1.1 Description of protocol

Packets are always six bytes long. There are two types of packets: polling packet and setting packet. There are also one byte long ack packets, but these are only sent by master mainboard to inform a sender that packet is received.

**********Examples**********

Typical polling packet: `1 21 11 0 A3 C6`

This packet is sent by control panel with address 21, and it polls variable A3 from master mainboard.

```
1  = Domain                    0  =Poll request
21 = Sender                    A3 =Polled variable
11 = Receiver                  C9 =Checksum
```

Typical setting packet: `1 11 21 A3 3 D9`

This packet is sent by master mainboard and it updates control panel's variable A3 with new data.

```
1  = Domain                    A3 =Variable
11 = Sender                    3  =Data
21 = Receiver                  D9 =Checksum
```

****

Domain is always 1.
Sender is a sending module's address: 11 = mainboard, 21-29 = different individual control panels

Receiver is a module targeted by packet: 10 = to all master&slave mainboards, 11 = to master mainboard, 20 = to all control panels, 21 – 29 = different individual control panels

Variable is a variable described by the variable table at the end of the document.

Data is the content of the variable.

Checksum is always automatically calculated by software. Every 8-bit byte in the packet is added together and carry bits are discarded (only 8 lower bits from 16-bit result are used).

Poll request is always 0. It defines packet as polling packet.

Polled variable defines polled variable.

Typical polling routine: control panel polls variable A3 from master mainboard and receives answer:

```
1 21 11 0 A3 C6
1 21 11 A3 3 D9
```

Typical setting routine: Control panel updates master&slave mainboard's variable A6 with new data:

```
1 21 11 A6 FF D8          Control panel sends a setting packet to master mainboard
D8                        Master mainboard answers with ack byte
1 21 10 A6 FF D7          Control panel sends a setting packet to all slave
                          mainboards
```

Special event:

Every time when the carbon dioxide sensors are read, all other traffic is halted and enabled by special variables. CO2 sensor 'speaks different language'.

Variable 91 halts module's transmissions
Variable 8F enables module's transmissions

When setting these variables, data byte must always be 0.

Typical CO2 reading routine, master mainboard halts traffic, communicates with CO2 sensor and enables traffic:

```
1 11 20 91 0 C3                Master mainboard halts traffic (to
                               all control panels)
1 11 20 91 0 C3                twice just in case if the first
                               packet is lost
E1                             CO2 sensor <-> master mainboard
DF                             conversation
82
16
98
6
13
F8
11
1 11 20 8F 0 C1                Master mainboard enables traffic (to
                               all control panels)
1 11 20 8F 0 C1                again twice
```

1.2 Description of modules

Master&Slave mainboards are inside the ventilation machine.

Master mainboard's address is always 11. There can be only one master mainboard in the same rs-485 line. Only master mainboard can send ack bytes when it's variables are set or answer to polls.

Slave mainboards don't have individual addresses, their common address is 10. Slave mainboards never transmit anything, so they can't be polled either.

Control panel's addresses can be 21-29. Address 20 targets every module in 21-29. Control panels do not reply to polls or send ack bytes. Control panels can poll variables from master mainboard.

LON gateway's address is always 28. LON gateway does not reply to polls or send ack bytes. It only polls variables from mainboard.

1.3 Description of data types

Variables have different data types. Fan speed can only be adjusted and read with correct values, humidity readings must be calculated etc.

Fanspeed:

#	Fan speed
1	1
3	2
7	3
F	4
1F	5
3F	6
7F	7
FF	8

Humidity:
Relative humidity values can be translated with following formula:
from data to %:
(x-51)/2,04 where x is the data from data grid (must be translated first from HEX to DEC).
from % to data:
x*2,04+51

Temp:
Temperature values can be translated with table shown in appendix A.

Dec:
Dec is a normal decimal number. CO2 setpoint and measured CO2 are 16-bit decimal values, they must be first combined together in HEX format and then converted to decimal.

