

P-NET

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P-NET Tutorial
Part 3

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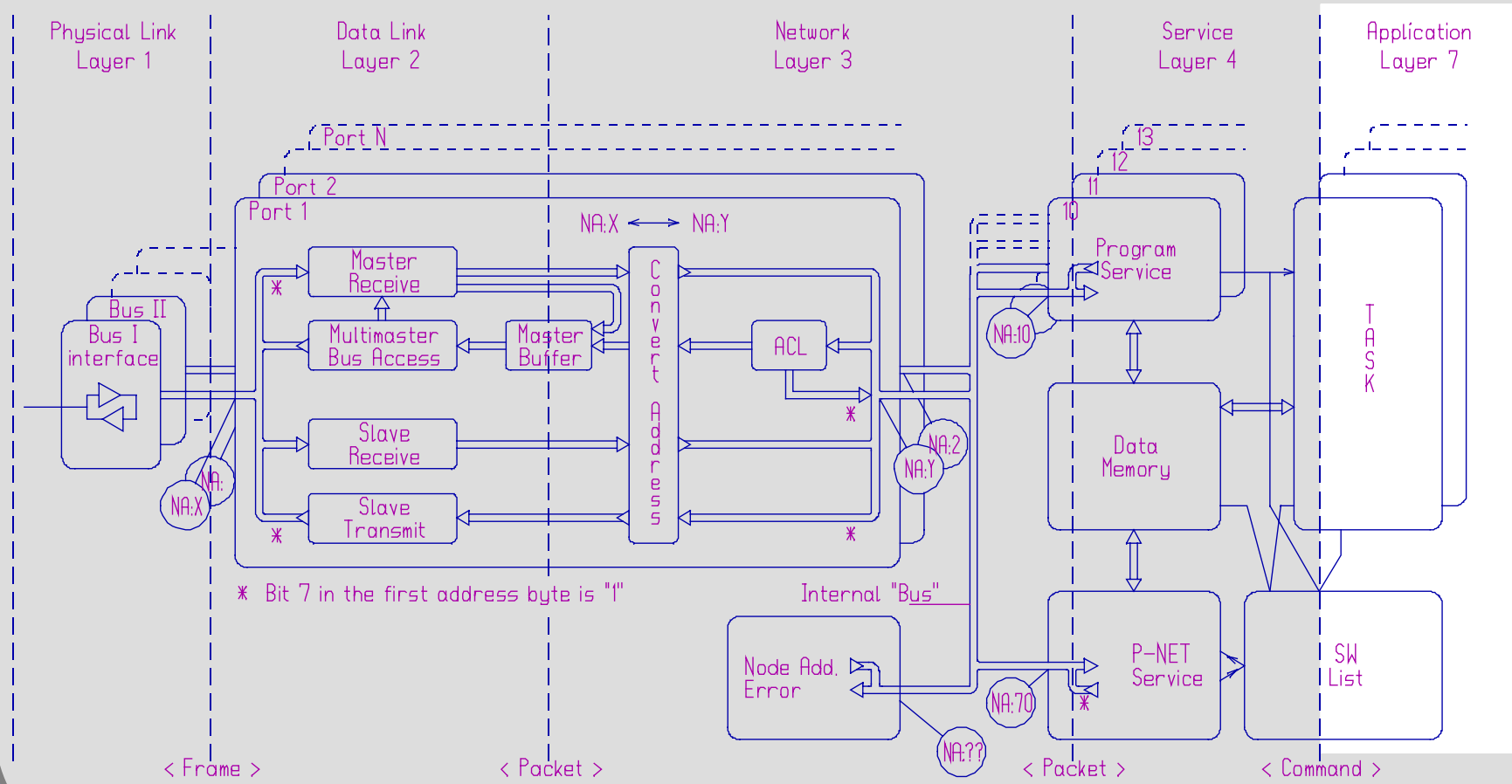
This part covers:

- The Application layer – layer 7:
 - Principle and structure
 - Data types and structure
 - Channel structure

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P-NET Application Layer

P-NET Architecture Complete System.
Based on ISO Open System Interconnection reference model.



