User Manual
Electronic Heat Cost Allocator

HCAe2

A1.01.2013

1 Application and Function

This heat cost allocator is designed for the measurement of the consumed thermal energy on radiators in use units. The term "use units" means the following premises:

- flats
- office premises
- business premises
- commercial premises or
- production rooms

which are supplied with heat centrally by a common heating system (central heating) or a common district heating connection.

The totality of the use units is a billing unit.

2 Contents of the Package

A package of electronic heat cost allocators contents:

- 40 pieces of HCAe2
- 1 package with 40 pieces of seal
- 1 installation quick start guide

The heat conductors have to be ordered separately!

A package of heat conductors contents:

- 40 pieces of heat conductors

There are also available:

- Optical extensions HCAe2 to cover previous mounting points of old equipment.
- Heat transfer adapter HCAe2, wide, for special radiator types with special designs or large space distances between the sections.
  This adapter is attached between the standard aluminum heat conductor and the radiator.
- Plug-in remote sensors (set consisting of remote sensor cable, remote sensor cover, mounting nut and locking plugs).
- Security seals (contents 40 pieces).
- Optocouplers for the optical readout unit (Opto Coupler). This is attached to the HCAe2 together with the optical readout unit and ensures fast and secure communication between the HCAe2 and the readout equipment.

You can find article codes, mounting accessories and additional equipment in the mounting instructions and the price list.

3 General Information
- The technical regulations of EN834 must be observed.
- This product fulfils the requirements of the European Council Directive on Electromagnetic Compatibility (EMC Directive) 2004/108/EC.
- All information and requirements of the mounting manual, user manual and mounting instructions must be observed.
- If the information and requirements in the mounting manual, user manual and mounting are not strictly followed, or if the installation is shown to be faulty, any resulting expenses will be charged to the company responsible for the installation.
- All specifications and instructions listed on the data sheet and in the Application Notes must be adhered to.
- Within a billing project, it is not permitted to use different types of heat cost allocators.
- Instruments with activated radio function are not allowed on air freight.
- The temperature sensor cables must not be kinked, rolled up, lengthened or shortened.
- To clean the heat cost allocator use a slightly moist cloth.
- To protect against damage and dirt the heat meter should only be removed from the packaging directly before installation.
- Instruments which have been replaced or exchanged must be disposed of according to relevant environmental regulations.
- It is important to note that the acknowledged state of the art technology rules and the relevant legal restraints (international and local; see "Relevant Norms / Standards / Literature") are to be observed.
- The installation has to be performed by authorized, skilled persons.
- The heat cost allocator left the factory in conformance with all applicable safety regulations. All maintenance and repair work is to be carried out only by qualified and authorized technical personnel.
- Further information can be obtained at **www.engelmann.de**.

4 General Mounting Information
All information and requirements of the Engelmann mounting manual and mounting instructions must be observed.
The different types of installation and the mounting accessories to be used in each case are listed in the mounting manual.
After installation of the heat conductor mount the heat cost allocator.
Insert the seal into the opening on the underside.
The heat cost allocator starts the operation mode automatically (plug on detection).

5 Display / Display Cycle
The heat cost allocator has a liquid crystal display with 7 digits and special characters.
After the installation the values are shown in a permanent display cycle.

5.1 Displays before and during installation of the HCAe2
- When delivered the HCAe2 is in Sleep mode. This is indicated in the display with the flashing "SLEEP" (**fig. 1: A**).
- Shortly after the placement of the HCAe2 to the aluminum conductor the configuration starts.
    - If a compact device is mounted appears for about 3 seconds *"CONFIG"* (**fig. 1: B**).
    - If a remote sensor is installed appears for about 3 seconds "CONF FF" (**fig. 1: C**).
- Then the display cycle starts.
- If a start date for the start of counting is programmed in HCAe2 then "GO mm.jj" (e.g. "GO 04.16") appears on the display and remains until reaching the starting month (**fig. 1: D**).
- After the completion of the internal configuration or upon reaching the preset starting month the display cycle starts (**5.2 and 5.3**).
- Make sure that the HCAe2 is permanently attached to the required mounting location.
- Make sure that the EHKV is sealed (manipulation).

