Welcome to the webinar
“Integration of smart measuring amplifiers into PC software applications”

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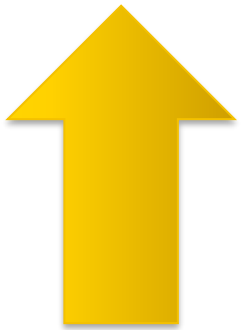
Michael Guckes

Overview:

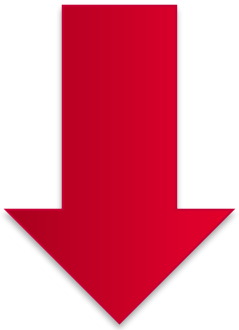
- Short overview – Industry 4.0
- Where does software take place?
- Intelligent measurement hardware
  - Interoperability and useful protocols
- Integration of measurement hardware in PC applications
  - Possibilities for integration into existing software
  - Open interfaces and API
- Practical demonstration

Short overview – Industry 4.0 & IoT

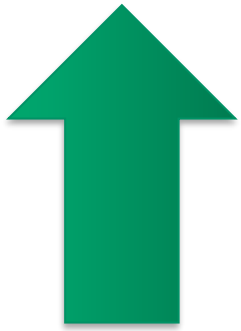
- Intelligent components
- Ensure quality
- Avoid rejects
- Avoid machine downtimes
- Increase transparency in the production



