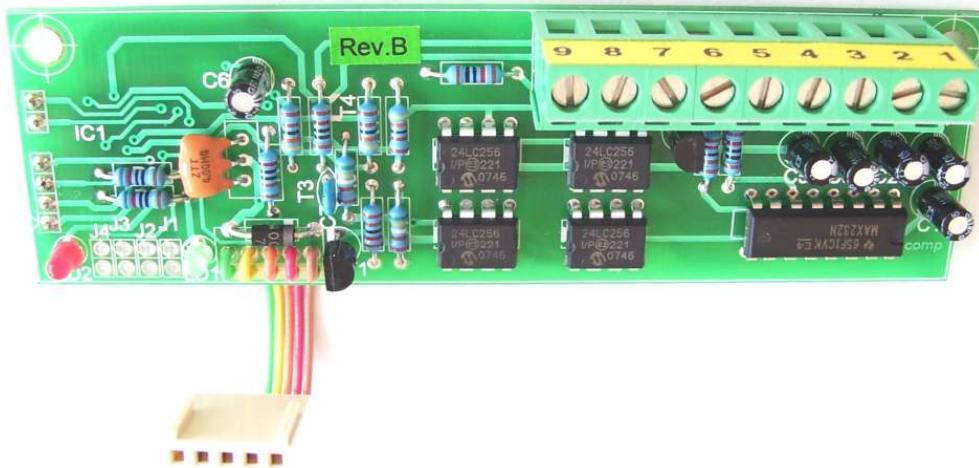


CM-232

RS-232 Communication Module
for ThermoControl Plus.. series



Rev.B2

Schwank
INNOVATIVE HEATING SOLUTIONS



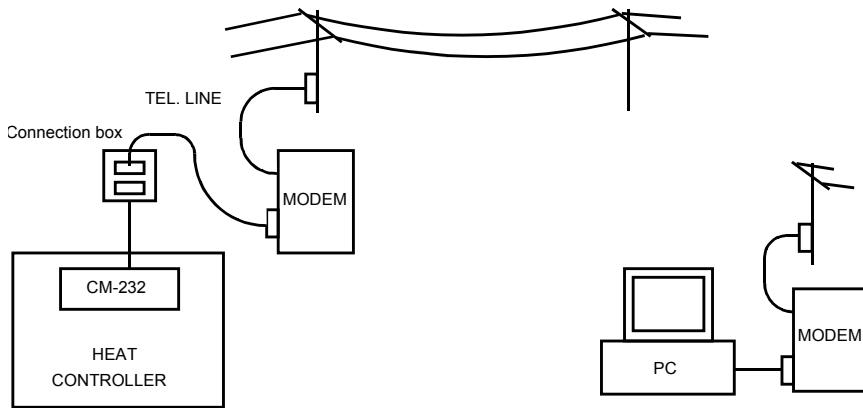
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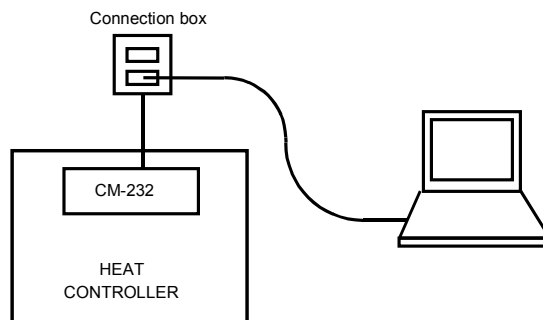
How to use CM-232

The Module can be built into any of the controllers in a very easy way. The controller will automatically recognize the presence of the module. The module makes it possible to see the measured values and to modify any control parameter. The module works as a data logger too: in every 15 minutes stores the measured values and parameters. A continuous history of the last 3 weeks can be read out from the module.

A separate connection box contains two 9-pole D-Sub connectors: one for a direct PC (Laptop) connection, another for a modem connection (or other devices like RS232-to-Ethernet converter etc.).

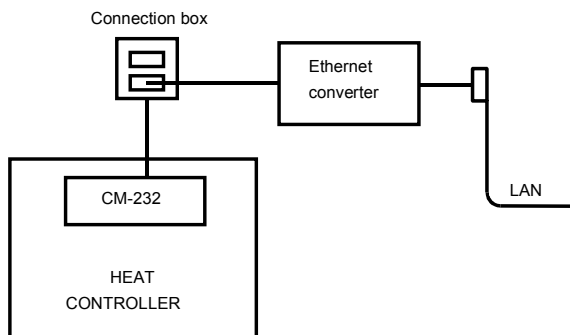


Connecting to a modem



Connecting to a PC (Laptop)

If the portable computer (Laptop) doesn't contain RS232 connection use a commercial RS232-USB converter device (ATEN, STLAB or other types).



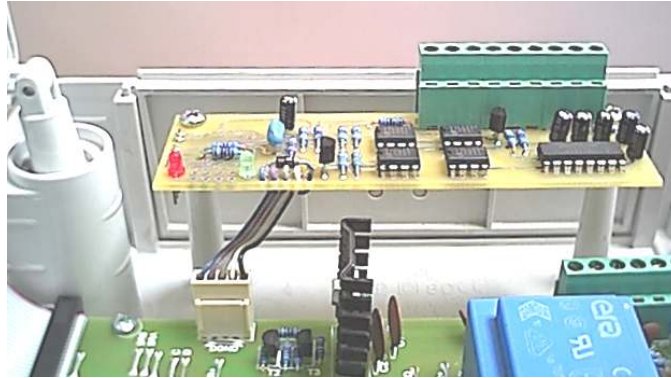
Connecting to a local network

The modem and Ethernet converter are commercial products, they can be bought from local dealers.

How to install the Module:

Before installation, the mains supply must be switched off. It is not enough to switch off the I/O switch on the front panel of the controller, the outside double pole mains switch must be switched off first of all to avoid electric shock.

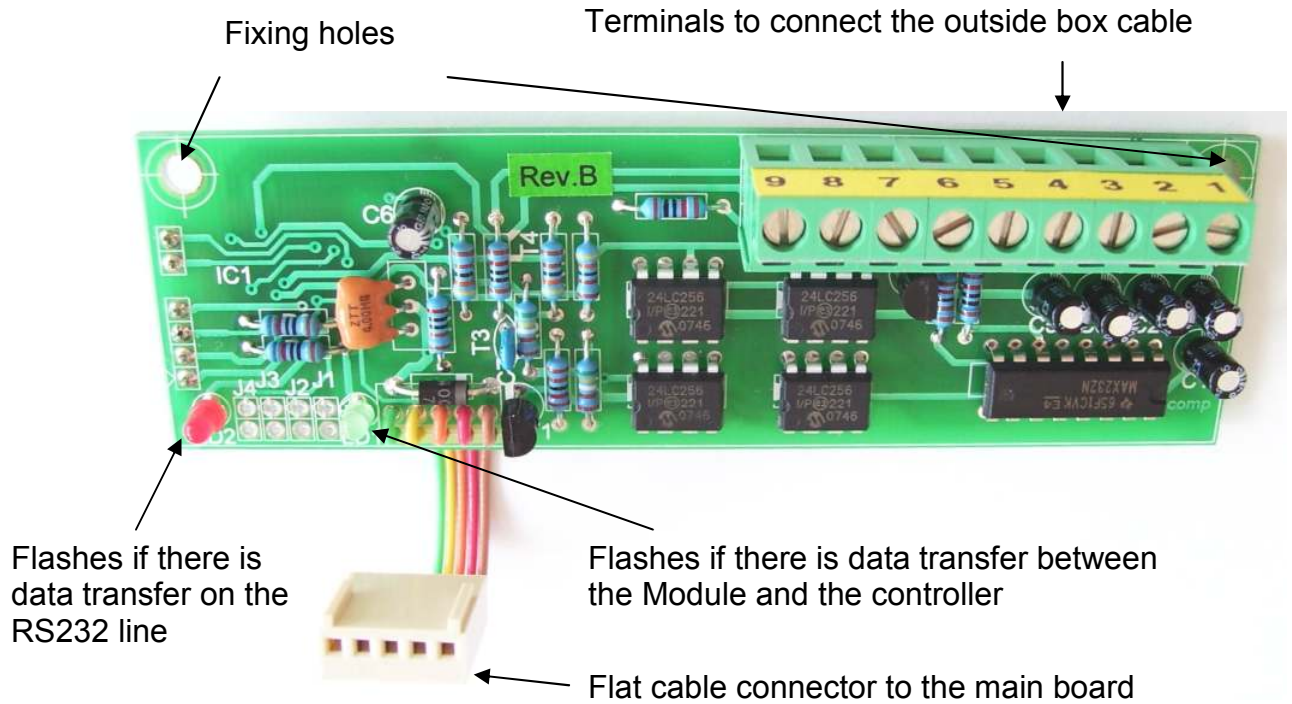
- Open the case after releasing the four big plastic screws at the corners.
- You will see two plastic spacer rods above the connection board. Fix the Module with the enclosed screws to the spacers (see picture below). If you have a controller in a wide case, use the enclosed plastic rail: fix the rail to the spacers then fix the Module to the rail.



