

TOPAS® ESK 2

(DN 15 – DN 50)

FW 2.0.3

Product specification



Static ultrasonic water meter for accurate reading and recording of consumption in all areas of drinking water supply.

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1 Functional description

1.1 Application

TOPAS® ESK 2 is a static ultrasonic water meter for accurate recording and reading of consumption in all areas of water supply.

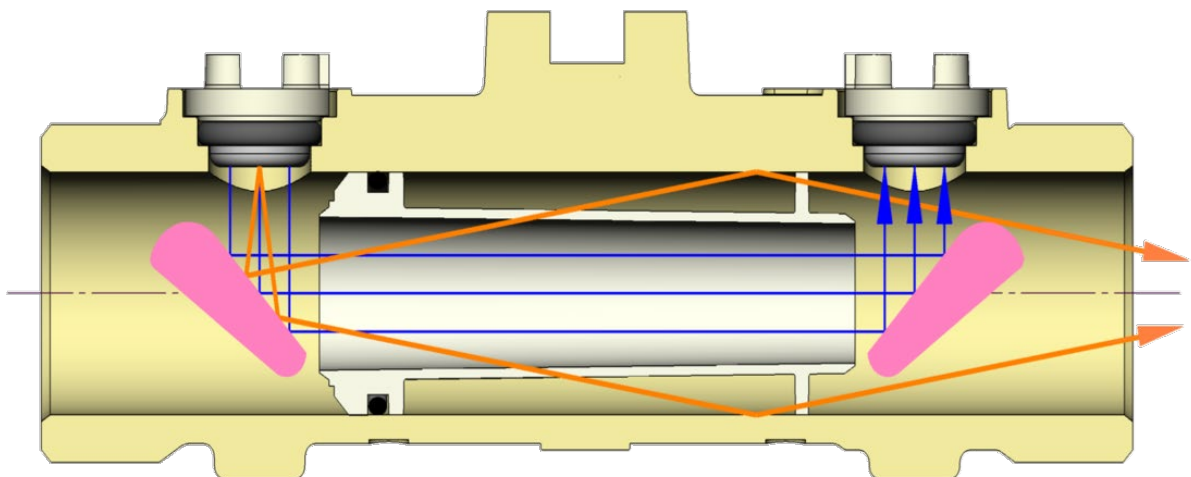
It is not affected by sediment and suspended solids in the water and so ensures stable long-term measuring accuracy even under difficult conditions.

With its innovative combination of ultrasonic technology and integrated communication, TOPAS® ESK 2 makes water consumption transparent and is ideal as part of an automatic meter reading (AMR) system. Reading is possible in seconds using the radio protocol to the Open Metering standard or a wired M-Bus interface and most accurate meter counts create the perfect database for smart metering. TOPAS® ESK 2 therefore provides the database for complex consumption profiles in real time if required.

1.2 Measuring principle

Ultrasonic measurement in TOPAS® ESK 2 is based on the time difference measuring procedure. The ultrasonic transducer in the meter sends an ultrasonic signal in the flow direction and against the flow direction. This ultrasonic signal is reflected by the reflector, passes through the measuring tube to the reflector opposite and sends the signal to the second ultrasonic transducer. During a flow of water the time needed by the signal in the flow direction is shorter than the time needed against flow direction. This measured time difference correlates with the flow velocity and thus to the flow volume. This value together with the cross-section of the measuring tube can be used to calculate the flow volume. TOPAS® ESK 2 makes every two seconds an ultrasonic measurement (standard measuring frequency).

The water temperature required to accurately determine the sound velocity and calculate flow effects is measured by a temperature sensor every sixteen seconds



1.3 Overview technical data

TOPAS® ESK 2 Overview technical data	
Electromagnetic environmental class	EN 14154-1: E1 and E2
Accuracy class	EN 4064-1: class 2
Ambient class	EN 14154-1: class C
Calming sections (not necessary)	U0 / D0
Protection class	IP 68
Nominal pressure	PN 16
MID approval for medium temperature	T30, T50, T70, T90
Medium temperature	0.1 ... +30° C (ESKR 2 and ESKMP 2) and 70° C (ESWR 2 and ESWMP 2)
Ambient operating temperature	1 ... 55° C
Ambient storage temperature	-10 ... +70° C (>35 ° C max. 4 weeks)
Volume calculation	every 2 seconds
Measurement water temperature	every 16 seconds
Updating of the display values	every 3 seconds
LCD display	9-digit
Communication interfaces	Optical, Radio 868 MHz, M-Bus, Pulse
Battery lifetime T30*/T50*	up to 16 years (two batteries)
Radio mode	T1 (R3) / R4 / R4+
OMS versions	OMS 3
Sending interval Mobile telegram (T1 (R3) / C1)	approx.. every 23 sec**
Sending interval Fixed Network telegram (R4)	approx.. every 60 min
Data storage	Data logging capabilities to record up to 1024 daily values (configurable to hourly, weekly, monthly) + 32 monthly (configurable to hourly, daily, weekly) values and an annual due date

*Battery life depends on the transmission interval of the radio telegram, the telegram length and the ambient temperature at the installation site.

** Fixed network ready configuration

1.4 Volume calculation and pendulum hysteresis

TOPAS® ESK 2 is approved according to the MID for forward volume and can detect reverse volume. The calibrated total volume (value with lock symbol in the display) is composed of the difference between the forward volume and the reverse volume and is the value relevant for accounting / billing.

In order to prevent a misinterpretation of forward- and reverse consumption in the case of low fluctuating water columns, the electronic has a built-in pendulum hysteresis. The actual addition / subtraction of volume consumption is as shown in the example below for a TOPAS® ESK 2 with Q_3 2.5 m³/h. This applies for forward- and also reverse volume. The pendulum hysteresis serves for the exact calculation of the billing-relevant consumption, the alarm mechanisms and the flow calculation are excluded.

The pendulum hysteresis depends on the Q_3 value of the meter:

Q_3 1.6 m³/h: 1.6 liter

Q_3 2.5 m³/h: 2.5 liter

Q_3 4 m³/h: 4 liter

Q_3 6.3 m³/h: 6.3 liter

Q_3 10 m³/h: 10 liter

Q_3 16 m³/h: 16 liter

Example for Q_3 2.5 m³/h -> Pendulum hysteresis 2.5 liter

Process	Volume consumption	Hysteresis storage	Difference – Volume consumption depending on the hysteresis storage	Total volume	Forward volume	Reverse volume
1	0 liter	0 liter	0 liter	0 liter	0 liter	0 liter
2	+ 10 liter	0 liter	0 liter	10 liter	10 liter	0 liter
3	- 5 liter	- 2.5 liter	- 2.5 liter	7.5 liter	10 liter	2.5 liter
4	- 3 liter	- 2.5 liter	- 3 liter	4.5 liter	10 liter	5.5 liter
5	+ 2 liter	- 0.5 liter	0 liter	4.5 liter	10 liter	5.5 liter
6	+ 1 liter	0.5 liter	0.5 liter	<u>5 liter</u>	10.5 liter	5.5 liter

5 liter as total volume at the end of the example processes

1.5 Conditions

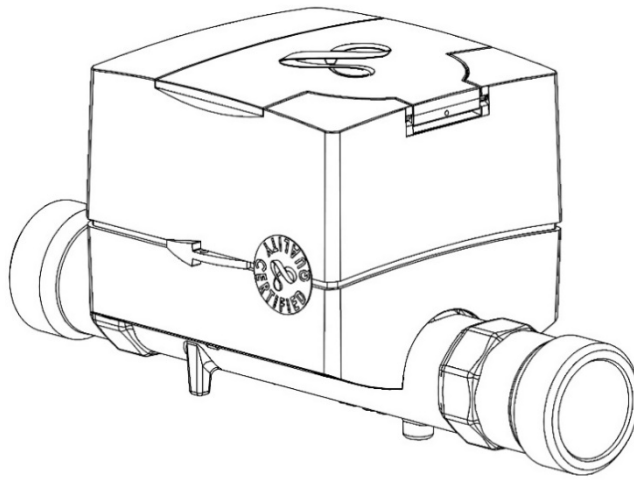
TOPAS® ESK 2 modes		Errors	Alarms	Radio	Measuring interval
Storage mode		on	off	off	1/60 Hz (1 minute)
↓ When water is detected	↑ When water is detected less than 3 hours				
Field mode		on	off	on	0.5 Hz (2 seconds)
↓ After detection of water for 3 hours without interruption					
Permanent field mode		on	on	on	0.5 Hz (2 seconds)

1.6 Mechanical design

TOPAS® ESK 2 consists of two main components – the hydraulic part and the encapsulated electronics. The hydraulic part consists of a brass or composite housing, ultrasonic transducer, temperature sensor and a plastic measuring insert with holders for the two reflectors. The ultrasonic transducers are connected to the printed circuit board by a cable and fixed to the brass (or composite) housing by plastic shells.

The complete electronics module consists of printed circuit board, batteries, LCD and the connected cables. It is fully potted to provide optimum protection against condensation or moisture penetrating from outside.

The electronics module is connected permanently to the hydraulic part of the meter and cannot be detached. TOPAS® ESK 2 is encased in a UV-resistant plastic housing with suitable plastic and adhesive seals to protect against unauthorized opening.