502058AE.PIC
502058AJ.WPG

P-NET Application Layer

- Access variables
 - Software list.
 - global variable declaration
 - application program.
 - located internally or in other nodes.
 - The variable declaration from the other nodes is used to generate the entries for the external located variables in this SW list.
 - application program
 - accesses its global variables through the SW list.
 - Application layer
 - Access global variable
 - Command block
 - Passes the block on to the service layer (4).
 - Notification from the service layer.

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P-NET Application Layer

- Access variables - all global variables
 - SW list
 - master node
 - slave nodes
 - Types
 - Physical addresses
 - Logical address – SWNo
 - Standardized general purpose channel types
 - All communication
 - to a Slave
 - SW list located in the slave.
 - SWNo
 - Entry in the SW list.

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P-NET Application Layer

- SW list
 - master node
 - external variable
 - SW list holds
 - node address
 - SWNo.
- SWno
 - The 16 SWNo's,
 - Reserved by standard
 - Fixed types
 - Channel 0

Data types and structure

Simple types

- Boolean
- Byte
- Char
- Word
- Integer
- Longinteger
- Real
- Longreal

Complex types

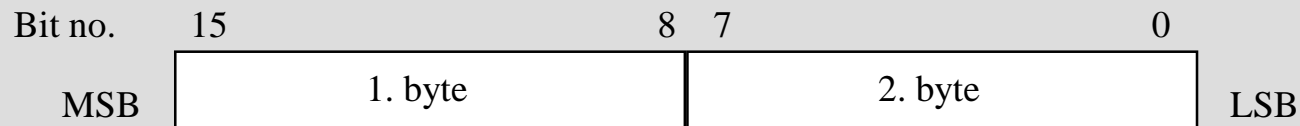
- Array
- String
- Record
- Buffer

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Data types and structure – simple types

WORD

A WORD contains an integer value between 0 and 65535. A WORD is transferred in two byte

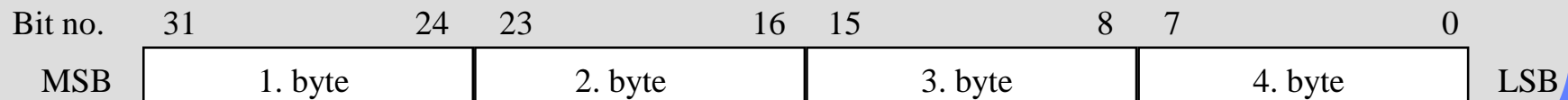


INTEGER

An INTEGER contains an integer value in the two's complement form between -32768 and +32767. An INTEGER is transferred in the same way as a WORD.

LONGINTEGER

A LONGINTEGER contains an integer value in the two's complement form between -2147483648 and +2147483647. A LONGINTEGER is transferred in four bytes.



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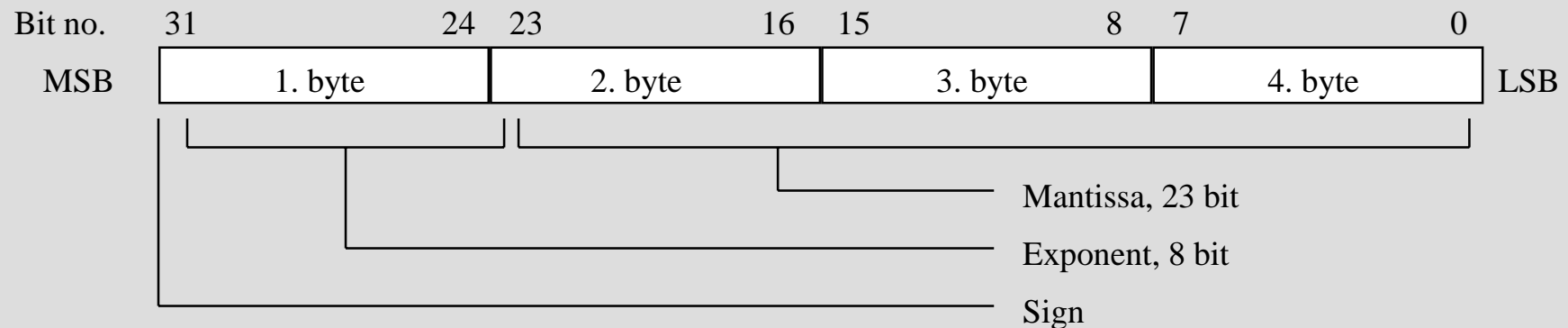
Data types and structure – simple types

