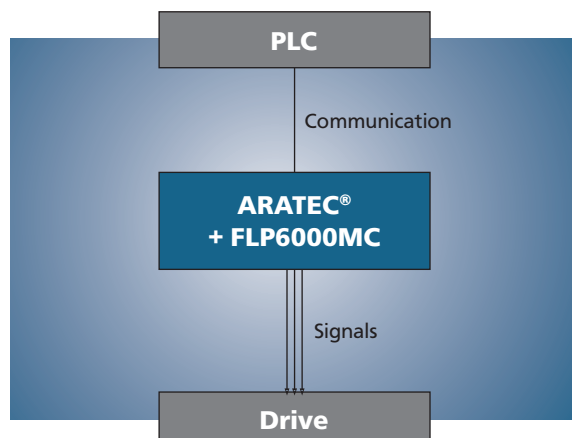
Advanced industrial control and positioning system for material handling in automated storage facilities.

ARATEC® is the leading solution for industrial positioning. A common application for the positioning system includes fully automated high-bay warehouses. The system instructs stacker cranes to move to warehouse target coordinates and ensures that storage and retrieval tasks are carried out with high precision. Our experts developed ARATEC® to offer positioning solutions tailored to the clients' needs and to simplify the integration of next-generation positioning technology into existing installations.



ARATEC® sample applications include hoists, crane systems, conveyor systems, shuttle cars, freight elevators and other industrial vehicles.

Complete Replacement/Upgrade for Conventional Positioning Systems



Advantages of ARATEC® vs. Traditional Positioning Systems

- >> Optimum integration guarantees an easy modernization of existing positioning systems.
- >> Easy to operate; no programming skills required.
- >> No separate setup software required (software access via web-based interface).
- >> Practically maintenance-free; the modular design enables quick and easy service and replacement of parts.
- >> Leading innovation and technology companies, such as SKF and Volkswagen, rely on PSI Technics.
- >> Fast computation cycles commands are executed at a rate of 1 millisecond.
- >> Fully automatic machine modeling—the system automatically determines the ideal control and positioning parameters for machine, drive and load.
- >> The self-learning characterization software determines the ideal travel profile and automatically detects control parameters.
- >> No creeping speeds.
- >> Stable control system: no unnecessary filters or dampening parameters required.
- >> Prevents interferences and failures from beam breaks, oscillations and motor failures during operation.
- >> Significantly reduces material wear.

Ideal Features

SIGNIFICANT COST SAVINGS POTENTIAL

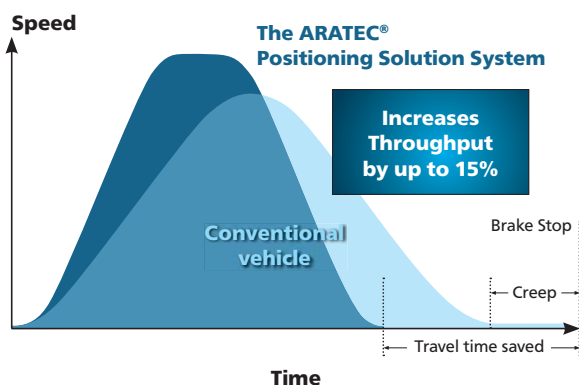


The features of the ARATEC® Positioning Solution System are not limited to distance measurement, but comprise time-optimized process control and positioning.

The ARATEC® Positioning Solution System uses maximum acceleration and velocity as well as the required traveling distance to compute individual travel profiles. In addition, motion paths are optimized and automated warehouse storage and retrieval tasks can be completed in the shortest amount of time. Dynamic parameters ensure that acceleration, velocity and positioning tolerances are adjusted while the vehicle is en route to its destination.

Due to its diverse set of features, ARATEC® takes on other popular positioning systems and significantly exceeds alternative positioning solutions such as PLC- or drive-based positioning systems. Two key features of the positioning system, however, leave the leading standard far behind: What the competition promotes as product advantages merely constitutes the foundation of ARATEC®.

ARATEC® Time Savings during Short Movements vs. Traditional Positioning Systems



The first of these key features is **ideal machine modeling**. This means that the positioning system ARATEC® completely adjusts not only to the motor drive, but to the machine itself. Where traditional systems solely adapt to the motor drive, ARATEC® models and attunes to all mechanical components. The positioning system analyzes machine behavior to such an extent that it can perform a characterization for virtually any type of machine. ARATEC® simulates the machine profile during the entire characterization process, and compensates for machine oscillations.