2 Approved meter data

DN 15 - 50		
Approval		MID DE-19-MI001-PTB012, OIML R49, EN 14154, TVO, KTW, ACS, WRAS, PZH, KIWA, SVGW, Belgaqua (not for DN 50), OTH, CZ, DM174/04
Dynamic range (Q3/Q1) - Q3 1.6 m ³ /h - T30 / T50	R	160 ; 400
Dynamic range (Q3/Q1) - Q3 1.6 m ³ /h - T70 / T90	R	160 ; 400H / 250V
Dynamic range (Q3/Q1) - Q3 2.5 m ³ /h - T30 / T50	R	160 ; 400 ; 800*
Dynamic range (Q3/Q1) - Q3 2.5 m ³ /h - T70 / T90	R	160 ; 400 ; 800H* / 400V**
Dynamic range (Q3/Q1) - Q3 4 m ³ /h - T30	R	160 ; 400 ; 800***
Dynamic range (Q3/Q1) - Q3 4 m ³ /h - T50 / T70 / T90	R	160 ; 400 ; 800H*** / 400V
Dynamic range (Q3/Q1) - Q3 6.3 m ³ /h - T30	R	160 ; 400
Dynamic range (Q3/Q1) - Q3 6.3 m ³ /h - T50 / T70 / T90	R	160 ; 400H / 250V
Dynamic range (Q3/Q1) - Q3 10 m ³ /h - DN 25 / DN 32 - T30	R	160 ; 400 ; 800
Dynamic range (Q3/Q1) - Q3 10 m ³ /h - DN 25 / DN 32 - T50 / T70 / T90	R	160 ; 400 ; 800H / 400V
Dynamic range (Q3/Q1) - Q3 10 m ³ /h - DN 40 - T30	R	160 ; 400
Dynamic range (Q3/Q1) - Q3 10 m ³ /h - DN 40 - T50 / T70 / T90	R	160 ; 400H / 250V
Dynamic range (Q3/Q1) - Q3 16 m ³ /h - DN 40 - T30	R	160 ; 400 ; 800
Dynamic range (Q3/Q1) - Q3 16 m ³ /h - DN 40 - T50 / T70 / T90	R	160 ; 400 ; 800H / 400V
Dynamic range (Q3/Q1) - Q3 16 m ³ /h - DN 50 - T30 / T50	R	160 ; 250
Dynamic range (Q3/Q1) - Q3 16 m ³ /h - DN 50 - T70 / T90	R	160 ; 250
Dynamic range (Q3/Q1) - Q3 25 m ³ /h - T30 / T50	R	160 ; 400
Dynamic range (Q3/Q1) - Q3 25 m ³ /h - T70 / T90	R	160 ; 400

* Maximum R 400 for DN 20 - 115 mm - Q3 2.5 m³/h at T30 / T50

** Maximum R 250 for D N20 - 115 mm - Q3 2.5 m³/h at T70 / T90

*** Maximum R 630 for DN 20 - 105 mm - Q3 4 m³/h

3 Materials

3.1 Components in contact with medium

Coupling housing	Lead-free brass or composite for threaded housing, UBA conformity for screw thread according to ISO 228-1, Material: CW724R (CuZn21Si3P); UBA conformity for flange housing according to DIN 2501, Material: CC770S (CuZn36Pb)
Measuring insert	Composite, KTW conformity
O-Rings	EPDM
Locating studs	PES / PPS glass-fibre reinforced
Reflectors	Stainless steel, stainless
Ultrasonic transducers	Composite, KTW conformity

3.2 Other components

Cover + meter housing	UV resistant composite housing
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4 Technical data

4.1 Electrical data

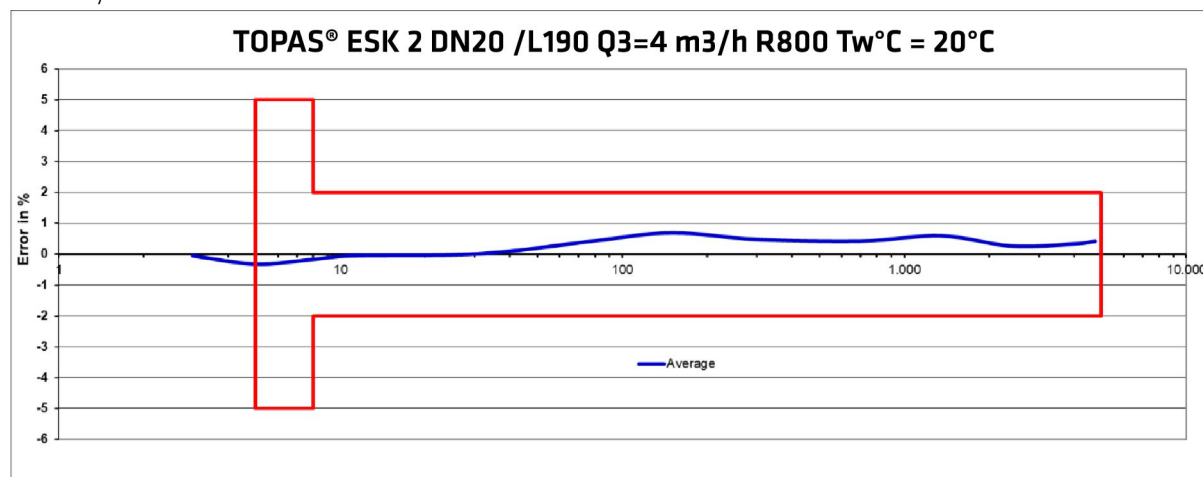
Power Supply	Two 3.6 VDC lithium-batteries
Battery lifetime T30*/T50*	up to 16 years
	*The battery life depends on the transmission interval of the radio telegram, the telegram length and the ambient temperature at the installation location
	Batteries cannot be replaced
LC display	9-digit
EMC data	MID class E1+E2

4.2 Mechanical data

Ambient class	EN 14154-1: class C
Ambient temperature	-10 ... 55° C
Protection class	IP68
Installation	Frost-free installation indoors or outdoors, in a shaft or installation box, resistant to UV rays
Medium temperature	0.1 ... 50° C
Storage temperature	-10 ... +70° C (>35° C max. 4 weeks)
Nominal pressure	PN 16

4.3 Accuracy

Accuracy class 2



T30, T50:

- ± 5 % in the range $Q_1 \leq Q < Q_2$
- ± 2 % in the range $Q_2 \leq Q \leq Q_4$
- T90:
- ± 5 % in the range $Q_1 \leq Q < Q_2$
- ± 3 % in the range $Q_2 \leq Q \leq Q_4$

5 Product design

5.1 14-digit manufacturer number

The 14-digit manufacturer number is based on the German standard DIN 43863-5.

Structure of the number:

The 14-digit manufacturer number consists of several components.

Division + Manufacturer + Manufacturer ID + 8-digit serial number of the meter

8 for cold water meter (Medium temperature class T30 and T50)

9 for hot water meter (Medium temperature class T90)

+

IMT Manufacturer (manufacturer identification)

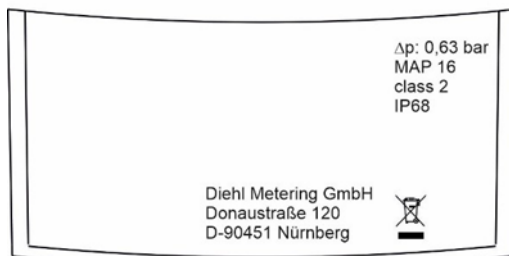
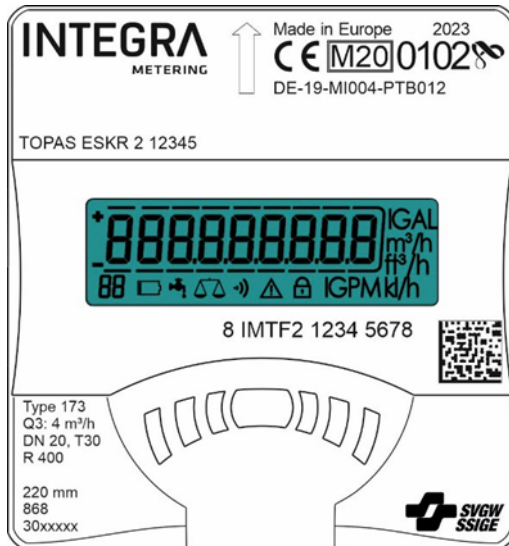
+

Manufacturer ID (associated device ID)

+

1234 5678 Serial number of the meter

5.2 Marking



6 Communication / interfaces

TOPAS® ESK 2 is equipped with different communication interfaces depending on the variant selected:

- Optical IrDA interface (standard - always)
- Radio 868 MHz
- M-Bus / Pulse / Pulse

6.1 Optical

The optical IRDA interface serves two purposes. First it is used as optical button and second as communication interface.

Optical button:

This is used for switching to the next display and operating the LC display. If the button is not pressed for about 4 minutes, the meter switches to sleep mode, i.e. the display is off but the meter is still in operation and records all data.

The LC display can be taken into operation by pressing the button or by opening the cover.

The meter starts with a display test (all segments on, then all segments off), then the display loop always start with the total volume. This remains for at least 10 seconds on the display (also when the optical button is pressed). Afterwards the display loop can be switched with the help of the optical button.

Optical interface:

Communication with the meter is possible over the optical IrDA interface with the aid of an opto head together with a laptop or PC and the associated IZAR@MOBILE 2 software.

The radio telegram can be configured to the customer's requirements over the optical interface, but it is recommended that the desired configuration is agreed on ex works before placing the order; if no prior agreement is made, the default factory setting is used.

The optical interface can also be used together with an opto head for carrying out quick tests using suitable electronic test beds.

6.2 Security role concept

To enable the customer to operate according to DSG, INTEGRA Metering has implemented a security role concept in all INTEGRA Metering products.

