

Medical Technology



Harmonic Drive SE







CSG-2UH



CanisDrive[®]

Therapy







Rehabilitation







CSD-2A

FLA

Contents
Drive technology
Product groups
Overview
Imaging diagnostics
Therapy
Rehabilitation
System solutions
Flexibility for you
Contacts

Medical technology | Robotics, handling & automation | Mechanical engineering | Special Environments | Aerospace

Our inspiration

With either Apollo 15 on the moon or in the depths of the rough oceans, for more than 50 years, we have been providing significant applications across the planet and beyond with our drive solutions. We, as an industry leader in high precision drive technology, have not only continued to expand our portfolio based on the unique Harmonic Drive[®] Strain Wave Gear but have also recognised the requirements of modern, trend setting markets and applications: The future of drive technology is intelligent, sustainable and efficient.

Thanks to their special characteristics, which have been continuously developed over decades, Harmonic Drive® Gears and Actuators are perfectly suited to important key industries, including medical technology, robotics, handling & automation, mechanical engineering, special environments and aerospace.

Highest precision and quality for our customers are key principles of our corporate culture. Eighty percent of our products that leave our factory in Limburg/Lahn are special versions and are therefore specially developed, designed and manufactured according to customer specifications - from space saving gear component sets to intelligent drive systems.

Due to the high complexity in the configuration of suitable drive technology components, we partner and advise our customers comprehensively. The proposed solution for the drive task to be realised is developed in close cooperation to enable the subsequent integration into the application environment without any problems. Vital for this are, on the one hand, the high flexibility and, on the other hand, the customised scope of services and the integration level. The result is an optimal, highly individualised drive solution.

Successful in demanding industries such as medical technology, actively shapes the future together with our customers and is a sign of our innovative strength in the field of high precision drive technology.

With production and development locations in Germany, Japan and America, providing the highest technology level, as well as subsidiaries in Europe and Asia ensure that we are able to offer highly specialised mechatronic and intelligent drive solutions worldwide.









Planetary gear



Gear with output bearing









Servo actuator

Harmonic Drive® Gears

Gear Component Sets

Harmonic Drive[®] Gear Component Sets work according to the strain wave gear principle and are characterised by high single stage gear ratios, zero backlash and precise motion as well as maximum torques with low weight and compact dimensions. Consisting of only three components Circular Spline, Flexspline and Wave Generator, they enable maximum flexibility in design integration. Harmonic Drive® Gear Component Sets are ideal for applications with existing output bearings. By using the existing bearings and housing structure, they can be used to achieve both a low total weight and a compact design within the application.

Gears with output bearing

Harmonic Drive® Gears with output bearings combine precise gear component sets with a tilt resistant cross roller or four point contact bearing. Due to its compact design and its high concentricity and accuracy, the output bearing complements perfectly with the strain wave gear. Different gear types allow use in different gear configurations. Motor mounted gearboxes provide the prerequisites for providing direct and easy interfacing of servomotors to the gear with little engineering and assembly expense. The hollow shaft gear allows the central implementation of supply cables and shafts.

Harmonic Drive[®] Servo Actuators

The continuously increasing demands placed on servo actuators require, among other things, perfect interaction between the motor, gears, motor feedback system and controller. To guarantee characteristics such as precision and dynamics, servo actuators from Harmonic Drive SE have a high degree of compatibility.

The option to choose between a zero backlash strain wave gear and a low backlash planetary gear. The tilt resistant output bearing enables the direct attachment of high payloads without additional support and thus permits a simple and space saving design. In addition, there are numerous possible combinations for the motor winding and the motor feedback system as well as choices for brakes, connecting cables and connectors. Due to the flexibility in the configuration of the motor winding and the motor feedback system, the compatibility with almost all servo controllers of

the market is guaranteed. The latest IHD Series also has an integrated drive controller and a dual measuring system for direct control of the position at the gearbox output. This system can be easily implemented in the application by means of fieldbus interfaces.

Harmonic Planetary Gears

Requirements of the market for gears that support high speeds or low ratios often require the highest precision. Harmonic Planetary Gears meet this requirement. Due to their integrated motor connection with clamping element and motor flange, they allow easy mounting of servo motors. The special design with a flexible ring gear in the last stage ensures consistently high precision over the entire service life - we call this Permanent Precision[®].

