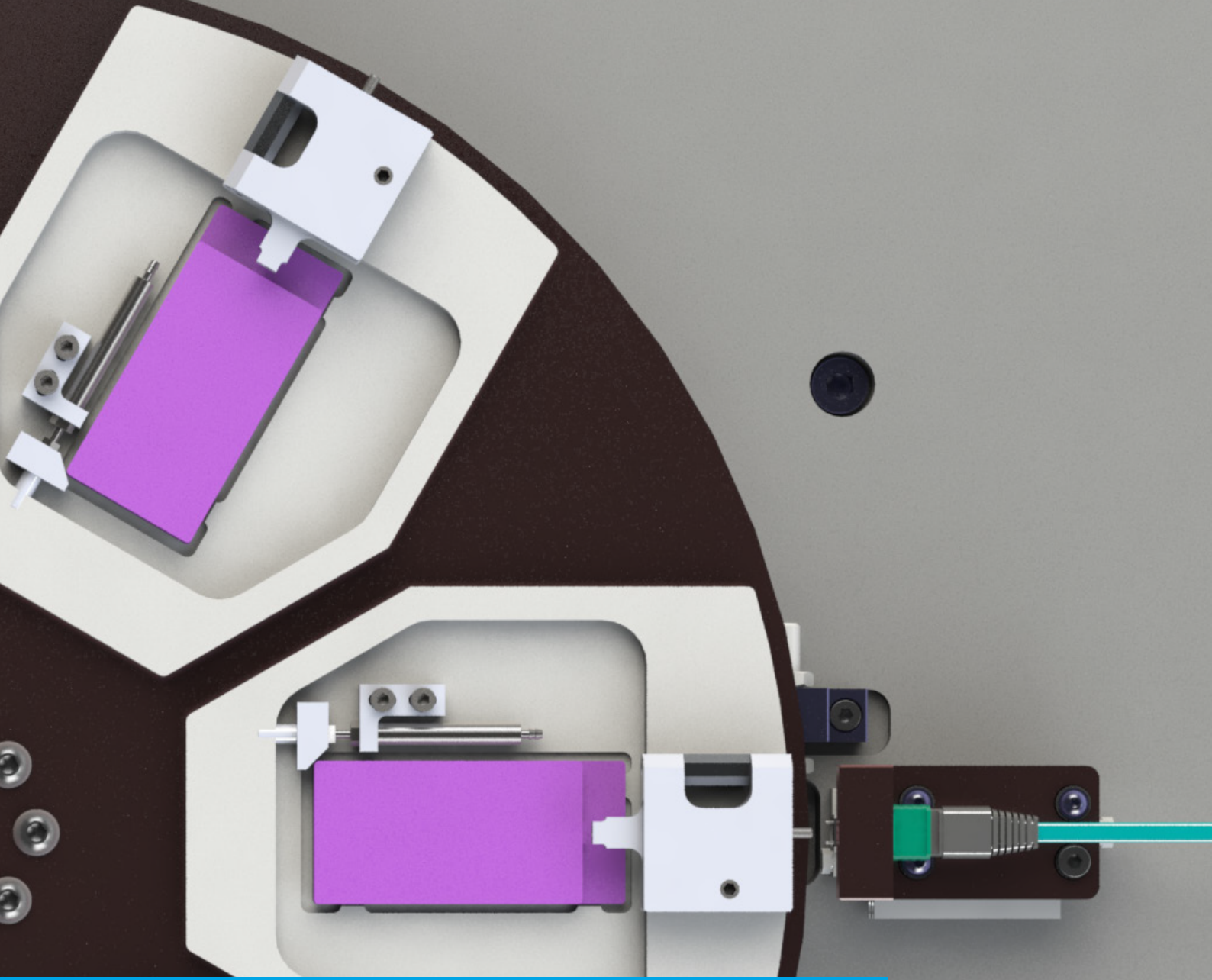


Etteplan Indigo Photonic Assembly Platform

A modular machine platform that enables a breakthrough in photonics assembly speed

Integrated photonics technology is the future. It transports data faster, over longer distances and consumes significantly less electrical power. Despite all the developments in these optical applications, the growth of integrated photonics is hampered by the high investment cost of essential infrastructure for producing these applications.