optimize processes



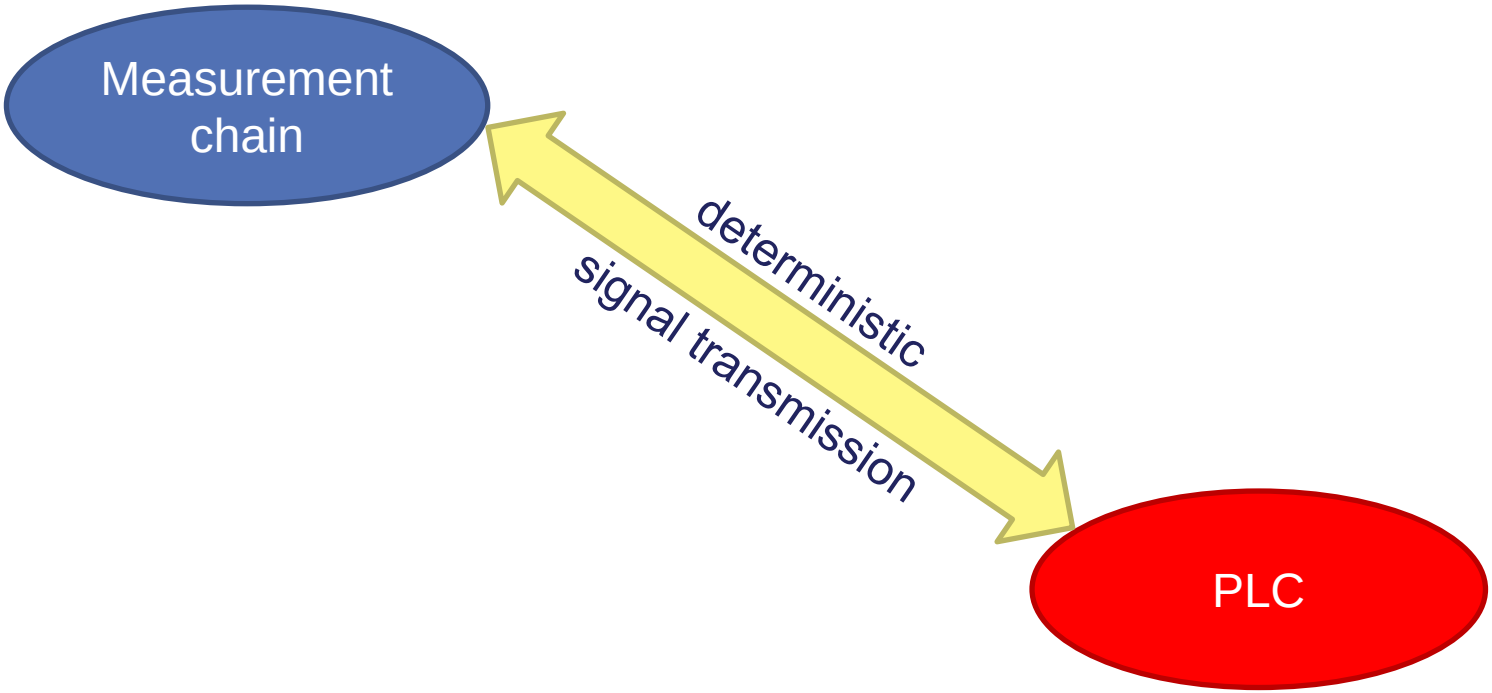
decrease costs



increase turnover

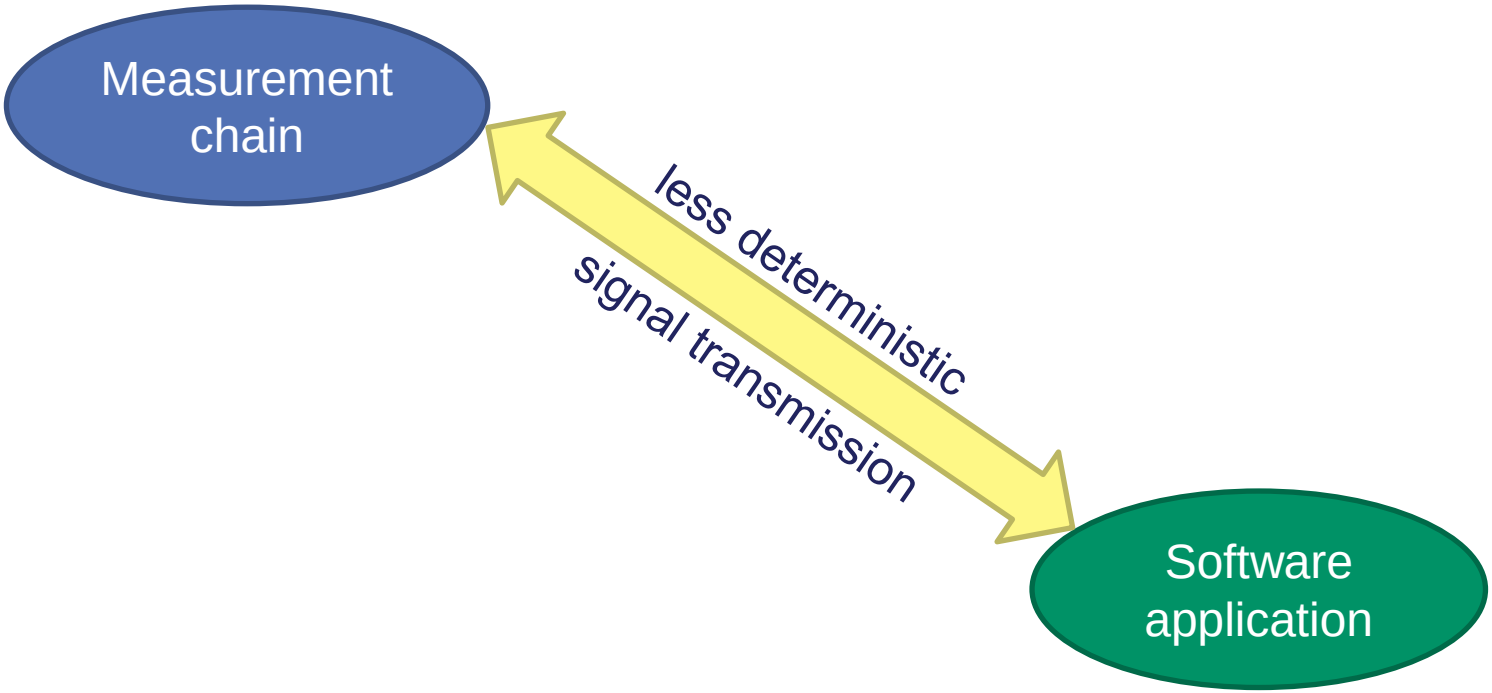
Where does software take place?

