Fakulta strojní VŠB – TUO

Department of Control Systems and Instrumentation

Automatic Control Devices

(Materials for write notes)

doc. Ing. Jaromír Škuta, Ph.D.

Fakulta strojní VŠB – TUO

Department of Control Systems and Instrumentation

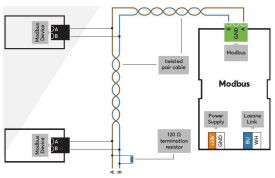
Lecture No. 5

Industrial networks, basic types, 7 layer model, physical layer....
application layer
(18, 21).

Fakulta strojní VŠB – TUO

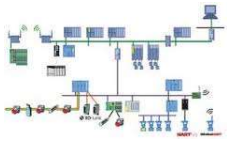
Department of Control Systems and Instrumentation

What do you find out?

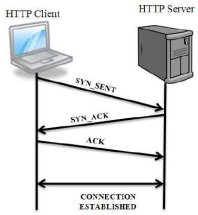


ILAN – industrial networks

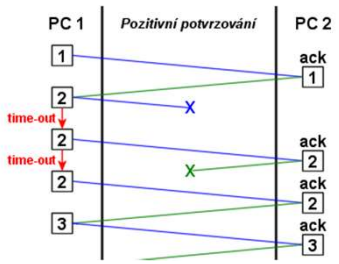
serves to transmit information in an industrial (disturbed) environment



ILAN confirmation

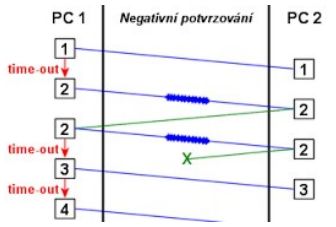


ILAN confirmation



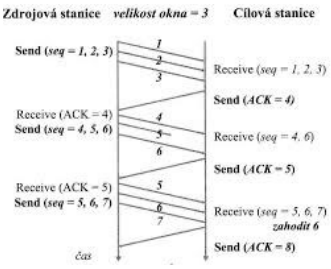
Fakulta strojní VŠB – TUO

ILAN confirmation



Fakulta strojní VŠB – TUO

ILAN confirmation

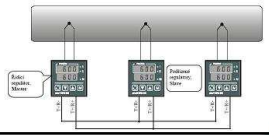


Fakulta strojní VŠB – TUO

Access to media

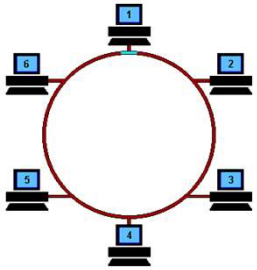
A multi-master

Master/Slave is



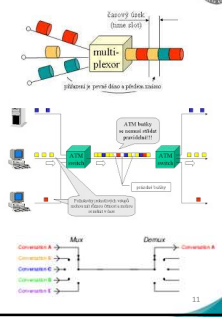
Access to media

The principle of the **Token ring** network is

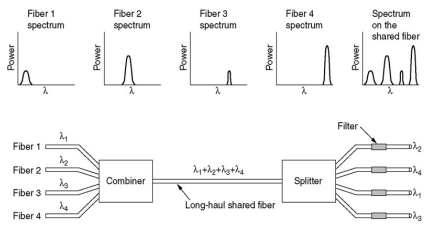


Access to media

Time division, **time multiplex** or



Access to media



Fakulta strojní VŠB – TUO

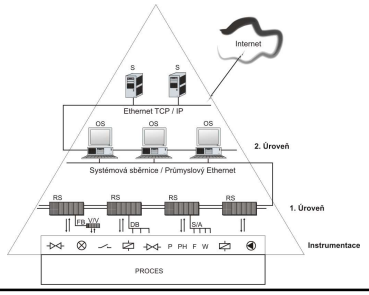
Motto:

Industrial communication systems

13

Fakulta strojní VŠB – TUO

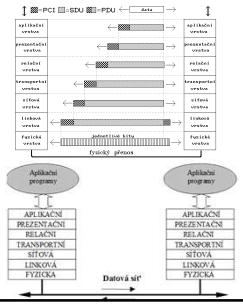
Industrial communication systems in the context of automation devices



14

Fakulta strojní VŠB – TUO

Communication links - ISO/OSI reference model



15

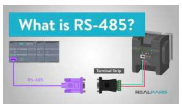
Communication links

- Individual layers can be implemented by

- Most ILAN networks are designed for

Physical Layer

- (Physical Layer) ensures the reception and



Data Link Layer

- (Data Link Layer) determines how messages are

Network Layer

- (Network Layer) ensures a connection

Transport Layer

(Transport Layer) ensures reliable message

Session Layer

- (Session Layer) must

Fakulta strojní VŠB – TUO

Presentation Layer

- (Presentation Layer) takes care of correct

22

Fakulta strojní VŠB – TUO

Application Layer

- (Application Layer) is

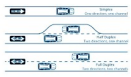
23

Fakulta strojní VŠB – TUO

Comparison of RS 485 and RS 232

- RS 232C
- Transmission distance: Transmission speed:
- 15 m 20 kbitů/s

- RS 485
- Transmission distance: Transmission speed:
- 12 m 10 Mbitů/s
- 120 m 1 Mbit/s
- 1200 m 100 kbitů/s