REAL

The format of REAL is following the IEEE 754 Floating Point Standard.

A REAL can hold any value in the interval

from -3.4×10^{-38} to $-3.4 \times 10^{+38}$ for negative numbers, and
from 3.4×10^{-38} to $3.4 \times 10^{+38}$ for positive numbers.



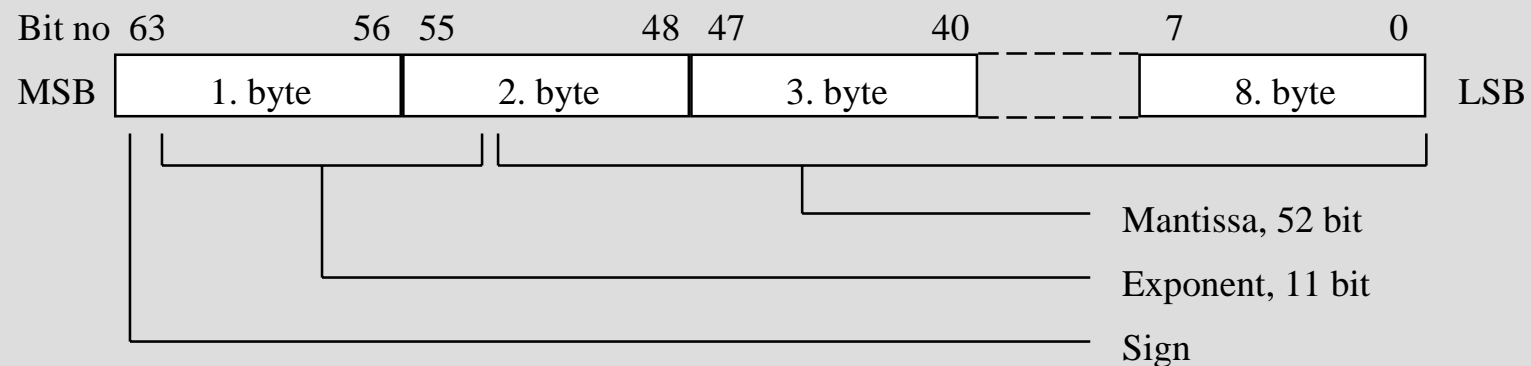
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Data types and structure – simple types

LONGREAL

The format for LONGREAL is following the IEEE 754 Floating Point Standard.
A LONGREAL can hold any value in the interval

from -1.7×10^{-308} to $-1.7 \times 10^{+308}$ for negative numbers, and
from 1.7×10^{-308} to $1.7 \times 10^{+308}$ for positive numbers.



Data types and structure – complex types

ARRAY

The elements of an ARRAY can be of any standard type, including ARRAY and RECORD. The element of an ARRAY with the lowest index will be transferred first.

Example: Transfer of a variable (a) of the type

ARRAY[1..2] OF ARRAY[1..3] OF BYTE

Bit no	7	0
	1. byte	a[1,1]
	2. byte	a[1,2]
	3. byte	a[1,3]
	4. byte	a[2,1]
	5. byte	a[2,2]
	6. byte	a[2,3]

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Data types and structure – complex types

STRING

The elements of an ARRAY can be of any standard type, including ARRAY and RECORD.

Data types and structure – complex types

RECORD

The fields in a RECORD can be of any standard type, including ARRAY and RECORD. The fields in a RECORD are transferred in the same order in which they are defined in the RECORD.