Figure 1 (A-D): Displayed status information before and during installation

```
SLEEP
```
A. Delivery mode / storage mode HCAe2 (display flashing / interval 1 sec)

```
CONFIG
```
B. Configuration display compact device (approx. 3 sec)

```
CONF FF
```
C. Configuration display when remote sensor is connected (approx. 3 sec)

```
60 04.16
```
D. If programmed (optional): starting month of recording data (e.g. 04.16 -> April 2016). Displayed until starting month is reached.
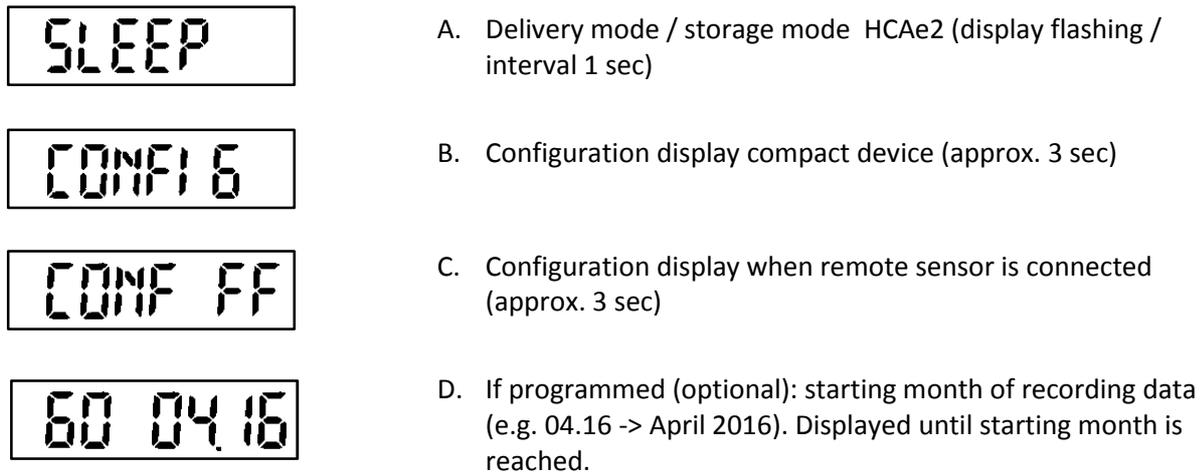
5.2 Default display of HCAe2 after installation

The following image shows the default display cycle of Engelmann factory setting.

Figure 2: Display cycle (factory setting)