Half-duplex (poloviční duplex)

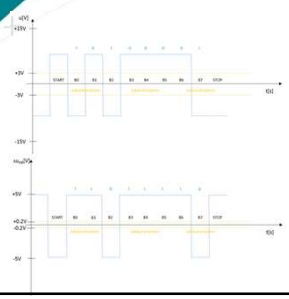
Full-duplex (plný duplex)

24

Fakulta strojní VŠB – TUO

Physical layer

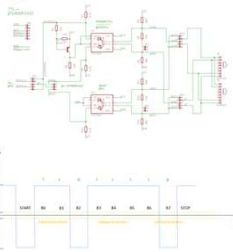
RS 232



Fakulta strojní VŠB – TUO

Physical layer

RS 485

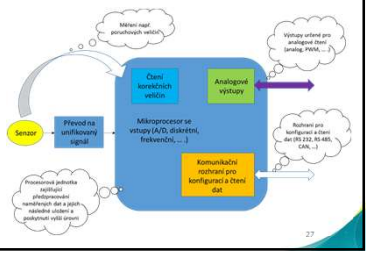


Fakulta strojní VŠB – TUO

Smart sensors

Inlet part **Inner part** **Output part**

A smart sensor can include:



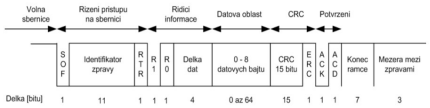
Fakulta strojní VŠB – TUO

Selected characteristics of the CAN bus

- **Two-wire serial data bus.**
- **The transmission path used can be a twisted pair.**

Fakulta strojní VŠB – TUO

CAN bus frames

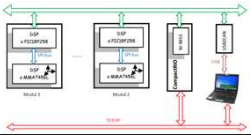


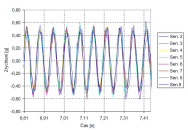
- **SOF** (Start Of Frame) –start of frame,
- **Identifikátor zprávy** – determines the priority,
- **RTR** (Remote Request) – data frame or data request,
- **R1**(IDE) – standard or extended frame,
- **Délka dat** -values 0-8,
- **Data** – 0-8 bytu,
- **CRC** – security,
- **ERC** – separator bit,
- **ACK** – confirmation,
- **ACD** – separator.

Fakulta strojní VŠB – TUO

Module requirements - firmware

- Option to set sensor registers using the ILAN (CAN) bus.

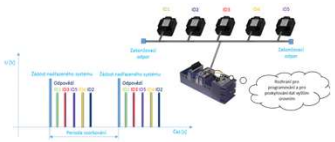




Configuration frameworks for MEMS

Byte	B0	B1	B2	B3	B4	B5	B6	B7
C1	255	x	x	x	x	x	x	x
	reading from all connected							
C2	ID_m	128	x	x	x	x	x	x
	reading from only one board							
C3	ID_m	1	ms	us	x	x	x	x
	setting time int.							
C4	ID_m	15	Adr	Hod	x	x	x	x
	recording in sensor registers							
C5	ID_m	240	Adr	x	x	x	x	x
	reading from the sensor register							

Frames sent by MEMS



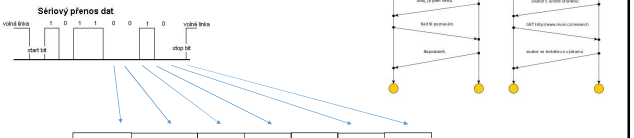
Byte	B0	B1	B2	B3	B4	B5	B6	B7
After command C1, C2								
	XL	XH	YL	YH	ZL	ZH	POC	DRDY
After command C4, C5								
	adr	hod	x	x	x	x	x	x

Protocol design (USART module)

- void Usart_Init(int)...MikroC
- Communication parameters:

Fakulta strojní VŠB – TUO

Draft Protocol



Address	Parameter	STA	DES	JED	CHECK	CR

Fakulta strojní VŠB – TUO

Encoding (interpretation)