The security role concept of INTEGRA Metering is based on different roles and each of the roles has a different purpose with different keys and accordingly different rights to read and write data in INTEGRA Metering products.

In addition to the safety role concept, the IZAR@MOBILE 2 software also has various licenses. With the combination of roles and licenses, the user can use TOPAS® ESK 2 as required.

Each TOPAS® ESK 2 is set up with five keys:

- Master key: key for data transport security - Radio key.
- Utility password: meter access security key - Optical interface key for utility role
- Technical service password: Meter access security key - Optical interface key for the technical service role.
- Laboratory password: meter access security key - optical interface key for the laboratory role
- Rework (repair) password: Meter access security key - Optical interface key for the rework (repair) role.

6.3 Radio

TOPAS® ESK 2 can send radio protocols with OMS standards. OMS protocols can be sent with a frequency of 868 MHz.

The integrated function is switched off on delivery and the meter is set to "Storage mode", in which TOPAS® ESK 2 performs an ultrasonic measurement every minute. The meter automatically activates itself (field mode) when it detects water in the measuring tube and starts a measurement every two seconds. The integrated radio is activated at the same time; the radio transmission remains permanently active after continuous operation (>3 hours) with water. The radio transmission in TOPAS® ESK 2 can be activated or deactivated separately with the IZAR@MOBILE 2 software.

TOPAS® ESK 2 transmits unidirectional radio frames in radio modes T1 and R4.

Radio power:

TOPAS® ESK 2 transmits at a power of <25 milliwatts.

A transmission takes 4 to 15 milliseconds for T1 / C1 / R4. Between each two transmissions, a transmission pause must be observed for the used frequency band and the application, which is at least thousand times the length of a transmission (duty cycle = 0.1%).

For example, after a transmission with a length of 10 milliseconds, a transmission pause of 10 seconds must be observed. The meter thus transmits a maximum of 86.4 seconds during the day.

A comparison with other transmitter:

Devices	Frequency	Maximum transmission power
TOPAS® ESK 2	868 MHz	< 25 mW
Bluetooth	2400 MHz	100 mW
WLAN	2400 MHz	100 mW
DECT (Cordless phone)	1900 MHz	250 mW
GSM (E-Network)	1800 MHz	1000 mW
GSM (D-Network)	900 MHz	2000 mW
Television transmitter	470-790 MHz	5 000 000 000 mW

Radio protocol:

TOPAS® ESK 2 provides the following OMS version: Generation 3 (encryption mode 5)

Encryption method OMS 3:

AES key (Advanced Encryption Standard): Used in OMS

- 16-byte hexadecimal (128-bit)

The AES key for OMS from INTEGRA Metering is set at the factory. If required, an individual customized key for OMS can be set in the customer's variant. We will be happy to create a key for you.

Scheme of a Open Metering Gen. 3 telegram:

Byte-Nr: 9 z. Bsp. 0XF2 TOPAS ESK2

Byte Nr:	Example	Designation	Description		
1	1E	L-Field	Without L-Field and CRCs		
2	44	C-Field	C-Feld = 0x44 for SND-NR		
3	A5	ManId0	INTEGRA Metering = IME		
4	11	ManId1			
5	81	A-Field IdentNo			
6	86	A-Field IdentNo			
7	98	A-Field IdentNo	e.g. 53988681		
8	53	A-Field IdentNo			
9	76	A-Field Version			e.g. 0x76 for TOPAS® ESK 2
10	07	A-Field DevType			e.g. 0x07 for water
11	27	CRC0			
12	AC	CRC0			
13	7A	CI-Field	CI-Feld = 0x7A,because 4 Byte Header are following		
14	B1	Access No	Transmission counter		
15	30	State	M-Bus Status Byte		
16	10	Configuration field	Information about encryption (Mode 5) and block number (one)		
17	05	Configuration field			
18	2F	AES-Verify 0	Encryption verification bytes		
19	2F	AES-Verify 1			
20	0C	Data Record 1	DIF (4 byte BCD)	AES Block 1	
21	13	Data Record 1	VIF (Volume in liter)		
22	00	Data Record 1	Total Volume = 200 liter		
23	02	Data Record 1			
24	00	Data Record 1			
25	00	Data Record 1			
26	7C	Data Record 2	DIF (4 byte BCD, StorageNo 1)		
27	13	Data Record 2	VIF (Volume in liter)		
28	00	Data Record 2	Due Date Volume = 0 liter		
29	B7	CRC1			
30	78	CRC1			
31	00	Data Record 2	Due Date Volume = 0 liter	AES Block 1	
32	00	Data Record 2			
33	00	Data Record 2			
34	2F	AES fill bytes	Necessary to fill 16 byte AES block		
35	2F	AES fill bytes			
36	76	CRC2			
37	C7	CRC2			

M-Bus status byte in the radio telegram:

The M-Bus status byte (byte no. 15) is transmitted in every open metering radio telegram. The status byte indicates which errors/alarms are currently present on the meter (hexadecimal coded).

Name of Status	Status Code	MBus Status manufacturer specific	MBus Status manufacturer specific	MBus Status manufacturer specific	MBus Status temporary	MBus Status permanent	MBus Status low power	MBus Status status field	MBus Status status field	Mbus Status By
Checksum										
Current Error	E01									
Continuous Error - Alarm	A01	0	0	0	0	1	x	1	1	0x0B
Historical Error	H01									
Backflow volume										
Current Error	E06									
Continuous Error - Alarm	A06	0	1	1	0	1	x	1	1	0x6B
Historical Error	H06	0	1	1	0	0	x	0	0	0x60
Hardware flow										
Current Error	E04									
Continuous Error - Alarm	A04	0	0	1	0	1	x	1	1	0x2B
Historical Error	H04	0	0	1	0	0	x	0	0	0x20
Undersized meter										
Current Error	E11	0	1	0	1	0	x	0	0	0x50
Continuous Error - Alarm	A11	0	1	0	1	0	x	1	1	0x53
Historical Error	H11	0	1	0	0	0	x	0	0	0x40
No usage										
Current Error	E12	1	0	0	0	1	x	0	0	0x88
Continuous Error - Alarm	A12									
Historical Error	H12									
Measurement interference										
Current Error	E22									
Continuous Error - Alarm	A22	0	0	1	1	0	x	1	1	0x33
Historical Error	H22									
Air in pipe										
Current Error	E07	0	1	1	1	0	x	0	0	0x70
Continuous Error - Alarm	A07									
Historical Error	H07									
Hardware temperature										
Current Error	E02									
Continuous Error - Alarm	A02	0	1	0	0	1	x	1	1	0x4B
Historical Error	H02									
High medium temperature										
Current Error	E13	1	1	0	1	0	x	0	0	0xD0
Continuous Error - Alarm	A13	1	1	0	1	0	x	1	1	0xD3
Historical Error	H13	1	1	0	0	0	x	0	0	0xC0
Freezing risk										
Current Error	E14	1	1	1	1	0	x	0	0	0xF0
Continuous Error - Alarm	A14	1	1	1	1	0	x	1	1	0xF3
Historical Error	H14	1	1	1	0	0	x	0	0	0xE0
Low battery										
Current Error	E09	x	x	x	x	x	1	x	x	0x04
Continuous Error - Alarm	A09									
Historical Error	H09									
Too much communication										
Current Error	E00	0	0	0	1	0	x	0	0	0x10
Continuous Error - Alarm	A00									
Historical Error	H00									
Leakage detection										
Current Error	E05									
Continuous Error - Alarm	A05	1	0	0	1	0	x	1	1	0x93
Historical Error	H05	1	0	0	0	0	x	0	0	0x80
Fallback mode - Only for HYDRUS 2.0 Bulk										
Current Error	E17									
Continuous Error - Alarm	A17	1	0	1	1	0	x	1	1	0xB3
Historical Error	H17	1	0	1	0	0	x	0	0	0xA0
Metrological log access										
Current Error	E18	1	0	1	0	1	x	0	0	0xA8
Continuous Error - Alarm	A18									
Historical Error	H18									
AnyApplicationError										
Current Error	E99	0	0	0	0	0	x	1	0	0x20
Continuous Error - Alarm	A99									
Historical Error	H99									
System reset										
Current Error	E98									
Continuous Error - Alarm										
Historical Error										

The M-Bus Status Byte only shows the Error / Alarm / Historical Alarm with the highest priority. The priorities are listed in chapter 8.6 Errors and Alarms.

A detailed description of all errors and alarms is available in chapter 8.4 Errors and Alarms.

All errors and alarms can be determined and differentiated via the manual optical readout of the error log.

The value can be displayed via the "Specific device alarm" column during a tour in the IZAR@MOBILE 2 / IZAR@NET 2.

The specified hexadecimal value must then be converted to a binary value (as listed in above table).

6.4 Wired M-Bus

M-Bus telegram according to M-Bus EN 13757

- Baud rate 300 or 2400 bauds
- Two-wire M-Bus cable with polarity reversal protection, 1.5 m long
- For communication with M-Bus receiver or IZAR CENTER
- No external power supply possible, power supply via internal battery
- Maximum data transmission of 100 bytes per minute possible

The application reset subcode 0 (0x00) for the wired M-Bus interface is factory-set. The following standard telegram is programmed:

Telegramm
Total volume
Forward volume
Reverse volume
Current flow
Current medium temperature °C
Current ambient temperature °C
Date & Time
Due date 1
Due date 1 total volume
Due date 2
Due date 2 total volume

The telegram length of the standard telegram is about 95 bytes, so a maximum read-out interval of around 1 minute is possible. Shorter read-out intervals lead to an exceeding of the limit value of the logic capacitor.

