

# Pressure measurement made to order



Walter Felber

*Pressure is measured in many technical systems in different conditions and requirements. As the number of necessary variants of electric pressure transmitters rises, the batch sizes in production must decrease. To still meet demand in an economical way, Sensor-Technik Wiedemann GmbH (STW) aims for a “modular system for pressure transmitters”.*

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## Huge variety in pressure measurement

Pressure transmitters measure pressure. That is about the only thing different pressure transmitters have in common. There is a range of possible differences when it comes to pressure measurement. The differences in their application and as such between the pressure transmitters are shown in Figure 01.

A normalization or reduction of the resulting variety of options is often technically impossible and is thus unlikely in the near future. Due to new requirements such as USB or Power Over Ethernet, the number of options is more likely to increase than decrease. The cost-effective production of rarely required versions remains a challenge. Customers, however, want suitable pressure transmitters on time and at the lowest possible cost.

## Solutions

All pressure transmitter manufacturers are facing this challenge and are addressing it with a range of solutions. To pass on the high cost of products that are made to order to the customers is not innovative. Another concept works by defining several series types which help narrow it down: “Hydraulics”, “low-pressure range”, “atmospheric gases” and other specifications that limit the options named above.

However, the transmitter series of different strengths stocked by STW so far weren't always sufficient to meet the demand for a wide range of different types. It was often just a matter of time until a needed combination couldn't be achieved with any of the transmitter series.

Another disadvantage for the customer was that he had to choose one or more of

the series and adapt to them, which often meant a compromise.

Moreover, the search, selection, qualification, supplier diversity and documentation of different series created a lot of work and effort for the customer. It was necessary to supply a transmitter series that meets as many requirements as possible.

### A modular system for pressure transmitters is produced

STW has decided to create the “universal transmitter with customizable properties”: the M01 modular system. This transmitter series is designed to cost-effectively achieve as many combinations as possible through modularization and standardization of module interfaces.

The customer checks the suitability of the M01 once, defines further variants and, apart from that, can rely on the same properties.

The customer can choose from an unusually large number of different modules to adjust the transmitter series to existing installation situations. The transmitters used are always the “same” and only differ in ways that the customers wants them to. Not all of the modules required to create all possible variants are yet available, but the existing selection is already remarkable (see Figure 02).

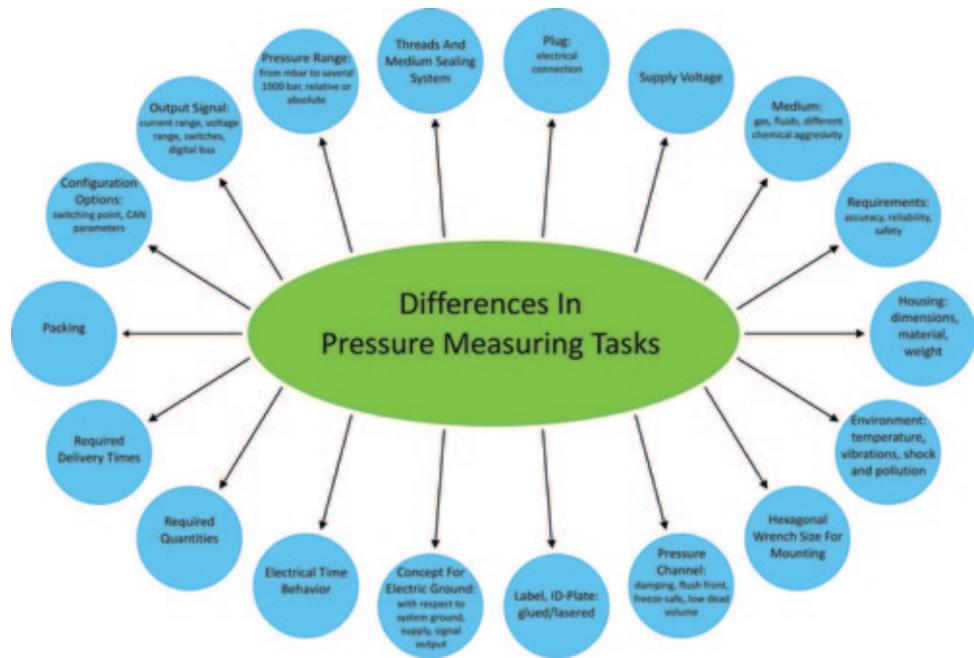
In purely mathematical terms, the customer can choose from around 1.5 million different pressure transmitters that can be built with these modules. Figure 03 shows a selection of modules.

