/ Perfect Welding / Solar Energy / Perfect Charging

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SHIFTING THE LIMITS



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WELDING TECHNOLOGY 4.0

AGENDA

/ **Industry 4.0.** My personal definition and impressions.

/ **Welding technology 4.0**. What does this imply on welding technology made by Fronius?

/ **Challenges.** What obstructive factors are currently present?

/ **Conclusion.** What has to be done?

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Industry 4.0

My personal definition and impressions.

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MY PERSONAL IMPRESSION

/ **Industry 4.0** is a very successful **marketing term** in **German-speaking countries**. It is used to **gain attention** from politics and mobilize **public funding**. The customer response is yet unclear.

/ **Industry 4.0** defines a certain kind of **global product strategy**. This strategy should be used by as many **production equipment manufactures** as possible to finally enable **smart production**.

/ Industry 4.0 **awakened** the marked. Every tech company **wonders**, whether or not all **ICT-trends** are incorporated **correctly** and in a **sufficient way**.

/ **Industry 4.0** became **quite annoying** as a term, due to the fact that it is used **always and everywhere by everyone**.

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MY PERSONAL DEFINITION

Industry 4.0 is basically the demand to introduce **team work!**

- What proofed to be **right for humans** should now be introduced **between machines** and **humans and machines**.
- **Production lines** should be constructed of **intelligent sub-components** which are able to **network, exchange data** and finally **cooperate perfectly.**
- These production lines should be able to handle a **huge variety of products** at **production costs** equal to those currently achieved by **mass production**.
- The **team work idea** is not limited to the production itself. It also **incorporates the suppliers** and the **customers**.

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MY PERSONAL DEFINITION

What constitutes team work?

- All **members** of the team **understand each other** – i.e. they **speak at least one common language**
- All members of the team **know** the **common goals** and pursue them.
- All members of the team **estimate** their **own skills** and **state** correctly and communicate this information to the whole team. Work **load is balanced accordingly**.
- Team **members help each other** to solve problems – especially if common goals are endangered. Even **unpredictable difficulties are solved** as a team.
- There exists **a team leader** who is in charge of **inducing these properties** to his team.

→ **All these properties** have to be transferred to **machine<>machine** and **human<>machine** collaboration

Welding technology 4.0.

What does this imply for welding technology made by Fronius nowadays?

