



SiWays® Spider D3-1100 R

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CONTENTS

Ways to improve efficiency	4
The SiWays [®] Spider	5
Load influence	6
Trace Optimization	7
Effector	7
Advantages	8
Low cost.....	8
Safety Standards.....	9
Simotion	9
Service and maintenance	10

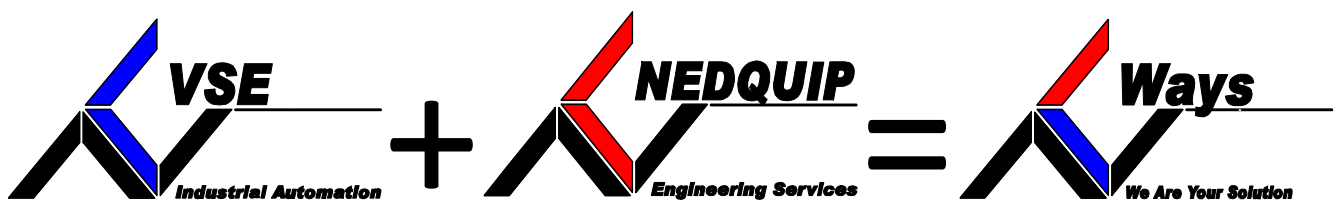
Ways to improve efficiency

Ways (We Are Your Solution) is the common denominator under which VSE Industrial Automation and NedQuip Engineering Services work together. Apply servo Technology effectively to existing machinery when a new machine concept has to be developed. The functionality of the existing mechanical components should be incorporated into the software of a motion controller. As much as possible mechanical axes are replaced with electrical. What is left is reduced to the minimum of mechanics. While inertia is minimized by eliminating mechanics, flexibility is maximized by creating adaptable software.

To achieve such functionality both mechanical engineering and software engineering are indispensable. Ways integrates these disciplines under one roof: VSE and NedQuip are located in the same building and together develop unique concepts under the Ways umbrella. For the customer this means twice the expertise and one solution partner.

The prefix 'Si' refers to the Siemens components used in the SiWays[®] Spider. The SiWays[®] Spider is equipped with Siemens Sinamics drives and Simotion Motion Controllers.

The SiWays[®] Spider compared to other Delta-Concepts is more flexible and can completely be tuned to the payload's weight, required precision and speed. In addition the SiWays[®] Spider is much lighter and cost effective. In comparison: For 20% of the cost the SiWays[®] Spider offers 80% of the performance found in comparable pick and place robots. Of course cost depends on functionality and chosen parts. SiWays[®] vision to adapt every robot individually to meet the specific needs will attract companies in search of maximum automation at minimal cost.