• FAST • ACCURATE • MODULAR • COST EFFECTIVE

A breakthrough in cost and cycle time

We have developed a fast, accurate, modular machine platform for the assembly of microoptical elements, to fill in the missing link. The result is a production platform that is capable of aligning two small optical elements with sub-micron accuracy. It has a short cycle time - up to ten times shorter than current solutions - and is modular, in order to meet the requirements of the various optical applications. This will significantly reduce your packaging cost and thus the cost price of photonics devices. The modular building block design allows for usage in R&D (start- up) environments, enabling accurate assembly of optical elements at relative low investment cost.

If the production volume increases, the system can be reconfigured by simply adding modules to become a fully automated assembly solution.

Versatile assembly platform

Photonic assembly requires high precision alignment of two optical elements, optimized to its specific performance. The core of the machine platform is ultra-fast, accurate, active alignment by which the alignment of the optical components is optimized for perfect coupling efficiency. This capability combined with flexible micro gripper technology and accurate bonding technologies, yield to a versatile assembly platform suited for a wide range of optical assemblies.

Software enabling short change-over times

Change-over times in production environments can be time consuming. We have greatly reduced change-over times with our innovative software.

Programming of machines can now be done without coding. With this software it is possible to program the machine with new instructions visually within minutes. Change instructions of modules to transport, dispense glue, align fibers, connect, harden materials etc. in no-time.

By using this software on our R&D platform or fully automated production lines, you are completely in control.

Process development included

We develop our production machines together with a solid assembly process, that fits your product requirements. During the project life cycle, the maturity of the product, process and machine increases. During these phases, information is shared between product, process and equipment to ensure that the interface between these key aspects are represented.

- **FAST: < 30 sec record-breaking cycle time for photonic assembly**
- **ACCURATE: 17 urad typical 0.02 dB (application dependent)**
- **MODULAR: configurable and expandable to production requirements**
- **COST EFFECTIVE: good return on investment, low maintenance cost**
- **FLEXIBLE: easy to modify for running multiple applications**
- **COMPLETE: the machine comes with a developed process**
- **SMALL FLOOR SPACE: < 1,1 m2**
- **CONTROL SOFTWARE: HMI easy to use, to develop and teach applications**

