

Note:

The start message is output with the baudrate set (see "Command BR") and the data format 8N1 (8 data bits, no parity, 1 stop bit).

The sensor is equipped with a half-duplex interface. If the sensor is set to automatic telegram output, commands can only be sent to the sensor without errors within the first 60 seconds. When commands are sent during independent telegram output, communication errors can occur.

10.1 Command Interpreter THIES

The sensor is equipped with the command interpreter type THIES, which can be used to change the behaviour of the device or query information. It is possible e.g., to change the station height for calculating the reduced air pressure with command "SH" or to query sensor information with the command "LL".

A command basically has the following structure:

- `<id><command><CR>` Without parameter: used to query the selected parameter
- `<id><command><parameter><CR>` With parameter: used to set a new parameter

The following placeholders have been used here:

id:	Identification number ("00" to "99")
Command:	Command consisting of 2 or 3 characters (see list of commands)
Parameter:	Parameter value with 1 to 10 places (decimal value in ASCII format directly following command without blanks)
<CR>:	Carriage return (13 _{dec} ; 0x0D)

The identification number 'id' can be used to operate several devices together in the bus system. Here each device is assigned an individual 'id' (see **Command ID**).

When sent, a command is acknowledged with a corresponding echo telegram. The echo telegram generally begins with "!", followed by the id, the command and the value set. This is followed by the characters "carriage return" and "new line".

The standard response deviates with erroneous commands or commands relating to status queries.

Commands can be sent either with or without parameters. If no parameter is specified, the set value is output.

<i>Example:</i>	00BR<CR>	Sendebefehl ohne Parameter
	!00BR00005<CR>	Standard Echotelegramm
	00EFS<CR>	Sendebefehl ohne Parameter
	Fault status:	Echotelegramm mit Fehlermeldung Vcc zu klein
	Main board:	0001
	Air pres.:	OK
	Dust:	OK

10.1.3 Status Information:

In the sensor there is a status word (32bit), which supplies information about the state of the sensor. The measured values undergo a plausibility check and are displayed in the status word, including the measured value telegrams (see command TR).

Bit number	Function	Description
Bit 0	VCC fault	The supply voltage is < 6 V or > 30V
Bit 1	3V fault	The 3V processor voltage is not OK
Bit 2	Fault pressure sensor	The pressure sensor reports fault
Bit 3	Without particulate matter sensor	No valid module was detected
Bit 4	Particulate matter sensor failure	The dust sensor reports an error
Bit 5	Reserved	Reserved
Bit 6	No hygro-thermo-measuring element	No valid hygro-thermo-measuring element was detected
Bit 7	Hygro-Thermal Sensor Error	The hygro-thermo-measuring element reports error

Table 3: Status Word

10.2 Commands and Description

The following table lists the available commands and the corresponding password for read and writing.

Command	Initial value Factory setting	MODBUS Register address	Description	Password	
				Read	Write
BR	96	40005	Baud rate	Without	User
CF	0	-	Calibration Status	Without	-
CI	0/1 ³	40013	Command interpreter	Without	User
EDC	0	40045	Manual particulate matter sensor maintenance	Without	User
EFS	-	-	Extended error status	Without	User
FB	1	40001	Quick start	Without	User
HW	-	-	Hardware Configuration	Without	-
ID	0/1 ⁴	40003	ID-number	Without	User
KY	0	40009	Key / Password	Without	-
LL	-	-	Inquiry of the sensor status	Without	-
OR	1000	40017	Telegram output interval	Without	User
PO	5000	40025	Air pressure offset	Without	-
RD	20	40019	Response delay	Without	User
RS	-	40021	Reset	Without	User
SF	0	40015	Frame format (RS485)	Without	User
SH	0	40023	Station height	Without	User
SN	individual	40007	Serial number	Without	-
TA	-	-	Part number	Without	-
TR	-	-	Telegram query	Without	-
TT	0	-	Automatic telegram query	Without	User

Table 4: List of commands

³ The device variant with THIES ACII interpreter is supplied with CI0, the variant with MODBUS RTU with CI1.