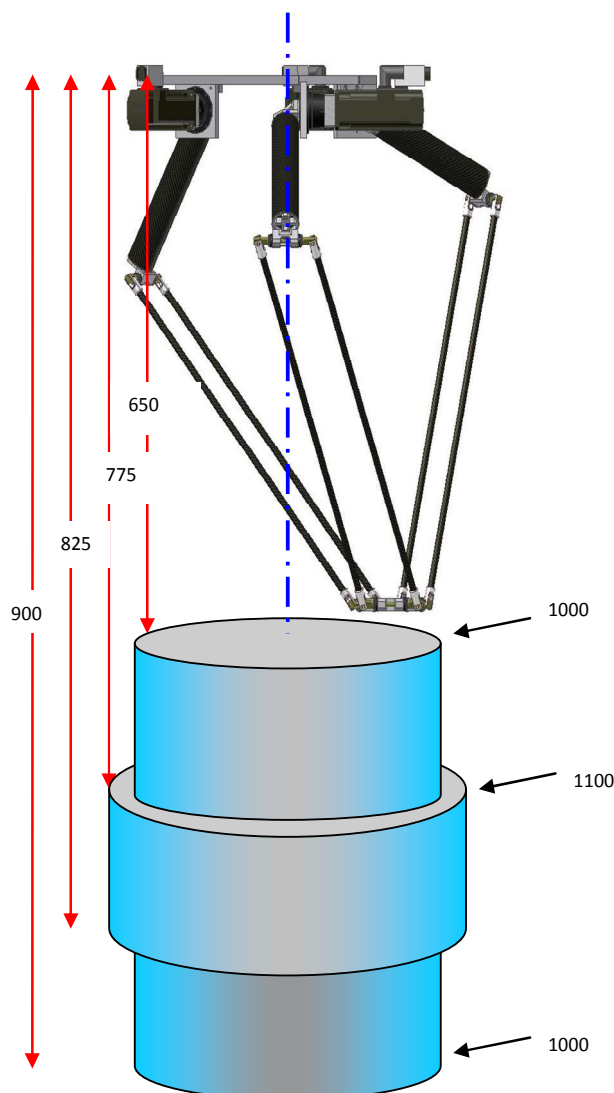


The SiWays® Spider

The SiWays® Spider is an excellent device for handling lightweight objects in large quantities. The Spider consists of a 3 or 4-axes industrial robot in a modular design. The Spider is specially designed for industries with a great need of flexible automation, such as pick and place operations and assembly. The robot is available in a variety of versions, depending on the working area needed. SiWays® will adjust the length of the Spider's arms. SiWays® has developed a spider with a 4th rotational axle, the R version.

The size of the cylindrical workspace is determined by only the length of the upper- and lower arms of the Spider. These are tailor made from standard tubes of fiber reinforced carbon. The drive- and control components are from the standard program of Siemens. This standard program is broad enough to guarantee the best selection for every application. For the drive section the Sinamics 1FK7 series was selected. This motor family contains a variety of motors with different speeds, dynamics, powers and admissible overloads. Also from this range certified motors are available for use in the food industry.

Working area of the SiWays® Spider D3-1100

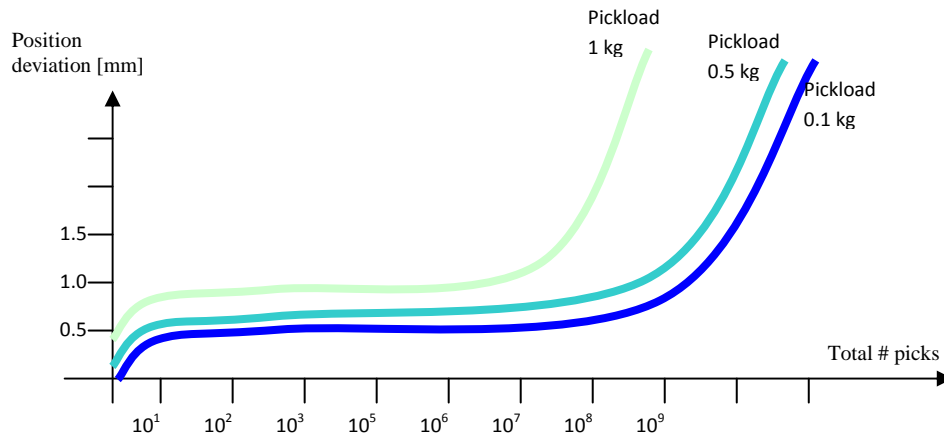


The Spider is the ideal solution for precision pick and place movements at high speed. Operating speeds in excess of 140 picks per minute allow conveyor belts moving at high speeds and result in handling more products per minute. The SiWays[®] Spider is manufactured using high quality combined radial plus axial bearings pairing high performance bearing material to specially coated aluminum shafts. Lightweight carbon fiber parts are used where possible. This results in low maintenance and wear and tear.

Load influence

The load influence is illustrated below and shows that external influences determine much of the performance. Therefore it is of no interest to the end user what maximum speed or acceleration the platform theoretically can achieve without a load. We think most important is the actual number of products the SiWays[®] Spider can handle on location, with the actual product.