TOPAS® ESK 2 has a separate logic capacitor for M-Bus communication. Error E00 is set if the limit of the capacitor is exceeded and deleted as soon as the capacitor drops below the limit again.

Method of operation of logic capacitor:

- Each byte received increments the logic capacitor by 1.
- Limit of logic capacitor: 65173 → 65173 bytes can be received before the limit is reached.
- The logic capacitor is decremented by 100 every minute. → Additional bytes can be received again.

An Application Reset 15 (0xF0) must be sent to the TOPAS® ESK 2 so that the meter answers with the customer telegram. The content of the wireless radio and wired M-Bus telegram will be identically created for the customer version.

6.5 Pulse outputs

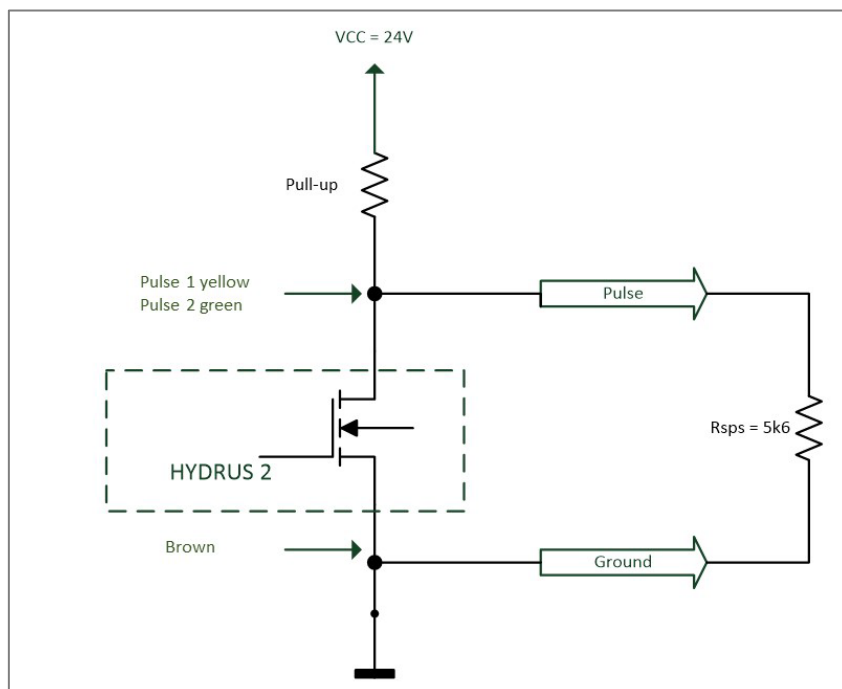
Cable pin assignment (M-Bus/Pulse):

The meter is supplied with M-Bus/Pulse/Pulse variant with a 1.5 m long, 5-wire connection cable with wire end sleeves.

	Variant M-Bus/Pulse/ Pulse
M-Bus	X
Pulse output 1	X
Pulse output 2	X
L-Bus	
Connection (Network name)	
GND	Brown
Pulse 1 or L-Bus	Yellow
Pulse 2	Green
M-Bus 1	White
M-Bus 2	Blue
Fraud	
Number of wires	5

Electrical isolation:

A voltage potential between the ground terminal of the L-Bus/pulse output and the meter housing ground (brass) must be avoided to prevent possible damage due to electrical corrosion.



The pulse outputs are wired as open drain.

There is a 0-ohm resistor in the drain branch, i.e. there is no current limitation within the meter, this must be provided externally by a protective resistor (if not available on site).

The internal resistance value of the switching device should be 5 times the protective resistance.

The TOPAS® ESK 2 has up to 2 interfaces for Pulse. Depending on the device configuration, the set pulse duration, pulse break and pulse frequency can be different.

Pulse outputs and pulse rates, technical data:

Maximum input voltage	30 V
Maximum input current	27 mA
Maximum voltage drop at active output	2 V / 27 mA
Maximum current through inactive output	5 μ A / 30 V
Maximum reverse current	27 mA
Pulse frequency	Time correct pulses: auto-adaptive, depends on transmitted volume - max. frequency 10 Hz Burst pulses: 4 Hz (configurable to 12 Hz on request in the customer variant)
Pulse width	Time correct pulses: 50 ms Burst pulses: 125 ms

Possible pulse variants:

Pulse 1: Sum volume or forward volume

Pulse 2: Forward volume, or reverse volume, or error, or direction

(When total volume on pulse output 1, only direction possible on pulse output 2)

It is possible to subsequently modify the pulse settings in the meter using the IZAR@MOBILE 2 software in conjunction with the expert license and a Bluetooth optohead.

There are two types of pulses available in TOPAS® ESK 2:

- Time correct pulses
- Burst pulses – Pulses sent out in Pulse-packages with 4 Hz (can be customized to 12 Hz on request)

Time correct pulses:

- Available for forward volume and reverse volume
- Variable frequency depending on the volume to be transmitted with a maximum of up to 10 Hz
- Pulse width is always 50 ms as a standard
- Pulse pause depends on flow and can vary
- Schematic example:



Figure 11.3: Pulse jam of the time-correct pulse calculation

This means the green marked configurations of flow and pulse value are possible for the time correct pulses:

Q3	1,6 m³/h	2,5 m³/h	4 m³/h	6 m³/h	10 m³/h	16 m³/h	25 m³/h	40 m³/h	63 m³/h	100 m³/h	160 m³/h
Q4	2,00 m³/h	3,13 m³/h	5,00 m³/h	7,88 m³/h	12,50 m³/h	20,00 m³/h	31,25 m³/h	50,00 m³/h	78,75 m³/h	125,00 m³/h	200,00 m³/h
0,1 l/Imp	5,56	8,68	13,89	21,88	34,72	55,56	86,81	138,89	218,75	347,22	555,56
1 l/Imp	0,56	0,87	1,39	2,19	3,47	5,56	8,68	13,89	21,88	34,72	55,56
10 l/Imp	0,06	0,09	0,14	0,22	0,35	0,56	0,87	1,39	2,19	3,47	5,56
100 l/Imp	0,01	0,01	0,01	0,02	0,03	0,06	0,09	0,14	0,22	0,35	0,56
1000 l/Imp	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,01	0,02	0,03	0,06

Burst Pulses

- Available for sum volume
- Fixed frequency of 4 Hz (12 Hz available on request, to be configured in the customer variant)
- Pulse width 125 ms for 4 Hz
- For higher flows Pulses will be stored and sent with the next burst
- Schematic example:

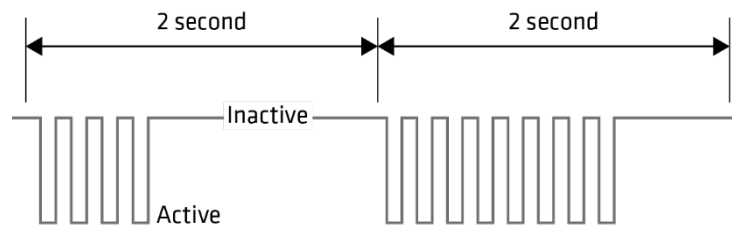


Figure 11.5: Burst pulse output characteristics

7 Programming / configuration

7.1 LC display

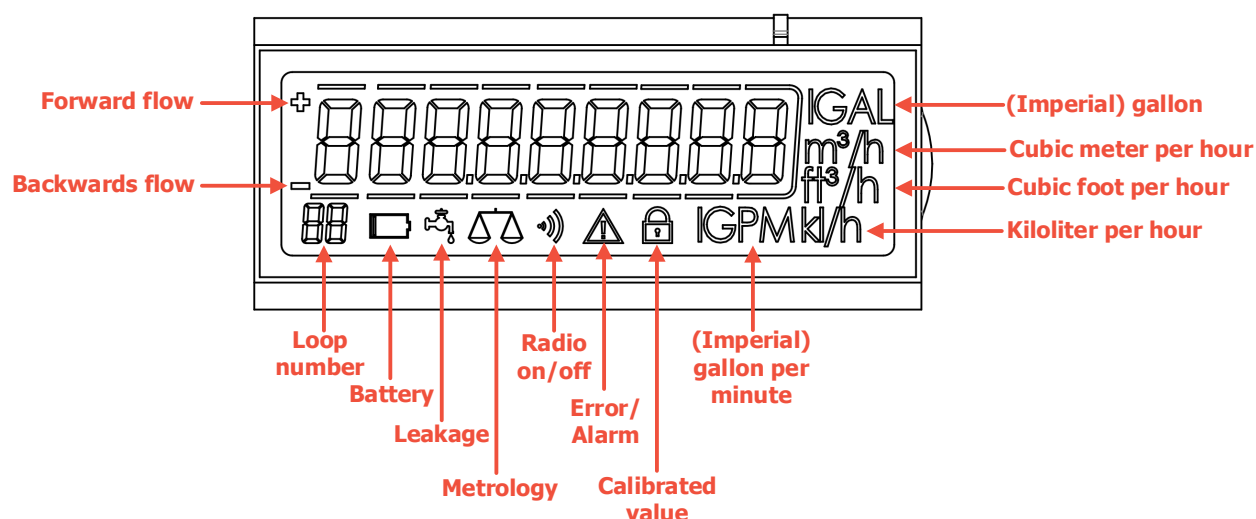
Meter information can be called up on the 9-digit LC display, with a digit size of 3.8 mm x 7.8 mm. The display information is arranged in a display loop in several display windows. The various display windows and display windows with automatic display changes are illustrated below. A list of the possible display information can also be found in the Communication Description.

The display windows can be changed by pressing the optical button. Each press of the button changes to the start display of the next display window.