### Modularity exemplified by electronic components

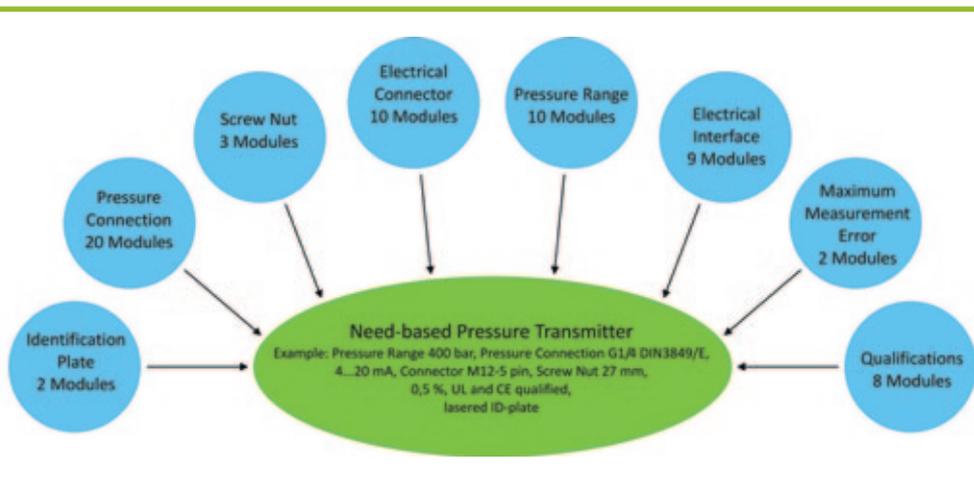
To achieve the modularity for the electronic requirements, necessary functions are divided into three circuit boards so that customers’ requirements can be taken into account by selecting the appropriate circuit board. The interfaces between the modules have to be very clearly defined in order to ensure that every possible combination meets the functional requirements:

- **Input board:** Processes the signal of the measuring sensor and normalizes it.
- **Amplifier board:** Resets to the normalized signal of the input board to the desired output signal or the digital output bus.
- **Output board:** Filters EMC interference and adapts the electronics to the different dimensions of the connector pins.

The three boards are easy to put together – like toy building blocks. By selecting the appropriate amplifier board, an analogue 0 ... 10V transmitter or a transmitter with CAN output can be created. Figure 04 shows how the boards are put together.



01 Differences in the pressure measuring tasks and subsequently the pressure transmitters



02 The modular system for pressure transmitters

In order to create a temperature transmitter, threads with integrated temperature-dependent resistors are mounted instead of pressure connectors. Other physical variables can be added to the modular system based on a bridge circuit or a single resistance. Table 1 provides a detailed list of the modules already available for pressure transmitters. Since the same modules can be used in all versions, they can be manufactured economically in large quantities.

### Customer-specific modules also possible

The modular system makes it possible to integrate customer-specific modules, enabling the connector plug, which has been adjusted based on the specified interface to the remaining transmitter, to be adapted with a minimum of effort and expense in terms of development and qualification. The adjustment of data protocols is also a routine matter with digital versions.



03 Several modules for pressure transmitters

Details, such as different plug colors depending on the pressure range, have likewise been integrated into the modular system according to customer request. However, accounting for such details often presupposes a quantity-to-cost ratio like



## Interview with Andreas Huster, M01 pressure transmitter series project manager at Sensor-Technik Wiedemann

### Will the modular system truly enable you to meet every need in terms of different versions of pressure transmitters?

No, there are some special applications that we will not be able to cover, of course, such as transmitters with an integrated display. We are also unable to handle high-precision measurements close to an absolute vacuum, such as might be necessary in process technology. But application coverage of roughly 80 % is real progress.

### What proved to be especially difficult in making the modular system a reality?

Since there is no uniform media-resistant measuring cell system for the stated pressure range, we had to come up with a design for the pressure connector that we could fit with silicon as well as stainless steel cells. That was not easy to do. It was also quite a complex

task to create testing equipment and automate testing procedures in such a way that it's possible to calibrate and test the wide range of transmitters effectively. Many administrative processes had to be adapted to the modular design principle.

### What sets your modular system apart from those of your competitors?

The sheer variety of modules, not to mention the extremely wide pressure range. And we plan to systematically round out the modular system going forward by continuously adding more modules. That is why we see variety vis-à-vis the modular design principle as our model for success. We are already able to profitably produce the M01 transmitter series in smaller batch sizes.

### Which modules exactly do you plan on adding?

Right at the moment we've added the modules for different widths across flats. That was necessary to be able to tighten transmitters with large connector plugs with a nut from behind. This was a request from a customer – and that's how we want to proceed in the future. If a customer makes a request that could prove interesting to others as well, then there will be a new module. In the medium term, we will probably be creating more field bus systems. Innovations have to provide our customers a tangible benefit. One other development in the works is expanding the safety features. Also completely new and

available shortly is a new stainless steel measuring cell that can go down to three bar, which means that customers will have a transmitter – even in the lower range – whose wetted parts are all made of stainless steel.