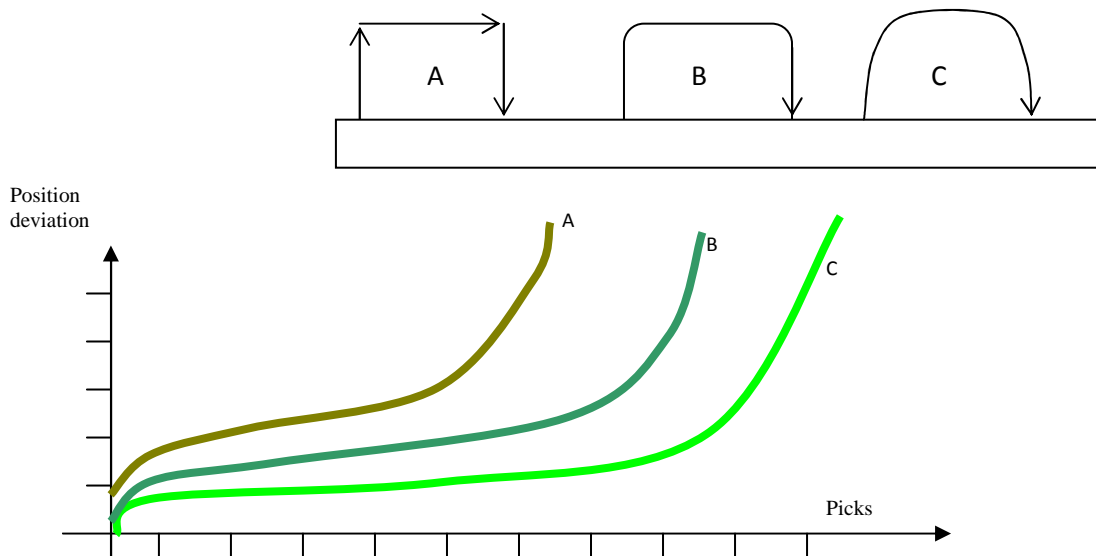
The effect of weight in a specific application shown in a graph.



The advantages of the used techniques ensure that quick revision and exchange of parts is easily achieved. The complete arms set of the Spider can be detached with 6 bolts and shipped to VSE where we will revise and renew the necessary parts before we will send the complete arms set in its own, specially designed canister.

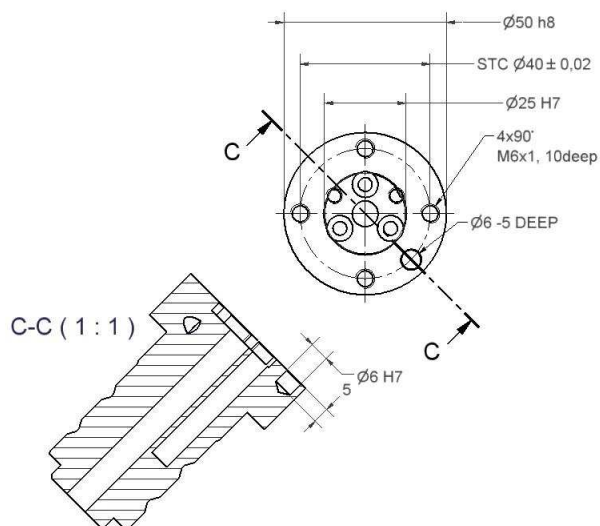
Trace Optimization

Through Trace optimization there is much to gain. By rounding the movements of the effector, stability increases and higher speeds are possible. This also results in lower noise levels and less wear and tear.



Effector

To handle the product an effector can be installed on the Spider's mounting flange. The effector including the payload must not exceed 1 kg. The used effector defines the use for the SiWays[®] Spider. There are grippers available, suckers for use with e.g. vegetables or meats and tools are also conceivable. The mounting flange for the effector is ISO 9409 compliant; if desirable the effector can be changed very easily.



Mounting flange

Advantages

In comparison to existing Delta Robots the SiWays[®] Spider is lighter, more flexible and tailor made to the weight of the product handled and the needed precision and speed of the application. The Spider is equipped with Siemens Sinamics drives and Simotion motion controllers. Combining the Spider with a vision system is relatively easy and communication over Ethernet ensures high speed data transfer. Unusual features of the Spider's construction are the joints on both ends of the parallelograms. Normally these joints are pushed together by springs causing high friction in the joints and restricting the acceleration of the arms. The Spiders upper arms can rotate beyond 90°; additionally guaranteeing a reliable link and therefore enhancing the positioning precision of the Spider, even with high acceleration of loads. This gives the SiWays[®] Spider advantage.