Modular

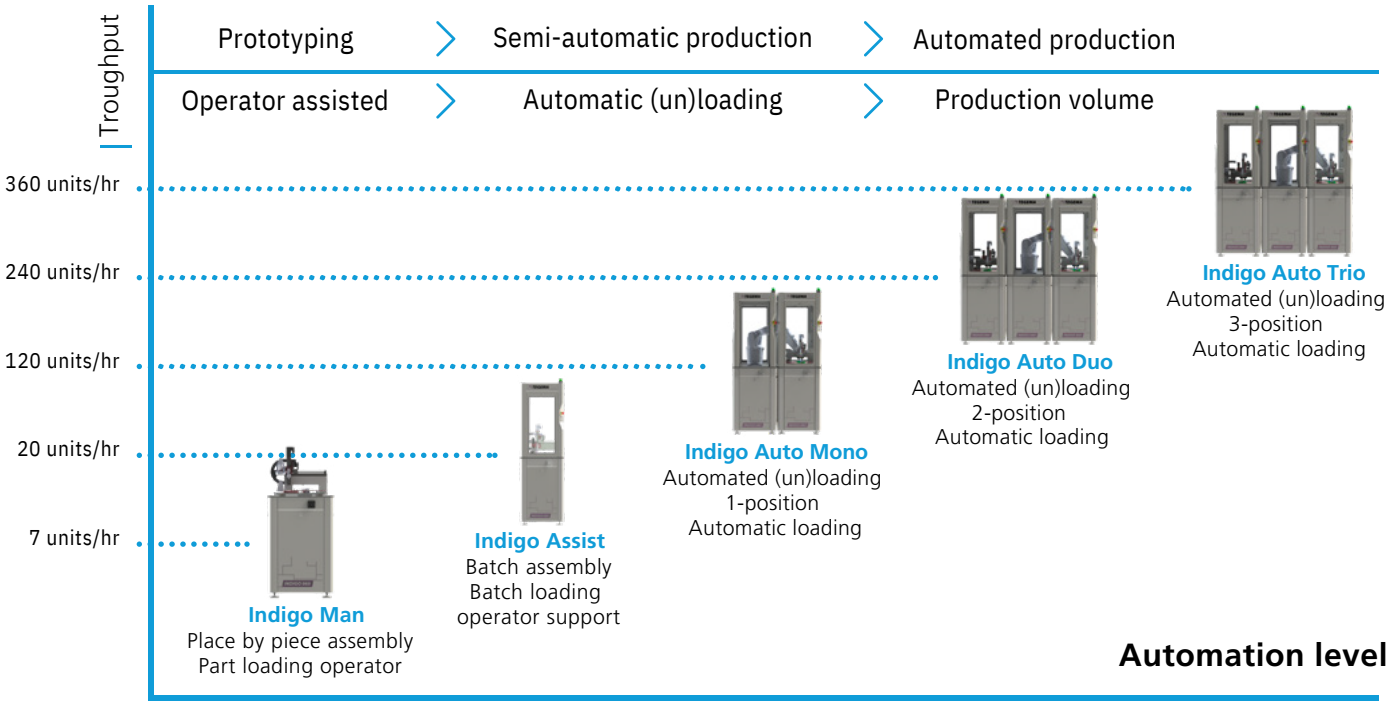
The platforms' unique modularity is a stepping stone approach for growing along with the production volume demand, from research phase to fully automatic production without having to invest in new equipment. The Indigo Man provides a solution for piece by piece assembly in an R&D environment. The Indigo Assist provides a solution for low volume production, where the operator loads the parts and the assembly is automated. When production volumes increases, the Indigo Assist can be upgraded to TEGauto by simply adding a loading and unloading unit from either tray loader or conveyor system.

Etteplan

Photonic device assembly

Etteplan Indigo product line is an assembly solution for operator assisted, semi-automatic to fully automated production of photonic devices. A solution where two optical components needs be aligned and bonded within ultra-precision. The machine platform can be modular configured for applications for chip to chip alignment, lens to chip, optical fiber to chip, and many others.

'Growth of integrated photonics hampered by a missing link in the assembly chain.'



'Very compact, very well thought out and a lot faster. We look forward to installing the first system.'

Pim Kat, CEO, Technobis

Ultimate flexibility for photonic R&D using our flexible software configurator

'Rapid prototyping is possible on the Photonic R&D platform because its software enables short change-over times.'

Change-over times

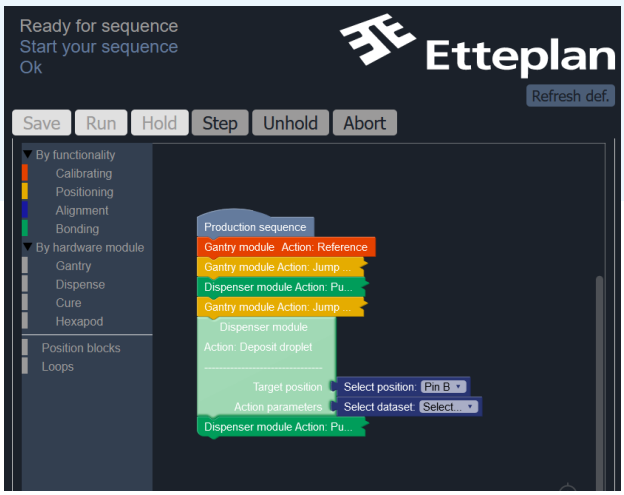
Fast change-over times are crucial for rapid prototyping. However, the process can be tedious at times. In most cases your machine supplier will have to be brought in on the job for the smallest of changes. Usual steps include: prepare software, simulate changes offline, document changes made, change the software and test the new programming of the machine. A job which could easily take a day. Time during which your equipment is not available. Even then, you rely on the availability of your machine supplier to support you in this process. In short: a change-over requires lots of time and money. Until now.