R 0000421	*Current value*
B AN 31.12 R	*Billing date* **AN** = ANNUAL (yearly billing date) **MON** = MONTHLY (monthly billing date)
B 0001293 R	*Billing value*
C 5987 R	*Checksum*
R 8888888	*Display test*
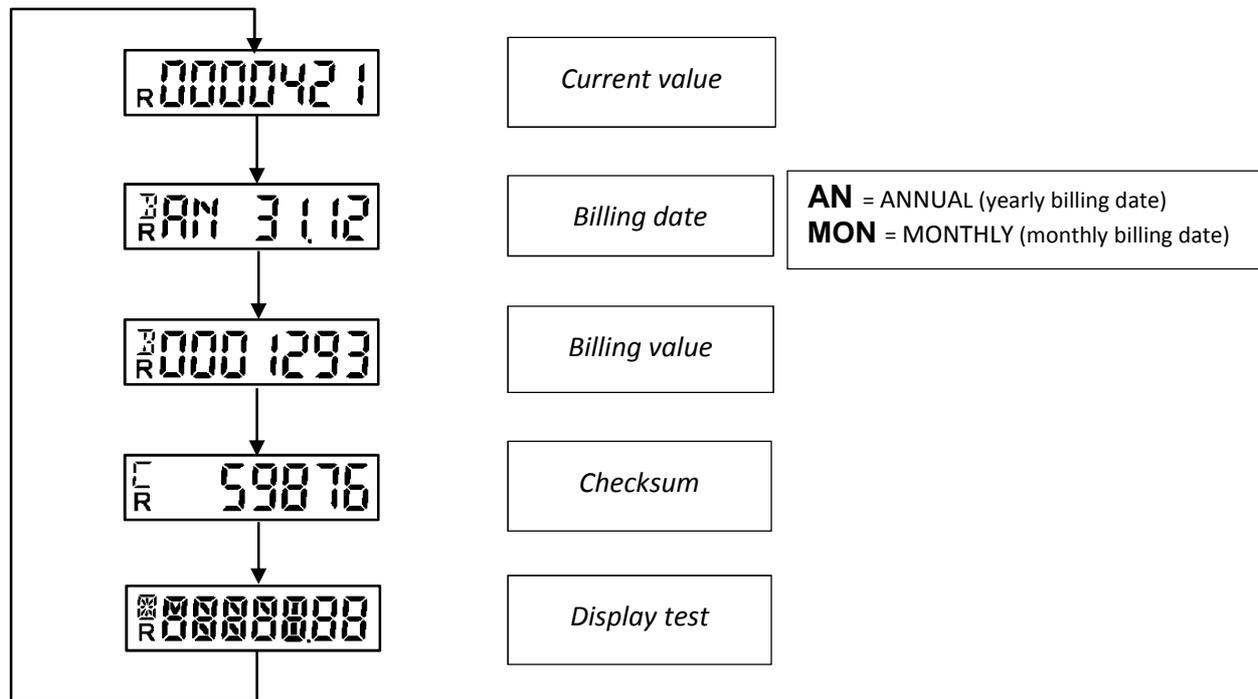
The following status indicators are also displayed:

Appears in the lower left corner of the display	Appears in the upper left corner of the display	Appears in the upper left corner of the display
R: Radio (radio is activated)	**B**: Billing Indicates the billing-relevant information *Billing date* and *Billing value*	**C**: Checksum Indicates the check digit for the *Billing value* (default) and / or the check digit for the *current value* (optional)

It should be noted that some of the standard 7-segments elements have been expanded by including more segments to increase the readability of the status indicators. These are visible in the segment test and are shown below:

Figure 3: Segment test (enlarged view)

5.3 Further status displays

The following status displays are shown for information purposes in addition to the standard display cycle, when parameterized, or a mode changes is initiated by internal algorithm.

- 1-sensor mode is selected (optional):

- Product scale is selected (optional): The entered radiator output in watts is displayed (e.g. 750W):

- The check sum for the current consumption has been selected (optional): These appear on the display loop directly after the current consumption (example):

- If the algorithm in the standard 2-sensor operation mode detects accumulated heat, the device switches to temporary 1-sensor mode. This is displayed as "1F HEAt" (please see also 8).

- If the HCAe2 is in storage mode / delivery mode and the ambient temperature drops below 0 °C then "COLd" is displayed.

- If the HCAe2 is opened after mounting on the radiator but within the mounting time frame (waiting period), appears "OPEN" (please see also 9).

- If the HCAe2 is opened outside the mounting time frame (waiting period), appears "OPEN C" (C = Contact) in the display cycle. Here, it is assumed that there is a manipulation of the HCAe2 (please see also 9.2).

```
OPEN C
```

- If a reset of the manipulation detection (OPEN C) is performed, the display shows "STBY" (STBY = Stand by) (please see also 9).

```
STBY
```

- If the Engelmann heating cost allocator HCAe2 is in the tenth year of operation, this information is indicated in the display as "ANNO 10". Analogously, "ANNO 11" is displayed in the eleventh year of operation.

```
R ANNO 10
```

