

## E1397 IR HEAD (Klax) SW Specs

**V04**



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### REV-History

REVNr	Author	Description
<b>V00</b>	2018-12-21-Ra	Create file
<b>V01</b>	2019-01-11-Ra	PL changes, LED definition added
<b>V02</b>	2019-01-28-Ra	New startup functionality added, dynamic AppKeys added
<b>V03</b>	2019-02-21-Ra	Changes and functionalities from FW V00.03 added
<b>V04</b>	2019-04-05-Ra	Typos corrected, units added to Payload IDs

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## 1 Device Default Settings

By default, the device is configured for usage on public networks with ADR (Adaptive Data Rate) turned on. The device's default RX2-Window data rate is SF12 (DR0).

**WARNING: When adding a device to a network, the RX2-Window data rate must match the settings of the network for it to work properly!**

The following device and filter parameters are set by default:

**Measurement Interval**    -> 15 Minutes (Uplink Interval -> 4x Measurement Interval -> 60 Minutes)  
**Register Filter 1**        -> 1.8.0  
**Register Filter 2**        -> 2.8.0  
**Register Filter 3**        -> 1.29.0  
**Register Filter 4**        -> 2.29.0

If a **HW-Reset** (Battery taken out, power cycle) has taken place, then the device starts in INIT mode by sending an INFO uplink, followed by a CONFIG and, in case the filter registers are set, a REG SET uplink (see chapter 4 for more information on the different payload structures supported by the device). Afterwards the device switches into RUN mode -> the IR measurement interval starts working (to confirm this, a special APP uplink is sent [IDs 02 & 03]) and the device sends an APP uplink (IDs 01 & 03) every 4<sup>th</sup> measurement cycle.

## 2 Functionality LED (Startup Behavior)

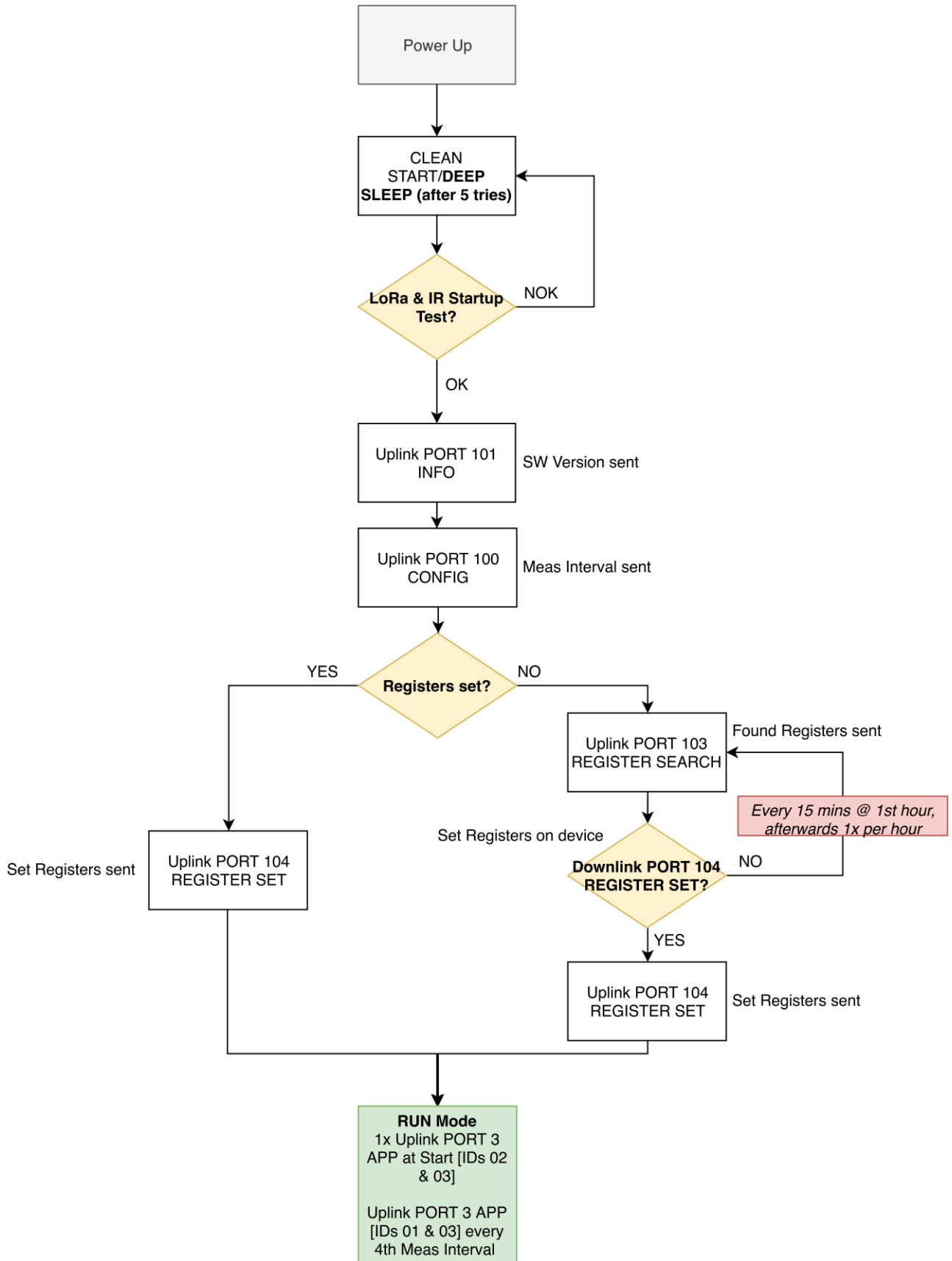
The IR HEAD has 1 status LED (orange, seen only when case open). This status LED is used to show the startup test results after powerup. The table below shows the different LED blinking profiles and their meaning.