Example: Transfer of a variable (b) of the type

RECORD

field1: BYTE;

field2: RECORD

sub1: INTEGER;

sub2: ARRAY[1..8] OF BOOLEAN;

END;

field3: BYTE;

field4: ARRAY[1..8] OF BOOLEAN;

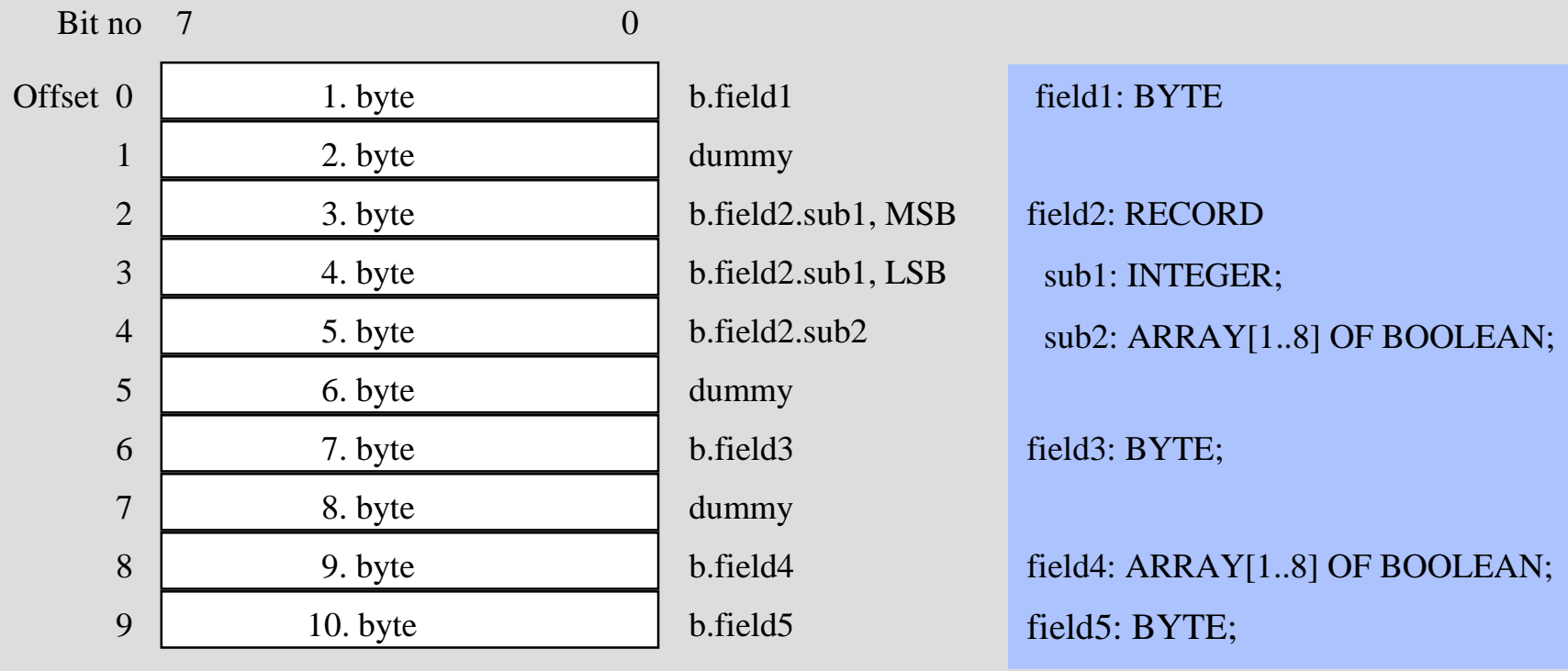
field5: BYTE;

END

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Data types and structure – complex types

RECORD



Data types and structure – complex types

- **BUFFER**
 - An element in the buffer is addressed without offset.
 - The buffer works as a FIFO (First In First Out). The first stored element will be the first element that can be loaded.
 - A buffer can hold a number of elements.
 - Only one element can be transferred in each transmission.
 - An element can only be read once.
 - Attempts to read an empty buffer will return "Buffer full/empty" in Control/Status.
 - Attempts to store to a full buffer will return "Buffer full/empty" in Control/Status.