>> *The system considerably improves positioning precision.*

Fast and easy integration is the system's second key feature. The ARATEC® Positioning Solution System is a stand-alone digital control system. Once ARATEC® has been integrated into the application and communicates with process computers and storage management systems, it starts executing process and storage management command chains. All components communicate either via serial protocols or data highway. ARATEC® controls the motor drive by transmitting set point values to the converter via analog voltage, analog power or Fieldbus.

Unlike other positioning systems, ARATEC® is compatible with all motor drives. The system uses cutting-edge optical distance meters, encoders or barcode systems to determine the measurement values for set point control.

>> *The system eliminates interdependencies between process control and positioning systems.*

Increased Efficiency THROUGH RETROFITTING



Progress in Positioning Technology has a Name: ARATEC®

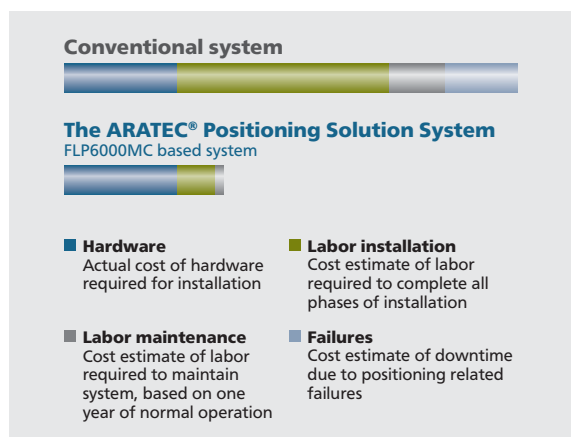
Since the ARATEC® Positioning Solution System eliminates interdependencies, it is ideal for easy system integration. ARATEC® can be implemented into **new and existing installations** from all PLC and drive manufacturers and works with all types of motor drives and controllers. It also works with older installations that use DC converters. The positioning system, therefore, enables the continued use of existing components such as PLC's, converters and motor drives after retrofitting, providing considerable benefits and cost-savings to the customer.

Once the system has been prepared for retrofitting, such as after a thorough inspection of the existing facility, the retrofitting process only takes two to three days and can actually be done over a weekend. Under ideal conditions, a standard configuration can be implemented in as little as two days.

Failure detection is another vital advantage of the ARATEC® Positioning Solution System. Signal disruptions, such as beam breaks, are compensated in a timely manner, and the corresponding data will be saved in the diagnostic storage over a period of several months. Thanks to detailed error analysis, failure messages and warnings are easily determined and understood. Thus, gear play, cable stretching, slips, delays, oscillations, beam breaks and temporary interruptions of the distance meter signal can be detected and analyzed. By prematurely detecting and intercepting oscillations or shifts in direction, ARATEC® enhances installation safety.

Customers benefit from these key ARATEC® differentiators through a significant **savings potential**. The ARATEC® Positioning Solution System's inherent time-optimization functionality substantially enhances productivity and throughput. In addition, the system extends the facility's lifespan, expands product life cycles and cuts production costs.

System Cost Analysis



The ARATEC® Positioning Solution System combines optimization functionalities and cuts energy costs:

- >> System independent
- >> Inherent time-optimization functionality
- >> Increased throughput
- >> Faster storage and retrieval cycles
- >> Optimized travel profile reduces wear and tear
- >> Extended product life
- >> Reduced production costs
- >> Increased energy efficiency

Innovative Technology

ENSURES SYSTEM RELIABILITY AND EASE OF USE



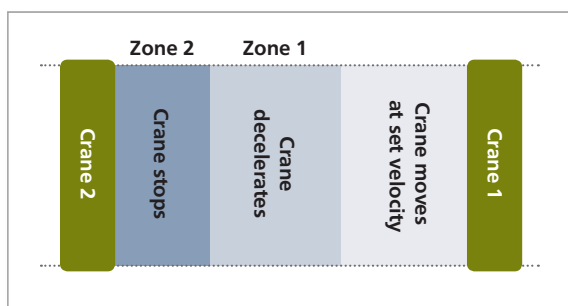
Optional add-ons for
the ARATEC® Positioning
Solution System



Collision Avoidance

When several machines are operated on the same tracks, avoiding collisions between two industrial vehicles, such as stacker cranes, is crucial. ARATEC® provides an easy way of integrating collision avoidance into your system. The collision avoidance feature can be conveniently configured for individual applications using the ARATEC® web interface. The system can, for example, be customized by including a sensor that triggers a digital signal whenever a safe distance threshold is exceeded, so that the vehicle either stops or decelerates. In addition, signals from an absolute encoder can be used to trigger certain actions, for example, the velocity can be reduced or acceleration ramps can be changed at pre-defined distances.