- Classic applications: measurement chain → PLC application



Where does software take place?

- Replacement of PLC tasks by software applications
- Condition: Less requirements for determinism



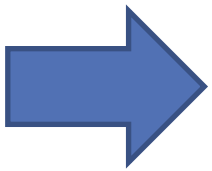
- Determinism increasingly available in software applications by using TSN protocols (Time-Sensitive-Network in Layer 2)

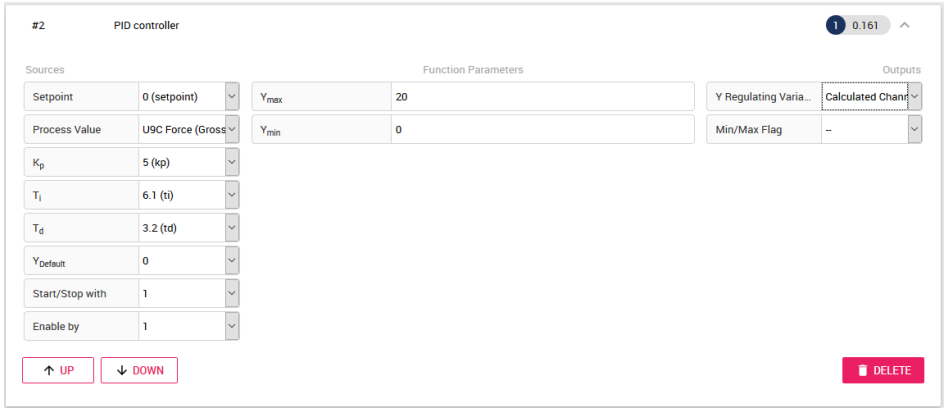
Intelligent hardware – Edge computing

- Intelligence in the measurement components
- Change from programming to parameterization
  - ➢ Pre-implemented logic

```
0001 IF switch = TRUE THEN
0002     devSpeed:=T#10ms;
0003 ELSE
0004     devSpeed:=T#25ms;
0005 END_IF
0006
0007 IF devTimer.Q THEN
0008     devTimer ( IN := FALSE, PT := devSpeed );
0009     engine :=  NOT engine;
0010     IF engine = FALSE THEN
0011         steps := steps + 1;
0012     END_IF
0013 ELSE
0014     devTimer ( IN := TRUE, PT := devSpeed );
0015 END_IF
```