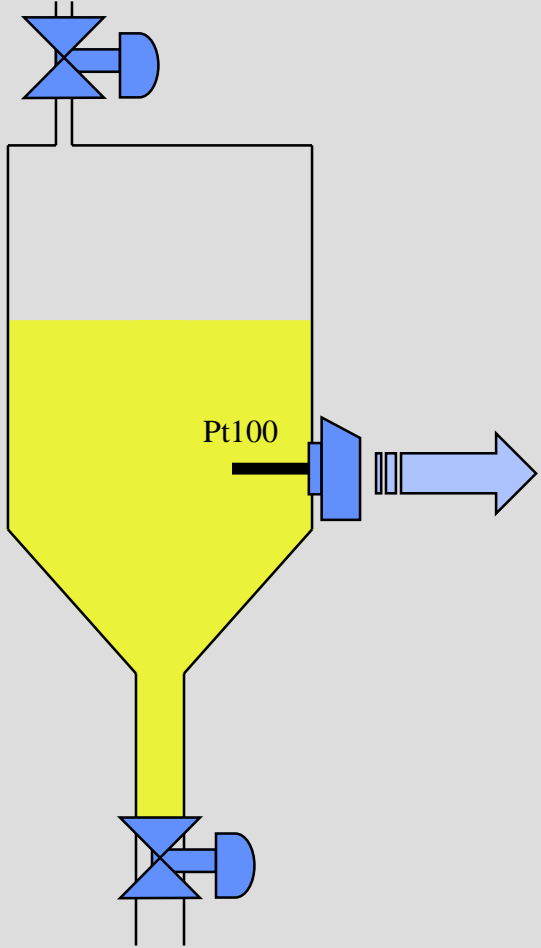
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P-NET Channel Structure “Layer 8”

- Standardised interface for I/O defined as objects
 - real time data in standard format (IEEE 754)
 - predefined functions
 - maintenance data
 - diagnostics and error messages
- Compatibility of channels from different vendors
- Software portability from device to device
- Variables mapped via SoftWire numbers
- High level language support

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MEASUREMENT



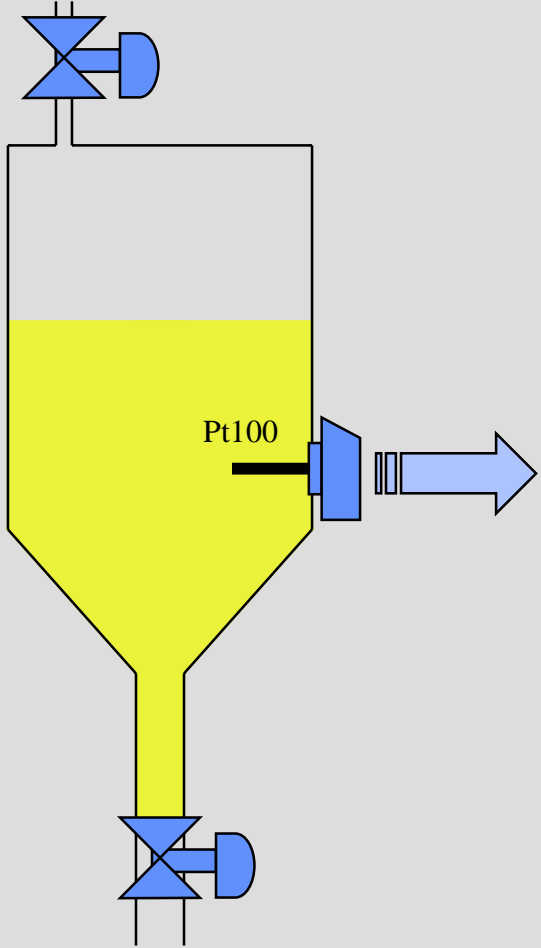
Interface module		
X0	AnalogIn	35,2°C
X1		
X2		
X3		
X4		
X5		
X6		
X7	HighLevel	
X8	LowLevel	
X9	ChConfig	
xA		
xB	FullScale	
xC	ZeroPoint	
xD	Maintenance	
xE	ChType	
xF	CHError	