- Snap the flat cable connector of the Module to the socket on the main connection board (see on the picture).
- Fix the separate connection box near to the controller and connect its cable (through the rubber inlets of the case) to the terminals of the module. Be very careful to keep the color order during connection:
1: red, 2:yellow, 3:blue, 4:grey, 5:orange, 7:braun, 8:green, 9:white
- Slide the „Setup” switch to „On” position (in the upper part of the case)
- Close the case and fix it with the plastic screws. Switch on the controller.
Push and keep pushed the **DISP** button until the parameter menu appears (Par).
Push repeatedly the **SEL** button until the „br” sign appears: this is the first parameter of the communication module: „br”=bit rate. Set the desired bit rate by the +/- buttons. Depending on the connected device set the maximal speed (38.4) if possible.
Push the **SEL** button again: a sign „bAnS.4” appears. Here you can set (by the +/- buttons) the number of rings for the modem to answer in case of a call: if you set 4, the modem will be activated after the 4-th rings. You can set max. 9 rings („bAnS.9”). If you set „0” the modem will not answer to the incoming calls.
When finished, push **DISP** button to go back to the base display mode.
- Switch off the controller by I/O and the outside mains switch.
- Open the case again and slide the „Setup” switch to „Off” position.
- Close the case and switch on the controller. The installation of the Module is finished, it is ready to work.

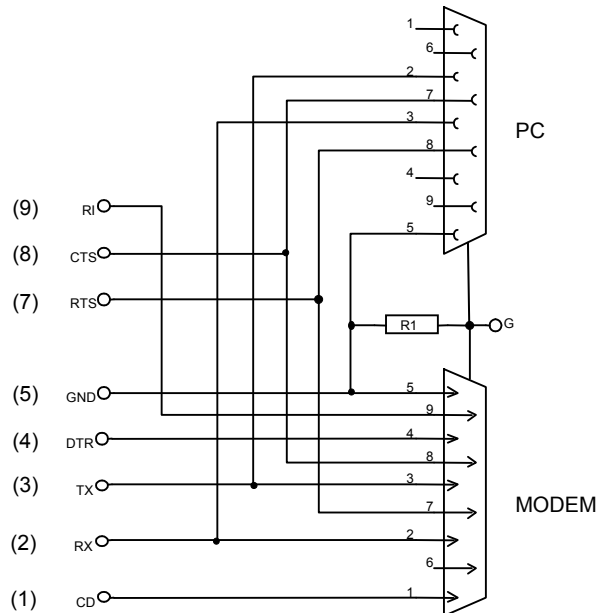
Technical Parameters:

- Bit rate: 600, 1200, 2400, 4800, 9600, 19200, 38400 bit/s can be selected
- Format: 8 data bit (ASCII text); parity no; 1 stop bit
- Transfer control: RTS / CTS , halfduplex
- Data recording: in every 15 minutes based on the inside clock of the controller
(During an hour: at 0, 15, 30, 45 minutes)
- Memory: EEprom 128kByte



Wiring of the connectors

- | | | |
|---|--------|-----|
| 9 | White | RI |
| 8 | Green | CTS |
| 7 | Brown | RTS |
| 5 | Orange | GND |
| 4 | Grey | DTR |
| 3 | Blue | TX |
| 2 | Yellow | RX |
| 1 | Red | CD |



Communication

The communication of the CM-232 Module is based on 16-bit registers. You can see or modify the parameters by reading or writing these registers. Each register has a 16-bit address.

Functions for data transfer and test:

- Reading: code 03h
- Writing: code 06h
- Test: code 08h

Remark: the letter „h” after the figures always means the hexadecimal format.

The length of one message is always 17 characters; the length of the answers may be different.

Register reading

In this example we ask for 1 register from address „0”.

The „:” is part of the message !
The „↵” means the 0Dh+0Ah line-end signal..

:02030000001FA↵

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
:	0	2	0	3	0	0	0	0	0	0	0	1	F	A	0Dh	0Ah

As an ASCII code:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
3Ah	30h	32h	30h	33h	30h	30h	30h	30h	30h	30h	30h	31h	46h	41h	0Dh	0Ah

Structure:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
:	02		fcode		Reg. address		Numb. of registers		LRC		CR	LF				
					Hi	Lo	Hi	Lo								

	02	03	00	00	00	01	FAh									
--	----	----	----	----	----	----	-----	--	--	--	--	--	--	--	--	--

$$\Sigma \text{ mod } 100\text{h} = 0$$

LRC: Check sum: if we add up the marked figures (between 2-15) then the sum must be dividable by 100h without rest.

CR: Carriage return
LF: Line feed

In the example the code fcode=03 indicates the reading request.
Reg.address=0000 gives the starting address.
Number=0001 means the number of required data register (max 7Fh). This may be more than 1, in that case the answer will be longer.

An answer may be:

:020302810375↵

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
:	02		Status	Length	Data		LRC		CR	LF				
:	02		03	02	81 03		75		0Dh	0Ah				
					Hi	Lo								

The „length” indicates that there will be 2 byte.

The 16-bit figures will arrive in High-Low order.

Byte order of the 32-bit figures: (sample: 4byte work-hour counter)

Hi	Lo	Hi	Lo	2x16bit 32bit
Hi		Lo		

Register writing:

In this example we are writing „1” to address „2”.

:020600020001F5.␣

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
:	0	2	0	6	0	0	0	2	0	0	0	1	F	5	0Dh	0Ah

As an ASCII code:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
3Ah	30h	32h	30h	36h	30h	30h	30h	32h	30h	30h	30h	31h	46h	35h	0Dh	0Ah

Structure:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
:	02		06		Reg. address				Data				LRC		CR	LF
					Hi		Lo		Hi		Lo					

In the example the code fcode=06 indicates the writing request.

Reg.address: indicates the 16-bit address.

Data: contains the 16-bit data

LRC, CR, LF : same as above at reading.

Only one 16-bit register can be written at a time.

If there was no error, the answer will be the same as the order:

:020600020001F5.␣

Test order:

„fcode=08” serves for test purposes. The Module will repeat the order but the content of the registers will not change. This procedure can be used to check the transfer way with different bit-patterns.

:02081234ABCD38.␣

Structure:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
:	02		08		X				Y				LRC		CR	LF

In the example the code fcode=08 indicates the test function.

X and Y means any 16-bit figures.

LRC, CR, LF : same as above at reading.

The answer given to the test will be the same as the order:

:02081234ABCD38.␣

Error Codes:

There may be four types of the error codes:

- Writing to invalid address. Error code: 02h
:0286**0**276┘
- Writing to invalid data. Error code: 03h
:0286**0**375┘
- Invalid function (fcode). Error code: 01h
:0284**0**179┘
- The Module is busy, it is not able to answer. Error code: 06h
:0283**0**675┘

Structure:

1	2	3	4	5	6	7	8	9	10	11
:	02	Status	Err	LRC	CR	LF				

If there is an error the upper bit of „status“=1. The following bits contain the function number where the error occurred.

Example: Status=86h error at writing, Status=83h error at reading

”Err“: contains the code (the type) of the error: 01, 02, 03, 06.

Register addresses:

The function of the registers in the Module depends on the type of the controller where the module is used. Detailed descriptions of the functions can be found in the manuals of the different controllers. Here you can find the list of addresses at the different types of controllers:

ThermoControl-Plus 1

The *-marked addresses are „Read-only“ types

- *0000h: Hi: Controller type code (35h),
Lo: Version number.
- 0002h: No function
- 0004h: Disable or enable buttons individually. Detailed in Appendix.
- 0006h: Simulation of pushing a button . Detailed in Appendix.
- 0008h: Special button combinations. Detailed in Appendix.
- 000Ah: Simulation of releasing a button.
- 000Ch: in Zone 1 control is enabled (On) or disabled (Off), 1: On, 0: Off
- 000Eh: in Zone 2 control is enabled (On) or disabled (Off), 1: On, 0: Off
- 0010h: No function
- 0012h: No function
- 0014h: No function
- 0016h: No function
- 0018h: No function
- 001Ah: No function
- 001Ch: Set value type selection in Zone 1:
 - 0000h: Based on time program,
 - 0001h: Frost protection value (continuously)
 - 0002h: Night value (continuously)
 - 0003h: Day value (continuously)
- 001Eh: Set value type selection in Zone 2: same as described at Zone 1
- 0020h: No function
- 0022h: No function