LED	Blink duration	Meaning
Orange	1 x 1 s	IR HEAD has been initialized
	500ms Toggling	Startup test is being carried on
	1 x 2 s after Toggling	Startup test result -> IR & LORA <span style="color: green;">OK</span>
	2 x 200ms after Toggling	Startup test result -> IR <span style="color: green;">OK</span> , LORA <span style="color: red;">NOK</span>
	3 x 200ms after Toggling	Startup test result -> IR <span style="color: red;">NOK</span> , LORA <span style="color: green;">OK</span>
	4 x 200ms after Toggling	Startup test result -> IR & LORA <span style="color: red;">NOK</span>

If the startup test was not passed (either IR or LoRa NOK), then the specific LED blinking profile showing the error is repeated every 3 seconds for 30 seconds before retrying the startup test again (max. 5 tries). If all Startup test tries were unsuccessful, the device turns itself off.

**In OFF state, the device can only be restarted with a power cycle (take out battery for at least 2 minutes, device signalizes a Reset with a 1 second LED pulse).**

### 3 Startup diagram



## 4 Payload Structure (Version 00)

The IR HEAD supports Uplinks and Downlinks in the following ports:

- **PORT 3:** APP Uplink/Downlink
- **PORT 100:** CONFIG Uplink/Downlink
- **PORT 101:** INFO Uplink/Downlink
- **PORT 103:** REG SEARCH Uplink/Downlink
- **PORT 104:** REG SET Uplink/Downlink

All Uplinks include the same exact "header" (see first two bytes in orange in the definitions below).

### 4.1 Uplink Port 3 APP

Byte Nr	Function	Remarks
0	Payload Version	UINT8
1	Status	Bit0-3    -> Battery Stand (From 0 to 10 in 10% Steps) Bit4-5    -> 00 for SML, 01 for IEC 62056-21 Mode B, 02 for IEC 62056-21 Mode C, 03 for Logarex Bit6    -> Registers configured (1 TRUE, 0 FALSE) Bit7    -> CONNECTION TEST (1 TRUE, 0 FALSE)
2	MESSAGE INDEX	UINT8
3	MESSAGE X/Y	4 MSBs    -> Message Number 4 LSBs    -> Total Messages
4	Payload ID	UINT8, see chapters 4.1.1 for more details
5 - X	Payload DATA	See chapters 4.1.1 for more details
X+1 - Y	Payload ID	UINT8, see chapters 4.1.1 for more details
Y+1 - Z	Payload DATA	See chapters 4.1.1 for more details

(and so on)