- Higher weight capacity at higher speeds
- Siemens totally integrated automation
- ISO 9409 standard gripper attachment
- Highly cost effective
- Conveyor synchronization
- Flexible solutions
- Fully customizable parts easily replaceable

VSE and NedQuip succeeded in integrating the SiWays[®] Spider into complete process lines. The advantage of one single control unit instead of a separate control for the robot and, for instance, conveyors or packaging units is revolutionary. The extra costs of having separate controls and realizing communication between different units in the process line is unnecessary.

Low cost

The SiWays[®] Spider can be produced at such low costs that applications can be met that previously were unavailable. Factors contributing to low cost are:

- The use of standard profiles of fiber reinforced carbon (CFRP) manufacturing the Spider's arms. (the arms dimensions can be customized to the customer's specification)
- Standard communication and control from one unit for a complete machine line.
- Fast and easy exchange of wear sensitive parts.
- The use of standard components (motors and control components by Siemens)

Parts are ordered directly from catalogues and waiting time for parts is drastically reduced. This means costs can be saved by the use of standard components in the SiWays[®] Spider. The amortization period for the Spider therefore is a fraction from normal.

Safety Standards

The SiWays[®] Spider conforms to EEC Standards Specified in the Machine Directives. The following standards are met:

- EN 292-1
- EN 292-2
- EN 954-1
- EN 60204
- IEC 204-1
- EN 775
- IEC 529
- EN 50081-2
- EN 50082-2

Safety was always a critical part in the development of the SiWays[®] Spider. Components are monitored continuously and the Spiders movements are shut down if one of the components fails.

With high quality components from Siemens and Wittenstein this will be highly improbable. The high torque, in line planetary gear heads are lubricated for life. Service or maintenance is not necessary. The Sinamics drives together with the Simotion System provide high accuracy and control. All moving components like arms and bearings are tested rigorously; the fiber reinforced carbon arms are stiff and light weight.

With every cycle start all systems are checked, should there be a malfunction in one of the systems the cycle will not start and the faulty system will be indentified. This complies with category 3 of EN 954-1.

Simotion

The control technology cost of the SiWays[®] Spider is reduced in many ways. As much as possible there was chosen for open, established and productive standards: the motion control system Simotion. Simotion couples excellent line dynamics to exact coordinated arm movements. With this system the movements of the robot can easily be synchronized with conveyor belts. The use of a simple encoder that communicates the position of the conveyor to the Simotion CPU is sufficient. Even at variable speeds the robots movements are synchronous with the conveyor. This makes the integration of the SiWays[®] Spider in, for instance, packaging processes extremely feasible.

The application software is standardized for all sizes and variations of the Spider. The kinematics, limits, maximum accelerations and speed are implemented into the software as parameters. Multiple tasks can be handled in one automation process reducing the amount of Simotion microprocessors needed with multiple Spiders in one process. This again reduces the cost per robot.

The Simotion control software offers the complete advantage of a totally integrated automation process. This means that the integration of a 3D-Vision system with product- and position recognition is relatively simple. Also 'Track & Trace' systems or quality guarantee through standard interfaces are implemented quite easily. Simotion also makes it possible to use a single control unit for the robot and the complete machine saving space, hardware and installation costs.

OMAC navigation structure

OMAC—Organization for Machine Automation and Control—is the global organization for automation and manufacturing professionals that is dedicated to supporting the machine automation and operational needs of manufacturing.

OMAC has about 500 members from end-user companies, OEM's, and technology providers and integrator companies. These members include companies with vested interest in developing and implementing open control technologies for manufacturing applications.

Using OMAC will ensure that operators are able to switch between OMAC based machines and control the interface using the same basic instructions.

