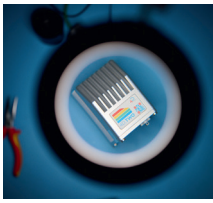
4D.TWO & 4D.WATCHER THE NEXT GENERATION PROCESS MONITORING SOLUTION

4D.TWO



YOUR BENEFITS

4D.TWO is your all-purpose multi sensor data source for (almost) any laser application where process monitoring for quality control is crucial. It exceeds other sensors' capabilities by far in speed, sensitivity and versatility. It provides >1M samples/s of 42+ single sensors of different physical aspects – in one compact device.

4D.WATCHER on the other hand is your hard- and software system which extracts relevant information, reduces the amount of data, simplifies the usability and enables you to handle even multiple 4D.**TWO** data sources easily.

More and diverse data enhance process monitoring accuracies and enables fault classification in many cases, and intelligent evaluation and data management make it easy to handle.

CORE ADVANTAGES

EXCELLENT DETECTION
LESS PSEUDO FAULTS

By extracting and combining only relevant data which correlates to your fault types best, it is now possible to eliminate disturbance values which decreases the amount of pseudo faults.

CLASSIFY FAULT TYPES
SEEK PRODUCTION PROBLEMS QUICKLY

With 4D.**watcher** you can create multiple Combi Channels and assign them to different root causes to your fault types. This approach helps to reduce down times after unforeseen production issues.

GOOD TO KNOW

- 4D.**watcher** enables tunable wavelength filtering, sensitivity adjustment and Combi Channel configuration all in software. Adjust almost any behavior of your sensor with a few clicks or provide remote access to our service partners for quick support.
- <30 min mechanical and optical adjustment. Exchange your broken optical heads quickly to reduce down times.
- 4D.**TWO** applies to almost any laser application. Simply compose your own settings in software for each of your applications and store them as presets.
- User friendly easy-to-use software is our main goal. 4D.**watcher** is made for touch screens.
- One-click teach-in process. Once you have set your relative limits for fault recognition it is easy to re-teach the evaluation after parameter changes in your laser process. The system tells you how confident it is regarding the amount of reference data.
- Integrated data reduction capabilities. No worries. It is up to you, how much and which data you would like to store.
- Pre-configured database applicable to your long-term storage server. For traceability reasons we recommend to attach a storage server. Let's talk to your IT how to set things up.

PRODUCT OVERVIEW

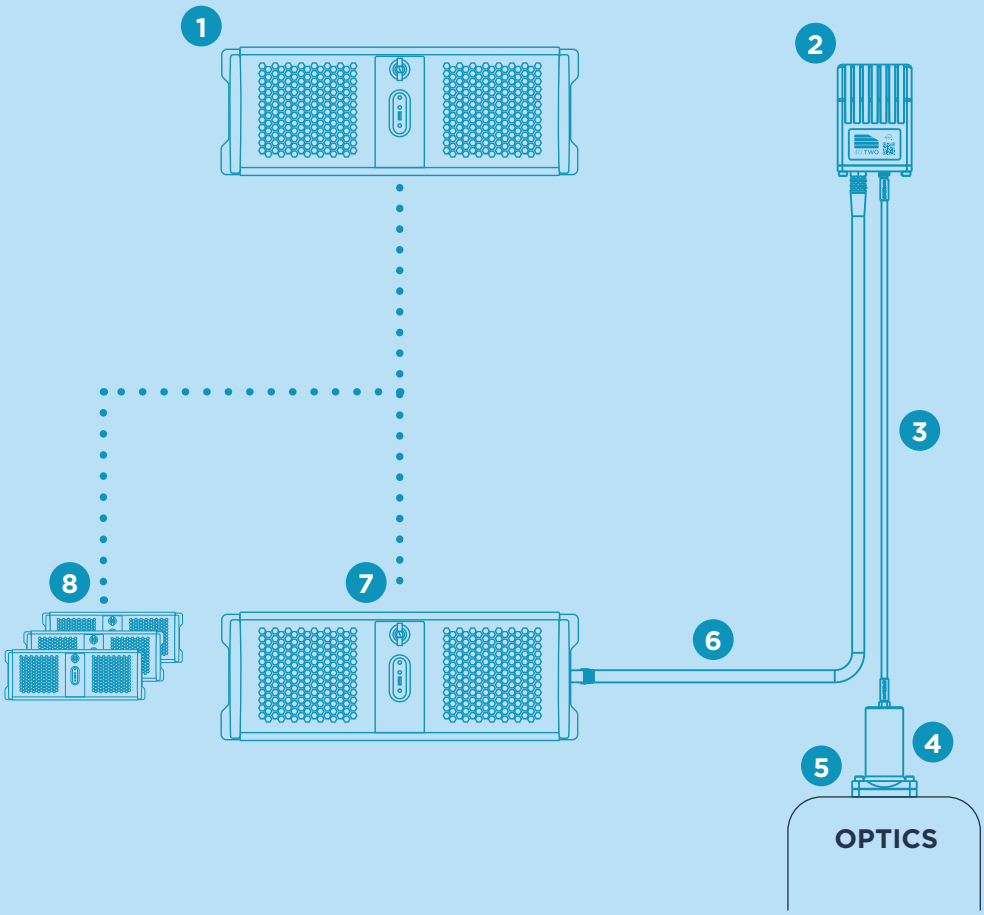
4D.WATCHER IS YOUR INDUSTRY READY SOFTWARE PACKAGE.