⁴ The device variant with THIES ACII interpreter is supplied with ID0, the variant with MODBUS RTU with ID1. If the sensor contains an additional label with the ID, the ID of the label is valid.

10.2.5 Command EFS

<id>EFS<parameter><CR> Status of the sensor (Extended Fault Status)

Access: Read

Description: The command returns the status of the Hygro-Thermo-Baro transducer. For each module of the Hygro-Thermo-Baro-Transducer the telegram sends a line with the name of the module and followed by the status. If a module is error-free, an OK is returned. Otherwise, the error code is returned. The telegram output depends on the variant. In the case of digital variants, for example, analog output is not output.

Parameter Type: -

Parameter: -

Type Return value: Character string

Return value: Status in hexadecimal form or OK

Sample answer:

```

Fault status:
Main board:      OK
Air pres.:      OK
Dust:           OK

Meas. element:  OK
I2C:            OK
EEPROM:         OK
SHT Humidity:   OK
RH Humidity:    OK
SHT35 Temp.:    OK
PT1000 Temp.:   OK
Dew point:      OK

```

Error code description:

Mainboard error:

Bit 0: Vcc error, voltage in invalid range
 Bit 1: 3v μ C internal voltage error

Air pressure sensor error (only if air pressure measurement is active):

Bit 0: Chip ID error
 Bit 1: Calculation error during initialization
 Bit 2: Calculation error in measurement mode
 Bit 3: Status bytes read wrong
 Bit 4: Wrong number of bytes read
 Bit 5: Air pressure invalid value range.
 Bit 6: Temperature invalid range of values.
 Bit 7: Sensor switched off

Particulate matter error:

- Bit 0: Sensor not found
- Bit 1: Readings delayed
- Bit 2: Fan speed out of normal range
- Bit 3: Fan error
- Bit 4: Laser error

Measuring element error (Hygro thermo modul):

- Bit 0: Module initialization error
- Bit 1: I2C error
- Bit 2: EEPROM read error
- Bit 3: EEPROM Page1 invalid
- Bit 4: Module mode error
- Bit 5: Sensor error
- Bit 6: unknown measuring element

I2C bus error:

- Bit 0: I2C activation error
- Bit 1: I2C write error
- Bit 2: I2C read error

EEPROM error:

- Bit 0: Module initializes but no valid measured value available
- Bit 1: CRC error
- Bit 2: Read error
- Bit 3: Write error
- Bit 4: Reading mirrored area failed
- Bit 5: Error writing to mirrored area
- Bit 6: Wrong address
- Bit 7: Value range error
- Bit 8: Free
- Bit 9: Item number wrong
- Bit 10: Sensor ID error
- Bit 11: Write request error
- Bit 12: no measuring element
- Bit 13: Pages have been fixed

Temperature and humidity errors:

- Bit 0: Measured value initialized but not yet a valid measured value
- Bit 1: Timed out writing
- Bit 2: Timed out reading
- Bit 3: CRC error
- Bit 4: calculation error
- Bit 5: Diagnostic mode, measurement invalid
- Bit 6: Calibration value invalid
- Bit 7: Invalid self-calibration parameter (humidity only)
- Bit 8: Initialization error 2
- Bit 9: Calculation error 2

Moisture correction error:

- Bit 0: Module initialised, no valid measured value available yet.
- Bit 1: Incorrect humidity input value
- Bit 2: Input value sensor temperature faulty
- Bit 3: Incorrect air temperature input value
- Bit 4: calculated temperature too small
- Bit 5: Table index too large
- Bit 6: calculated humidity < 0%
- Bit 7: calculated humidity > 100%

PT1000 Modul Fehler:

- Bit 0: Module initialised, no valid measured value available yet.
- Bit 1: Initialization "shut down" error
- Bit 2: Wake up failed
- Bit 3: Start measurement failed
- Bit 4: Get reading failed
- Bit 5: Shut down failed
- Bit 6: Calculation failed
- Bit 7: free
- Bit 8: wrong mode
- Bit 9: Failed to read parameters
- Bit 10: Gain parameter invalid
- Bit 11: Invalid parameter offset

Dew point calculation error:

- Bit 0: Module initialised, no valid measured value available yet.
- Bit 1: Input value humidity invalid
- Bit 2: Input value temperature invalid
- 0xFFFF -> Query error, parameters of called function not valid.