0024h: No function
 0026h: No function
 0028h: No function.
 002Ah: No function
 002Ch: Zone1 Day set value ×10 with plus/minus sign.
 Example: 00C7h 19.9°C
 002Eh: Zone2 Day set value ×10 with plus/minus sign.
 0030h: No function
 0032h: No function
 0034h: No function
 0036h: No function
 0038h: No function
 003Ah: No function
 003Ch: Zone1 Night set value ×10 with sign.
 003Eh: Zone2 Night set value ×10 with sign.
 0040h: No function
 0042h: No function
 0044h: No function
 0046h: No function
 0048h: No function
 004Ah: No function
 004Ch: Zone1 Frost protection value ×10 with sign. This value acts as a low limit for
 all of the other set values. Factory settings: 0050h 8.0°C
 004Eh: Zone2 Frost protection value ×10 with sign.
 0050h: No function
 0052h: No function
 0054h: No function
 0056h: No function
 0058h: No function
 005Ah: No function
 *005Ch: Selected application program (P0, P1, P2) number. At this type: 0, 1, 2
 *005Eh: Number of Zones as configured. Max: 2 at this type.
 *0060h: Error signals: in case of an error the corresponding bit: 1
 bit7: Error relay is on (relay contacts closed)
 bit6: Sensor Error
 bit2: Button is stuck
 bit1: Alarm signal (contact input is opened)
 bit0: Battery is low (discharged)
 *0062h: State of the contact inputs (a closed contact sets the bit to 1):
 bit2: „Error” (Störung) contact
 bit1: „Alarm” contact
 bit0: „Remote” contact
 *0064h: Outside temperature ×10 with sign. Example: FFE2h -3.0°C
 When ATF sensor is not connected: F830h (-200.0)
 *0066h: **bit0**: State of the ventilator relay: 1 if relay is on (relay contacts closed)
 *0068h: State of Zone 1:
 bit7: 1 when Zone 1 is enabled (see: 000Ch)
 bit6: 1 when there is a sensor error in Zone 1
 bit5: 1 when „Error” (Störung) contact is closed
 bit3: 1 when Ventilator relay is on,
 bit2: 1 when heater is operated with full load (Stage 2) in Zone 1
 bit1: 1 when heater is operated with part load (Stage 1) in Zone 1
 bit0: 1 when selected control mode is 2-stage in Zone 1;
 0 when selected control mode is 1-stage in Zone 1

- *006Ah: State of Zone 2: format same as at Zone 1.
- *006Ch: No function
- *006Eh: No function
- *0070h: No function
- *0072h: No function
- *0074h: No function
- *0076h: No function
- *0078h: Zone1 Actual set value ×10 with sign, the controller presently tries to keep this temperature value.
- *007Ah: Zone2 Actual set value ×10 with sign.
- *007Ch: No function
- *007Eh: No function
- *0080h: No function
- *0082h: No function
- *0084h: No function
- *0086h: No function.
- *0088h: The measured and displayed room temperature ×10 with sign in Zone1.
- *008Ah: The measured and displayed room temperature ×10 with sign in Zone2.
- *008Ch: No function
- *008Eh: No function
- *0090h: No function
- *0092h: No function
- *0094h: No function
- *0096h: No function
- *0098h: State of the heater relays in Zone1: 1 if the relay is switched On
 In case of P0, P1 application programs:
 bit7: State of Relay 1
 In case of P2 application program:
 bit7: State of Relay 1
 bit6: State of Relay 2
- *009Ah: State of the heater relay in Zone2:
 In case of P0, P1 application programs:
 bit6: State of Relay 2
- *009Ch: No function
- *009Eh: No function
- *00A0h: No function
- *00A2h: No function
- *00A4h: No function
- *00A6h: No function
- *00A8h: 0 if the maintenance warning counter is switched off (not operating).
- *00AAh: Remaining working hours till the next maintenance time.
- *00ACh: Selected length of the maintenance period (the number of hours).
- *00C6h: Work-hour counter content for Relay 1; 4byte length
- *00CAh: Work-hour counter content for Relay 2; 4byte length
- *00CEh: No function
- *00D2h: No function
- *00D6h: No function
- *00DAh: No function
- *00DEh: No function
- *00E2h: No function
- *01C0h: Serial number of the controller, length: 6 ASCII characters.
- *01C6h: Name of the controller, max. 10 characters, the end is indicated with „0” (TC Plus1)

- *0000h: Hi: Controller type code (36h),
Lo: Version number.
- 0002h: No function
- 0004h: Disable or enable buttons individually. Detailed in Appendix.
- 0006h: Simulation of pushing a button . Detailed in Appendix
- 0008h: Special button combinations. Detailed in Appendix
- 000Ah: Simulation of releasing a button.
- 000Ch: in Zone 1 control is enabled (On) or disabled (Off), 1: On, 0: Off
- 000Eh: in Zone 2 control is enabled (On) or disabled (Off), 1: On, 0: Off
- 0010h: in Zone 3 control is enabled (On) or disabled (Off), 1: On, 0: Off
- 0012h: in Zone 4 control is enabled (On) or disabled (Off), 1: On, 0: Off
- 0014h: No function
- 0016h: No function
- 0018h: No function
- 001Ah: No function
- 001Ch: Set value type selection in Zone 1:
 - 0000h: Based on time program,
 - 0001h: Frost protection value (continuously)
 - 0002h: Night value (continuously)
 - 0003h: Day value (continuously)
- 001Eh: Set value type selection in Zone 2: same as described at Zone 1
- 0020h: Set value type selection in Zone 3: same as described at Zone 1
- 0022h: Set value type selection in Zone 4: same as described at Zone 1
- 0024h: No function
- 0026h: No function
- 0028h: No function
- 002Ah: No function
- 002Ch: Zone1 Day set value ×10 with plus/minus sign.
Example: 00C7h 19.9°C
- 002Eh: Zone2 Day set value ×10 with plus/minus sign
- 0030h: Zone3 Day set value ×10 with plus/minus sign
- 0032h: Zone4 Day set value ×10 with plus/minus sign
- 0034h: No function
- 0036h: No function
- 0038h: No function
- 003Ah: No function
- 003Ch: Zone1 Night set value ×10 with plus/minus sign
- 003Eh: Zone2 Night set value ×10 with plus/minus sign
- 0040h: Zone3 Night set value ×10 with plus/minus sign
- 0042h: Zone4 Night set value ×10 with plus/minus sign
- 0044h: No function
- 0046h: No function
- 0048h: No function
- 004Ah: No function
- 004Ch: Zone1 Frost protection value ×10 with sign. This value acts as a low limit for all of the other set values. Factory settings: 0050h 8.0°C
- 004Eh: Zone2 Frost protection value ×10 with sign
- 0050h: Zone3 Frost protection value ×10 with sign
- 0052h: Zone4 Frost protection value ×10 with sign
- 0054h: No function

0056h: No function
 0058h: No function
 005Ah: No function
 *005Ch: Selected application program (P0, P1...) number. At this type: 0,1,2,3
 *005Eh: Number of Zones as configured. Max: 4 at this type.
 *0060h: Error signals: in case of an error the corresponding bit: 1.
 bit7: Error relay is on (relay contacts closed)
 bit6: Sensor Error
 bit2: Button is stuck
 bit1: Alarm signal (contact input is opened)
 bit0: Battery is low (discharged)
 *0062h: State of the contact inputs (a closed contact sets the bit to 1)
 bit2: „Error” (Störung) contact,
 bit1: „Alarm” contact,
 bit0: „Remote” contact
 *0064h: Outside temperature ×10 with sign. Example: FFE2h -3.0°C
 When ATF sensor is not connected: F830h (-200.0)
 *0066h: **bit1**: State of the vent. Relay 3-4: 1 if relay is on (relay contacts closed).
 bit0: State of the vent. Relay 1-2: 1 if relay is on (relay contacts closed).
 *0068h: State of Zone 1:
 bit7: 1 when Zone 1 is enabled (see: 000Ch)
 bit6: 1 when there is a sensor error in Zone 1
 bit5: 1 when „Error” (Störung) contact is closed
 bit3: 1 when Ventilator relay is on,
 bit2: 1 when heater is operated with full load (Stage 2) in Zone 1
 bit1: 1 when heater is operated with part load (Stage 1) in Zone 1
 bit0: 1 when selected control mode is 2-stage in Zone 1;
 0 when selected control mode is 1-stage in Zone 1
 *006Ah: State of Zone 2: format same as at Zone 1
 *006Ch: State of Zone 3: format same as at Zone 1
 *006Eh: State of Zone 4: format same as at Zone 1
 *0070h: No function
 *0072h: No function
 *0074h: No function
 *0076h: No function
 *0078h: Zone1 Actual set value ×10 with sign, the controller presently tries to keep
 this temperature value
 *007Ah: Zone2 Actual set value ×10 with sign
 *007Ch: Zone3 Actual set value ×10 with sign
 *007Eh: Zone4 Actual set value ×10 with sign
 *0080h: No function
 *0082h: No function
 *0084h: No function
 *0086h: No function
 *0088h: The measured and displayed room temperature ×10 with sign in Zone1
 *008Ah: The measured and displayed room temperature ×10 with sign in Zone2
 *008Ch: The measured and displayed room temperature ×10 with sign in Zone3
 *008Eh: The measured and displayed room temperature ×10 with sign in Zone4
 *0090h: No function
 *0092h: No function
 *0094h: No function
 *0096h: No function