4D.WATCHER.CORE 7 is receiving all the data – up to 1M samples/s – coming in from 4D.**TWO** 2. It synchronizes your PLC data and assigns part, group and seam numbers, combines multiple channels to your specification and takes care of the whole evaluation process.

4D.WATCHER.CLIENT 1 on the other hand is the frontend to you. It enables you to visualize and parametrize multiple 4D.**watcher** cores 8, thus increasing robustness by dedicated CPUs. It is also your data hub as it retrieves all evaluated data of all connected cores (up to 4).

- **Live raw signals:** let you ensure that everything is correct at the appropriate time by comparing the live signals with your PLC signals
- **Combi Channels:** combine different channels into up to 4 Combi Channels to classify faults
- **Teach-in process:** start the teach-in process with just one click and the next signals will be used to create a scatterband to classify faults
- **Fault recognition:** find faults more sensitively by a couple of new technologies such as lossless recording or by selecting your evaluation channels that fit your process deviations best
- **Traceability:** data storage in a local database, therefore it is easy to have a look into historical data; for long term storage it is recommended to write the data into your own server solution – we provide a ready-to-go approach for your IT

1. 4D.WATCHER.CLIENT IPC
2. 4D.TWO
3. OPTICAL FIBER
4. FIBER COUPLER
5. ADAPTER
6. SENSOR CABLE
7. 4D.WATCHER.CORE IPC
8. MULTIPLE CORES

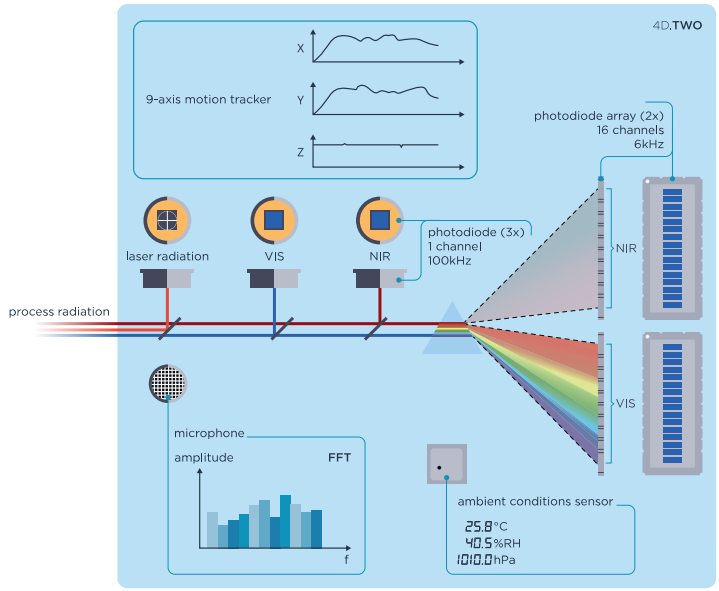


42+ sensors in a small industry proof device. Beautiful. Isn't it?