6 Consumption Calculation

Due to the radiator exponent is part of the calculation algorithm and thus a basis for calculating of the counting process of he HCAe2, the following formula is used to calculate the consumption value:

In case of operation with product scale:

$$Consumption\ value = Displayed\ value$$

In case of operation with unit scale:
1-sensor mode:

$$Consumption\ value = Displayed\ value * \frac{Kc1 * Kq}{1,181}$$

2-sensor mode:

$$Consumption\ value = Displayed\ value * \frac{Kc2 * Kq}{2,288}$$

Remote sensor (RS) mode:

$$Consumption\ value = Displayed\ value * \frac{KcRS * Kq}{1,097}$$

7 Remote Sensor

The Engelmann heat cost allocator HCAe2 can be equipped with a separately available remote sensor (2 m and 5 m cable length).

7.1 First installation of the remote sensor

The remote sensor is press-fitted with the contact block on the rear side of the device in the provided opening in such a way that the contact block rests fully and flat on the plastic edge of the provided opening. The cable is guided downwards through the housing recess provided for this purpose. The recess is closed by a predetermined breaking point. This can be very easily broken out with the thumb or a screwdriver.

When installed on the aluminum heat conductor, the device detects the attached remote sensor and configures accordingly for the remote sensor mode (see 5.1).
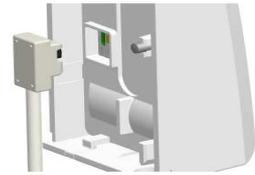
7.2 Retrofitting: remote sensor <= => compact device

The Engelmann heat cost allocator offers a special feature relating to the subsequent modification of the operating mode. In the case of an Engelmann heating cost allocator, which is already in operation, it is possible to retrofit a compact device with a remote sensor, as well as retrofit a device with an already connected remote sensor back into a compact device. The following procedure (VG) must be observed.

Compact device = => Remote sensor device

VG	Description
1.	Demounting of the heating cost allocator from aluminum heat conductor.
2.	Reset the manipulation/sabotage detection (display screen OPEN C) using the Engelmann customer software "Device Monitor" (STBY appears in the display) (see also 5.3).
3.	Attaching the remote sensor to the rear of the unit (see also 7.1).
4.	Installation of the heat cost allocator at a location where the device integrated room temperature sensor is not directly influenced by the heating output of the radiator. Please refer to the Engelmann mounting manual for the mounting distances to be observed. The aluminum heat conductor is also used for wall mounting as a mounting bracket for the heat cost allocator. After mounting the heat cost allocator on the aluminum heat conductor, the internal configuration begins. The device detects the connected remote sensor (see 5.1).
5.	Connect the sensor side of the remote sensor (ring eyelet) to the radiator with the remote sensor cover (please refer to the Engelmann mounting manual for the required mounting method).

Points 4 and 5 can also be carried out in the reverse order.

Remote sensor device = => Compact device

VG	Description
1.	Disassembly of the heat cost allocator **with attached remote sensor** from the aluminum heat conductor (OPEN C appears in the display). **Watch out!!!** It is absolutely necessary that the remote sensor remains connected during the disassembly of the heat cost allocator until the manipulation/sabotage detection has been reset by software (see VG 2).
2.	Reset manipulation/sabotage detection (OPEN C) with the help of the Engelmann customer software "Device Monitor" (STBY appears in the display) (see also 5.3).
3.	Now the remote sensor can be disconnected from the device.
4.	The heat cost allocator can now be used again as a compact device and mounted on the radiator.
4.	After mounting the heating cost allocator on the aluminum heat conductor, the internal configuration begins. The device is recognized as a compact device (see also 5.1).

It is important to note that different Kc values are required depending on the application mode (compact or remote sensor)!