- *0098h: State of the heater relays in Zone1: 1 if the relay is switched On
 In case of P0, P1 application programs:
 bit7: State of Relay 1
 In case of P2, P3 application programs:
 bit7: State of Relay 1
 bit6: State of Relay 2
- *009Ah: State of the heater relays in Zone2:
 In case of P0, P1 application programs:
 bit6: State of Relay 2
 In case of P2 application program:
 bit5: State of Relay 3
 In case of P3 application program:
 bit5: State of Relay 3
 bit4: State of Relay 4
- *009Ch: State of the heater relays in Zone3:
 In case of P0, P1 application programs:
 bit5: State of Relay 3
 In case of P2 application program:
 bit4: State of Relay 4
- *009Eh: State of the heater relays in Zone4:
 In case of P0, P1 application programs:
 bit4: State of Relay 4
- *00A0h: No function
- *00A2h: No function
- *00A4h: No function
- *00A6h: No function
- *00A8h: 0 if the maintenance warning counter is switched off (not operating)
- *00AAh: Remaining working hours till the next maintenance time
- *00ACh: Selected length of the maintenance period (the number of hours)
- *00C6h: Work-hour counter content for Relay 1; 4byte length
- *00CAh: Work-hour counter content for Relay 2; 4byte length
- *00CEh: Work-hour counter content for Relay 3; 4byte length
- *00D2h: Work-hour counter content for Relay 4; 4byte length
- *00D6h: No function
- *00DAh: No function
- *00DEh: No function
- *00E2h: No function
- *01C0h: Serial number of the controller, length: 6 ASCII characters
- *01C6h: Name of the controller, max. 10 characters, the end is indicated with „0” (TC Plus 2)

ThermoControl-Plus 4

The *-marked addresses are „Read-only” types

- *0000h: Hi: Controller type code (37h),
 Lo: Version number.
- 0002h: No function
- 0004h: Disable or enable buttons individually. Detailed in Appendix.
- 0006h: Simulation of pushing a button . Detailed in Appendix
- 0008h: Special button combinations. Detailed in Appendix
- 000Ah: Simulation of releasing a button.

000Ch: in Zone 1 control is enabled (On) or disabled (Off), 1: On, 0: Off
 000Eh: in Zone 2 control is enabled (On) or disabled (Off), 1: On, 0: Off
 0010h: in Zone 3 control is enabled (On) or disabled (Off), 1: On, 0: Off
 0012h: in Zone 4 control is enabled (On) or disabled (Off), 1: On, 0: Off
 0014h: in Zone 5 control is enabled (On) or disabled (Off), 1: On, 0: Off
 0016h: in Zone 6 control is enabled (On) or disabled (Off), 1: On, 0: Off
 0018h: in Zone 7 control is enabled (On) or disabled (Off), 1: On, 0: Off
 001Ah: in Zone 8 control is enabled (On) or disabled (Off), 1: On, 0: Off
 001Ch: Set value type selection in Zone 1:
 0000h: Based on time program,
 0001h: Frost protection value (continuously)
 0002h: Night value (continuously)
 0003h: Day value (continuously)
 001Eh: Set value type selection in Zone 2: same as described at Zone 1
 0020h: Set value type selection in Zone 3: same as described at Zone 1
 0022h: Set value type selection in Zone 4: same as described at Zone 1
 0024h: Set value type selection in Zone 5: same as described at Zone 1
 0026h: Set value type selection in Zone 6: same as described at Zone 1
 0028h: Set value type selection in Zone 7: same as described at Zone 1
 002Ah: Set value type selection in Zone 8: same as described at Zone 1
 002Ch: Zone1 Day set value ×10 with plus/minus sign.
 Example: 00C7h 19.9°C
 002Eh: Zone2 Day set value ×10 with plus/minus sign
 0030h: Zone3 Day set value ×10 with plus/minus sign
 0032h: Zone4 Day set value ×10 with plus/minus sign
 0034h: Zone5 Day set value ×10 with plus/minus sign
 0036h: Zone6 Day set value ×10 with plus/minus sign
 0038h: Zone7 Day set value ×10 with plus/minus sign
 003Ah: Zone8 Day set value ×10 with plus/minus sign
 003Ch: Zone1 Night set value ×10 with plus/minus sign
 003Eh: Zone2 Night set value ×10 with plus/minus sign
 0040h: Zone3 Night set value ×10 with plus/minus sign
 0042h: Zone4 Night set value ×10 with plus/minus sign
 0044h: Zone5 Night set value ×10 with plus/minus sign
 0046h: Zone6 Night set value ×10 with plus/minus sign
 0048h: Zone7 Night set value ×10 with plus/minus sign
 004Ah: Zone8 Night set value ×10 with plus/minus sign
 004Ch: Zone1 Frost protection value ×10 with sign. This value acts as a low limit for
 all of the other set values. Factory settings: 0050h 8.0°C
 004Eh: Zone2 Frost protection value ×10 with sign
 0050h: Zone3 Frost protection value ×10 with sign
 0052h: Zone4 Frost protection value ×10 with sign
 0054h: Zone5 Frost protection value ×10 with sign
 0056h: Zone6 Frost protection value ×10 with sign
 0058h: Zone7 Frost protection value ×10 with sign
 005Ah: Zone8 Frost protection value ×10 with sign
 *005Ch: Selected application program (P0, P1...) number. Here: 0,1,2,3,4,5
 *005Eh: Number of Zones as configured. Max: 8 at this type.
 *0060h: Error signals: in case of an error the corresponding bit: 1.
 bit7: Error relay is on (relay contacts closed)
 bit6: Sensor Error
 bit2: Button is stuck
 bit1: Alarm signal (contact input is opened)
 bit0: Battery is low (discharged)

- *0062h: State of the contact inputs (a closed contact sets the bit to 1)
bit2: „Error” (Störung) contact,
bit1: „Alarm” contact,
bit0: „Remote” contact
- *0064h: Outside temperature ×10 with sign. Example: FFE2h -3.0°C
When ATF sensor is not connected: F830h (-200.0)
- *0066h: **bit3**: State of the vent. Relay 7-8: 1 if relay is on (relay contacts closed).
bit2: State of the vent. Relay 5-6: 1 if relay is on (relay contacts closed).
bit1: State of the vent. Relay 3-4: 1 if relay is on (relay contacts closed).
bit0: State of the vent. Relay 1-2: 1 if relay is on (relay contacts closed).
- *0068h: State of Zone 1:
bit7: 1 when Zone 1 is enabled (see: 000Ch)
bit6: 1 when there is a sensor error in Zone 1
bit5: 1 when „Error” (Störung) contact is closed
bit3: 1 when Ventilator relay is on,
bit2: 1 when heater is operated with full load (Stage 2) in Zone 1
bit1: 1 when heater is operated with part load (Stage 1) in Zone 1
bit0: 1 when selected control mode is 2-stage in Zone 1;
0 when selected control mode is 1-stage in Zone 1
- *006Ah: State of Zone 2: format same as at Zone 1
- *006Ch: State of Zone 3: format same as at Zone 1
- *006Eh: State of Zone 4: format same as at Zone 1
- *0070h: State of Zone 5: format same as at Zone 1
- *0072h: State of Zone 6: format same as at Zone 1
- *0074h: State of Zone 7: format same as at Zone 1
- *0076h: State of Zone 8: format same as at Zone 1
- *0078h: Zone1 Actual set value ×10 with sign, the controller presently tries to keep
this temperature value
- *007Ah: Zone2 Actual set value ×10 with sign
- *007Ch: Zone3 Actual set value ×10 with sign
- *007Eh: Zone4 Actual set value ×10 with sign
- *0080h: Zone5 Actual set value ×10 with sign
- *0082h: Zone6 Actual set value ×10 with sign
- *0084h: Zone7 Actual set value ×10 with sign
- *0086h: Zone8 Actual set value ×10 with sign
- *0088h: The measured and displayed room temperature ×10 with sign in Zone1
- *008Ah: The measured and displayed room temperature ×10 with sign in Zone2
- *008Ch: The measured and displayed room temperature ×10 with sign in Zone3
- *008Eh: The measured and displayed room temperature ×10 with sign in Zone4
- *0090h: The measured and displayed room temperature ×10 with sign in Zone5
- *0092h: The measured and displayed room temperature ×10 with sign in Zone6
- *0094h: The measured and displayed room temperature ×10 with sign in Zone7
- *0096h: The measured and displayed room temperature ×10 with sign in Zone8
- *0098h: State of the heater relays in Zone1: 1 if the relay is switched On
In case of P0, P1 application programs:
bit7: State of Relay 1
In case of P2, P3, P4, P5 application programs:
bit7: State of Relay 1
bit6: State of Relay 2
- *009Ah: State of the heater relays in Zone2:
In case of P0, P1 application programs:
bit6: State of Relay 2
In case of P2 application programs:
bit5: State of Relay 3