10.2.6 Command FB

<id>FB<parameter><CR>	Quick start mode
Access:	Read / write
Description:	<p>The command is used to select the quick start mode or to query the set mode.</p> <p>In the quick start modes, the bootloader immediately jumps into the firmware and does not output any data. If the quick start mode is inactive, the bootloader outputs its software version, 9 times the C and the set parameters BR, SF, CI and ID.</p> <p>In quick start mode 1, the firmware does not output a telegram for the encoder status. In quick start modes 0 and 2, the firmware outputs the "LL" telegram once after the start.</p>
Parameter Type:	Unsigned integer
Parameter:	<p>0: Quick start mode off</p> <p>1: Quick start mode on (without telegram output)</p> <p>2: Quick start mode on (only telegram LL is sent once)</p>
Type Return value:	Unsigned integer
Return value:	See parameter
Range of values:	0...2
Initial value:	1

10.2.7 Command HW

<id>ID<parameter><CR>	Hardware configuration
Access:	Read
Description:	<p>The command is used to read out the type of hardware. At the start, the hardware variant and the configuration are read out and checked for plausibility. The result of this plausibility check is read out with this command.</p>
Parameter Type:	Unsigned integer
Parameter:	<p>0: Digital</p> <p>1: HTB with power output</p> <p>2: HTB with voltage output</p> <p>3: Reserved</p> <p>4: Hardware invalid</p>
Type Return value:	Unsigned integer
Return value:	See parameter
Range of values:	0 ... 4
Initial value:	-

10.2.8 Command ID

<id>ID<parameter><CR>	Identification number
Access:	Read / write
Description:	This command sets the identification number (THIES interpreter) or the slave address (MODBUS RTU interpreter). A response telegram is sent only when the 'ID' in the command matches the one set in the sensor. An exception here is the generic 'ID', to which all sensors respond (THIES interpreter). Once the 'ID' has been changed, the device will immediately respond with the new 'ID'.
Parameter Type:	Unsigned integer
Parameter:	99 generic 'ID' (THIES interpreter) 0 Broadcast slave address (MODBUS RTU interpreter)
Type Return value:	Unsigned integer
Return value:	See parameter
Range of values:	0 up to 99 (THIES Interpreter) 1 up to 247 (MODBUS RTU Interpreter)
Initial value:	0 (THIES Interpreter) für Sensor 1.1006.54.xxx 1 (MODBUS RTU Interpreter) für Sensor 1.1006.54.xx1

10.2.9 Command KY

<id>KY<parameter><CR>	Key/password										
Access:	Read / write										
Description:	The value for the key (password) is set with this command. The following 2 password levels are possible: Query (only read access) User (general settings) Admin (Thies version configuration) Calibration (calibration laboratories)										
Parameter Type:	Unsigned integer										
Parameter:	<table border="1"> <thead> <tr> <th>Parameter</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>Without</td> <td>Query = read</td> </tr> <tr> <td>1</td> <td>User</td> </tr> <tr> <td>-</td> <td>Admin (Thies internal)</td> </tr> <tr> <td>On request</td> <td>Calibration for laboratories</td> </tr> </tbody> </table>	Parameter	Description	Without	Query = read	1	User	-	Admin (Thies internal)	On request	Calibration for laboratories
Parameter	Description										
Without	Query = read										
1	User										
-	Admin (Thies internal)										
On request	Calibration for laboratories										
Type Return value:	Unsigned integer										
Return value:	See parameter										
Range of values:	0, 1, ...										
Initial value:	0										