8 Detection of Accumulated Heat

The detection of accumulated heat at HCAe2 is carried out by the internal calculation algorithm. Here are several averages of detected temperature values calculated permanently. When these average values falls below a certain threshold, the algorithm detects the heat accumulation and changes in the internal 1-sensor operation mode (1F HEAt). If the threshold is exceeded again, it takes up to 6 hours to change back into the standard 2- sensor mode and the heat accumulation signaling is terminated. The change in the 1-sensor (heat accumulation)-mode does not affect the functionality of your HCAe2, due to the fact that this behavior is part of the internal calculation algorithm and thus to the approval of the HCAe2.

9 Plug on / Manipulation (Plug off) Detection

The Engelmann heating cost allocator HCAe2 has a combined plug on / sabotage detection (plug off). Depending on the mounting status (not mounted or mounted), program functions are called up during the action *mounting* or during the action *demounting* / sabotage. These status indicators are shown in the display.

9.1 Plug on detection

The HCAe2 has a plug on detection.
If the plug on detection is activated by mounting process for ≥ 5 sec. the operation "plug on" is triggered and configuration starts (see 5.1)
This initiates the device-internal configuration (display "CONFIG / CONF FF") and the HCAe2 changes to the operating mode; the radio transmission (radio version) starts automatically (see 11.2.6)

9.2 Manipulation detection (plug off detection)

The HCAe2 has a manipulation detection (plug off detection).
If the HCAe2 is removed within 1 hour after its initial installation on the heat conductor, the display shows "OPEN" (see 5.3). By re-install the device within this mounting time frame, then "CONFIG / CON FF" appears again on the display (see 5.1 and 9.1) and the standard display cycle continues.
Repeated removing and re-installing can be done within the mounting time frame several times; but the mounting time frame is not extended.

Only at the end of the mounting time frame for installation (waiting period), the measurement function of HCAe2 is enabled!

If the HCAe2 is removed after the end of the mounting time frame for installation from the heat conductor or fitted again after the end of the mounting time frame, the display shows "OPEN C" in the display cycle (see 5.3). Here manipulation is suspected. The "OPEN C" hint persists after re-install the HCAe2 and will appear in the display cycle.

By using the costumer software "Device Monitor" (register parameterization – reset removal detection -) the hint "OPEN C" can be reset.

The display briefly shows "*STBY*", then "*CONFIG / CONF FF*" appears and the device continue with recording data by displaying standard display cycle.
If the reset is performed on the removed HCAe2, the "*STBY*" appears on the display and will persist until the re-install of the device. After re-install the display briefly shows "*CONFIG / CONF FF*" and the device continue with recording data by displaying standard display cycle.

10 Operating Conditions / Technical Data

Norm; approval		EN 834:2013; A1.01.2013 approved to German HKVO
Dimensions	mm	height 95 / width 38 / depth 30
Ambient temperature	°C	- 25 – 60; see „Influencing_factors_battery_lifetime" at www.engelmann.de
Temperature range medium 2-sensor mode	°C	35 – 95
Temperature range medium 1-sensor mode	°C	55 – 95
Temperature range medium remote sensor mode	°C	35 – 105 (2-sensor mode) 55 – 105 (1-sensor mode)
Start of enumerating at temperature difference (radiator overtemperature) $\Delta\Theta$	K	4,5
Protection class		IP41 (mounted)
Power supply	V	3; lithium battery
Battery lifetime; estimated		11 years + 1 year storage; see „Influencing_factors_battery_lifetime" at www.engelmann.de
Data storage		132 monthly values and 132 semimonthly values
Display		7 digits + special characters
Interfaces	standard	infrared according to ZVEI standard
	optional	wireless M-Bus
Remote temperature sensor		
Sensor type		NTC pre aged
Length of cable	m	2 or 5
Dimensions of cover	mm	height 26 / width 12 / depth 10

11 Interfaces and Options

11.1 Optical (infrared) interface

For the communication with the optical interface an optocoupler and the 'Device Monitor' is necessary. The optocoupler and the 'Device Monitor' software are available as accessory equipment.
Baud rate: 2400 baud

11.2 Radio interface wireless M-Bus (optional)

The radio interface is for the transmission of meter data (absolute values).