- In case of P3, P4, P5 application programs:
 - bit5:** State of Relay 3
 - bit4:** In case of P2 application programs:
- *009Ch: State of the heater relays in Zone3:
 - In case of P0, P1 application programs:
 - bit5:** State of Relay 3
 - In case of P2 application programs:
 - bit4:** State of Relay 4
 - In case of P3 application programs:
 - bit3:** State of Relay 5
 - In case of P4, P5 application programs:
 - bit3:** State of Relay 5
 - bit2:** State of Relay 6
- *009Eh: State of the heater relays in Zone4:
 - In case of P0, P1 application programs:
 - bit4:** State of Relay 4
 - In case of P2 application programs:
 - bit3:** State of Relay 5
 - In case of P3 application programs:
 - bit2:** State of Relay 6
 - In case of P4 application programs:
 - bit1:** State of Relay 7
 - In case of P5 application programs:
 - bit1:** State of Relay 7
 - bit0:** State of Relay 8
- *00A0h: State of the heater relays in Zone5:
 - In case of P0, P1 application programs:
 - bit3:** State of Relay 5
 - In case of P2 application programs:
 - bit2:** State of Relay 6
 - In case of P3 application programs:
 - bit1:** State of Relay 7
 - In case of P4 application programs:
 - bit0:** State of Relay 8
- *00A2h: State of the heater relays in Zone6:
 - In case of P0, P1 application programs:
 - bit2:** State of Relay 6
 - In case of P2 application programs:
 - bit1:** State of Relay 7
 - In case of P3 application programs:
 - bit0:** State of Relay 8
- *00A4h: State of the heater relays in Zone7:
 - In case of P0, P1 application programs:
 - bit1:** State of Relay 7
 - In case of P2 application programs:
 - bit0:** State of Relay 8
- *00A6h: State of the heater relays in Zone8:
 - In case of P0, P1 application programs:
 - bit0:** State of Relay 8
- *00A8h: 0 if the maintenance warning counter is switched off (not operating)
- *00AAh: Remaining working hours till the next maintenance time
- *00ACh: Selected length of the maintenance period (the number of hours)

- *00C6h: Work-hour counter content for Relay 1; 4byte length
- *00CAh: Work-hour counter content for Relay 2; 4byte length
- *00CEh: Work-hour counter content for Relay 3; 4byte length
- *00D2h: Work-hour counter content for Relay 4; 4byte length
- *00D6h: Work-hour counter content for Relay 5; 4byte length
- *00DAh: Work-hour counter content for Relay 6; 4byte length
- *00DEh: Work-hour counter content for Relay 7; 4byte length
- *00E2h: Work-hour counter content for Relay 8; 4byte length
- *01C0h: Serial number of the controller, length: 6 ASCII characters
- *01C6h: Name of the controller, max. 10 characters, the end is indicated with „0” (TC Plus 4)

Common Register Addresses:

The following addresses have the same functions in every controller types:

- 00F0h-00F5h: Data of the Clock (Real Time Clock)
- 00F6h-0143h: Data of the time program in a zone
- 0144h-0174h: Data of the holiday program
- *01E0h-01EFh: Data of the display segments (16x8bit)
- *01F0h-01FFh: Data of the blinking segments (16x8bit)
- *0200h: state of Error(bit 7) and Service (bit 6) LED when 0201h=D2h.
- *0201h: D2h, when built-in a second generation LCD.
- *0FFCh: The length of a record.
- *0FFDh: Code to identify the type of the controller (without version information): on the lower 8 bits (Example: TCP-1: 0031h or 0035h).
- *0FFEh: ID number of the CM-232 module (RevB: 0024h).
- *0FFFh: Number of stored records in the data memory of the module.

} Available only in controllers produced after 01.05.2008.

The following Clock, Time program and Holiday program reading and writing possibility is available only in controllers produced after 01.05.2008.

Description of Clock (RTC) registers

Address	00F0h		00F2h		00F4h	
	Hi	Lo	Hi	Lo	Hi	Lo
Content	Hour	Minute	Month	Day	Year	Command / Error

- Commands: 22h: Load momentary RTC data into the registers (load as a snapshot).
- 41h: Write registers content into RTC (rewrite and save Clock data).
- Error: See at chapter „Setting the Clock”

Reading out the Clock in two steps using 22h command:

Load 0022h into register address 00F4h : 020600F40022E2↓
 Read out data from addresses 00F0h – 00F5h : 020300F0000308↓
 The result will contain the snapshot of the momentary Clock data: Hour, Minute, Month, Day, Year, Error.

: 020306090F03130800BF.↓
 Hour ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑
 Minute ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑
 Month ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑
 Day ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑
 Error (00h) ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑
 Year (08: 2008) ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑

To get actual fresh Clock data repeat the above two steps.

Setting the Clock - example:

Set the following Clock data: Hour:14, Minute:05, Month: 03, Day:22, Year: 2008

Load Hour and Minute into register 00F0h : 020600F00E05F5↓

Load Month and Day into register 00F2h. : 020600F20316ED↓

Load Year (08h) and command 41h into register 00F4h : 020600F40841BB↓

Loading 41h will start the Clock-set procedure.

Then read out data from addresses 00F4h – 00F5h : 020300F40001FE↓

The result will contain the Year and Error informing about the successful loading.

: 0203020800F1

↑ Error information

If the Error is 0 all Clock data is loaded.

Possible Error types and codes are listed here:

In case of an error all Clock data loading will be prohibited.

Error	Caused by
81h	Hour > 23
82h	Minute > 59
83h	Month > 12
84h	Too many Days
85h	Year<8, Year>50

Time program registers overview

The table below contains the register addresses of the different time programs.

All the data of a time program is stored in two 16-bit registers.

Program Nr.	Address
1	00F6h
2	00FAh
3	00FEh
4	0102h
5	0106h
6	010Ah
7	010Eh
8	0112h
9	0116h
10	011Ah

Program Nr.	Address
11	011Eh
12	0122h
13	0126h
14	012Ah
15	012Eh
16	0132h
17	0136h
18	013Ah
19	013Eh

0142h	0143h
Zone Nr.	Command / Error

Zone Nr.: Between 1..8 depending on the type of the controller

Commands: 22h: Load data of a certain Zone into the registers.

41h: Write content of the registers into a certain Zone.

Error: See at chapter „Writing time program into a Zone”

Reading out a time program from a certain Zone

Load 0122h into register 0142h. : 02060142012293↓

↑ Zone number (here:1) ↑

After this the data of the 19 time programs on Zone 1 will be loaded to registers 00F6h-0141h. Then the time programs can be read out one by one.

For example:

Reading out time program Nr.2 from address 00FAh : 020300FA0002FF↓

In the answer we will get all data of time program Nr.2:

:020304067C03CFA3.↓

Hi	Lo	Hi	Lo
Status + Value type	Group of days	Minute (0...1439)	
06h	7Ch	03CFh	
00000110b	01111100b	975	
Active + Night value	Workdays	16 hour 15 minute	

↑
bit2=1 Active
bit2=0 Inactive

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
1	1	1	1	1	0	0

↑
[bit1-bit0]
01: Frost protection value
10: Night value
11 or 00: Day value

Writing time program into a Zone

The switching parameters must be loaded into 00F6h-0141h.

After this the Zone Nr. and 41h must be loaded into address 0142h

Command 41h will start the writing procedure.

:02060142014174.↓

To check result read out 0142h-0143h:

:020301420001B8.↓

The answer will indicate Zone Nr. and Error state

:0203020100F8

↑ Error information

Writing is completed if Error is 0.

Possible Error types and codes are listed here:

In case of any error the writing of the good data will also be prohibited. Data checking will be carried out only at active-state programs.

The same program can be writing into different zones. To do this write new data only into 0142h-0143h registers.

Error	Caused by
82h	Minute>1439
84h	Group of days=0
86h	Inactive program is followed by an active one
87h	Two different programs at the same time
88h	The given zone number is not existing in the unit
89h	A manual setting is presently going on at the unit

Holiday program registers overview

The table below contains the register addresses of the different holiday programs..

All the data of a holiday program is stored in three 16-bit registers.