Greatly reduced change-over time with FPS

To remove the need to bring in external programmers and accelerate your R&D process, we created a flexible production solution (FPS). FPS is our software controlling the PLC. With this software, you can visually program the process sequence and steps for your application(s) without effort. With some initial training, it enables an inhouse process engineer to program changes for the machine within minutes. This way you can spend more time on your product instead of figuring out how to get your machine to run. Changes include: adding/deleting process steps like positioning steps, dispensing data, etc. Our software can assist with fast change-over times by quickly programming machines, from operator assisted prototyping all the way to automated production.

Key benefits

- Rapid change-over times
- Reduce dependency on machine supplier
- Spend time on your products, not the machine making them
- Visually programming without effort
- Visual documentation instead of PLC programming with separate documentation
- Re-use of programming possible on different machines
- Infinitely scalable

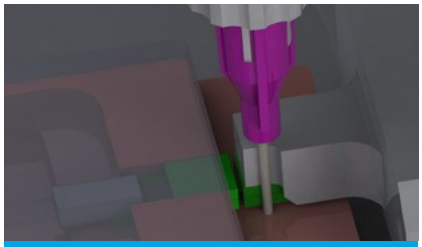


Key features machine platform

- Automatic photonic device assembly Sub micron accuracy (< 100 nm application specific)
- Excellent Price performance ratio
- Cycle time < 30 sec (fully automated)
- Small footprint 1,1 m2
- Flexibility (quick change over application specific tooling)
- Fully manual to semi-automated machine versions
- Configurable closed-loop active alignment
- Data/media logging and reporting function (SPC)
- Modular machine platform allows in filed retrofitting during service life
- Individual machine configurations with application specific process modules
- Bonding technologies, adhesive bonding (UV curing, Thermal curing), soldering, solder, relow, laser welding, thermal compression
- FPS user interface: user-friendly programmable and configurable process sequences/steps

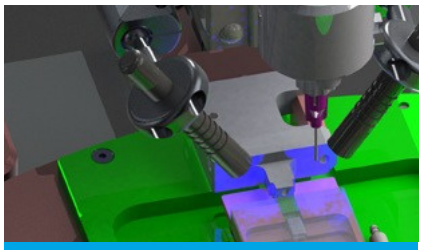
Application specific gripper design

Rotary stage package handling



Automatic dispensing

Automatic part (un)loading



Automatic curing

Automatic mating of any industrial standard optical connector

Field of use

- Fiber Optic module assembly
- Micro lens assembly
- Photonic device assembly
- Camera module assemby
- Optical interconnect assembly for fiber optics and waveguides
- LIDAR assembly

Part feeding and handling

- Manual placement by operator
- Automatic robot handler (parts terminated package)
- Tray loader
- Transport belt
- Application specific toolplate
- Optical fiber gripper standard
- Optical fiber rotational gripper (polarization direction)

Process modules

- Alignment module 6DOF / resolution 2 nm / range 25 mm (single or mulitple)
- Adhesive dispenser
- UV curing source
- Thermal curing source
- Soldering process module
- Laser welding module
- Analogue power meter
- Polarization meter
- Optical interconnect to all optical interconnect standards (manual or automatic)
- Machine vision for coarse alignment, collision prevention
- Probe unit to activate PIC for alignment process

Prototyping phase > Semi-automatic production > Automated production

Operator assisted loading > Automatic (un)loading > Production volume

Modular-configurable

- Operator assisted solution
- Full automatic configuration
- Easy to swap or add additional process modules
- Software enabling rapid change-over times
- Daisy chain multiple systems in line
- Scalable, parallelizable
- Can be integrated in existing production lines

'I am very excited about the modular structure of Etteplan system.'

Boudewijn Docter, President, Effect Photonics

Etteplan

Etteplan is a Technology Service company that specializes in engineering solutions, software and embedded solutions, and technical documentation solutions. You can rely on the expertise of over 4,000 professionals in Finland, Sweden, the Netherlands, Germany, Poland, Denmark and China.

We deliver comprehensive Automation & Robotics solutions for machines, plants and production lines and maximizes your production performance in terms of efficiency and quality.

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