General information about the radio interface

When installing the radio components, avoid metallic material directly in front of the housing.
The transmission quality (range, telegram processing) of radio components can be negatively influenced by instruments or equipment with electromagnetic emissions, such as telephones (particularly LTE mobile radio standard), wi-fi routers, baby monitors, remote control units, electric motors, etc.
In addition, the construction of the building has a strong influence on the transmission range and coverage.

The factory-setting of the internal clock inside the heat cost allocator is standard (winter) Central European Time (GMT +1). There is no automatic changeover to daylight savings (summer) time.

The radio function is deactivated upon delivery (see 11.2.6 "Activation of the radio interface")

11.2.1 Technical data radio

Frequency	868 MHz
Transmission power	up to 10 dBm
Protocol	wireless M-Bus based on EN 13757-4
Selectable modes	S1 / T1 / C1
Telegrams	- short telegram AMR (in conformity to OMS-Spec_Vol2_Primary_v301): serial number, date/time, current consumption, due date, due date value, hint flag, time of hint flag - long telegram for walk-by read-out: serial number, date/time, current consumption, due date, due date value, 15 monthly values, 15 semimonthly values, hint flag, time of hint flag
Encryption	AES: Advanced Encryption Standard; key length: 128 bits

11.2.2 Radio configuration

Parameter	Possible settings	Factory setting (battery lifetime, estimated: 1 + 11 years)
Mode	S1 / T1 / C1; unidirectional	T1; unidirectional
Transmission period	00:00 - 12:00 pm; any time period in the day	8:00 am - 6:00 pm
Transmission interval	120 seconds - 240 minutes	120 seconds
Weekdays	Monday – Sunday (any weekday)	Monday - Friday
Weeks in a month	1 - 4 (4: uninterrupted, incl. a possible 5th week)	1 - 4 (4: uninterrupted, incl. a possible 5th week)
Months	1 - 12	1 - 12
Radio activation date	annually variable (except 29.02.)	not set
AES-128-Encryption (Key-Type)	- Master Key - customer specific key - random key per instrument	Master Key
AES-128-Encryption	- activated / deactivated	activated
Type of telegram	- short telegram AMR (OMS-Spec_Vol2_Primary_v301) - long telegram for walk-by read-out	long telegram for walk-by read-out

11.2.3 OMS 4 mode 7

A special radio variant offers the possibility of radio communication according to OMS 4 Mode 7. The protection profile for smart metering of the Federal Office for Information Security (BSI/Germany) is taken into account here.

11.2.4 Technical data radio OMS 4 mode 7

Frequency	868 MHz
Transmission power	up to 10 dBm
Protocol	wireless M-Bus based on EN 13757-4
Selectable modes	T1 / C1
Type of telegram	- short telegram AMR (in conformity to OMS-Spec_Vol2_Primary_v4.11): serial number, date/time, current consumption, due date, due date value, hint flag, time of hint flag
Encryption	AES: Advanced Encryption Standard; key length: 128 bit

11.2.5 Radio configuration OMS 4 mode 7

Parameter	Possible settings	Factory setting (battery lifetime, estimated: 1 + 11 years)
Mode	T1 / C1; unidirectional	T1; unidirectional
Transmission period	00:00 - 12:00 pm; any time period in the day	00:00 - 12:00 pm
Transmission interval	120 seconds - 240 minutes	15 minutes
Weekdays	Monday - Sunday	Monday - Sunday
Weeks in a month	1 - 4 (4: uninterrupted, incl. a possible 5th week)	1 - 4 (4: uninterrupted, incl. a possible 5th week)
Months	1 - 12	1 - 12
Radio activation date	annually variable (except 29.02.)	not set
AES-128-Encryption (type of key)	- random key per instrument	- random key per instrument
AES-128- Encryption	- activated / deactivated	- activated
Type of telegram	- short telegram AMR (in conformity to OMS-Spec_Vol2_Primary_v4.11)	- short telegram AMR (in conformity to OMS-Spec_Vol2_Primary_v4.11)

11.2.6 Activation of the radio interface

The radio interface **leaves the factory deactivated.** After putting the heat cost allocator on the heat conductor the radio interface will be activated automatically.