Program Nr	Address	Program Nr.	Address
1	0144h	5	015Ch
2	014Ah	6	0162h
3	0150h	7	0168h
4	0156h	8	016Eh

0174h	0175h
On / Off	Command / Error

On / Off:

The switched-on program is indicated by a bit 1

Commands:

22h: Load the eight holiday programs into the registers.

41h: Write content of the registers into the eight holiday programs

Error:

See at chapter „Writing the holiday program”

Reading out the holiday program

Load 0022h into register 0144h. :02060144002292↓

As a result the data of the eight holiday programs will be loaded to register area 0144h-0173h.

To read out the data of holiday program 1 from address 0144h :020301440003B4↓

In the answer we will get all data of holiday program 1:

Content	Value
Start day	18
End day	18
Start month	03
End month	03
Start year	2008
End year	2008

:020306121203030808BB↓

Read out address 0174h :02030174000181↓

It will show which ones of the 8 programs are presently switched on (On/Off Mask):

:020302A00059↓

HOL.	1	2	3	4	5	6	7	8
	80h	40h	20h	10h	8h	4h	2h	1h
On	x		x					

Writing the holiday program

Load the table (0144h – 0173h) with the necessary data in the following order: start day, end day, start month, end month, start year, end year. Year must be given as 08 not 2008.

After this write into address 0174h the "On/Off Mask" (see above) and 41h.

Command 41h will start the writing procedure. :02060174A041A3↓

Then read out area 0174h – 0175h. :02030174000186↓

In the answer we will get the On/Off Mask and the possible errors.

:020302A00059



Error	Caused by
83h	Month>12
84h	Too many days
85h	Year<8, Year>50
89h	A manual setting is presently going on at the unit
8Ah	Ending date is earlier than starting date

If the value of the error is 0 the writing is carried out.

Possible Error types and codes are listed here.

In case of any error the writing of the good data will also be prohibited. Data checking will be carried out only at the on-state programs.

Content of the Data Memory:

The CM-232 module has 128kbyte non-volatile memory to store the data of a 3-week period. If the memory is full, the oldest data will be overwritten. This will ensure that you can always read out from the memory all the data of the past 3 weeks (counted back from the present time).

The CM-232 module is completed with a user program running under Windows. This program can read out the stored data and creates a text file and a graphical chart for monitor display (see Appendix 2.) The text file can be imported into standard application programs like Microsoft Excel, Word, etc. In the text file the columns are separated by tabulator characters (ASCII:09), this must be set in the application program before opening the text file.

The data logger stores the following parameters in every 15 minutes (in an hour at 0, 15, 30, 45 min.):

- Month
- Day
- Hour
- Minute
- Restart, state of the contact inputs in the zones
- Error signals in every zones
- State of the ventilator relays in the zones
- Outside temperature measured by ATF
- Set temperature values in the zones
- Measured temperatures in the zones
- State of the relays in the zones
- State of the zones.

The length of a record depends on the type of the controller. After installation the module will recognize the type of the controller. If a module is uninstalled from a controller and installed into an other one, a special record with full of zeros will indicate this. The maximal number of records can be read out from the 0FFFh register.

How to read out the data logger:

The records can be found on the 1000h virtual address, here is the last record, on the 1001h address there is the data stored 15 minutes earlier. Reading is made as it was described in the „Register Reading” chapter.

Example for the reading out order:

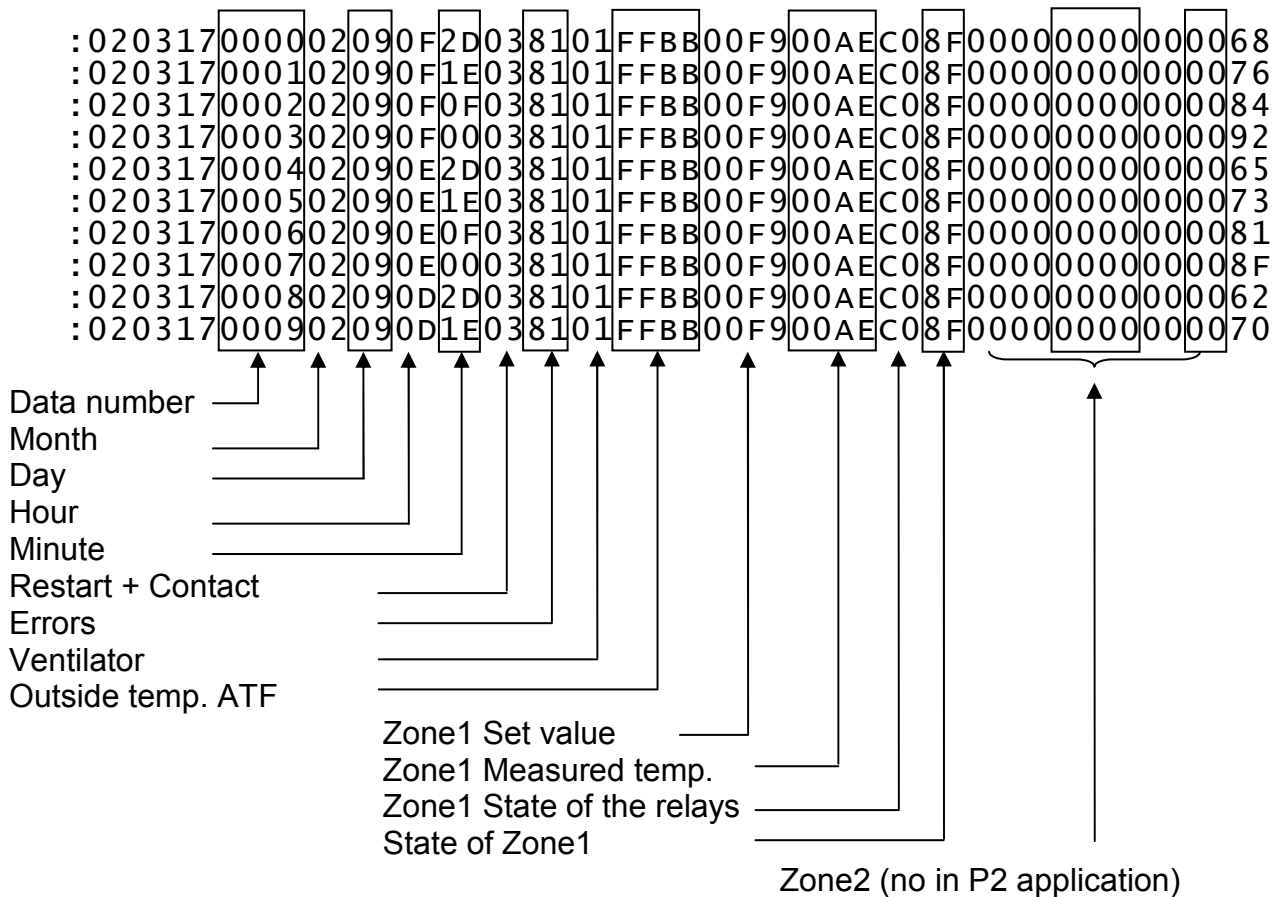
:02031000000AE1

In this example we want to read out 000Ah pieces of records from the location beginning at the 1000h address.

Structure:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
:	02	03	Virtual address				Number of record				LRC		CR	LF		
			Hi		Lo		Hi		Lo							

The answer (with a controller: TCP-1, application program P2)



By modifying the start address to 100Ah the reading out of the records can be continued.

:0203100A000AD7

In the answer we will get the records from 100Ah – 1013h.

Structure of the records depending on the controller's type

ThermoControl Plus-1

The first column shows the relative address inside the record.

00h	Record serial number	16 bit	
02h	Month	8 bit	
03h	Day	8 bit	
04h	Hour	8 bit	
05h	Minute	8 bit	
06h	Contact inputs	8 bit	→ bit7=1 if there was a restart bit1=1 if „Alarm” contact is closed bit0=1 if „Remote” contact is closed
07h	Error signals	8 bit	than 0060h
08h	State of ventilator relay	8 bit	than 0066h
09h	Outside temp. value	16 bit	than 0064h
0Bh	Zone1 Set value	16 bit	than 0078h
0Dh	Zone1 Measured temp.	16 bit	than 0088h
0Fh	Zone1 Relay's state	8 bit	than 0098h
10h	Zone1 State information	8 bit	than 0068h
11h	Zone2 Set value	16 bit	than 007Ah
13h	Zone2 Measured temp	16 bit	than 008Ah
15h	Zone2 Relay's state	8 bit	than 009Ah
16h	Zone2 State information	8 bit	than 006Ah

ThermoControl Plus-2

The first column shows the relative address inside the record.