Temperature is measured in a tank
Analogue input from PT100 sensor
Connection to interface module

Value is calculated in engineering units

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CONFIGURATION



Interface module		
X0	AnalogIn	35,2°C
X1		
X2		
X3		
X4		
X5		
X6		
X7	HighLevel	
X8	LowLevel	
X9	ChConfig	-----
xA		
xB	FullScale	-----
xC	ZeroPoint	0,0°C
xD	Maintenance	
xE	ChType	
xF	CHError	

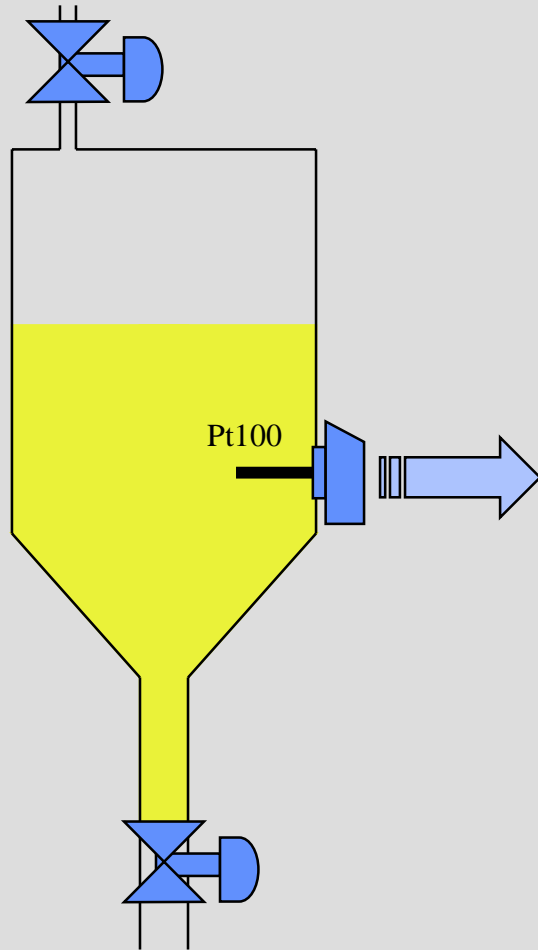
Configuration data

Calibration data

Predefined functions

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ERRORS



Interface module		
X0	AnalogIn	35,2°C
X1		
X2		
X3		
X4		
X5		
X6		
X7	HighLevel	
X8	LowLevel	
X9	ChConfig	-----
xA		
xB	FullScale	-----
xC	ZeroPoint	0,0°C
xD	Maintenance	
xE	ChType	-----
xF	CHError	-----