The distance to a second crane or vehicle can be divided into two distinct safety zones. If the distance between the vehicles is greater than the defined zone limits, the cranes move at the set velocity. If, for example, crane 1 enters zone 1 in relation to crane 2, crane 1 decelerates. If crane 1 subsequently reaches zone 2, it will be stopped. The ARATEC® Positioning Solution System then either instructs the vehicle to move in the opposite direction or it will hold the vehicle in position until the crane 2 leaves the boundaries of zone 2. The graphic below illustrates the collision avoidance feature.



DCC for Manual Control

ARATEC®'s digital command control (DCC) enables BUS communication and can be used for parallel digital signal transmission that enables manual control, for example, for troubleshooting.

Digital command control is based on a communication method that uses digital inputs. The digital inputs can be used to enable or disable manual control during regular operation to determine the travel direction and to select up to 6 different velocity levels. In addition, different acceleration levels can be selected for accelerating, decelerating or stopping the vehicle. Manual control parameters are configured via the ARATEC® web interface.

When digital command control is disabled the system operates in automatic mode and transmits the travel commands sent by the PLC. When digital command control is enabled commands from the PLC will be ignored and the system can only be operated manually.

Moreover, digital command control can be used to implement efficient positioning control for existing installations that currently rely on digital signal transmission alone.

Collision avoidance: The system detects when a vehicles enters a safety zone.



Advanced Skew Control Software INCREASES CRANE PERFORMANCE



Optional add-on for
the ARATEC® Positioning
Solution System



**PSI Technics' FLP6000ASC
(ASC = Advanced Skew Control)**
**The FLP6000ASC add-on software for
the ARATEC® Positioning Solution Sys-
tem is an extremely accurate position-
ing solution that eliminates skew.**

The FLP6000ASC controls logistics vehicles by using two independent drives for bridge cranes and, in part, for stacker cranes (lifting table). It comprises skew control as well as an optional trolley and hoist control.

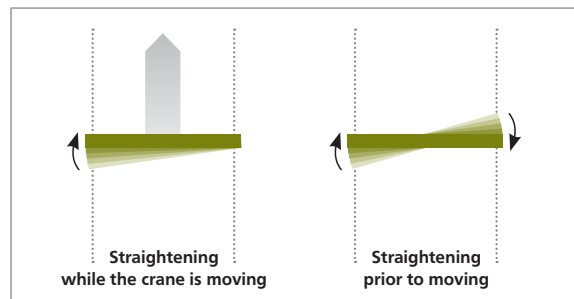
The linear control features lessen wear and dampen load vibrations, preventing or reducing undesired oscillations to a minimum. Skew caused by friction or the slipping of a single axis, uneven loads, load changes or wear of drive wheel rails increases the machine's rate of wear.

The FLP6000ASC add-on for the ARATEC® Positioning Solution System ensures accurate positioning in the shortest possible time, simultaneously reducing facility wear, because it not only guarantees a synchronized motor operation but also a straight, consistent movement of the bridge.

Bridge Crane Alignment

The FLP6000ASC can adjust the skewing of bridge cranes prior to crane operation or while the crane is en route to its destination. For particular applications, deliberate skewing can be introduced.

Example: A bridge crane lowers steel plates onto a production line that is positioned diagonally to the crane path. In this case, skewing can be introduced to ensure that the crane is moving parallel to the production line and lowers the plates at the correct angle. This can be defined in the vehicle's motion path profile.



YOUR ADVANTAGES:

- >> Compensates for and eliminates skew by adapting motion path planning while the machine is moving
- >> Fast, integrated closed-loop positioning
- >> Additional trolley or hoist positioning
- >> Reduced facility wear
- >> Extremely fail-safe system
- >> Communication protocols: ASCII, Modbus, DF 1, Profibus, Profinet, DeviceNet
- >> Industry-standard components





Aside from the FLP6000ASC, the complete **system configuration** includes two distance meters that are used as absolute measuring systems and are installed on each crane axis. The FLP6000ASC controls the independent motor and gear components of each axis. The FLP6000ASC thus enables the synchronized operation of both absolute encoders, eliminating accidental sampling-related skewing.