To save the battery, the meter switches to sleep mode if the button is not pressed for approx. 4 minutes (see also section "Optical button").

After awakening, the display shows first a screen check (i.e. all symbols in the display are briefly switched on and off) and then the total volume. This remains for at least 10 seconds on the display (also when the optical button is pressed). Afterwards the display loop can be switched with the help of the optical button.

7.2 Display symbols:



7.3 Display loop

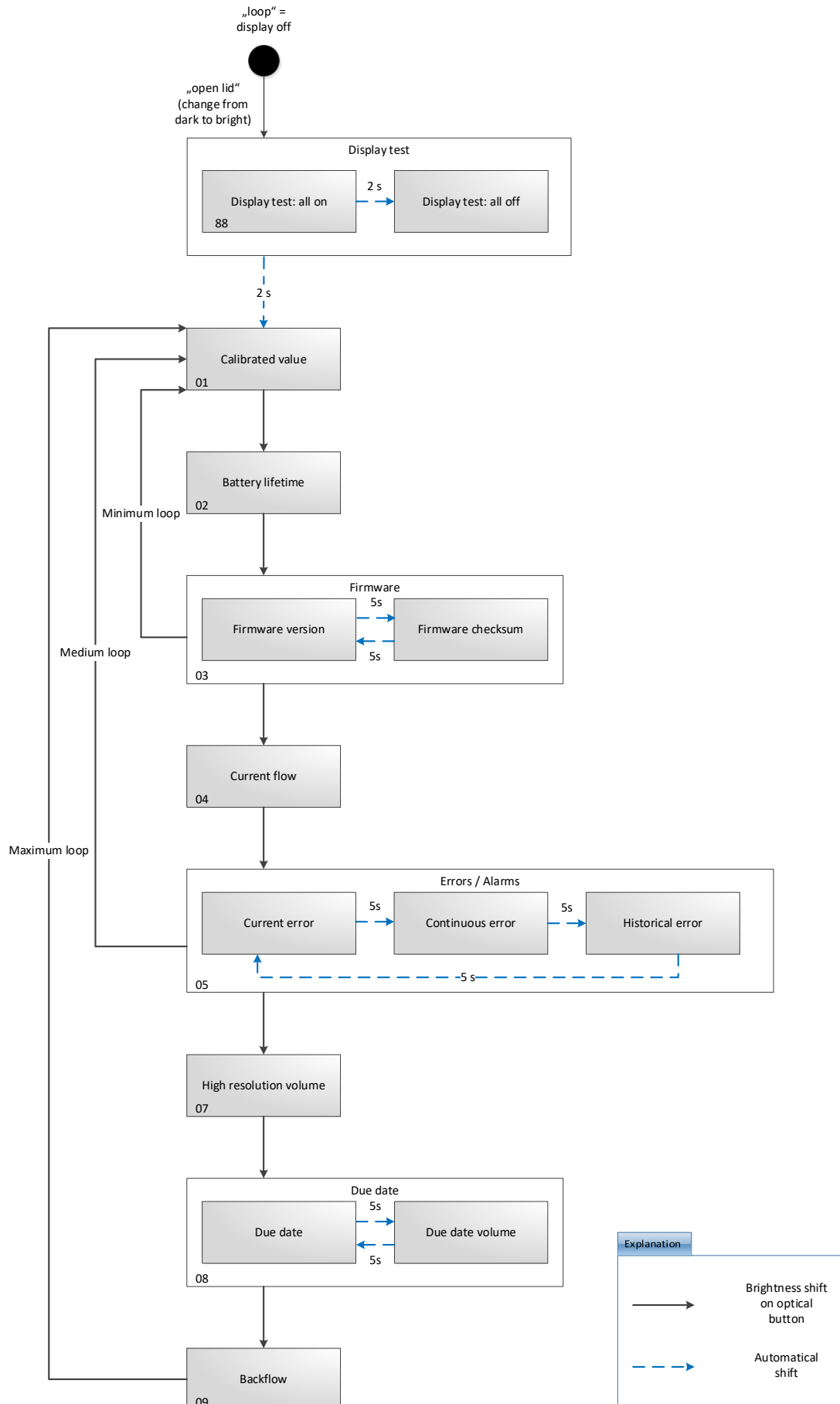
The meter can be factory pre-configured with one of the following loops:

Maximum loop
Display test
Total volume
Battery lifetime
Firmware version / Checksum
Current flow
Errors / Alarms
High resolution total volume
Due date / Due date volume
Reverse volume

As of FW 2.0.2. it is possible to configure the display loop in the field and to define a customer-specific display loop in the customer variant, i.e. ex works.

The factory settings of the loops are shown in detail below

- Display test (88)
- Current metrological volume (01)
- Battery lifetime (02)
- Software version alternating with the checked sum of the software (03)
- Current flow rate (m³/h) (04)
- Error messages (05)
- Total volume high resolution (07)
- Total volume of the due date function alternating with the last due date (08)
- Current reverse volume (09)
- Forward volume (10)
- Water temperature (11)
- Operating time (13)
- Current date alternating with current time (14)
- Secondary address name alternating with Secondary address value (15)
- Primary address name alternating with Primary address value (16)
- Reverse volume of the due date function alternating with the last due date (17)
- Forward volume of the due date function alternating with the last due date (18)
- Error time (19)
- Total volume (20)
- Total volume of the due date function alternating with the last due date (21)



7.4 Radio / M-Bus telegram

The TOPAS® ESK 2 has an integrated radio, which provides an interface for unidirectional communication for reading the meter. The data generated by the meter is transmitted every 23 seconds in R3 mode for mobile reading (fixed network ready transmission mode) and every 60 minutes in R4 mode. During data transmission, the currently measured data is always transmitted.

Mobile reading in Walk-by / Drive-by / Passive Drive-by:

The data sent by TOPAS® ESK 2 can be collected using INTEGRA Metering portable receiver IZAR RECEIVER BT with a handheld device as well as the software IZAR@MOBILE 2 for Walk-by/Drive-by, an IZAR RDC Vehicle for passive Drive-by or applying devices from qualified third parties. Data is then transferred directly to a centralized monitoring system.

Fixed network:

The stationary receivers IZAR RDC Standard/IZAR RDC Battery (fixed network) or IZAR RDC Premium (long-range fixed network) installed in buildings will collect the data and send it fully automatically at predefined intervals, via GPRS or LAN, to a centralized server. Reading through M-Bus application with an IZAR CENTER associated to an IZAR RECEIVER M-BUS and IZAR@NET 2 software, is possible as well.

Radio specifications	
Sending intervals	Every 14 ... 256 seconds (variable, according to 0.1 duty cycle (min. 14 seconds); depending on protocol length and programming)
868 MHz frequency band	Transmission power (EN 300 220-2): 25 mW e.r.p

Telegram R3 for mobile reading

For mobile reading, the meter is preconfigured at the factory with the following telegram package:

Telegram
Total volume
Error bits
Battery life remaining
Medium temperature °C
Key date
Key date Total volume
Periodic memory 1 - date / time
Periodic storage 1 - total volume

Telegram R4 for fixed network

For fixed networks, the meter is preconfigured at the factory with the following telegram package:

Telegramm
Total volume
Key date
Key date cumulative volume
Key date forward volume
Cut-off date backward volume
Flow rate
Battery life remaining
Medium temperature °C
Periodic memory 1 - date / time
Periodic memory 1 - total volume

When the telegram value "Error bits" is selected, all currently active error / alarm are transmitted and no prioritization in the transmission of the errors / alarms takes place as with the M-Bus Status Byte when several error/alarms are currently on the meter. Also all possible errors/alarms of the TOPAS® ESK 2 can be transmitted. The value can then be displayed via the "Info code" column during a tour in the IZAR@MOBILE 2 respectively in the IZAR@NET 2.

In the following, you can see the list of available telegram contents:

- Volume (metrological)
- Volume (metrological) (high resolution)
- Forward volume
- Reverse volume
- Current flow
- Water temperature
- Ambient temperature
- Remaining battery lifetime
- Battery expiration date
- Error Bits

- Error time
- Ownership number
- Operating time
- Date and time
- Firmware version
- Firmware version metrological
- Log entry 1 – Max. volume flow
- Log entry 1 – Min. volume flow
- Log entry 1 – Date & Time
- Log entry 1 – Total volume
- Log entry 1 – forward volume
- Log entry 1 – reverse volume
- Log entry 1 – error flags
- Log entry 1 – current flow
- Log entry 1 – operating time
- Log entry 1 – water temperature
- Log entry 1 – ambient temperature
- Log entry 1 – error time
- Log entry 2 – Max. volume flow
- Log entry 2 – Min. volume flow
- Log entry 2 – Date & Time
- Log entry 2 – Total volume
- Log entry 2 – forward volume
- Log entry 2 – reverse volume
- Log entry 2 – error flags
- Log entry 2 – current flow
- Log entry 2 – operating time
- Log entry 2 – water temperature
- Log entry 2 – ambient temperature
- Log entry 2 – error time
- Log entry 3 – Max. volume flow
- Log entry 3 – Min. volume flow
- Log entry 3 – Date & Time
- Log entry 3 – Total volume
- Log entry 3 – forward volume
- Log entry 3 – reverse volume
- Log entry 3 – error flags
- Log entry 3 – current flow
- Log entry 3 – operating time
- Log entry 3 – water temperature
- Log entry 3 – ambient temperature
- Log entry 3 – error time
- History Log interval
- Due date 1 val. 1 – Total volume
- Due date 1 val. 1 – Forward volume
- Due date 1 val. 1 – Reverse volume
- Due date 1 val. 1 – Date

- Due date 1 val. 2 – Total volume
- Due date 1 val. 2 – Forward volume
- Due date 1 val. 2 – Reverse volume
- Due date 1 val. 2 – Date
- Due date 1 val. 3 – Total volume
- Due date 1 val. 3 – Forward volume
- Due date 1 val. 3 – Reverse volume
- Due date 1 val. 3 – Date
- Due date 2 val. 1 – Total volume
- Due date 2 val. 1 – Forward volume
- Due date 2 val. 1 – Reverse volume
- Due date 2 val. 1 – Date
- Due date 2 val. 2 – Total volume
- Due date 2 val. 2 – Forward volume
- Due date 2 val. 2 – Reverse volume
- Due date 2 val. 2 – Date
- Due date 2 val. 3 – Total volume
- Due date 2 val. 3 – Forward volume
- Due date 2 val. 3 – Reverse volume
- Due date 2 val. 3 – Date
- Date next due date 1
- Date next due date 2
- ADE config byte
- Production number
- Fabrication number

Installation telegrams

After starting the Installation mode TOPAS® ESK 2 will send out installation telegrams for 1 hour.