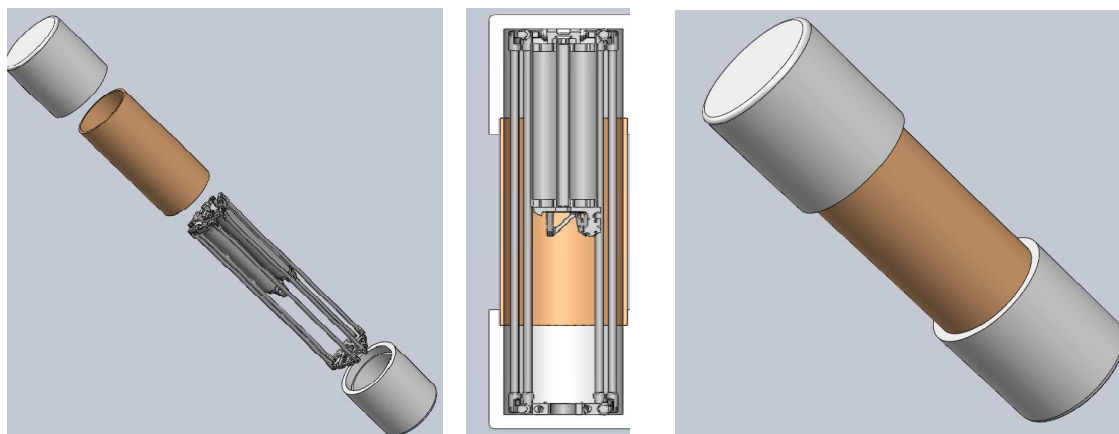
There are four basic modes in an OMAC navigation structure:

- Stop
- Automatic
- Manual
- Single-Step

Using the interface the operator can always switch between modes.

Service and maintenance

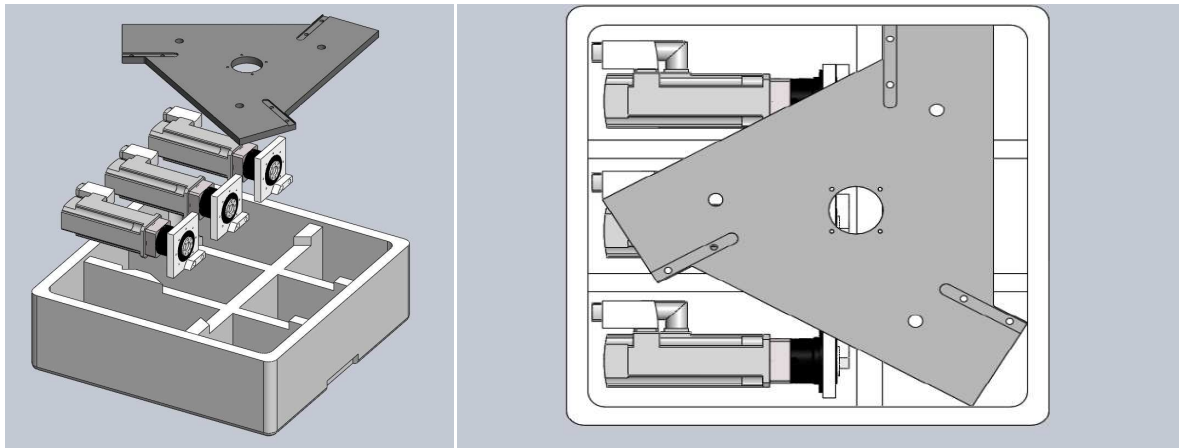
The SiWays[®] Spider distinguishes itself through low cost- and easy maintenance. Most of wear and tear appears in the moving parts, in this case the upper and lower arms with their bearings. Ways developed a delta picker robot with light weight carbon fiber arms. These arms can be shipped around the world in specially designed canisters. In case of bearing maintenance, our clients would have one set of arms in stock. They can exchange the arms as soon as bearing wear occurs to ensure maximum continuity, send the used set of arms to VSE where we will exchange bearings etc. After a complete check of the arms VSE will send the complete set back to the client where they will have a complete set in stock again.



The arms consist of carbon reinforced fiber tubes connected by light weight brackets to the gearboxes. The weight of the complete arms-set is 2500 gr.

The other moving parts are the drives and gear heads. The Wittenstein Alpha planetary gear heads are lubricated for life and need no maintenance. The Sinamics 1FK drives with integrated temperature sensors provide the highest degree of dynamic response for your process.

The complete drive-system with gear heads and mounting plates is also available for shipping in its own, specially designed transport box.



If a rotational axle is needed, VSE can also ship this lightweight package (2.58 kg.) including its own drive in a transport box.