The axis retains the proper adjustment during all stages of movement. The FLP6000ASC can even eliminate manually introduced skewing by straightening the bridge.

Improved Solution for New and Existing Installations

The positioning system ARATEC® is an ideal replacement for existing PLC- or drive-based applications and fine-tunes skew control in industrial facilities.

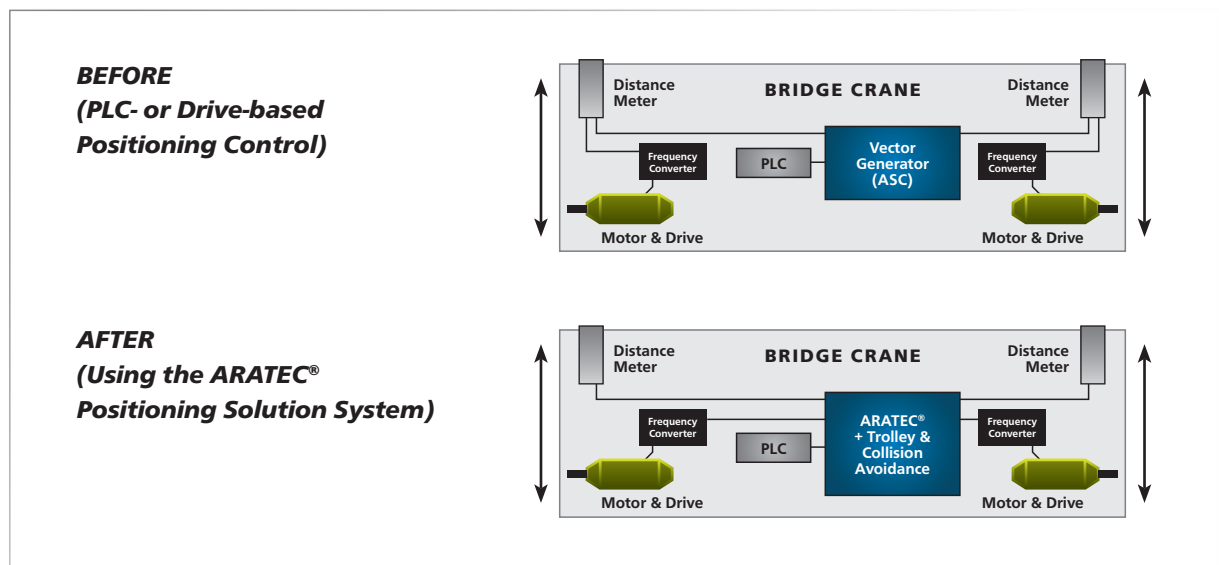


Sample Application

Long-span bridge cranes used in the aluminum and steel industries.

Improved Positioning:

- >> Travel distances up to 800 m
- >> Maximum velocity up to 8 m/s
- >> Maximum acceleration up to 10 m/s²



Tandem Operation

INCREASES THE CAPACITY OF YOUR CRANE



Optional add-on for
the ARATEC® Positioning
Solution System



PSI Technics' Tandem Operation

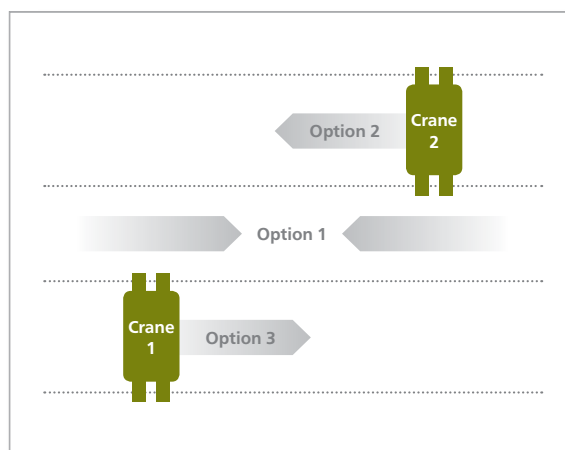
Tandem operation increases the capacity and the operating efficiency of cranes or trolleys.

The tandem operation add-on enables two independently driven cranes to work in unison.

A single crane that transports unusually long goods can quickly reach the available space limits as well as its rated load capacity. Using the tandem operation functionality from PSI Technics, two cranes or trolleys can transport certain goods like a single machine and the permissible skew is freely configurable.