(R)EVOLUTION - INVERTER WELDING MACHINES

Standard Inverter



1980

Digital Revolution



1998

Intelligent Revolution



2013

TPS/I – THE PERFECT TEAM

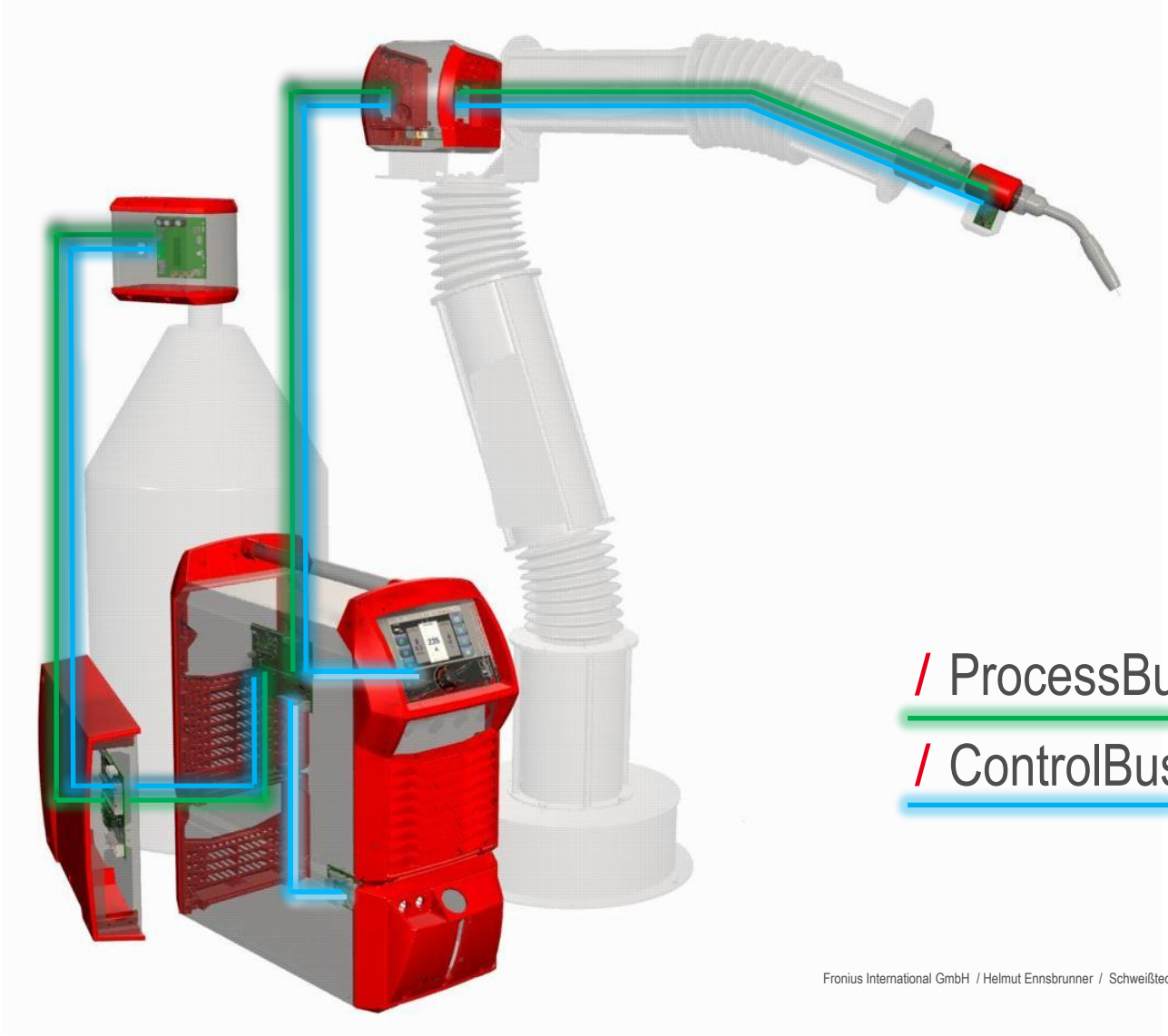


- / New applications
- / New processes
- / Connectivity
- / Future-proof
- / Modular expandability

NO LIMITS

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SPEED NET – THE TEAM LANGUAGE



/ ProcessBus

/ ControlBus

INTEGRATION, CONNECTIVITY, DATAMANAGEMENT











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Challenges.

What obstructive factors are currently present?

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SOME GENERAL QUESTIONS

/ Why does such a huge amount of different **AC power socket standards** exist? **Not even within Europe** we have a single standard - **despite using 230V/50Hz**!

/ The first, second and third industrial revolution happened a long time ago. Why do we have so many **different standards for screws**? Aren't they used for **the same purpose** all over the world?

/ **Homo sapiens left Africa roughly 100.000 years ago** and spread all over the world. Why wasn't it possible to **establish a single, optimal language for all humans** over this rather long period of time? **Every human** is, with regard to anatomical prerequisites, able **to speak every existing language!**

SOME GENERAL STATEMENTS

- **Humans by nature don't want to be compatible!**
- Being **compatible implies** in some sense being **equal** – at least at the **interface**.
- What's **compatible** can be **compared** and subsequently **replaced**.
- The **Babylonian confusion of tongues** is not God-given – it is **man-made**!

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LINGUISTIC CONFUSION – INDUSTRY BUSSES:

/ IEC 61158

Digital data communication for measurement and control - ***Fieldbus for use in industrial control systems***

CPF1	FOUNDATION Fieldbus	CPF10	VNET/IP
CPF2	ControlNet	CPF11	TCnet
CPF3	PROFIBUS	CPF12	EtherCAT
CPF4	P-NET	CPF13	Ethernet POWERLINK
CPF5	WorldFIP	CPF14	EPA
CPF6	INTERBUS	CPF15	Modbus
CPF7	SwiftNet	CPF16	SERCOS
CPF8	CC-Link	CPF17	RAPIEnet
CPF9	HART	CPF18	SafetyNET p

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CONSEQUENCES

- **Standards** at the **interfaces enable communication** (i.e. it has to be the same language). **Limits** in the communication **content** and **speed limit innovation** (e.g. field bus images).

- **Manufacturers** of industrial equipment will stick to their **own, probably optimal communication standards**. As humans – they **don't want to be compatible**.

- The I4.0 requirement to **interconnect all devices** in a production place will only work out, if the **devices are properly chosen** – not all devices on the marked will be compatible!
  As soon as a single **colleague** in a team speaks a **different language**, the team will **not work**. The **team leader has to take care**.

- Consequently the **main challenge of Industry 4.0** from my point of view is to **establish communication** between a **huge amount** of industrial **devices** without sacrificing the **overall system performance**.

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Conclusions.

What has to be done?

CONCLUSIONS

- **Communication requires compatibility** in
  - the **physical layer** (human: air pressure variation)
  - the **used protocol** (human: one common language)
  - the **content transport** (human: the content of spoken words has to be transported correctly)
- Industrial **devices have to be multi-lingual** in the future. Simultaneous translators will help.
- Manufactures of industrial devices have to **build partnerships** to establish the **correct content transport**. **R&D collaborations** between different companies will gain **much more importance**.

- The demand **to introduce team work** on the shop floors will finally cause all well known **issues from human interaction** to **reappear in our production equipment**.
- Well **organized teams of devices and humans** will revolutionize the way production takes place in the future. **Fronius will be part of it!**



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