4D.TWO IS THE SENSOR FOR ALL YOUR APPLICATIONS – TAILORED TO EACH APPLICATION BY SOFTWARE CONFIGURATION.

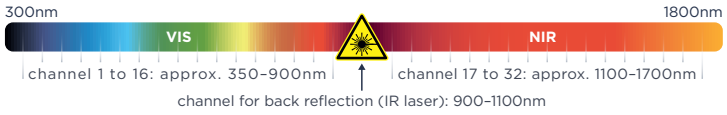
MINIMIZED ADJUSTMENT TIME

The amount and the duration of on-site adjustment is minimized as almost every setting can be adjusted remotely by software.



FULL SPECTRUM CAPTURING

4D.**TWO** captures the full spectra both in NIR* and in VIS at the same time – with 16 channels in the visible light range (VIS) and 16 channels in the near-infrared area (NIR*). In addition to these spectrally resolved channels there are 0th order channels for VIS, NIR and back reflection. With these channels, the spectral ranges are also recorded in full with sampling rates of up to 100 kHz.



LOSSLESS TECHNOLOGY

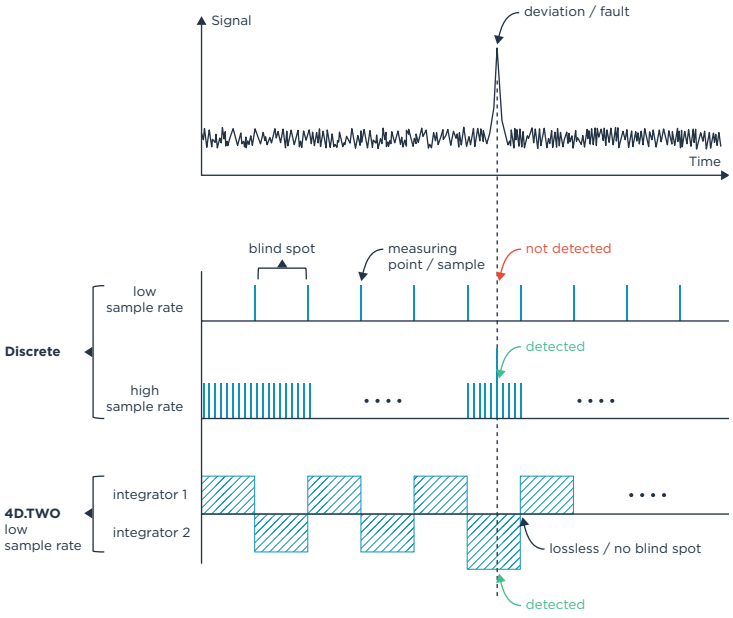
State of the Art requires high sample rates and extensive data storage to recognize and trace short deviations.

With the lossless technology, you now generate significantly less data volume thanks to the lower sampling rate. Due to the integrated measuring concept, the system is able to detect even small deviations that would otherwise only be detectable with a significantly higher sampling rate.

This makes the 4D.**TWO** suitable for applications with high welding speeds such as bipolar plates (≥ 1 m/s).

The sensor is also able to track orientation and acceleration with a 9-axis motion tracker, e.g. in order to detect deviations in the robot path during the process. Recording temperature, relative humidity and air pressure is possible as well. In the future, acoustic emissions will be captured, too.