Available for all crane installations – the coupling mode is freely configurable

The tandem operation add-on can be tailored to your requirements – for maximum safety and production flexibility.



Advanced skew control during tandem operation – YOUR ADVANTAGES:

- >> Increases the capacity of cranes beyond the rated load.
- >> The system can flexibly switch from single axis to tandem mode during regular operation.
- >> Increased profitability due to a more efficient use of personnel resources.
- >> Optimized use of existing crane installations.

- Option 3
Master mode: The master crane moves to the position of the subordinate crane.
- Option 2
Subordinate mode: The subordinate crane moves to the position of the master crane.
- Option 1
Master-Subordinate mode: Both cranes move to a predefined position.

The tandem operation of cranes and trolleys increases the functionality and the operating efficiency of your installation by providing excellent system reliability, an optimized travel profile and by minimizing wear and tear.

The Energy Optimizing Software EXTENDS THE LIFESPAN OF INDUSTRIAL FACILITIES



Optional add-on for
the ARATEC® Positioning
Solution System



PSI Technics' FLP6000EOS

Industrial conveyor systems, such as stacker cranes, hoists, overhead cranes, shuttles or elevators, incur operating costs on a regular basis. To keep those expenses at a minimum and to enable plant operators to leverage the benefits of potential savings, PSI Technics developed the Energy Optimizing Software FLP6000EOS for the ARATEC® Positioning Solution System.

FLP6000EOS was specifically developed for systems with multiple axes and is available as an optional add-on for the ARATEC® Positioning Solution System.

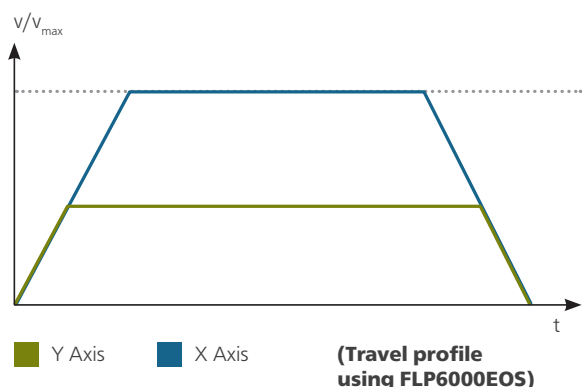
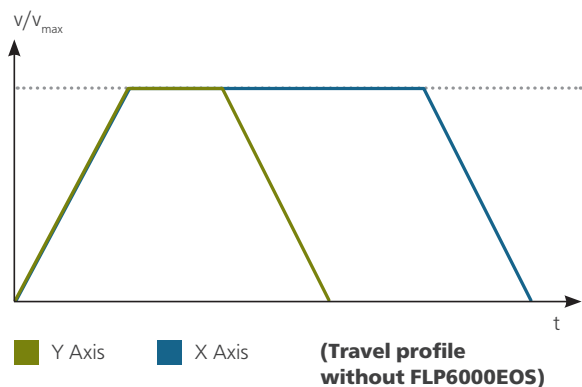
ARATEC® provides time-optimized controls that enable logistic facilities to operate at maximum capacity. FLP6000EOS enables you to precisely reduce operating expenses to achieve optimum positioning performance.

YOUR ADVANTAGES:

- >> Reduces the amperage by up to 30%
- >> Optimized energy consumption
- >> Saves energy by reducing braking and acceleration ramps
- >> Reduces mechanical wear and power consumption
- >> Extends the facility's life span
- >> Easy to operate;
no programming skills required
- >> No additional setup software required

Increased Motion Path Efficiency

Conventional travel profile $v(t)$ for both axes. After the FLP6000EOS calculates and optimizes the travel profile, the y axis' final speed can be reduced to less than half of v_{max} . The maximum power input for this travel profile is reduced by 30%.



The FLP6000EOS module considerably increases positioning efficiency, saves energy as well as maintenance costs, not only contributing to an increased life span of industrial facilities, but also ensuring a fast return on investment.

Service and Maintenance

POWERFUL PERFORMANCE

We provide you with the most efficient and optimized solutions for your business.



Our Commitment to Our Customers

PSI Technics' approach to modernizing logistics applications is to diagnose before prescribing. To accomplish this, we recommend starting every project with a detailed site audit to better understand the existing application and determine opportunities for enhanced efficiency, improved safety, increased throughput and energy savings through the use of the ARATEC® Positioning Solution System and accompanying intelligent software.

