



MICROELECTRONICS THE BACKBONE AND CENTRAL NERVOUS SYSTEM OF GLOBAL COMMUNICATION

In the future, the competitive ability of countries and companies will depend, to an increasing degree, on how digital transformation is promoted.

The Internet, cloud-based software and data storage solutions for modern, highly efficient mobile networks, social networks and the Internet of Things (IoT) are all technologies which require sophisticated microelectronics and can only be efficient thanks to these.

Virtual communication and online meetings have experienced something of a boom over recent months, and are now a fixed part of our lives. The same applies to artificial intelligence, which we already come into contact with on a daily basis, for example when using speech commands on mobile phones, navigation systems in cars or home entertainment systems. From a technical point of view, these digital communication systems can be thought of as the central nervous system of the economy and society.

It must be emphasized here that, in addition to its importance in industrial processes, the majority of us as "consumers" are using these technologies to an increasing degree in our personal lives as well.

Fears that the coronavirus pandemic and its economic impact would severely curb investments have therefore not materialized in the semiconductor industry. The drivers of growth in the semiconductor industry remain as they were.

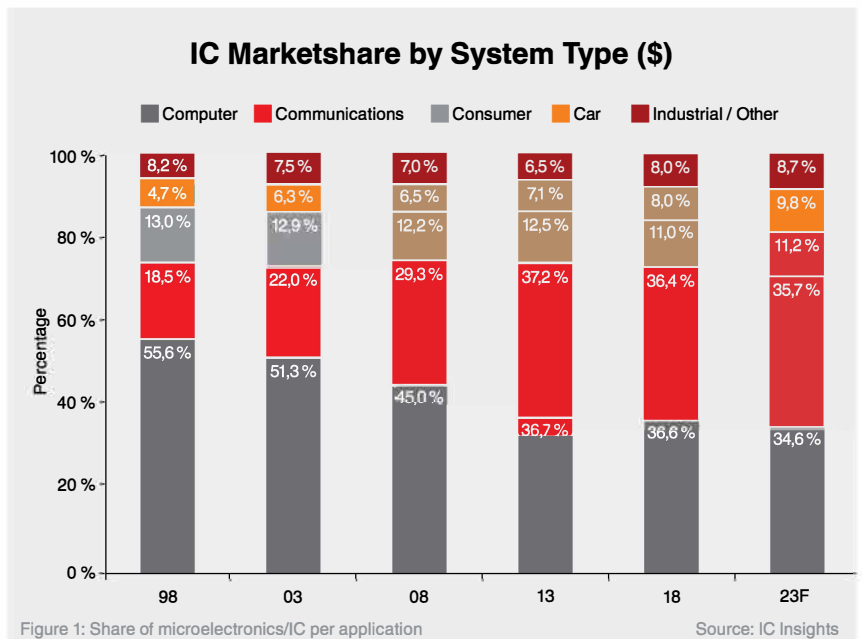
Many consumers which were already catering for virtual communication to a reasonable extent before the pandemic, such as by using Skype and Teams, were able to react more quickly to the situation. Due to its high proportion of international business, GEMÜ had already moved its entire telephone communications to Skype for Business in 2019 and started to introduce the project management and communication system Microsoft Teams. Preparing in this way was an excellent decision and, when confronted with the coronavirus situation, was supplemented with specific training courses, both online and virtually.

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Major areas of application for microelectronics/ICs

While computers, machine control systems and sensor systems of most varied types used to be the major area of application for microelectronics previously, nowadays there are significantly more areas where microelectronics is used. Communications technology has since overtaken computers and is the largest area of use at over a third. (see Figure/Table 1).



The new oil of industry in the 21st century

The importance of these areas of application, which in principle also reflect our behavioural changes in use of technology in the professional and personal environments, can also be seen in the development of global market leaders.

What must be considered here is that highly efficient microelectronics are also required for displays on flatscreen TVs, mobile phone touch screens, as well as many other functions in mobile phones (cameras, memory, etc.), servers for social networks and cloud providers, solar cells and many other products.

A world in motion, the global players of communications technology and the basis of the semiconductor ecosystem

A comparison between the world's largest companies in 2020 with those from 2010 (see Figure/Table 3) makes clear the importance of these applications and

the companies relevant to the "ecosystem" of the semiconductor industry.

Building a smarter and better world

What a well-known saying that is! Critics will say that those are just general marketing slogans. Of course, there is a wide range of other industrial areas, such as the food and pharmaceutical industries or water treatment. Yet without microelectronics, the lights would certainly go out – quite literally.

Let's take a look at three specific examples:

Firstly, e-mobility, electric car technology and charging infrastructure mean a higher proportion of electronic systems/microchips. It must be noted that for products such as power chips and MEMS, European companies are among the market leaders and are constantly expanding their capacities. GEMÜ valve solutions are well represented in these production plants.

Two leading European power chip and MEMS manufacturers, currently building new factories to increase capacity, rely on GEMÜ solutions. Designed VMB manifolds are used together with designers, end users and plant engineers.

Process media are distributed with the help of GEMÜ manifolds. They represent the connection between the generally central supply system and the processing devices in the actual production departments.