State flag:
State flag variable has 8 on/off flags. For example A3 bit 0 is a power state flag. When it is 1, ventilation machine is on and when it is 0, ventilation machine is off.

Variable table

#	Name	Type	Description	
29	Fan speed	fanspeed	Current fan speed. Legal values: HEX 1 = speed 1 HEX 3 = speed 2 HEX 7 = speed 3 HEX F = speed 4	 HEX 1F = speed 5 HEX 3F = speed 6 HEX 7F = speed 7 HEX FF = speed 8
2A	Current relative humidity	humidity	higher measured relative humidity from 2F and 30. Translating Formula: (x-51)/2,04 (Data is in hex).	
2B	Current level of CO2 high byte	dec		
2C	Current level of CO2 low byte	dec	Last measured amount of CO2. 2B=upper byte and 2C=lower byte. You can use 16-bit conversion tool to translate this. Just write both hex numbers to HEX box, high byte first.	
2F	%RH from sensor 1	humidity	formula: (x-51)/2,04	
30	%RH from sensor 1	humidity	formula: (x-51)/2,04	
32	Outside temp	temp	Measured temperature from outside air duct.	
33	Exhaust temp	temp	Measured temperature from exhaust air duct.	
34	Inside temp	temp	Measured temperature from inside air duct.	
35	Incoming temp	temp	Measured temperature from incoming air duct.	
A3	SELECT	state flag	bit 0=Power state 1=CO2 adjust state 2=%RH adjust state 3=Heating state 4=Filterguard indicator 5=Heating indicator 6=Fault indicator 7=service reminder	
A4	Heating setpt.	temp	Sets the temperature of the incoming air.	
A5	MAX fan speed	fanspeed	Sets the maximum fan speed. Use same values as in variable 29.	
A6	Service reminder	dec	Sets the interval of service reminder in months.	
A7	Preheating setpt	temp	Preheating is turned on when exhaust air temperature drops under this setpoint.	
A8	Input fan stop	temp	Input fan stops when exhaust air temperature drops under this setpoint.	
A9	MIN fan speed	fanspeed	Sets the minimum fan speed. Use same values as in variable 29.	
AA	PROGRAM	state flag dec	PROGRAM has two parts: lower nibble (bits 0-3) set the adjustment interval of CO2 and %RH in minutes. bit 4 = automatic RH basic level seeker state bit 5 = Boost switch mode(1=boost sw. 0=fireplace sw.) bit 6 = radiator type: 0 = electric 1 = water bit 7=cascade adjust 0=off 1=on	
AE	Basic humidity lev.	humidity	Displays apartment's normal humidity level when there aren't any humidity sources.	
AF	HRC bypass	temp	Heat recovery cell bypass setpoint.	
B0	DC fan input adj.	dec	DC-type input fan adjustment %	
B1	DC fan output adj.	dec	DC-type output fan adjustment %	
B2	Cell defrosting	temp	Defrosting routine starts when exhaust air drops below this setpoint.	
B3	CO2 setpt upper	dec	CO2 adjustment's setpoint upper byte.	
B4	CO2 setpt lower	dec	CO2 adjustment's setpoint lower byte. See variable 2C.	
B5	PROGRAM2	state flag	bit 0 = Function of max speed limit, 0=with adjustments 1 = always	