00h	Record serial number	16 bit	
02h	Month	8 bit	
03h	Day	8 bit	
04h	Hour	8 bit	
05h	Minute	8 bit	→ bit7=1 if there was a restart bit1=1 if „Alarm” contact is closed bit0=1 if „Remote” contact is closed
06h	Contact inputs	8 bit	
07h	Error signals	8 bit	than 0060h
08h	State of ventilator relay	8 bit	than 0066h
09h	Outside temp. value	16 bit	than 0064h
0Bh	Zone1 Set value	16 bit	than 0078h
0Dh	Zone1 Measured temp.	16 bit	than 0088h
0Fh	Zone1 Relay's state	8 bit	than 0098h
10h	Zone1 State information	8 bit	than 0068h
11h	Zone2 Set value	16 bit	than 007Ah
13h	Zone2 Measured temp	16 bit	than 008Ah
15h	Zone2 Relay's state	8 bit	than 009Ah
16h	Zone2 State information	8 bit	than 006Ah
17h	Zone3 Set value	16 bit	than 007Ch
19h	Zone3 Measured temp	16 bit	than 008Ch
1Bh	Zone3 Relay's state	8 bit	than 009Ch
1Ch	Zone3 State information	8 bit	than 006Ch
1Dh	Zone4 Set value	16 bit	than 007Eh
1Fh	Zone4 Measured temp	16 bit	than 008Eh
21h	Zone4 Relay's state	8 bit	than 009Eh
22h	Zone4 State information	8 bit	than 006Eh

ThermoControl Plus-4

The first column shows the relative address inside the record..

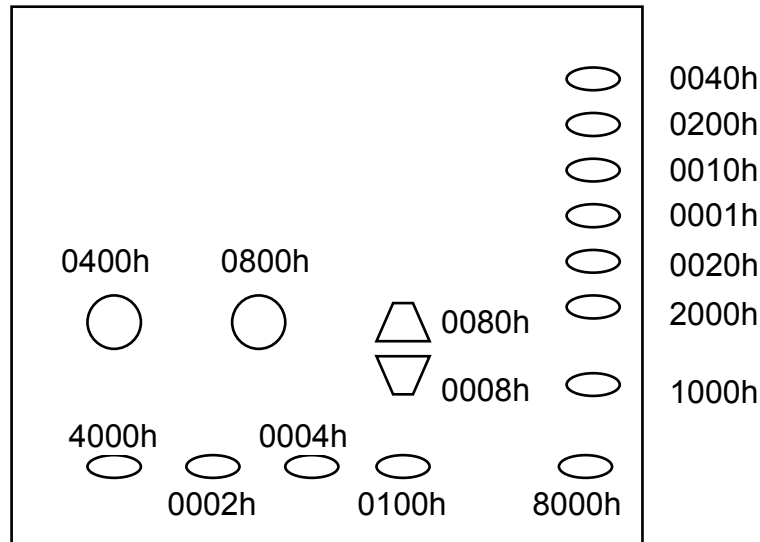
00h	Record serial number	16 bit	
02h	Month	8 bit	
03h	Day	8 bit	
04h	Hour	8 bit	
05h	Minute	8 bit	
06h	Contact inputs	8 bit	→
07h	Error signals	8 bit	than 0060h
08h	State of ventilator relay	8 bit	than 0066h
09h	Outside temp. value	16 bit	than 0064h
0Bh	Zone1 Set value	16 bit	than 0078h
0Dh	Zone1 Measured temp.	16 bit	than 0088h
0Fh	Zone1 Relay's state	8 bit	than 0098h
10h	Zone1 State information	8 bit	than 0068h
11h	Zone2 Set value	16 bit	than 007Ah
13h	Zone2 Measured temp	16 bit	than 008Ah
15h	Zone2 Relay's state	8 bit	than 009Ah
16h	Zone2 State information	8 bit	than 006Ah
17h	Zone3 Set value	16 bit	than 007Ch
19h	Zone3 Measured temp	16 bit	than 008Ch
1Bh	Zone3 Relay's state	8 bit	than 009Ch
1Ch	Zone3 State information	8 bit	than 006Ch
1Dh	Zone4 Set value	16 bit	than 007Eh
1Fh	Zone4 Measured temp	16 bit	than 008Eh
21h	Zone4 Relay's state	8 bit	than 009Eh
22h	Zone4 State information	8 bit	than 006Eh
23h	Zone5 Set value	16 bit	than 0080h
25h	Zone5 Measured temp	16 bit	than 0090h
27h	Zone5 Relay's state	8 bit	than 00A0h
28h	Zone5 State information	8 bit	than 0070h
29h	Zone6 Set value	16 bit	than 0082h
2Bh	Zone6 Measured temp	16 bit	than 0092h
2Dh	Zone6 Relay's state	8 bit	than 00A2h
2Eh	Zone6 State information	8 bit	than 0072h
2Fh	Zone7 Set value	16 bit	than 0084h
31h	Zone7 Measured temp	16 bit	than 0094h
33h	Zone7 Relay's state	8 bit	than 00A4h
34h	Zone7 State information	8 bit	than 0074h
35h	Zone8 Set value	16 bit	than 0086h
37h	Zone8 Measured temp	16 bit	than 0096h
39h	Zone8 Relay's state	8 bit	than 00A6h
3Ah	Zone8 State information	8 bit	than 0076h

bit7=1 if there was a restart
bit1=1 if „Alarm” contact is closed
bit0=1 if „Remote” contact is closed

Appendix

Codes of the buttons

On the schematic picture of a certain controller the buttons can be assigned by the codes given below:



When switching On the power the register 0004h will be loaded with FFFFh. This ensures that all the buttons on the control panel will be enabled.

If we want to disable any of the buttons, the code of that button must be subtracted from FFFFh and the resulting value must be written back to register 0004h. After this procedure the disabled buttons will not work. If we write 0000h into register 0004h: all of the buttons will be disabled.

After switching the power Off/On the buttons (all of them) will be enabled again.

If we write a button code into register 0006h: this will simulate a press on that button (even if the button is presently disabled).

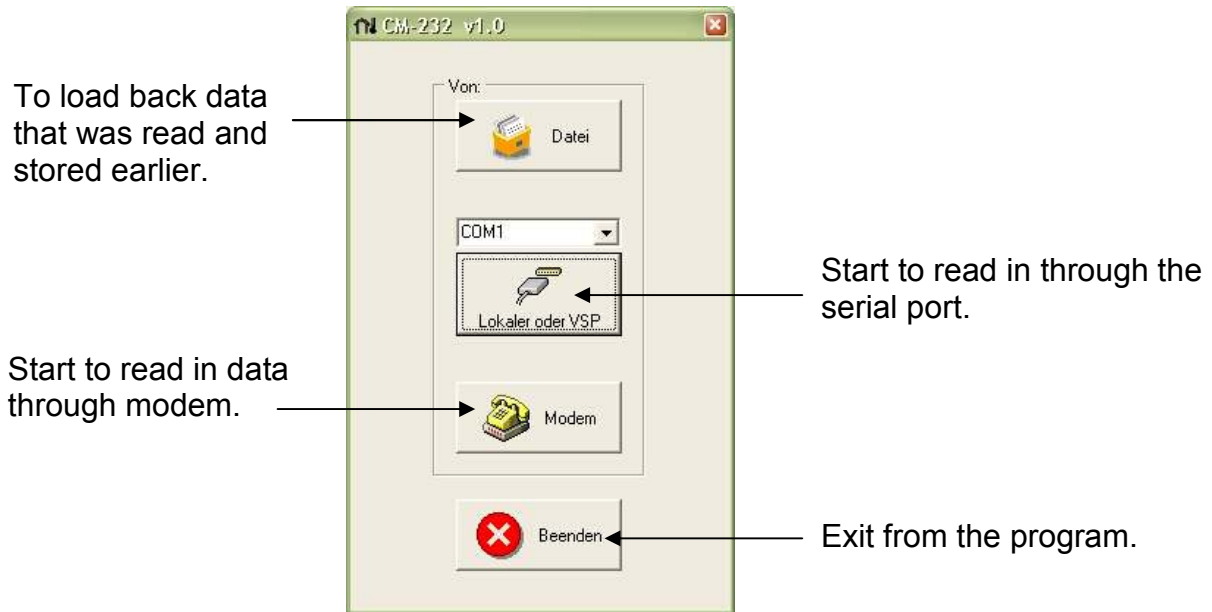
Special combination of buttons:

Values can be written into 0008h register, the result:

- 0001h: Simulates that **DISP** button is kept pressed to start "Par" menu.
- 0002h: Simulates that **SEL+Clr** buttons are pressed to start „LOAD” menu.
- 0003h: Simulates that **"+"+Clr** buttons are pressed to start „SAVE” menu.
- 0004h: Simulates that **ZONE** button is kept pressed.