Channel errors

Module error

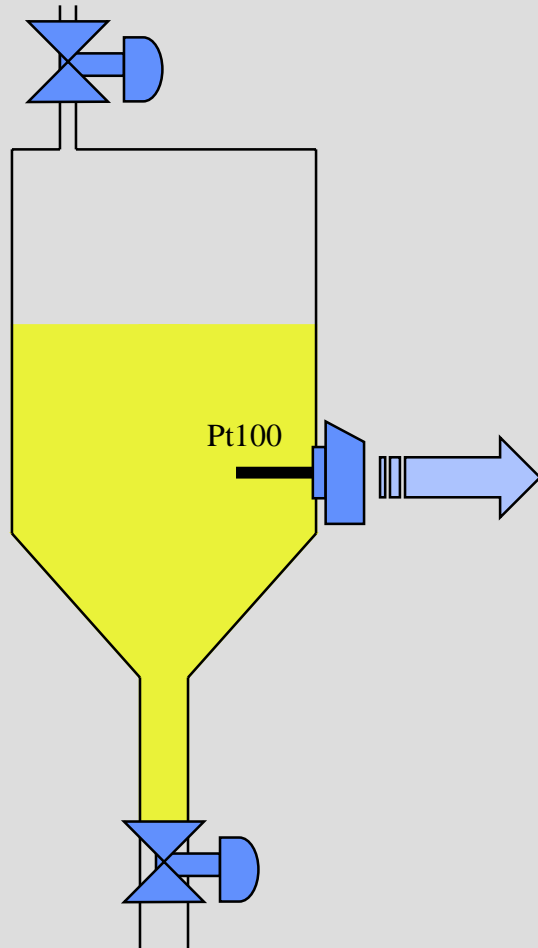
Actual and Historical

Channeltype info:

ID and
implementation

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PROCESS OBJECT



Interface module		
X0	AnalogIn	35,2°C
X1		
X2		
X3		
X4		
X5		
X6		
X7	HighLevel	40,0°C
X8	LowLevel	15,0°C
X9	ChConfig	-----
xA		
xB	FullScale	-----
xC	ZeroPoint	0,0°C
xD	Maintenance	-----
xE	ChType	-----
xF	CHError	-----

- Measurement
- Configuration
- Calibration
- Limitswitches
- Maintenance
- Channeltype
- Errors

- SoftWire numbers

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Channel Configuration: Analog Input Channel

PhysId: Write enable

Configuration | Calibration | Maintenance

Input signal:

Filter time constant:

Signal High Alarm No Load Alarm (3mA) High Level Alarm

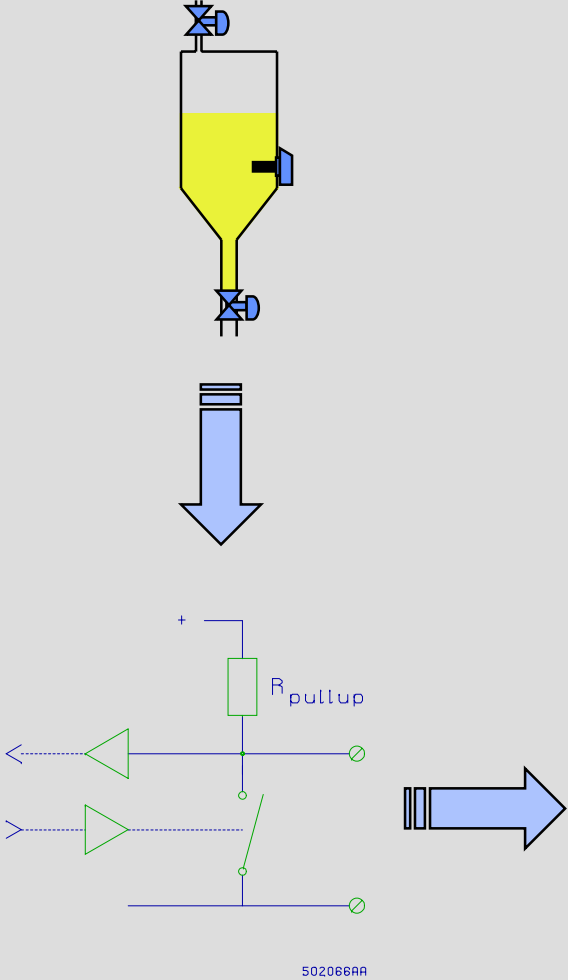
Signal Low Alarm Input Simulation Low Level Alarm

Analog In:

Error:

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Digital I/O channel



Digital channel		
X0	FlagReg	-----
X1	OutTimer	5,3 s
X2	Counter	0
X3	OutCurrent	0,4 A
X4	OperatingTime	200,5 s
X5	UserByteArray	-----
X6	FBTimer	5,9 s
X7	FBPreset	8,0 s
X8	OutPreset	2,0 s
X9	ChConfig	-----
xA	MinCurrent	0,25 A
xB	MaxCurrent	0,81 A
xC	UserRealArray	-----
xD	Maintenance	-----
xE	ChType	-----
xF	CHError	-----

FlagRegister

Automatic functions

Current measurement

FeedBack control

Maintenance

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Channel Configuration: Digital Channel