APPENDIX A

CONVERSION TABLE: NTC SENSOR VALUES <--> °C

HEX	DEC	°C	HEX	DEC	°C	HEX	DEC	°C	HEX	DEC	°C
00	0	-74	40	64	-12	80	128	9	C0	192	34
01	1	-70	41	65	-12	81	129	9	C1	193	34
02	2	-66	42	66	-12	82	130	9	C2	194	35
03	3	-62	43	67	-11	83	131	10	C3	195	35
04	4	-59	44	68	-11	84	132	10	C4	196	36
05	5	-56	45	69	-11	85	133	10	C5	197	36
06	6	-54	46	70	-10	86	134	11	C6	198	37
07	7	-52	47	71	-10	87	135	11	C7	199	37
08	8	-50	48	72	-9	88	136	11	C8	200	38
09	9	-48	49	73	-9	89	137	12	C9	201	38
0A	10	-47	4A	74	-9	8A	138	12	CA	202	39
0B	11	-46	4B	75	-8	8B	139	12	CB	203	40
0C	12	-44	4C	76	-8	8C	140	13	CC	204	40
0D	13	-43	4D	77	-8	8D	141	13	CD	205	41
0E	14	-42	4E	78	-7	8E	142	13	CE	206	41
0F	15	-41	4F	79	-7	8F	143	14	CF	207	42
10	16	-40	50	80	-7	90	144	14	D0	208	43
11	17	-39	51	81	-6	91	145	14	D1	209	43
12	18	-38	52	82	-6	92	146	15	D2	210	44
13	19	-37	53	83	-6	93	147	15	D3	211	45
14	20	-36	54	84	-5	94	148	15	D4	212	45
15	21	-35	55	85	-5	95	149	16	D5	213	46
16	22	-34	56	86	-5	96	150	16	D6	214	47
17	23	-33	57	87	-4	97	151	16	D7	215	48
18	24	-33	58	88	-4	98	152	17	D8	216	48
19	25	-32	59	89	-4	99	153	17	D9	217	49
1A	26	-31	5A	90	-3	9A	154	18	DA	218	50
1B	27	-30	5B	91	-3	9B	155	18	DB	219	51
1C	28	-30	5C	92	-3	9C	156	18	DC	220	52
1D	29	-29	5D	93	-2	9D	157	19	DD	221	53
1E	30	-28	5E	94	-2	9E	158	19	DE	222	53
1F	31	-28	5F	95	-2	9F	159	19	DF	223	54
20	32	-27	60	96	-1	A0	160	20	E0	224	55
21	33	-27	61	97	-1	A1	161	20	E1	225	56
22	34	-26	62	98	-1	A2	162	21	E2	226	57
23	35	-25	63	99	-1	A3	163	21	E3	227	59
24	36	-25	64	100	0	A4	164	21	E4	228	60
25	37	-24	65	101	0	A5	165	22	E5	229	61
26	38	-24	66	102	0	A6	166	22	E6	230	62
27	39	-23	67	103	1	A7	167	22	E7	231	63
28	40	-23	68	104	1	A8	168	23	E8	232	65
29	41	-22	69	105	1	A9	169	23	E9	233	66
2A	42	-22	6A	106	2	AA	170	24	EA	234	68
2B	43	-21	6B	107	2	AB	171	24	EB	235	69
2C	44	-21	6C	108	2	AC	172	24	EC	236	71
2D	45	-20	6D	109	3	AD	173	25	ED	237	73
2E	46	-20	6E	110	3	AE	174	25	EE	238	75
2F	47	-19	6F	111	3	AF	175	26	EF	239	77
30	48	-19	70	112	4	B0	176	26	F0	240	79
31	49	-19	71	113	4	B1	177	27	F1	241	81
32	50	-18	72	114	4	B2	178	27	F2	242	82
33	51	-18	73	115	5	B3	179	27	F3	243	86
34	52	-17	74	116	5	B4	180	28	F4	244	90
35	53	-17	75	117	5	B5	181	28	F5	245	93
36	54	-16	76	118	5	B6	182	29	F6	246	97
37	55	-16	77	119	6	B7	183	29	F7	247	100
38	56	-16	78	120	6	B8	184	30	F8	248	100
39	57	-15	79	121	6	B9	185	30	F9	249	100
3A	58	-15	7A	122	7	BA	186	31	FA	250	100
3B	59	-14	7B	123	7	BB	187	31	FB	251	100
3C	60	-14	7C	124	7	BC	188	32	FC	252	100
3D	61	-14	7D	125	8	BD	189	32	FD	253	100
3E	62	-13	7E	126	8	BE	190	33	FE	254	100
3F	63	-13	7F	127	8	BF	191	33	FF	255	100