software program code

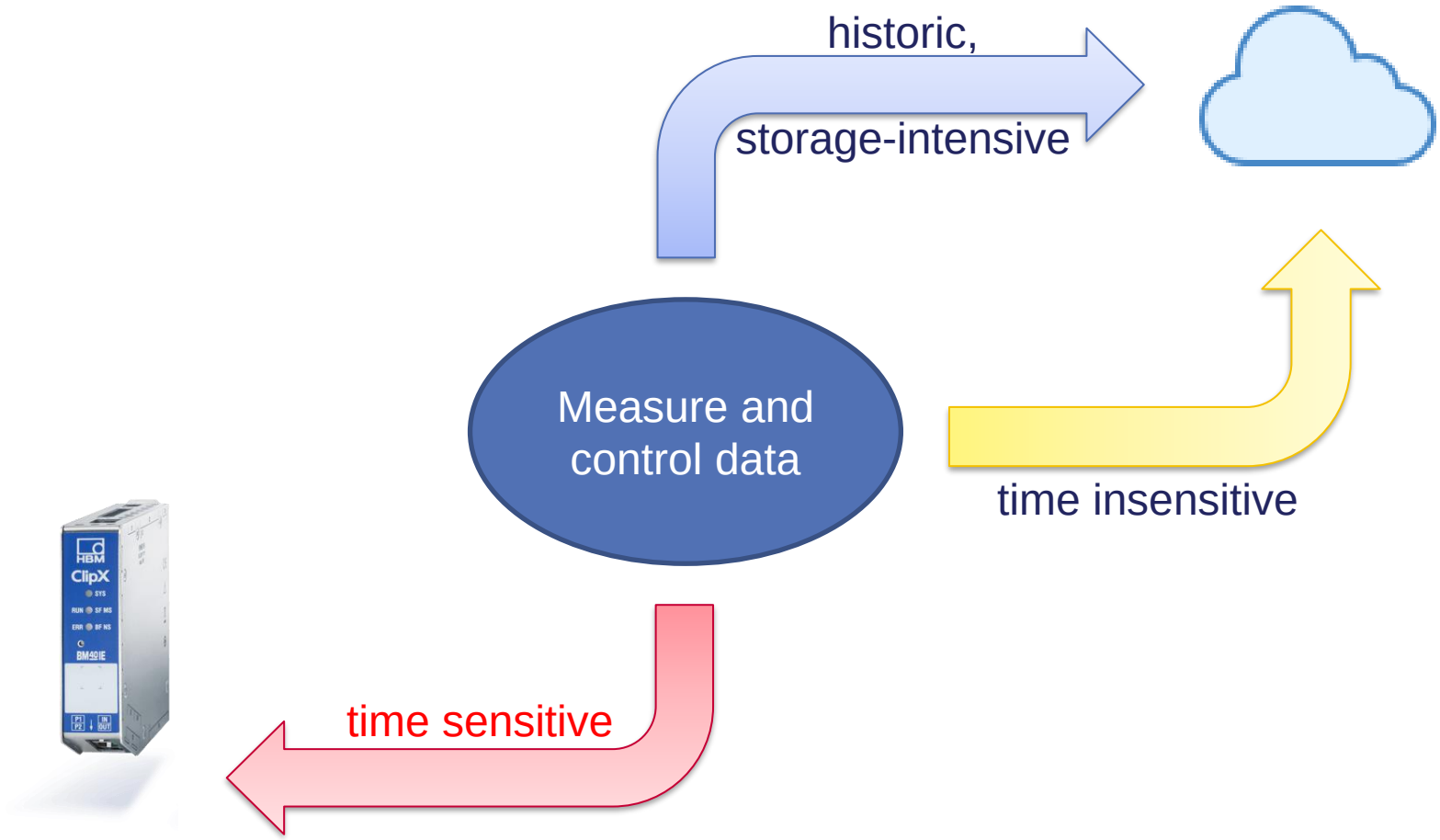




Pre-implemented calculated channel in the edge controller

Intelligent hardware – data processing

- Despite cloud uptake – edge computing is essentially
- ‘Process data where it is most useful’



Remote maintenance and diagnostics

Live demo accessible world wide (max. 2 connections)

ClipX live via internet: http://clipxdemo.hbm.com

Integration of hardware in software applications

- Connection to well-known DAQ- and data processing software
- Universal controllability
- Open interfaces for easy integration
  - ➢ Device API