Installation telegrams have the following content:

- Telegramm-Header
 - OpenMetering SecurityProfile A (=OMS v3 Encryption Mode 5): 17 Bytes
- Radio-Telegramm-Counter (4 Bytes)
- Date and time (6 Bytes)
- Total volume (max. 12 Bytes)
- Current flow (max. 12 Bytes)
- Water temperatur (4 Bytes)
- OSN / MeterPoint ID (max. 44 Bytes)
- ZVERRBI (5 Bytes)
- Fill-Bytes (7 Bytes)

Depending on the configured radio technology, the radio-sending intervals vary as follows:

- T1 every 45 seconds
- R4 every 45 seconds

7.5 Errors and alarms

Error messages (visual notification on LC display in case of error). 3 error categories:

E - Current errors: The error event is active now.

A - Continuous errors: The error event has been active for a certain time (configurable); an alarm is generated in the system; hold time as described in the table below

H - Historical faults: The fault event has been active for a certain time (configurable); hold time as described in the table below.

Name of Status	Description	Status Code
Checksum error	Event is triggered if any data in Flash or RAM is corrupted or was manipulated in any way	01
Hardware temperature	Event is triggered if temperature sensor cable is broken	02
Hardware flow	Event is triggered if flow measuring error occurs	04
Leakage detection	Event is triggered if the continuous consumption over a period of one day (configurable) is higher than a configurable threshold	05
Back flow volume	Event is triggered if the reverse volume is higher than the configurable threshold	06
Air in pipe	Event is triggered if air is detected in the pipe	07
Low battery	Event is triggered if calculated battery life is less than 1 ½ years	09
Undersized meter	Event is triggered if flow is higher than a configurable threshold	11
No consumption	Event is triggered if volume is lower than a configurable threshold for a configurable period of time	12
High medium temperature	Event is triggered if medium temperature is higher than the threshold	13
Freezing risk	Event is triggered if medium temperature is lower than 3°C	14
Fallback mode	Event is triggered if a significant deviation of the measurement in the two measuring paths occurs	17
Metrological log access	Event is triggered if the metrological log has been accessed	18
Measurement interference	Event is triggered if the measurement is disturbed by influences of cavitation, air water mixture or electromagnetic interference	22
System reset	Event is triggered if the system processor has been reset	98
Any application error	Event is triggered if the bidirectional communication (M-Bus or optical Interface) has been corrupted	99
Too much communication	Event is triggered if the communication through the optical interface exceeds the threshold	00

There is an entry in the error log for all current errors except E99 and E00.

Errors and alarms in the display

E - Current error	E _ _ _ _ _ e.g. E _ _ _ _ 13.00
A - Continuous error	A _ _ _ _ _ e.g. A _ _ _ _ _ 06
H - Historic error	H _ _ _ _ _ e.g. H _ _ 02.13.00

Four errors of each type (current, continuous, historic) are displayed at the same time.
In case of more than four errors of each type (current, continuous, historic), the four errors with the highest priority are displayed. Error priorities are listed below.

Overview errors/alarms (Error flag, Display, entry in error log):

Name of Status	Priority	Status Code	Error Flag Mask	Code in Display	Symbol in Display	EventLog entry	Priority of Error in EventLog
Checksum	1						
Current Error		E01				x	High
Continuous Error - Alarm		A01	00 00 00 01	x			not logged
Historical Error		H01					not logged
Backflow volume	6						
Current Error		E06				x	Low
Continuous Error - Alarm		A06	00 00 00 20	x			not logged
Historical Error		H06	00 20 00 00	x			not logged
Hardware flow	2						
Current Error		E04				x	High
Continuous Error - Alarm		A04	00 00 00 02	x			not logged
Historical Error		H04	00 04 00 00	x			not logged
Undersized meter	5						
Current Error		E11	00 00 04 00	x		x	Low
Continuous Error - Alarm		A11	00 00 00 10	x			not logged
Historical Error		H11	00 10 00 00	x			not logged
No usage	9						
Current Error		E12	00 00 10 00	x		x	Low
Continuous Error - Alarm		A12					not logged
Historical Error		H12	01 00 00 00	x			not logged
Measurement interference	10						
Current Error		E22				x	Low
Continuous Error - Alarm		A22	00 00 00 80	x			not logged
Historical Error		H22	02 00 00 00	x			not logged
Air in pipe	8						
Current Error		E07	00 00 08 00	x		x	Low
Continuous Error - Alarm		A07					not logged
Historical Error		H07					not logged
Hardware temperature	3						
Current Error		E02				x	High
Continuous Error - Alarm		A02	00 00 00 04	x			not logged
Historical Error		H02					not logged
High medium temperature	12						
Current Error		E13	00 00 40 00	x		x	Low
Continuous Error - Alarm		A13	00 00 02 00	x			not logged
Historical Error		H13	08 00 00 00	x			not logged
Freezing risk	11						
Current Error		E14	00 00 20 00	x		x	Low
Continuous Error - Alarm		A14	00 00 01 00	x			not logged
Historical Error		H14	04 00 00 00	x			not logged
Low battery	15						
Current Error		E09	00 02 00 00		x	x	Low
Continuous Error - Alarm		A09					not logged
Historical Error		H09					not logged
Too much communication	13						
Current Error		E00	00 00 80 00	x			not logged
Continuous Error - Alarm		A00					not logged
Historical Error		H00					not logged
Leakage detection	4						
Current Error		E05				x	Low
Continuous Error - Alarm		A05	00 00 00 08	x	x		not logged
Historical Error		H05	00 08 00 00	x	x		not logged
Fallback mode - Only for HYDRUS 2.0 Bulk	7						
Current Error		E17	sd			x	Low
Continuous Error - Alarm		A17	00 00 00 40	x			not logged
Historical Error		H17	00 40 00 00	x			not logged
Metrological log access	14						
Current Error		E18	00 01 00 00	x (only for LAB Role)			not logged
Continuous Error - Alarm		A18					not logged
Historical Error		H18					not logged
AnyApplicationError	0						
Current Error		E99					not logged
Continuous Error - Alarm		A99					not logged
Historical Error		H99					not logged
System reset	16						
Current Error		E98				x	High
Continuous Error - Alarm							not logged
Historical Error							not logged

7.6 Detailed description of alarms:

Too much communication E00

E00 activation condition:

E00 is activated by too much optical readings in a short time. In case the communication capacity (optical or M-Bus communication) reaches 0 Bytes the communication is temporarily paused.

E00 deactivation condition:

When minimum communication threshold (500 Bytes – configurable) is reached (regeneration by 100 Bytes / minute), then the communication is released again.

Checksum A01

A01 activation condition:

A01 is activated immediately when any checksum is corrupt.

A01 deactivation condition:

A01 never deactivates

Holding times are listed in the table below.

Hardware temperature A02 / H02

A02 activation condition:

A02 is activated if a hardware temperature error is detected for 1 minute, e.g. temperature cable is cut, or damaged.

A02 deactivation condition:

A02 condition is deactivated if no hardware temperature error is detected for 1 minute

H02 is activated together with A02.

Holding times are listed in the table below.

Hardware flow A04 / H04

A04 activation condition:

A04 is activated if a hardware error at the flow measuring or an ultrasonic sensor defect is detected

A04 deactivation condition:

A04 condition is deactivated after ultrasonic measurement for 1 minute without error

H04 is activated together with A04.

Holding times are listed in the table below.

Leakage detection E05 / A05 / H05

Activation condition:

E05 is activated if the 15 minute average consumption is always above the leakage threshold in 24 consecutive hours. E05 is only activated if the limit was always exceeded in the 24 hours (otherwise the meter starts the 24-hour calculation from the beginning).

Q3 1,0...9,9: $|\Delta Q_{\text{sum}}\{15 \text{ min}\}| > 0,8 \text{ l}$ for 24 hours

Q3 10...99: $|\Delta Q_{\text{sum}}\{15 \text{ min}\}| > 8 \text{ l}$ for 24 hours

Q3 100...999: $|\Delta Q_{\text{sum}}\{15 \text{ min}\}| > 80 \text{ l}$ for 24 hours

Q3 1000...9999: $|\Delta Q_{\text{sum}}\{15 \text{ min}\}| > 800 \text{ l}$ for 24 hours

Deactivation condition:

E05 condition is deactivated if the 15 minute average consumption is below the leakage threshold.