This emphasizes our commitment to provide added value and increased benefits to our customers.

Identifying optimization potential, analyzing and eliminating motion-related weak spots

PSI Technics analyzes the baseline performance of your machines to determine the potential for optimization and reducing energy consumption. **PSI Technics' FLP6000MA Motion Analyzing Software** provides a comprehensive analysis of the system performance and identifies issues that can impact performance.

PSI Technics then delivers a comprehensive report that details suggestions for replacing weak system components, considerations for changing machine parameters for improved operation and throughput, and an energy consumption analysis that identifies any opportunities to reduce energy usage and cost within the application.

PSI Technics' Service during Retrofitting

- >> Spare parts and rental equipment during retrofitting (as quantities permit)
- >> Inquiries to our PSI Technics hotline will be handled with priority
- >> On-site system and installation check
- >> On-site service
- >> Guaranteed support, 24 hours a day, 7 days a week
- >> Repair and maintenance services

PSI Technics is your reliable factory automation partner for new installations, optimization, modernization and retrofitting.

- >> Would you like to receive additional information regarding service and maintenance for existing systems?
- >> Would you like to take advantage of the benefits our modern Positioning Solution System has to offer?
- >> Are you looking for a fast, easy and cost-efficient transition?

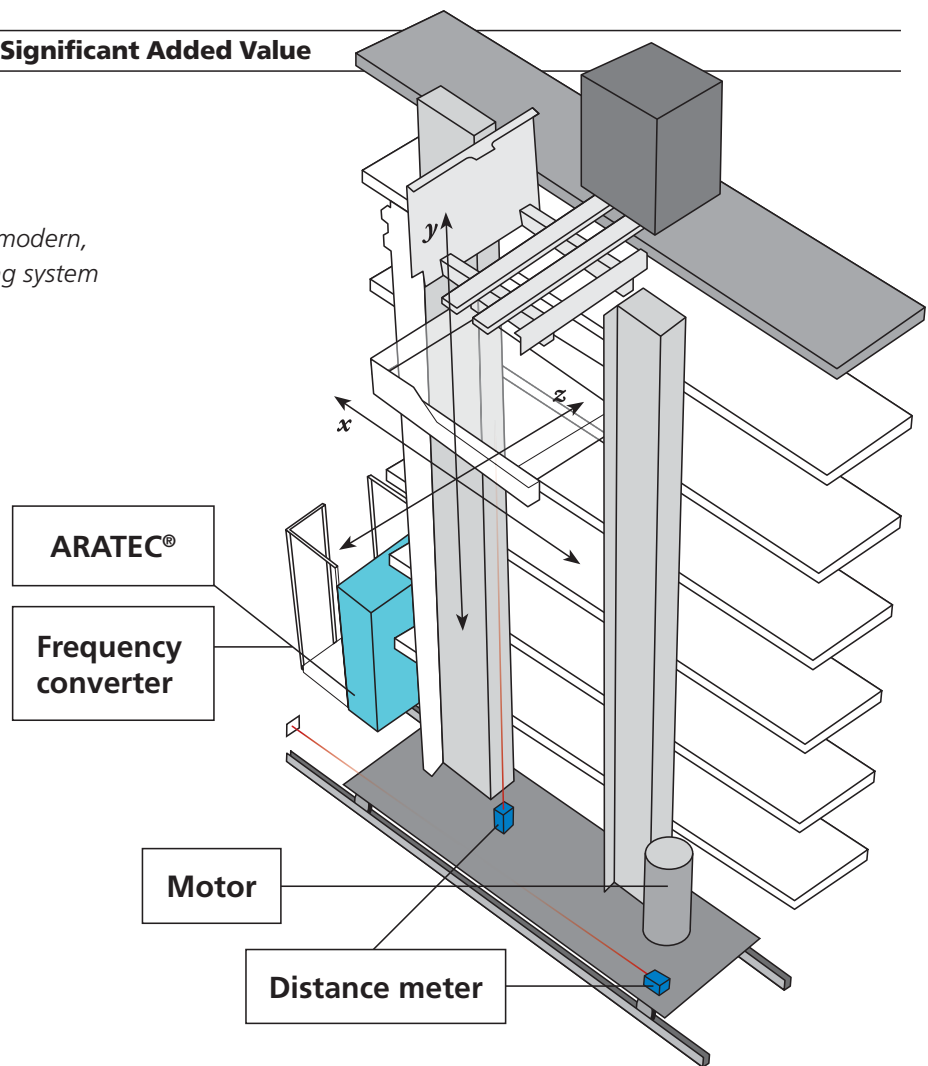
Our product experts provide free and knowledgeable advice tailored to your needs.