### Can all modules really be put together manually to form a pressure transmitter?

Yes and no. The individual circuit boards are equipped with connector plugs and can be pieced together quite easily. The “modular system” is an image, however, and serves to illustrate the concept. The stainless steel cells and the housing are welded together with a laser due to concerns over quality, for instance.

### How does your company benefit from the concept of the modular system?

We gain satisfied customers as we are able to offer small production volumes at affordable prices thanks to lower production costs. But savings come in the form of streamlined sales as well.

### How would you summarise the benefit for the customer in one sentence?

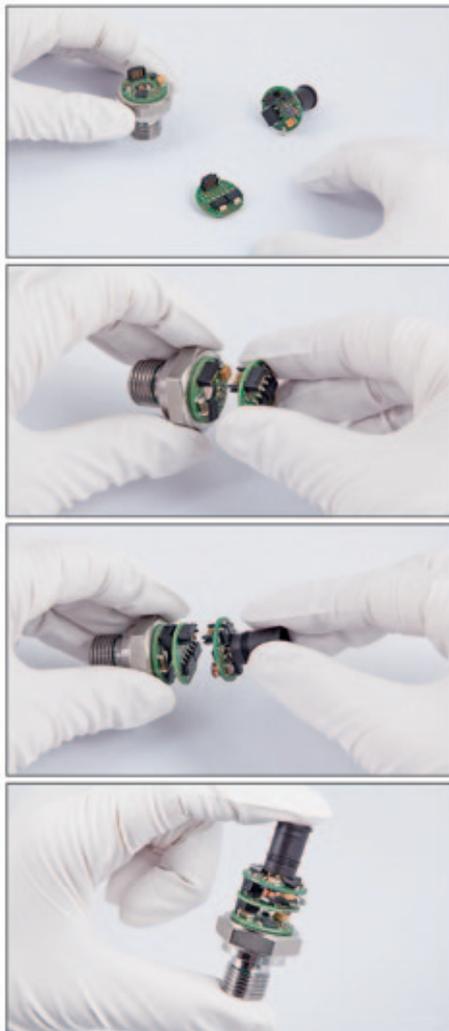
Qualify once – and (nearly) all your transmitter needs can be met. Or even better: We offer pressure transmitters to go!

Module designation	Available modules
Pressure range	1, 5, (absolute or relative, respectively), 10, 16, 25, 50, 100, 250, 400, 800, 1,000, 2,000 bar, and intermediate ranges
Pressure connection	G1/4, G1/8, 1/4 NPT, 1/4 NPTF, 3/8 NPT, M10x1, M12x1, M12x1.5, M18x1.5, M22x1.5, 7/16-20 UNF (SAE4) O-ring and cone, 9/16-18 UNF (SAE6), DIN 20043 DN10, many connections also available with damping, G1/4 also with pressure gauge pin, as internal thread, with drain valve, flush mounted
Electrical interface	Voltage 0-5V, 1-5V, 0-10V, ratiometric, electricity (double and triple conductor), voltage, CAN, switching outputs (NPN/PNP),
Connector plug	M12 plastic, M12 stainless steel, AMP55, AMP-EJ, DeutschDT04, MPM, EN175301-803-A, DIN-72585 DIN Bayonet, Cannon connector, SuperSeal, cable outlet, T-piece for CAN,
Screw Nut	22 mm, 27 mm and 30 mm
Maximum measurement error	1% or increased accuracy 0.25 %
Qualifications	UL, CE, E1, ASIL, SIL, PL, calibrated, (ATEX in preparation)
Identification plates	Adhered, laser engraving; customer logos and 2-D barcodes also possible

Table 1: Details on existing modules

that of the “typical” production of transmitters. The in-house production of the thin film for manufacturing measuring cells also leaves room for customer-specific solutions.

Special solutions, such as uncommon connection threads or adapted EMC properties, were cause for making additional expansions to the modular system in the past. Final assembly of the modules directly at the customer’s place of business creates the potential for further applications.



04 Piecing and plugging together the electronic module components

## Summary

Customers – especially those who require electronic pressure transducers for spare parts supply or product development – value the high degree of flexibility and quality of STW products. Customers who only have an irregular or low level of need for such products are also taking advantage of the benefits provided by the M01 modular system: the cost-effective and quick manufacturing of high-quality pressure transmitters – even for smaller production volumes.

By systematically implementing the modular system, STW seeks to unite the efficient mass production of pressure transmitters with otherwise costly customization. The customer should have to use nothing but one well-known product – and still have all the necessary configurations available.

**Photographs:** STW Technic LP, Norcross, GA 30071

[www.stw-technic.com](http://www.stw-technic.com)



## About

Company name: STW Technic LP

Headquarters: Norcross, GA 30071

Employees: approx. 400

Established: 1985

Products: controllers, I/O modules, sensors, measurement technology, hybrid technology, teleservices