Integration into existing software

- Connection to well-known DAQ- and data processing software necessary

DIAdem

MATLAB

catman

NATIONAL INSTRUMENTS
LabVIEW

Integration into existing software

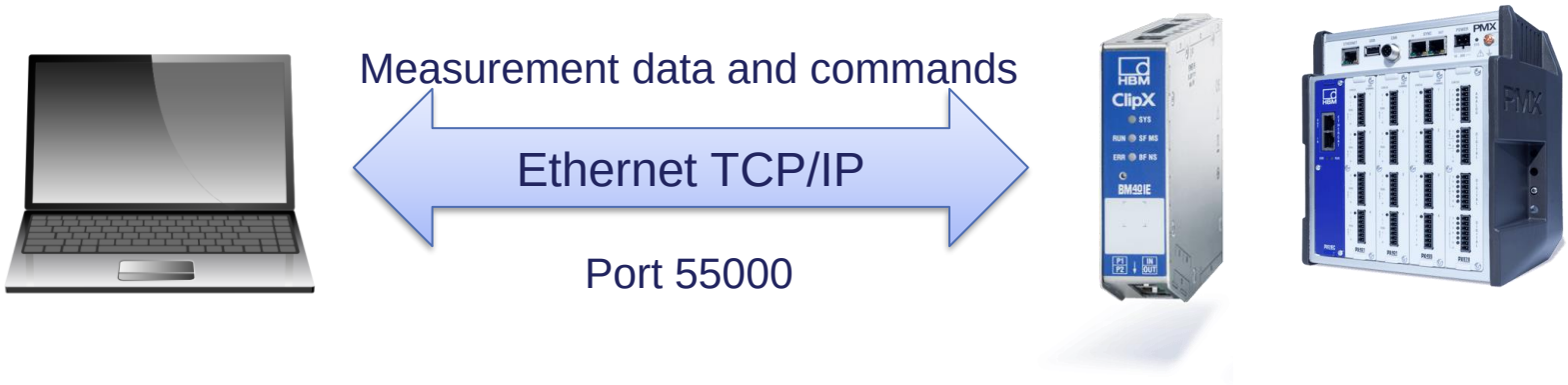
- Integration via industry standard protokols
  - REST protokol
  - OPC-UA

Server ←→ Client principle
More primitive structure
Data is send to an HTTP server in predefined intervals
Client must know the server
No communication from server to client

OPC UA is a standardized, platform-independent software interface
Minimal software development and maintenance effort
Powerful, user-friendly and flexible
Multi access possible
Secure → User rights
Works with client/server principle

Open interfaces

- Possibility for integration in smaller, user-dependent software
- Simple basic structure for communication with the device
  - ➢ ClipX and PMX → Object directory



Open interfaces – object directory

- List of all objects/parameters can be downloaded from the device
- Direct access with command SDO(?) Index,Subindex for writing (reading)