Q3 1,0...9,9: $|\Delta Q_{\text{sum}}\{15 \text{ min}\}| \leq 0,8 \text{ l}$

Q3 10...99: $|\Delta Q_{\text{sum}}\{15 \text{ min}\}| \leq 8 \text{ l}$

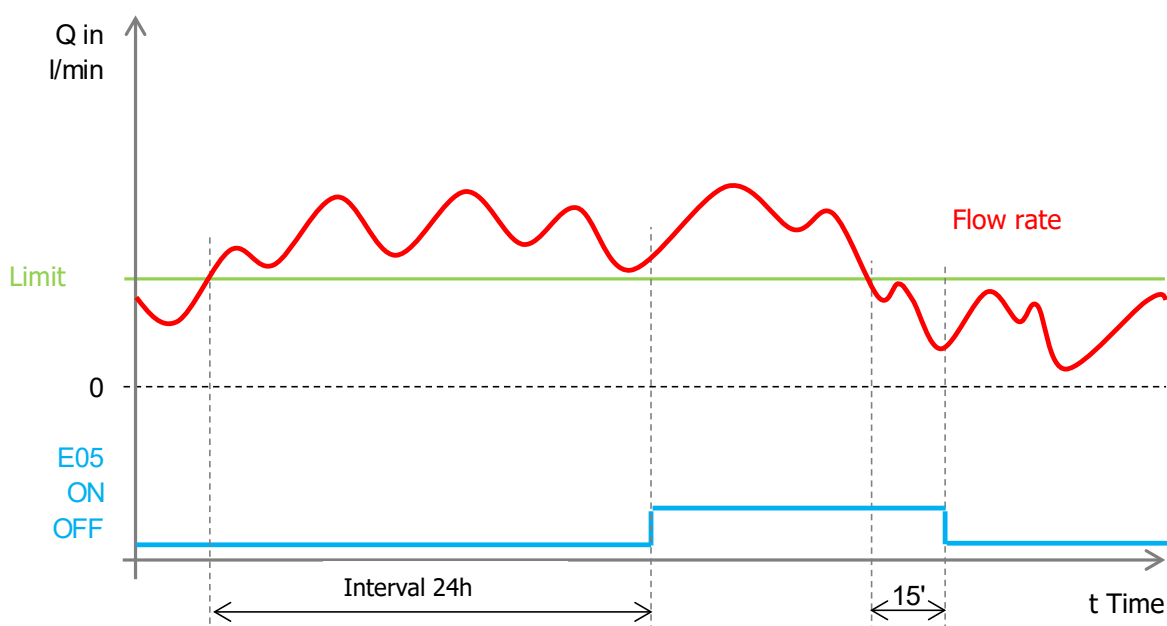
Q3 100...999: $|\Delta Q_{\text{sum}}\{15 \text{ min}\}| \leq 80 \text{ l}$

Q3 1000...9999: $|\Delta Q_{\text{sum}}\{15 \text{ min}\}| \leq 800 \text{ l}$

H05 is activated together with A05.

Holding times are listed in the table below.

A05 / H05 activate the leakage symbol on the TOPAS® ESK 2 display.



Example: In a 1-family house there has to be no flow (flow below the leakage threshold) for 15 min. once in a 24 hours timespan, otherwise a leakage may exist. The time window (15 min.) can be selected as desired or set ex works and the leakage threshold can also be defined. This means, for example, that the leakage threshold can be specified as the threshold in a factory in which water is generally drawn around the clock.

Backflow volume A06 / H06

A06 activation condition:

A06 is activated if the 15 min average flow is below the backflow (negative flow) threshold of $Q_3 / 100$

$$\Delta Q_{\text{sum}}\{15 \text{ min}\} < -Q_3/100$$

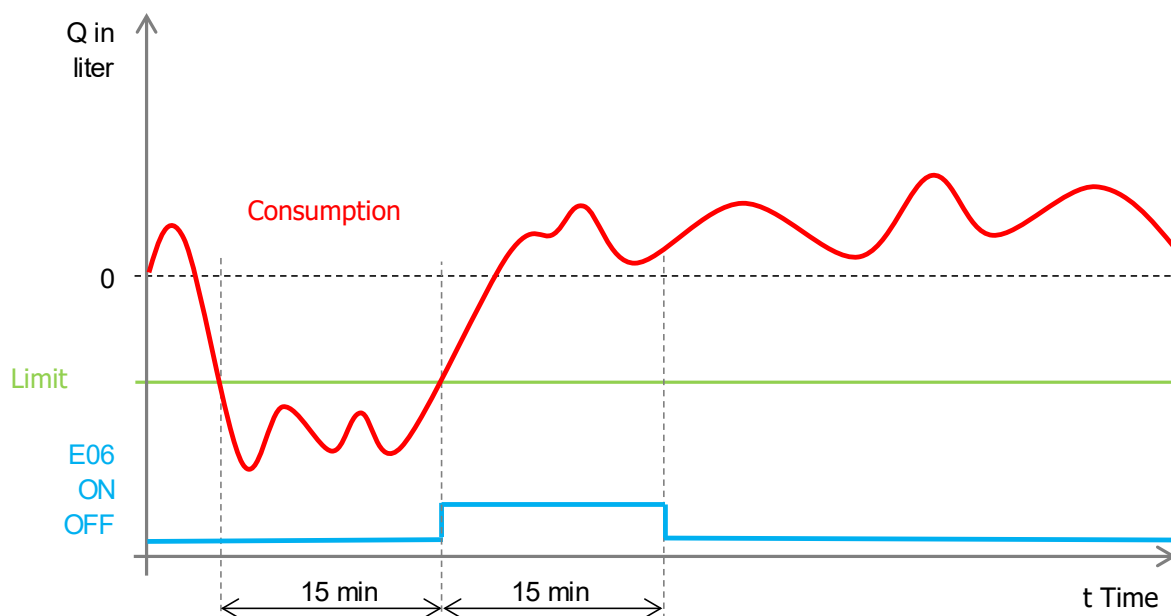
A06 deactivation condition:

A06 condition is deactivated if the 15 min average flow is above the backflow (negative flow) threshold of $Q_3 / 100$

$$\Delta Q_{\text{sum}}\{15 \text{ min}\} \geq -Q_3/100$$

H06 is activated together with A06.

Holding times are listed in the table below.



Air in pipe system (no flow rate measurement) E07

Activation condition:

E07 is activated if air in pipe is detected for 1 minute.

Deactivation condition:

E07 is deactivated if no air in pipe is detected for 1 minute

Low battery E09

Activation condition:

E09 is activated 1 ½ years before the calculated end of life date.
current date $\geq$ end of life date - 11/2 years

Deactivation condition:

E09 is deactivated if current date $<$ end of life date - 11/2 years

Undersized meter E11 / A11 / H11

Activation condition:

E11 is activated if the flow (with standard measuring rate 0,5 Hz – every 2 seconds) is above the undersized meter threshold of $1,3 * Q_3$ for one minute
 $\Delta Q\{2\text{ s}\} > 1,3 * Q_3$ for 1 minute

Deactivation condition:

E11 is activated if the flow (with standard measuring rate 0,5 Hz – every 2 seconds) is below the undersized meter threshold of $1,3 * Q_3$ for one minute
 $\Delta Q\{2\text{ s}\} \leq 1,3 * Q_3$ for 1 minute

A11 and H11 are activated after 30 consecutive minutes of active E11.
Holding times are listed in the table below.

No usage E12 / H12

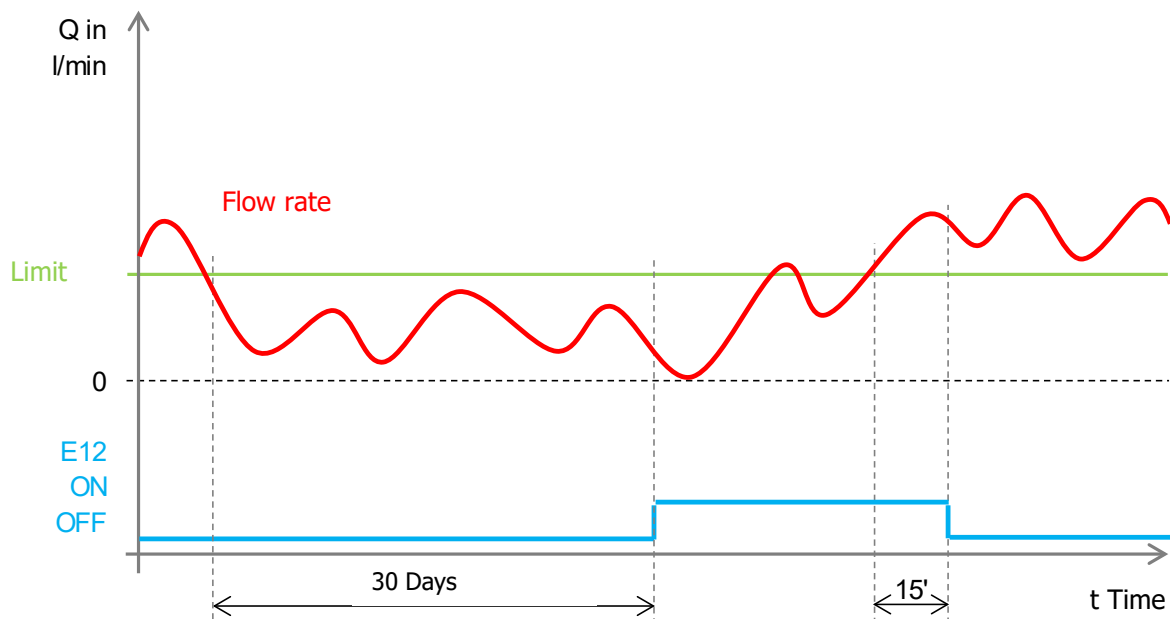
E12 activation condition:

E12 is activated if the 15 min average consumption is below the no usage threshold for 30 days
Q3 1,0...9,9: $|\Delta Q_{\text{sum}}\{15\text{ min}\}| < 8\text{ l}$ for 30 days
Q3 10...99: $|\Delta Q_{\text{sum}}\{15\text{ min}\}| < 80\text{ l}$ for 30 days
Q3 100...999: $|\Delta Q_{\text{sum}}\{15\text{ min}\}| < 800\text{ l}$ for 30 days
Q3 1000...9999: $|\Delta Q_{\text{sum}}\{15\text{ min}\}| < 8000\text{ l}$ for 30 days

E12 deactivation condition:

E12 is deactivated if the 15 min average consumption is above the no usage threshold
Q3 1,0...9,9: $|\Delta Q_{\text{sum}}\{15\text{ min}\}| \geq 8\text{ l}$
Q3 10...99: $|\Delta Q_{\text{sum}}\{15\text{ min}\}| \geq 80\text{ l}$
Q3 100...999: $|\Delta Q_{\text{sum}}\{15\text{ min}\}| \geq 800\text{ l}$
Q3 1000...9999: $|\Delta Q_{\text{sum}}\{15\text{ min}\}| \geq 8000\text{ l}$

H12 is activated together with E12.
Holding times are listed in the table below.



High medium temperature E13 / A13 / H13

E13 activation condition:

E13 is activated if the measured medium temperature $> 90\text{ }^{\circ}\text{C}$ for 1 minute

E13 deactivation condition:

E13 is deactivated if the measured medium temperature $\leq 90\text{ }^{\circ}\text{C}$ for 1 minute

A13 and H13 are activated if E13 is active for 60 consecutive minutes.

Holding times are listed in the table below.

Freezing risk E14 / A14 / H14

Activation condition:

E14 is activated if the medium temperature is $< 3\text{ }^{\circ}\text{C}$ for 1 minute.

Deactivation condition:

E14 is deactivated if the medium temperature is $\geq 3\text{ }^{\circ}\text{C}$ for 1 minute

A14 and H14 are activated if E14 is active for 60 consecutive minutes.

Holding times are listed in the table below.

Metrological log access E18

Activation condition:

E18 is activated by an entry into the metrological log (only for LAB Role)

Deactivation condition:

E18 never deactivates

E18 activates the scale symbol on the TOPAS® ESK 2 display.

Measurement interference A22 / H22

Activation condition:

A22 condition is activated by cavitation, air-water-mixture, as well as heavy electro-magnetic, or mechanic interferences (vibration), e.g. caused by pumps, other heavy duty equipment close to the meter

Deactivation condition:

A22 condition is deactivated as soon as heavy electro-magnetic, or mechanic interferences (vibration) have stopped.

A22 and H22 are activated if the A22 condition is active for 7 consecutive days.

Holding times are listed in the table below.

System reset E98

Activation condition:

E98 is activated if a system reset is recognized

Deactivation condition:

E98 is deactivated after the system reset is done

Any application error (Status code 99)

Activation condition:

Any application error is activated if an error in the command execution (only used for bidirectional communication interfaces, i.e. optical communication) is detected

Deactivation condition:

Any application error is deactivated after maximum 60 minutes or by receiving a new command or by an ApplicationReset.

Any application error is not visible in the display or in the telegrams.

7.7 Holding times

Holding time:	
A – Continuous errors	3 days
H – Historic errors	15 months

The holding time for A - Continuous Errors is 3 days. Continuous Errors are useful for Fixed Network customers. Within 3 days, the continuous error information should be delivered to the customer via Fixed Network.

The holding time for H - Historic Errors is 15 months. Historic Errors are useful for Mobile Walk-By / Drive-By customers. Within 15 months, the historic error information should be delivered to the customer via a Walk-By / Drive-By tour, which usually happens at least once in a year.

Following subjects can be modified ex works by the customer (to be specified in the Customization Sheet):

- Deactivation of specific Current / Continuous / Historic Errors
- Modification of Holding times (same for all Continuous Errors and Historic Errors each)
- Modification of Error thresholds

For Leakage detection E05 / A05 / H05 it is possible to modify the leakage interval in the meter using the IZAR@MOBILE 2 software.

Information about

- which Errors are shown in the display with the respective Error code (and specific errors with a display symbol)
- which Errors are logged with their date and time in the Error Log

are listed in the table above (8.4 Overview errors/alarms (Display, entry in error log)).

7.8 Minimum / maximum flow rate

TOPAS® ESK 2 average flow rate calculated over the period of the last 16 seconds are compared every 2 seconds and overwritten in the log memory if necessary.

Minimum and maximum flow are recorded in the periodical log by default and in the history log if configured.

7.9 History log 1 (Monthly log)

The History log 1 saves 32 hourly, daily, weekly or monthly entries. The data log is set ex works for saving **data monthly**. The data shown below are logged at 23:59 at the end of each month. The data log can be read out over the optical interface using IZAR@MOBILE 2 software in conjunction with the Bluetooth optohead.

Note:

The History log 1 is a ring memory and has only a limited space available. If the space is occupied, the oldest entry is overwritten with the newest entry in each case. Thus at least 32 entries are always available.

The History log 1 table shown in the IZAR@MOBILE 2 software can be exported as a .csv file and processed in MS Office Excel.

The following data are saved:

Periodical log	
1	Current date
2	Total volume
3	Forward volume
4	Reverse volume
5	Maximum flow
6	Minimum flow
7	Medium temperature
8	Ambient temperature
9	On time
10	Error time
11	Error status

Description of the values

1. Current date:

The date and time at the time of entry in the History log 1.

2. Total volume:

Total volume at the time of entry in the History log 1.

3. Forward volume:

Total detected forward volume at the time of entry in the History log 1.

4. Reverse volume:

Total detected reverse volume at the time of entry in the History log 1.

5. / 6. Minimum / Maximum flow:

The minimum/maximum flow rate will be logged once per month in the History log 1.
The minimum or maximum flow value of the last monitoring period (last month) is always stored, see description "8.7. Minimum / maximum flow rate".

7. Medium temperature:

Medium temperature at the time of entry in the History log 1.

8. Ambient temperature:

Ambient temperature at the time of entry in the History log 1.

9. On time:

On time specify since how many hours the meter is in the field mode. The hours are thus summed up monthly.

10. Error time:

The error time specify how many hours the meter ever detects Error E1 and/or E4. The error time are thus summed up monthly.

11. Error Status:

In the field "Error Status" the central error- and alarm register will be emitted at the time of entry in the History log 1, e.g. E7 (Air in the pipe).

7.10 History log 2 (Daily log)

The History log 2 saves 1024 hourly, daily, weekly or monthly entries. The data log is set ex works for saving data daily.

At the end of every day TOPAS® ESK 2 logs the following data for 1024 days:

Current Date, Total volume, Ambient temperature °C, Error Status

The data memory is a so-called ring memory; this means after 1024 days, the oldest value is replaced by the newest value (first in - first out).

The memory can read via the optical interface using the Bluetooth Optohead and the IZAR@MOBILE 2 software in conjunction with the Bluetooth optohead.

Description of the values:

1. Current date:

The date and time at the time of entry in the History log 2.

2. Total volume:

Total volume at the time of entry in the History log 2.

3. Ambient temperature °C:

Ambient temperature °C at the time of entry in the History log 2.

4. Error Status

In the field "Error Status" the central error- and alarm register will be emitted at the time of entry in the daily log, e.g. E7 (Air in the pipe).

7.11 Event log

Errors are saved in the Event log with their date and time. The Event log can store up to 128 x 4-byte values and can also be read out over the optical interface using IZAR@MOBILE 2 software and a Bluetooth optohead.

Errors are shown in the log with a 0 or 1 flag. 0 = error not occurred and 1 = error occurred. If an error is no longer existing, TOPAS® ESK 2 sets also an entry with 0 for this error.

Only current errors are logged in the Event log.

Note:

All errors are logged, even if several are present at the same time.

The error log is a so-called ring buffer; i.e. the old values are replaced by the new values after 128 entries, depending on the error priorities.

Error priorities:

Name of Status	Status Code	Priority
Checksum error	01	High
Hardware temperature	02	High
Hardware flow	04	High
Leakage detection	05	Low
Back flow volume	06	Low
Air in pipe	07	Low
Low battery	09	Low
Undersized meter	11	Low
No consumption	12	Low
High medium temperature	13	Low
Freezing risk	14	Low
Fallback mode	17	Low
Metrological log access	18	Not logged in the Event log, but in the Metrological log
Measurement interference	22	Low
System reset	98	High
Any application error	99	Not logged in the Event log
Too much communication	00	Not logged in the Event log

Errors with “High” priority are always logged. If the 128 entries are occupied, then the first entry will be overwritten, except for the Event log entry 0.

Errors with “Low” priority are logged, if the 128 entries are not occupied and if the same error has not been logged 16 times in the event log.

In case there is no available log entry for an error with “Low” priority, then the last date of this “Low” priority error will be stored in the basic data storage of the meter.

The error log table shown in the IZAR@MOBILE 2 software can be exported as a .csv file and processed in MS Office Excel.

8 TOPAS® ESK 2 documentation

The following additional documents are valid in conjunction with the product specification and can be found on our home page at [TOPAS ESKR 2 | INTEGRA Metering AG \(integra-metering.com\)](https://integra-metering.com)

- Data Sheet
- Installation guide
- Conformity declaration