Dec	Hx	Oct	Char	Dec	Hx	Oct	Html	Chr	Dec	Hx	Oct	Html	Chr	Dec	Hx	Oct	Html	Chr
0	0	000	NUL (null)	32	20	040		Space	64	40	100	@	@	96	60	140	`	`
1	1	001	SOH (start of heading)	33	21	041	!	!	65	41	101	A	A	97	61	141	a	a
2	2	002	STX (start of text)	34	22	042	"	"	66	42	102	B	B	98	62	142	b	b
3	3	003	ETX (end of text)	35	23	043	#	#	67	43	103	C	C	99	63	143	c	c
4	4	004	EOT (end of transmission)	36	24	044	$	$	68	44	104	D	D	100	64	144	d	d
5	5	005	ENQ (enquiry)	37	25	045	%	%	69	45	105	E	E	101	65	145	e	e
6	6	006	ACK (acknowledge)	38	26	046	&	&	70	46	106	F	F	102	66	146	f	f
7	7	007	BEL (bell)	39	27	047	'	'	71	47	107	G	G	103	67	147	g	g
8	8	010	BS (backspace)	40	28	050	(	(	72	48	110	H	H	104	68	150	h	h
9	9	011	TAB (horizontal tab)	41	29	051	)	)	73	49	111	I	I	105	69	151	i	i
10	A	012	LF (NL line feed, new line)	42	2A	052	*	*	74	4A	112	J	J	106	6A	152	j	j
11	B	013	VT (vertical tab)	43	2B	053	+	+	75	4B	113	K	K	107	6B	153	k	k
12	C	014	FF (NP form feed, new page)	44	2C	054	,	,	76	4C	114	L	L	108	6C	154	l	l
13	D	015	CR (carriage return)	45	2D	055	-	-	77	4D	115	M	M	109	6D	155	m	m
14	E	016	SO (shift out)	46	2E	056	.	.	78	4E	116	N	N	110	6E	156	n	n
15	F	017	SI (shift in)	47	2F	057	/	/	79	4F	117	O	O	111	6F	157	o	o
16	10	020	DLE (data link escape)	48	30	060	0	0	80	50	120	P	P	112	70	160	p	p
17	11	021	DC1 (device control 1)	49	31	061	1	1	81	51	121	Q	Q	113	71	161	q	q
18	12	022	DC2 (device control 2)	50	32	062	2	2	82	52	122	R	R	114	72	162	r	r
19	13	023	DC3 (device control 3)	51	33	063	3	3	83	53	123	S	S	115	73	163	s	s
20	14	024	DC4 (device control 4)	52	34	064	4	4	84	54	124	T	T	116	74	164	t	t
21	15	025	NAK (negative acknowledge)	53	35	065	5	5	85	55	125	U	U	117	75	165	u	u
22	16	026	SYN (synchronous idle)	54	36	066	6	6	86	56	126	V	V	118	76	166	v	v
23	17	027	ETB (end of trans. block)	55	37	067	7	7	87	57	127	W	W	119	77	167	w	w
24	18	030	CAN (cancel)	56	38	070	8	8	88	58	130	X	X	120	78	170	x	x
25	19	031	EM (end of medium)	57	39	071	9	9	89	59	131	Y	Y	121	79	171	y	y
26	1A	032	SUB (substitute)	58	3A	072	:	:	90	5A	132	Z	Z	122	7A	172	z	z
27	1B	033	ESC (escape)	59	3B	073	;	;	91	5B	133	[	[	123	7B	173	{	{
28	1C	034	FS (file separator)	60	3C	074	<	<	92	5C	134	\	\	124	7C	174			|
29	1D	035	GS (group separator)	61	3D	075	=	=	93	5D	135	]	]	125	7D	175	}	}
30	1E	036	RS (record separator)	62	3E	076	>	>	94	5E	136	^	^	126	7E	176	~	~
31	1F	037	US (unit separator)	63	3F	077	?	?	95	5F	137	_	_	127	7F	177	&#127;	DEL

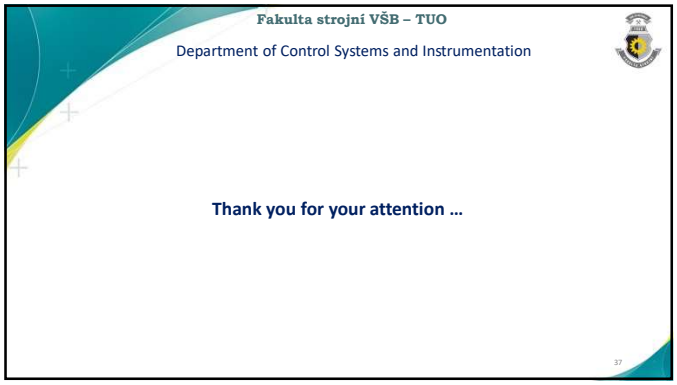
Source: www.LookupTables.com

Fakulta strojní VŠB – TUO

Department of Control Systems and Instrumentation

What was the content of the lecture

- Industrial networks
- Topology
- Protocol
- Access methods
- Confirming messages
- …
- 7 layer model
  - physical layer
  - …
  - application layer


Fakulta strojní VŠB – TUO
Department of Control Systems and Instrumentation
Thank you for your attention …
37