Hardware SCHEMATICS



A System that Provides Significant Added Value

Figure:
Typical schematic view of a modern,
closed-loop-based positioning system



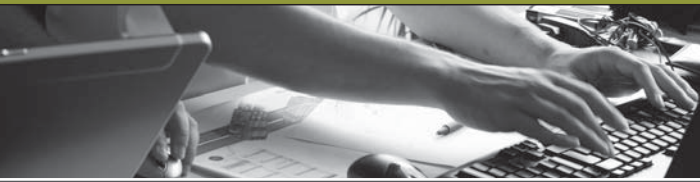
Advantages of Dynamic Control Loops

- >> Centralized control (a single unit can be used for multiple axes)
- >> Axis-dependent control ensures efficient operation of multiple axes
- >> Parameters are determined for the entire facility
- >> Definition of time-optimized paths

THE RESULT:
Considerable
energy savings

Hardware Specifications

FOR FAST AND EASY RETROFITTING



The control unit is ready for use. It includes:

Industrial specifications:

Onboard

- >> Separate, opto-isolated I/O
- >> Server monitoring (heartbeat), relay output

I/O Modules (optional)

- >> Module with 1, 2, 4 or 8 channels
- >> Digital and analog I/O modules, SSI module
- >> Communication modules, e.g. RS232, RS485
- >> 0°C to +55°C (32°F to 131°F)

Fieldbus

- >> Modbus RTU
- >> Modbus TCP
- >> DF 1
- >> ASCII
- >> Profibus DP Slave
- >> ProfiNet Device
- >> CANopen
- >> DeviceNet

Rugged Design

- >> EMC class B
- >> Passive cooling
- >> Soldered components
- >> No rotating mass storage

Embedded Real-Time Operating System

- >> Remote OS updates

Technical specifications:

Computer

- >> Processor: Coretex A8, 600MHz

Memory

- >> RAM 256MB
- >> Internal CF storage 256MB
- >> SD Memory Card 2GB

Environmental

- Power supply: nom. 24 VDC (-25% / +30%), 14W
- Housing: Thermoplastic polymer (PC), passive cooling, without fans
- Mounting system: DIN Rail TS 35
- Operating temperature: 0°C to +55°C (32°F to 131°F)
- Certification: CE, IP20, UL508, EMC immunity of interference acc. to EN 61000-6-2: 2005, EMC emission of interference acc. to EN 61000-6-3: 2007 + A1: 2011
- Weight: 0.55 lb (250 g)

Dimensions

- (W x H x D): 4.409 x 2.559 x 3.937 in / 112 x 65 x 100 mm (one I/O module); 7.716 x 2.559 x 3.937 in / 196 x 65 x 100 mm (1 axis, 8 I/O modules); 9.606 x 2.559 x 3.937 in / 244 x 65 x 100 mm (2 axes, 12 I/O modules); 11.968 x 2.559 x 3.937 in / 304 x 65 x 100 mm (3 axes, 17 I/O modules)

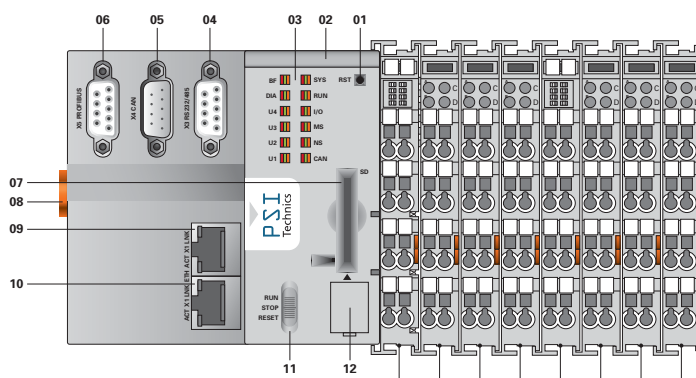


The positioning system ARATEC® consists of the following components:

- >> Control unit
- >> FLP6000MC software
- >> Appropriate distance meter (e.g. laser distance meter, absolute encoder, barcode reader)
- >> Optional add-ons:
 - Advanced Oscillation Control FLP6000AOC
 - FLP6000ASC Advanced Skew Control Software
 - Tandem Operation of cranes or trolleys
 - FLP6000MA Motion Analyzing Software
 - FLP6000EOS Energy Optimizing Software

Hardware Configuration

FOR MACHINES WITH UP TO THREE AXES



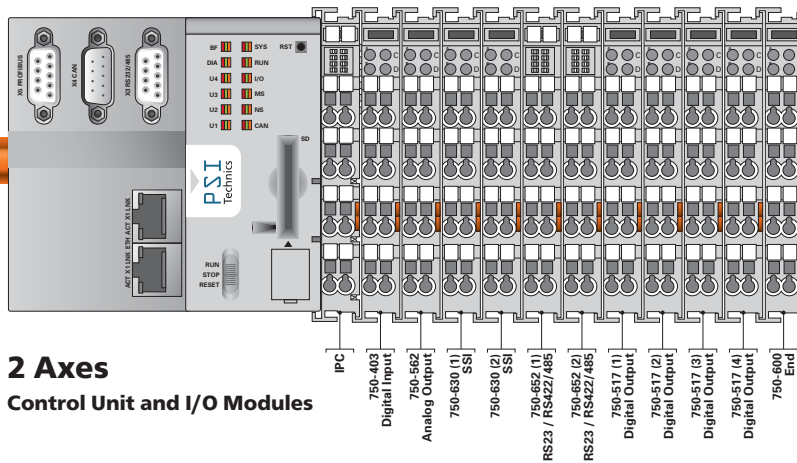
1 Axis
Control Unit and I/O Modules

- 01 - Reset button
- 02 - Marking option
- 03 - LED indicators – power supply
- 04 - Serial interface
- 05 - Fieldbus connection CAN, CANopen
- 06 - Fieldbus connection PROFIBUS
- 07 - Slot for memory card
- 08 - Safe locking feature
- 09 - Ethernet connection RJ-45
- 10 - Ethernet connection RJ-45
- 11 - Mode selector switch
- 12 - Service interface

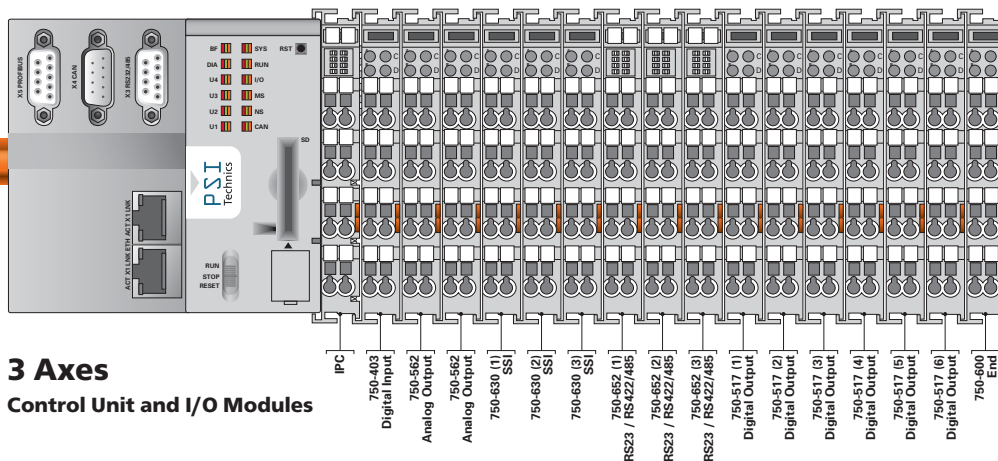
ARATEC® can be used with a multiplicity of distance meters., e. g.:

DME 4000 / 5000, DME 3000, DL50 Hi, DL100 Hi, LE 200, AMS 200, BPS 8 / 34 / 37, VDM100, ATM60

The distance meter is connected to the SSI module, e.g. laser or infrared distance meter, absolute encoder



2 Axes
Control Unit and I/O Modules



3 Axes
Control Unit and I/O Modules



www.psi-technics.com/E

Awards and memberships:



Important FLP6000MC Information

Please note that the FLP6000MC software can only be ordered in combination with the ARATEC® Positioning Solution System hardware, because the installation of a runtime license is required. The software can not be ordered separately or at a later date.

To download product manuals and additional information please visit the PSI Technics website at:

www.psi-technics.com/E.

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