*NIR version only



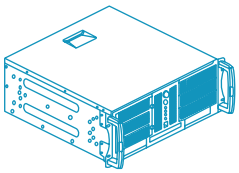
LOSSLESS TECHNOLOGY MINIMIZES THE AMOUNT OF DATA WHILE INCREASING THE DETECTION OF SHORT DEVIATIONS.

You are a potential customer? You love the technology? You are a competitor? You like the marketing? You'd love to join this cool team? – In any case: **Get in touch with us!**

sales@4d-photonics.com

COMPONENTS, NETWORK AND INTEGRATION

COMPONENTS

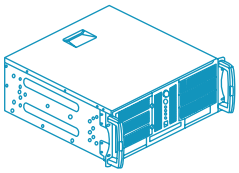


4D.WATCHER.CLIENT IPC

4D.TWO

FIBER COUPLER

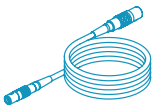
OPTICAL FIBER



4D.WATCHER.CORE IPC

4D.TWO MOUNT

ADAPTER



SENSOR CABLE

NETWORK

4D.**watcher**.client
frontend

4D.**watcher**.core 1
backend

4D.**TWO**

4D.**watcher**.core 2
backend

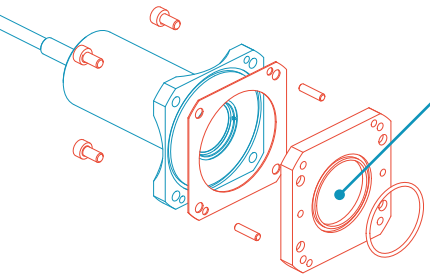
4D.**TWO**

4D.**extender***

*additional information on request

One frontend handles up to four cores. Each core can handle one 4D.**TWO** and one 4D.**extender**.

INTEGRATION



Adapters for fiber coupler integration to processing head

- **(C-MOUNT & SM1)**
- **HIGHYAG**
- **JPT**
- **LASERLINE**
- **PRECITEC**
- **RAYLASE**
- **SCANLAB**
- **SCANSONIC**
- **TRUMPF**
- **...**

Integration with ease: 4D.**TWO** connected to TRUMPF's programmable focusing optics PFO 33

SOFTWARE FEATURES

FEATURE: LIVE RAW SIGNALS

This feature lets you view all raw signals live at any given time during your production. Experts may add all synchronized machine communication to track down timing issues.

FEATURE: COMBI CHANNELS

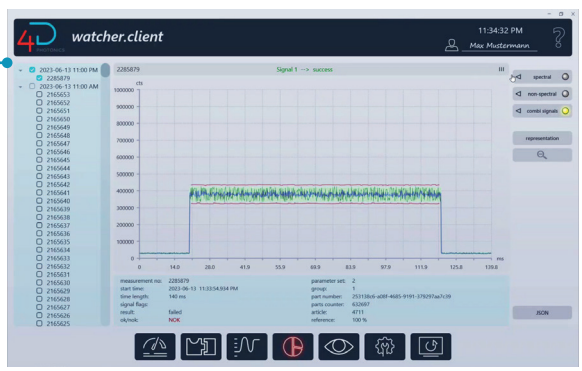
Combining multiple channels into Combi Channels allows for the reduction of data while eliminating disturbance inputs. In many applications you can define Combi Channels correlating different fault classes. Each Combi Channel may be evaluated differently.

FEATURE: TEACH-IN PROCESS

By clicking the teach-in button, the system automatically generates new references for all Combi Channels. The system indicates the level of confidence. It is not necessary to define a fixed amount of 'good' processes. Stable processes require less OK processes, fluctuating processes will delay the teach-in mechanism until full confidence is reached.

FEATURE: FAULT DETECTION

There are plenty of aspects how to define devations resulting in a 'fault recogniton'. Most common features are single fault, multi fault, min. length and max. deviations.

FEATURE: TRACEABILITY (DATA HISTORY)

For a short term history look-up you may want to use this feature directly at your machine. For long-term traceability the data is pre-conditioned and may be transferred to your IT server systems.