When the radio interface is activated an "R" is shown permanently left below in the LCD (please see 5.2).

The Engelmann heat cost allocator is equipped with an installation radio mode. After the attachment has recognized the installation of the heat cost allocator, the device sends a radio telegram for one hour every 36 seconds.

If using the compact mode, for one hour after activation the heat cost allocator transmits in installation mode. This means that format telegrams and compact telegrams are sent alternately.

12 Hint Flags

The Engelmann heat cost allocator has eight basic reference codes, which can also be used in combination. Hint codes are information on events that differ from the normal operating mode of the heat cost allocator. The hint codes may have the character of pure information (no limitation of the measurement and memory function), as well as indicate one or more serious errors of the measurement and memory function. Depending on the content and type, the indications appear in the display, in the optical reading and in the transmission via radio in different representation (see also 12.1.1 and 12.1.2).

12.1 Possible hint flags and their representation

Presentation and display of hint flags	H 01 / Bit 0	H 02 / Bit 1	H 04 (=ANNO 10) / Bit 2	H 08 (=OPEN C) / Bit 3	H 16 / Bit 4	H 32 / Bit 5	H 64 / Bit 6	H 128 / Bit 7
Presentation at display: integrated		H 02 (blinking)	ANNO 10 ANNO 11 (blinking)	OPEN C (blinking)				
Presentation at display: permanent	H 01 (blinking)				H 16 (blinking)	H 32 (blinking)		
Reading via: optical interface	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7
Reading via: radio	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7

12.1.1 Representation of hint flags in the display

The displayed hint flags are shown in the form of "H" (H = hint) in conjunction with a two-digit reference number (e.g. H 02). The Engelmann heat cost allocator generally has two different kinds of displayed hierarchy level.

The messages of the first hierarchy level are information which has no influence on the correct measurement function and / or the data storage. Some of these messages of the first hierarchy level are additionally integrated as display elements into the display loop, such as "OPEN C" (= H 08) or "ANNO 10" (= H 04).

In the case of hint flags of the second level, the heating cost allocator switches from the operating mode to a separate hint mode. These messages indicate a serious error, since no measured data is recorded and / or stored here. These hint flags are shown permanently blinking in the display.

The hints appearing in the display are listed in the overview 12.1 (for example H 01).

If several hints of the first hierarchy level appear together or also offset in time, they are also integrated in the display loop.

If several hints of the second hierarchical level appear, as well as the simultaneous occurrence of first and second level hints, these hints are displayed in the form of a **combined hint code** permanently flashing (the note numbers are "added" to this, see below).

Examples for combined hint codes:
  H 16 (breaking of a temperature sensor) + H 08 (sabotage detection / plug off = OPEN C) = **H 24**.
  H 02 (unexpected reset) + H 32 (short circuit of temperature sensor) = **H 34.**

If a permanently flashing message code is shown in the display, an error of the second hierarchical level is always involved and the device must be replaced!

- The hints "H 04", "H 64" and "H 128" have no influence on the correct function of the device. The hint "H 64" and "H 128" are not shown in the display.
  "H 04" is shown in the display loop as "ANNO 10" or "ANNO 11".
- The hint "H 08" is displayed as "OPEN C" in the display loop. This message indicates that the opening detection has responded. Temperature measurement and measurement data storage is still active.
- The hint "H 02" is displayed integrated into the display loop. This message indicates an unexpected reset. The measuring functionality (temperature measurement and measurement data storage) is still active. **Since it cannot be ruled out that the hint flag "H 02" can be a first indication of a serious fault, the exchange of the heat cost allocator is recommended**.
- **The device must be replaced in the case of the hint flags "H 01", "H 16" and "H 32" (or even when combined with other hints - please see examples under 12.1.1). These hints permanently flashing in the display. No measurement and no storages are carried out!**

12.1.2 Representation of hint flags via optical reading / radio transmission

In the case of optical and / or radio readout, the indication bits are represented in the following form: Bit x: *Description text* (for example bit 3: sabotage contact released, drop detected).