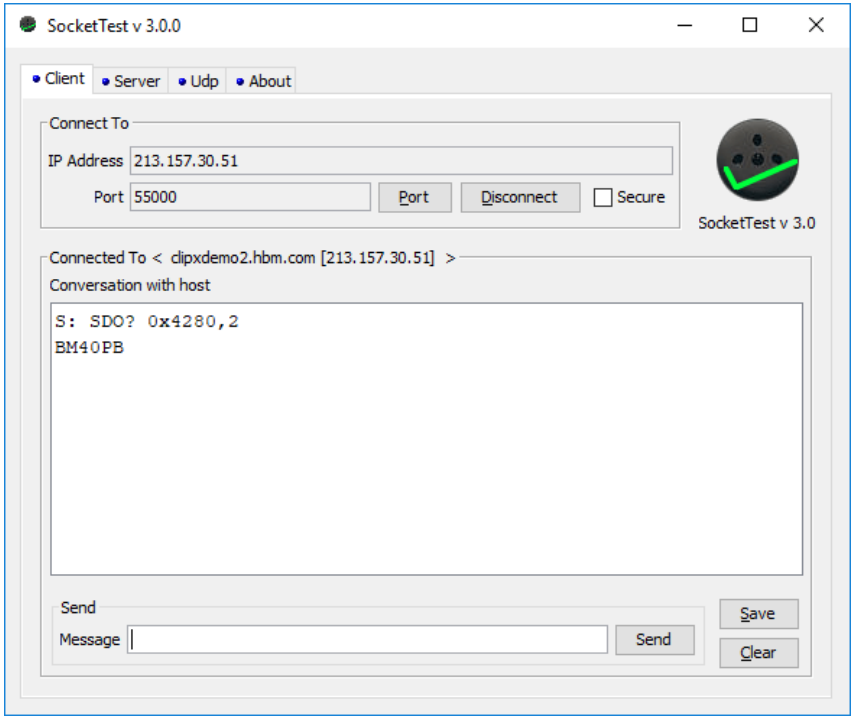
Path	Name	Idx	SubIdx	Type	Access	Description
sys/	deviceTypeStr	0x4280	2	STRING	RO	DeviceTypeStr
sys/	fwVersion	0x4280	3	STRING	RO	FW version
sys/	upVersion	0x4280	4	STRING	RO	UP version
sys/ethernet/	macArray	0x4280	5	UINT8	RO	MAC(array)
sys/	cpuLoad	0x4280	250	UINT16	ROY	CPU load (%)
sys/	chipTempC	0x4280	7	FLOAT	ROY	Chip temp C
sys/	sysReboot	0x4280	12	---	WO	System reboot
sys/	factoryReset	0x4280	8	UINT16	WO	Factory reset
sys/	cmdCreateParamsCsv	0x4280	9	---	WO	Create 'params.csv' in file system
sys/	cmdCreateOdCsv	0x4280	17	---	WO	Create 'clipx_od.csv' in file system
sys/	unitType	0x4280	10	STRING	RW	Unit type
sys/	pcbAssemblyType	0x4280	11	UINT32	RW	pcb assembly type
sys/	fwUpdating	0x4280	13	INT8	RO	FW update running
sys/	fsCleanMaxload	0x4280	14	UINT16	RW	FS-cleaner max. CPU load
sys/	fsCleanDelay	0x4280	15	UINT16	RW	FS-cleaner interval
sys/	ntpEnable	0x4280	18	UINT8	RW	enable NTP client
sys/	ntpServer	0x4280	19	STRING	RW	NTP server
sys/	tzOffset	0x4280	20	INT32	RW	timezone offset

Open interfaces – object directory

- Example: read device description string

Command: SDO? 0x4280,2

Response: BM40PB



Device API for integration in own software

- Compatibility with Windows & Linux → relative platform independency
  - .so (Shared Object) file for Linux
  - .dll (Dynamic Link Library) file for Windows
- Provision of a basic functional framework
  - Connection, measuring, control via calling functions
- Easy import in coding environment

Device API for integration in own software

- ClipX Api available for free at https://www.hbm.com/
- Integration in programming environments with C++ .dll file with optional C-interface
- Controlling by using the object directory

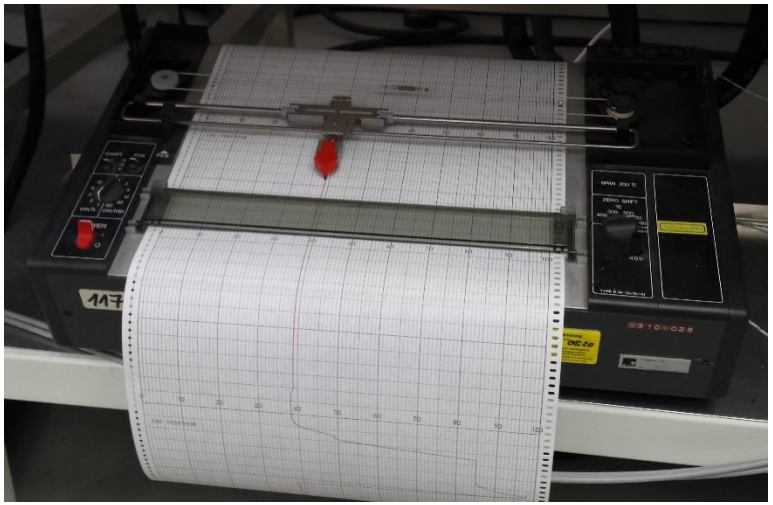

```
ClipX_API int Connect(const char* IP);
ClipX_API int Disconnect();
ClipX_API int SDORead(int idx, int subidx, char* res, int size);
ClipX_API int SDOWrite(int idx, int subidx, const char* val);
ClipX_API int startMeasurement();
ClipX_API int AvailableLines();
ClipX_API int ReadNextLine(double* MVLine);
ClipX_API int ReadNextBlock(int maxreads, double* time, double* value1, double* value2, double* value3, double* value4, double* value5, double* value6);
ClipX_API int stopMeasurement();
ClipX_API bool GetOverFlowFlag();
ClipX_API bool isConnected();
ClipX_API void ClearBuffer();
```