Figure 3: Valve Manifold Boxes (VMB) in a semiconductor factory (★)

The general construction of a manifold is always the same:

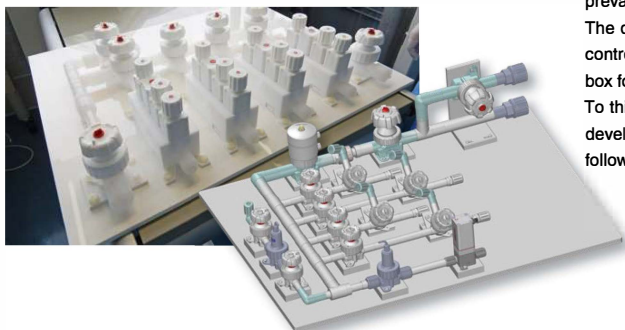
- ⇒ Feeding the medium through the inlet
- ⇒ Guiding the process medium through the main pipe (main), then distributing to individual sticks (pipe trains)
- ⇒ The sticks guide the medium to the application or process
- ⇒ Option for integrated back pressure control to ensure adequate supply of medium to the sticks for a loop construction
- ⇒ In the event of maintenance, the manifold can be drained completely via the drain.

The major advantages of the manifold are as follows:

- ⇒ Turnkey solutions, which can be quickly and easily mounted in the factory
- ⇒ Use of valve types with high Kv values
- ⇒ Manifold design with a low space requirement/low number of connection points
- ⇒ The hold-up volume of media in the system is reduced in a measurable way, the flow is optimized and draining is improved
- ⇒ Low danger from leakage thanks to a reduction in the number of connections
- ⇒ This enhances the performance capability of the entire system and reduces media consumption

Manifolds manufactured by GEMÜ are tried and tested leak-proof units. In addition, depending on requirements, measurement and control systems can be used alongside the valves and fittings.

Prerequisites for processing customized subassemblies like this are a high level of transparency of the requirements and precise planning, since errors in the planning of production plants result in high consequential costs due to delays and extra costs: For validation, late commissioning, contaminated batches and later modifications to the plant. GEMÜ therefore works together with customers very closely in planning and implementation. GEMÜ offers manifolds in PFA as well as stainless steel.



2010			2020		
Ranking	Company	Company value	Rank	Company	Company value
1.	Exxon	406	1.	Apple	2290
2.	PetroChina	321	2.	Saudi Aramco	1870
3.	Apple	315	3.	Microsoft	1690
4.	ICBC (China)	288	4.	Amazon	1670
5.	Petrobras	243	5.	Alphabet (Google)	1190
6.	China Construction Bank	230	6.	Facebook	788
7.	Microsoft	227	7.	Tencent (China)	692
8.	Shell	220	8.	Alibaba (China)	639
9.	BHP Billiton	217	9.	Tesla	631
10.	Nestle	212	10.	Berkshire Hathaway	539

The world in motion – The world's largest companies in 2020 compared to 2010 (in billions of US dollar)

Secondly, we are seeing rising demand for semiconductor products due to the energy transition. Photovoltaic systems and storing energy also require a high proportion of application specific semiconductor products, and customized valve and system solutions to manufacture them.

Thirdly, there is the health sector. Here, too, we have come full circle; for example, in the transformation from analogue to digital cameras, or from inefficient light bulbs to LEDs, or in the replacement of CDs (with plastic sleeves and packaging) with music downloads or streaming services, we ourselves are essentially the end consumer by buying and using wireless headphones for jogging, a smart watch or a fitness tracker..

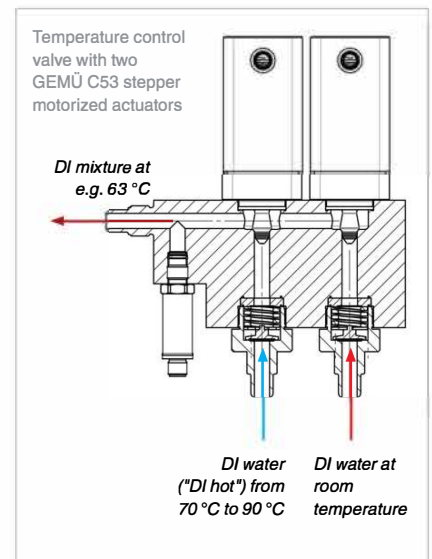
Valve, measurement and control systems for production plants manufacturing microelectronics

In order to comply with the variety of requirements for individual production processes in which ultra pure water and chemicals are used, valve, measurement and control systems made of various plastics or stainless steel are employed. The components find numerous uses in manufacturing steps, such as ultra pure silicon production and wafer production, wet and coating processes or chemical cleaning processes in high purity water treatment plants, chemical supply and wet process equipment. They ensure reliable handling for the various process media, precise control of media flows, precise positioning of mixing (also in the on-site blending procedure), precise batching and filling, as well as media recycling.

Let's take the example of a mixing and temperature control valve for what have become known as EUV mask boxes. Together with a leading plant engineering company, the solution has been designed, tested and now used in series. When cleaning EUV mask boxes, it is usual to work at elevated temperatures in order to speed up the cleaning process. The challenge here is very precisely mixing and controlling the plant supply's prevailing room temperature and hot DI supply.

The design shown in Figure 1 allows for very precise control of the warm water flow for cleaning the transport box for the highly sensitive and expensive EUV masks. To this end, two GEMÜ C53 stepper actuators, newly developed by GEMÜ, are used, which offer the following main advantages:

- ⇒ Both actuators control in parallel in order to achieve the required mixing ratio as quickly as possible and maintain constancy in the supply lines despite fluctuations.
- ⇒ The "hot DI" temperature in the plant is approx. 70 to 90 °C
- ⇒ This allows a mixture at 63 °C, for example, to be kept very constant by the valve block.
- ⇒ Integrated check valves prevent a backflow of DI water in order to prevent the two supply lines from being mixed up.
- ⇒ The interaction of the PLC, temperature sensor and control valve is decisive for a precise temperature controller result.



Increasingly integrated system solutions are used here, which are characterized by their resource saving use of materials, adjusted function, exceptional service life, as well as cost efficiency. Therefore, they also provide a specific, valuable contribution to long-term usage of products in the plants and in production for end users, microchip, MEMS, LED, touch panel and flat screen manufacturers.