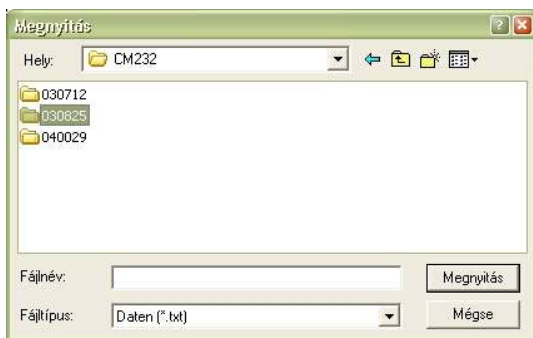
How to use the enclosed data processing software

The enclosed program can be used under Windows. To install the program start "Setup.exe". The installed TCP_CM232 program can be started from the „Start” menu.

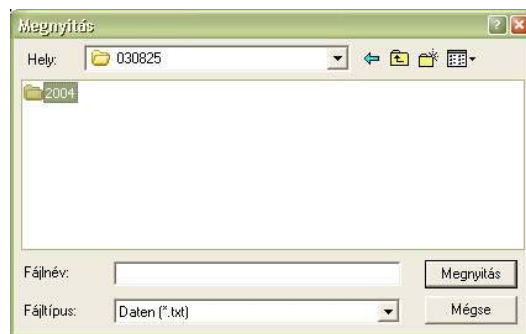


How to see data that was read and stored earlier

1. Select the controller (controllers are identified by their serial number).



2. Select the year when data was stored.



3. Select the file you want to see. File names indicate the original date of the reading out. File name format: month-day-hour-minute_Z2 ("Z2" means the zone number if there were more).

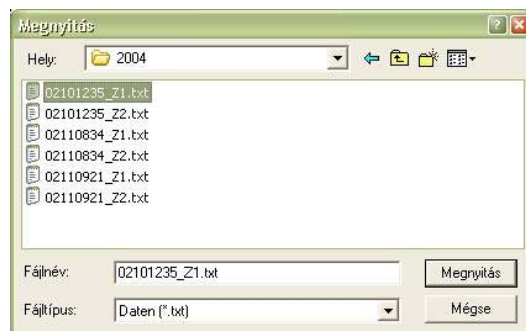


Table of data

The stored data can be seen in table format:

Zone selection, if there are more than one.

Draw a diagram

Main characteristic parameters for the controller: type, serial nr., zone number, control mode, set values, etc. and a list of signs (legends) used in the Table.

Stored parameters with 15 min. intervals. Nr.1 data is the latest one, previously stored data can be found by going down the list. The „X” means in the Table:
 Error signals: error was present
 Relay outputs: Relay is switched on
 Contact inputs: contact is closed.

The screenshot shows a window titled 'Protokoll - 02101235_21.txt'. It has a 'Datei' menu and a 'Diagramm' button. Below the menu is a metadata section with fields: 'Datei', 'Datum', 'Uhrzeit', 'Typ', 'Gerätenummer', 'Zone', and 'Anwendungsprogramm'. Below this is a data table with columns: 'Numm', 'Datum', 'Zeit', 'Sol', 'Innen', 'Außen', 'AF', 'FF', 'VF', 'BF', 'R1', 'R2', 'RV', 'AK', 'RK', 'VK', 'NF'. The table contains 23 rows of data with 'X' marks in various columns.

Quick Keyboard functions: F4: jump and load previous file; F5: jump and load next file. If there was no SA sensor connected: the column „Außen” (Outside) will be empty. If there was an SR sensor error: the „Innen” (Room) will be empty and in the „FF” (Fühlerfehler) column the „X” sign will appear. „NF” (Netzausfällen): the „X” indicates that mains power was switched on here (possibly there was a power failure or it was switched off previously).

The Diagram

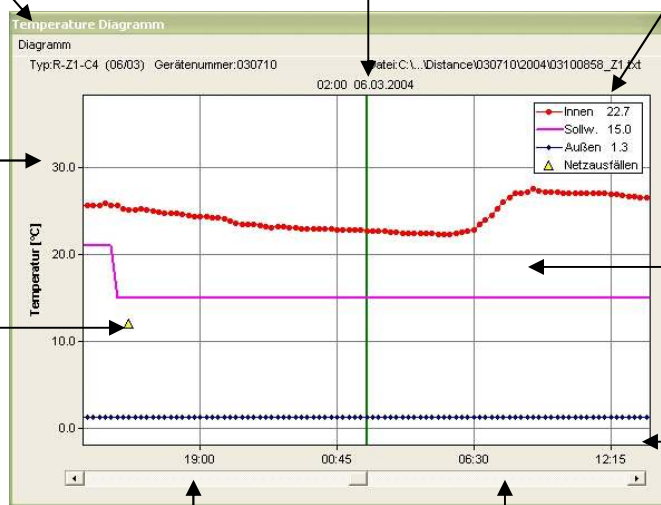
Push „Diagramm” button to see the temperature parameters as a graphical chart.

Push here to see more functions: print; zoom; hide.

„Cursor” with time; date values at this position. Marked data will be the same in the Table.

Legend, and numerical values for data at the cursor position.

Temperature axis.
 Mains power was Off: here the time difference between two subsequent data may be higher than 15 min.



Left button on mouse: Push button over the chart to grab and move it in any direction.

Time axis: Visible period is always 24 hours.

Click here to jump back 12 hours

Click here to jump forward 12 hours

On the diagram dots show the normal operation of the temperature sensors. In case of a sensor error the missing dots will indicate the unusable measurement. If there was no ATF outside sensor connected, the „Außen” line will be missing from the chart.



Connection to a serial port

The serial port of the PC must be connected to the „PC” sign connector on the connection box.

From the rolling down menu select the serial port you want to use.

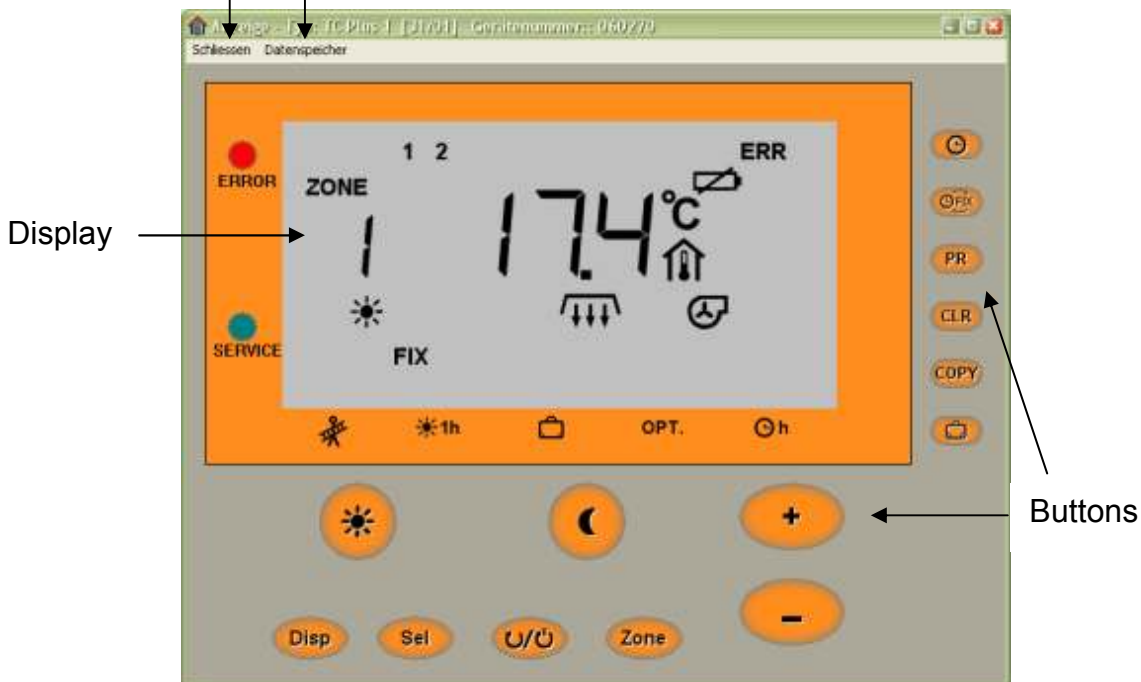
After pushing the button above, the program will try to build up the connection with the CM232 module, starting at the highest bit rate and decreasing it step by step. The connection will be realised at the speed that was selected in the "PAR" menu at the controller.



When connection is ready, the virtual picture of the controller's front panel will appear on the monitor. The arrangement of the buttons and the display content will vary according to the type of the controller. Functions and operation are detailed in the manual of the controller.

You can use the buttons to see and set everything just as if you were in front of the controller at the spot (there will be a little delay in reactions on display depending on the connection speed).

Disconnect communication Start reading-out of the data logger



If you click on „Schliessen”: communication is closed and goes back to the start menu.