In addition to the hint flag, the date and time (time stamp) are stored on the first occurrence of a hint. If the same hint occurs, the date is not changed. This makes it possible to see when a hint has occurred first. If another, other hint appears, the date of this new hint is also stored.

The hint flags are displayed individually in the order of their occurrence. The date is not stored by the hints "Bit 2" (ANNO 10 / ANNO 11) and "Bit 7" (remote sensor is mounted).

In the case of optical readout and read-out by radio, the corresponding hint bit is <u>always</u> transmitted!

Analogous to the description of the message codes in the display (see 12.1.1), it is recommended to replace the device when "bit 1" occurs. When the notes "Bit 0" or "Bit 4" or "Bit 5" appear, the device must be replaced, as no measured value calculation and measured value storage take place.

12.2 Description of hint flags

Hint flags (decimal representation)	Hint flags (binary representation)	Description
H 01	Bit 0	Memory error; during access to database an error occurred
H 02	Bit 1	Unexpected reset by POR, RAM-parity, access violation
H 04 (= ANNO 10 / ANNO 11)	Bit 2	The device has reached the tenth / eleventh year of operation
H 08 (= OPEN C)	Bit 3	A removal of the HCAe2 from the heat conductor was detected; response of manipulation detection (plug off detection)
H 16	Bit 4	Break of one of the measuring (temperature) sensors
H 32	Bit 5	Short circuit of one of the measuring (temperature) sensors
H 64	Bit 6	Reset by watch dog timer (WDT)
H 128	Bit 7	Remote sensor is connected

12.3 Hint causes

Hint flag / hint bit	Description	Effect	Possible cause
H 01 / Bit 0	Memory error; during access to database an error occurred.	No calculations and no storage are carried out. The register for consumption is not being updated.	Corrupt (defect) memory chip
H 02 / Bit 1	Unexpected reset by POR, RAM-parity, access violation.	The measured values and the time since the last saving in the E^2PROM are lost (max. one hour). Calculations are still being carried out.	Undervoltage detection, CPU access error
H 04 / Bit 2	The device has reached the tenth / eleventh year of operation.	No influence on the calculation.	Device is in the tenth year of operation / device is in the eleventh year of operation.
H 08 / Bit 3	A removal of the HCAe2 from the heat conductor was detected.	No influence on the calculation.	Plug off or manipulation
H 16 / Bit 4	Break of one of the measuring sensors.	No calculations are carried out. The register for consumption is not being updated.	Defect on PCB board, high-resistance NTC; defect of the remote sensor in the remote sensor operating mode
H 32 / Bit 5	Short circuit of one of the measuring sensors.	No calculations are carried out. The register for consumption is not being updated.	Defect on PCB board, low-resistance NTC; defect of the remote sensor in the remote sensor operating mode
H 64 / Bit 6	Reset by watch dog timer.	The measured values and the time since the last saving in the E^2PROM are lost (max. one hour). Calculations are still being carried out.	Undefined program status, program sequence is not within the specified time cycle.
H 128 / Bit 7	Remote sensor is mounted.	No influence on the calculation.	Remote sensor was mounted.

13 Manufacturer

Engelmann Sensor GmbH

Rudolf-Diesel-Str. 24-28

69168 Wiesloch-Baiertal

Germany

Tel: +49 (0)6222-9800-0

Fax:+49 (0)6222-9800-50

E-Mail: info@engelmann.de

www.engelmann.de