A healthy decision: Harmonic Drive[®] in diagnostics

Every medical treatment starts with a diagnosis. This is used to determine the clinical picture. Medical personnel can choose from a wide range of different diagnostic options. In instrument based diagnostics, products from Harmonic Drive[®] provide considerable support for experts in two areas:

Imaging diagnostics: Our actuators are used here for positioning x-ray generators and x-ray detectors. With their support, the positioning process is accurate, energy saving and safe.

Laboratory diagnostics: In this area, drive solutions from Harmonic Drive[®] are used in automation solutions, such as point of care systems.

When technology becomes a factor in success: Therapy

Following a diagnosis, illnesses must be treated. This stage of medical care often requires operations, where robotics and assistance systems can provide valuable help – these systems are expected to offer the utmost precision and reliability.

Our drive solutions make a significant contribution. Throughout the procedure, the expert performing the operation can rely on the entire team, which includes robotic colleagues.

Harmonic Drive[®] offers drive solutions for a wide range of assistance systems, such as surgical robots, positioning systems or microscope stands.



Drive for new movement: Rehabilitation

Following treatment, there is often a need for rehabilitation. The aim of this is to restore the patient's mobility. Training equipment is often used here to actively execute or support the patient's movements.

As part of the safety-critical drive train, Harmonic Drive[®] Products in this equipment ensure the safe execution of movements.

One specific type of equipment is the exoskeleton. Designed for long-term use, it is not only used as part of the rehabilitation process. If necessary, it can be a permanent support for the patient.

Patients in focus: Imaging diagnostics

Imaging processes are used in both conventional diagnostics and during operations.

In diagnostics, they provide experts with a view inside the human body, for example, to identify broken bones. During intraoperative use, imaging processes support navigation and can be used to monitor success.

High performance Harmonic Drive[®] Gears in the CSG and SHG Series are used for the rotation and positioning of C-arms, a familiar system in intraoperative use. In particular, the rigidity of our gears is a key advantage while the generously dimensioned output bearing can support the loads of the C-arm.

Patient orientation – quite literally

In the area of conventional diagnostics, stationary x-ray systems are still used but modern positioning technology is increasingly also being implemented. The focus is on the patients – they are not positioned to the device, but instead the x-ray generator and detector is positioned accordingly.

Our CanisDrive[®] Actuators are particularly useful thanks to their technical details. In addition, supply and data cables can be fed directly through the large hollow shaft – so there are no cables in the way and nothing to restrict the system's freedom of movement.



CSG-2UH







SHG





Therapy

For us, the term "Therapy" primarily refers to systems that support surgical procedures. Solutions for conventional physiotherapy are grouped under the term "Rehabilitation." Products from the Harmonic Drive® Group are often used in surgical robots. The extremely compact design of the gears is particularly useful when designing slim robot arms. These ensure:

- Excellent freedom of movement in the operating theatre
- Easy access to patients

Drive solutions must be as rigid as possible, while also running as smoothly as possible. This is the only way to avoid vibrations – an essential requirement for successful operations, and a prerequisite for the start of a problem-free healing process.

Fully optimised. Highly integrated.

A growing number of customers require complete solutions for their drive axes. Harmonic Drive[®] Gears are particularly impressive in this respect due to their extraordinary level of integration. When it comes to complete solutions, an excellent alternative to the gears is the IHD Hollow Shaft Actuator. The integrated output side position measurement system of the smart servo actuator always offers reliable position data for your drive axis. Thanks to the integrated controller, you can connect the actuator to your control system without problems using a single-cable solution. Practical: The cable can be fed through the hollow shaft, which saves space.

For systems with heads: Practical solutions

In addition to surgical robots, surgical microscopes are another area of application. Here, for example, the head of the microscope is moving. Drive axes are needed to make that movement without any jerks. At the same time, systems must be compact and light to keep the weight of the moving part as low as possible. Lightweight gear component sets from the CPL Series offer ideal characteristics for use in surgical microscopes.













Step by step improvements: Rehabilitation

In the field of rehabilitation, Harmonic Drive[®] Products are usually used in equipment for movement training. There is a wide range of applications.

These include:

- Simple systems for mobilisation after a joint operation
- Equipment that provides support in re-learning movements
- Exoskeletons designed to enable people with physical impairments to use paralysed limbs again.

All these applications have one thing in common: they need drive solutions that are as flat and light as possible.