PhysId: Write enable

Configuration | Calibration | Maintenance

Functions:

No Overload Alarm Feedback Simulation
 Underload Alarm Input Simulation

Feedback Input A Feedback Input B

Flag Register

Out In
 Control InA
 InB FBStatus

OutCurrent: A
Counter: Operatingtime: s
FB Timer: s Out Timer: s

Error:

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OTHER CHANNELS

Channel N		
X0	PrimaryValue	Scaled Unit
X1		
X2		
X3		
X4		
X5		
X6		
X7		
X8		
X9	ChConfig	-----
xA		
xB		
xC		
xD	Maintenance	-----
xE	ChType	-----
xF	CHError	-----

PID Channel

Printer Channel

Weight Channel

Program Channel

Communication Channel

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COMMON CHANNEL

Service Channel (0)

X0 NumberOfSWno
X1 DeviceID
X2 NotUsed
X3 Reset
X4 PNETSerialNo
X5 NotUsed
X6 TimeDate
X7 FreeRunTimer
X8 WDTimer
X9 ModuleConfig
xA WDPreset
xB MailFilter
xC MailBox
xD WriteEnable
xE ChType
xF CommonError

In ALL modules

Fixed type

Always Channel 0

ID and Node configuration

Program Channel

Registers on ProgramChannel (channel n).

SWNo.	Identifier	Memory Type	Read Out	Type
n0	ProgramControl	RAMRead Write	- - - - -	Record
n1	ProgramStatus	RAMRead Only	- - - - -	Record
n2	ProgramID	Read Only	- - - - -	Record
n3*	TaskControl	RAMRead Write	- - - - -	Record
n4 *	TaskStatus	RAMRead Only	- - - - -	Record
n5 *	SystemPointer	Read Only	Hex	LongInteger
n6				
n7	MemoryInfo	Read Only	- - - - -	Record
n8	IDAndCode	Special function	- - - - -	Record
n9	ChConfig	EEPROMRPW	- - - - -	Record
nA	LibraryControl	RAMRead Write	- - - - -	Record
nB	LibraryStatus	RAMRead Only	- - - - -	Record
nC	LibraryProgramID	Read Only	- - - - -	Record
nD	Maintenance	EEPROMRPW	- - - - -	Record
nE	ChType	PROMRead Only	- - - - -	Record
nF	ChError	RAMRead Only	- - - - -	Record

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Program Channel

ProgramControl

Record

Command : BYTE;
ProgramToSelect : Word;
ErrorStatus : Bit32;

End

Command

38	SelectProgram
39	UnSelectProgram
40	Start
41	Stop
42	Resume
43	Reset
44	Kill

Program Channel

ProgramStatus

Record

State : BYTE;
SelectedProgram : Word;
ErrorStatus : Bit32;

End

State

0	Non-Selected
1	UnRunnable
2	Idle
3	Running
4	Stopped
5	Starting
6	Stopping
7	Resuming
8	Resetting

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Communication Channel

Variables on Communication channel 1 (channel x).

SWNo	Identifier	Memory type	Read out	Type
* x0	OutputBuffer	RAMReadWrite	-----	Buffer
* x1	InputBuffer	RAMReadWrite	-----	Buffer
* x2	NodeParam	RAMInitEEPROM	-----	Record
x3	Baudrate	RAMInitEEPROM	Decimal	LongInteger
* x4	Retries	RAMInitEEPROM	Decimal	Byte
x5				
x6				
x7				
* x8	ReserveTimer	RAMReadWrite	Decimal	Timer
x9	ChConfig	RAMInitEEPROM	-----	Record
* xA	ReservePreset	BatteryRAM	Decimal	Real
* xB	Reservation	BatteryRAM	Decimal	Boolean
* xC	DatamodeParam	RAMInitEEPROM	-----	Record
xD	Maintenance	BatteryRAM	-----	Record
xE	ChType	PROMReadOnly	-----	Record
xF	CHError	RAMReadOnly	Binary	Record