Integration example – ClipX in the HBM quality assurance

- Manufacturing of ring torsion load cells
- Monitoring of temperature in the ovens

Integration example – previous state

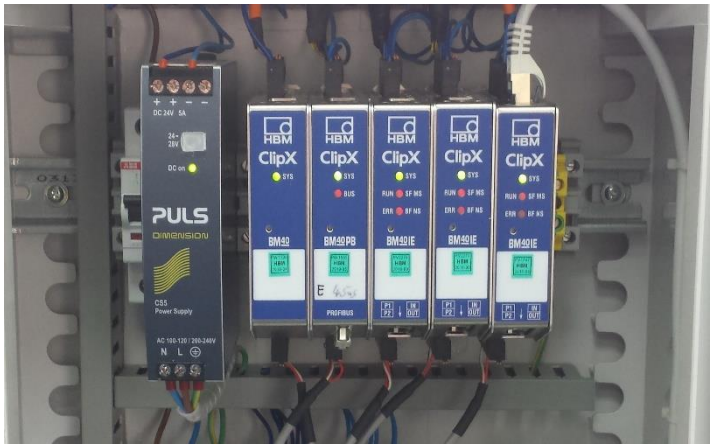
- Need for adjustment of the analog temperature curve
- Manually by employees using a template



Integrationsbeispiel – Automatisierte Lösung

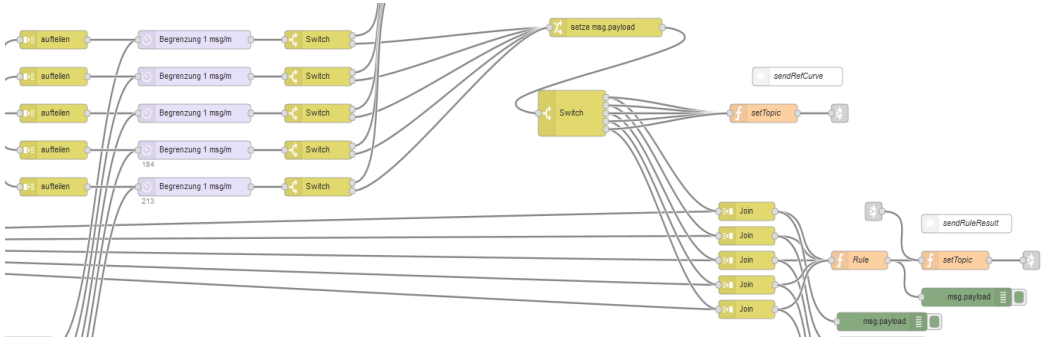
- Temperaturüberwachung durch PT100 Sensoren und ClipX Messverstärker (über ClipX Bus verbunden

- Daten werden mittels REST-Protokoll an PPM gesendet



Integration example – automized solution

- NodeRED for implementing rules



- Automatic comparison with the ideal curve

- Alarm if devation > delta

Practical demonstration

Seminars of the HBM Academy

Gain more experience in practical exercises at the HBM Academy:
https://www.hbm.com/en/0224/seminars-trainings-events-tradeshows/

Our tip:

– Individual In-house seminars by appointment

Contact us! seminare@hbm.com or +49 6151 8038061

Any questions?

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- Or email the presenter directly: michael.guckes@hbm.com

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