Our flat gear types are particularly useful here. They include:

- CSD Gears: The CSD Gear Series includes short-build cup gears designed as components sets, which can be integrated without problems into individual customer structures.
- SHD Gears: The SHD Gear includes an output bearing which means it can be used as a bearing position at the same time.
- FLA Servo Actuator: This combines the advantages of short-build Harmonic Drive[®] Gears with an extremely flat and perfectly matched motor – the ideal addition to our range.



CSD-2A







FLA



Special solutions for medical technology

80 % of our products are specially tailored to meet customer requirements – in the field of medical technology, this figure is even higher. The following two applications are examples of tailored solutions.

C-arm

C-arms are mobile scanning devices that hold an x-ray generator and detector at the end of a C-shaped support. The arm can be swivelled and moved in various directions.

Harmonic Drive[®] Gears are usually used in C-arms for the rotation of the arm. To ensure that the drive train is as compact as possible, two key functions must be provided:

- The rotation axis of the arm must be driven
- The arm must be held/supported in its position

The loads involved are very varied. The torque required for rotation is usually quite low. The large distance from the x-ray generator and detector to the actual rotary axis in turn requires a high mass moment of inertia, which means that rigidity is an important consideration when selecting the gear.

Compact and cost-saving

When the arm is supported, due to the mass distribution high tilting torques occur, which must be tolerated. To ensure that the design is as compact and cost effective as possible, components of varied sizes can be combined.

In the example, a gear from our SHG Series in size 25 is combined with a cross roller bearing in size 40 using corresponding adapter plates. The interfaces are designed so that customer counterparts can be mounted directly. The drive motor is positioned in parallel; the input shaft is used for this. A hollow shaft can also be used to feed through the power cables.



Surgical Robot

Robust, easy-to-operate robotic systems support medical staff during surgical operations. When these systems are installed, there is often a clear desire for individual axes that can be freely moved manually. Their use can save valuable time, while still offering high levels of robotic precision.

For one such project, the basic axis of a surgical robot was fitted with an adapted BHA Actuator. A coupling element was required here to allow the free rotation of the output side of the actuator (without motor and gears). This requirement was met in the form of a downstream clutch for the variable engagement of the actuator. The bearing concept also featured a Harmonic Drive[®] Cross Roller Bearing at the output, which can hold and support the forces of the robot arm.

One shaft. Many advantages.

The actuator was executed with a hollow shaft, which means that supply cables for the downstream axes can be fed through. Thanks to the hollow shaft, the position of the output flange can be transmitted through the entire actuator to a second position measurement system. This ensures that the precise position of the flange is known at all times. Another advantage is that the hollow shaft running through the entire actuator rotates at the "slow" output side speed, so the supply cables are protected from "fast" rotating parts.

Close cooperation with the customer during component selection ensured that this tailor-made system meets all approval-related requirements.





Contacts

Your idea, our engineering, your drive solution

We know that the configuration of suitable components is complex. Together with you, we can therefore develop a complete solution proposal for the drive task. Starting with the selection of the most suitable gears and the matching motor and sensor components, we can configure the complete drive axis for your application.

In doing so, we draw on decades of experience. Since 1970, we have been building on a sizeable number of complex drive solutions, giving our customers a definite technological edge. All design elements can be customised and optimally matched to each other. Integration into the application always takes place in close partnership with our customers. The key factors here are, on the one hand, the high flexibility and, on the other hand, the individual scope of services and the level of integration. The result will be optimal overall solution for your application.

In our modern development centre, a team of more than 40 designers and engineers is available on a daily basis. Up-to-date design and calculation tools, self designed tools for fast analytical calculations and equally established FEM supported methods are in place. In the directly connected test field, the newly developed actuators and drive systems are verified for performance and functionality with the help of specific test benches. The knowledge gained from this is fed back into development and gives the basis for further optimisation.

We know: Every application has its own unique requirements and needs an individual specification. We also know that it is difficult to find the right component. That is why it is important to us to respond to your needs individually and with personal advice.



Lars Wandura

T +49 6431 5008-230 M +49 162 423 25 98

lars.wandura@harmonicdrive.de

Manager International Sales / Medical





Harmonic Drive SE Hoenbergstraße 14 65555 Limburg/Lahn Germany

T +49 6431 5008-0 info@harmonicdrive.de www.harmonicdrive.de

We reserve the right to make technical changes and modifications without prior notice.