#### 4.1.1 PAYLOAD IDS

Payload ID	Function	Structure	Size in Bytes w/ ID
01	Register Filtering ID (enough place for 2 registers, sent twice if 4 registers set)	<p>- 1 Byte: REGISTER MASK (which registers are being sent)  <b>Bit 0 -&gt; REGISTER FILTER POSITION 1 ACTIVE</b>  <b>Bits 1-2 -&gt; REGISTER FILTER POSITION 1 SELECTOR</b>            <b>00 -&gt; REGISTER FILTER 1</b>            <b>01 -&gt; REGISTER FILTER 2</b>            <b>10 -&gt; REGISTER FILTER 3</b>            <b>11 -&gt; REGISTER FILTER 4</b>  <b>Bit 3 -&gt; LAST FETCHED DATA POS 1 VALID</b>  <b>Bit 4 -&gt; REGISTER FILTER POSITION 2 ACTIVE</b>  <b>Bits 5-6 -&gt; REGISTER FILTER POSITION 2 SELECTOR</b>            <b>00 -&gt; REGISTER FILTER 1</b>            <b>01 -&gt; REGISTER FILTER 2</b>            <b>10 -&gt; REGISTER FILTER 3</b>            <b>11 -&gt; REGISTER FILTER 4</b>  <b>Bit 7 -&gt; LAST FETCHED DATA POS 2 VALID</b></p> <p>- 1 Byte: REGISTER UNITS            <b>4 LSBs -&gt; UNIT FOR REGISTER POSITION 1</b>            <b>4 MSBs -&gt; UNIT FOR REGISTER POSITION 2</b>  <b>DEFINED UNITS:</b>            * 0 -&gt; NDEF            * 1 -&gt; Wh            * 2 -&gt; W            * 3 -&gt; V            * 4 -&gt; A            * 5 -&gt; Hz</p> <p>- 4 Bytes: REGISTER FILTER POSITION 1 – CONTENT NOW  - 4 Bytes: REGISTER FILTER POSITION 1 – CONTENT NOW – 1* MEAS INTERVAL  - 4 Bytes: REGISTER FILTER POSITION 1 – CONTENT NOW – 2* MEAS INTERVAL  - 4 Bytes: REGISTER FILTER POSITION 1 – CONTENT NOW – 3* MEAS INTERVAL  - 4 Bytes: REGISTER FILTER POSITION 2 – CONTENT NOW  - 4 Bytes: REGISTER FILTER POSITION 2 – CONTENT NOW – 1* MEAS INTERVAL  - 4 Bytes: REGISTER FILTER POSITION 2 – CONTENT NOW – 2* MEAS INTERVAL  - 4 Bytes: REGISTER FILTER POSITION 2 – CONTENT NOW – 3* MEAS INTERVAL</p> <p>*ALL ZEROS IF INVALID READ OR NOT USED, INT32*</p>	35
02	Registers NOW	<p>-1 Byte: REGISTER MASK  <b>Bit 0: REGISTER FILTER 1 SET</b>  <b>Bit 1: REGISTER FILTER 2 SET</b>  <b>Bit 2: REGISTER FILTER 3 SET</b>  <b>Bit 3: REGISTER FILTER 4 SET</b>  <b>Bit 4: REGISTER FILTER 1 VALID</b>  <b>Bit 5: REGISTER FILTER 2 VALID</b>  <b>Bit 6: REGISTER FILTER 3 VALID</b>  <b>Bit 7: REGISTER FILTER 4 VALID</b></p> <p>- 1 Byte: REGISTER UNITS            <b>4 LSBs -&gt; UNIT FOR REGISTER FILTER 1</b>            <b>4 MSBs -&gt; UNIT FOR REGISTER FILTER 2</b></p>	20







## 4.2 Downlink Port 3 APP

Byte Nr	Function	Remarks
0	CONNECTION TEST	VALUE MUST BE TRUE -> an value != 0x00

Note that changes in the settings will not take effect until the next uplink (due to Class A, RX only after TX).

**IMPORTANT:** A CONNECTION TEST message sends a Payload IDs 02+03 (Registers NOW + Server ID, see chapter 4.1.1)

### 4.2.1 Example

**Connection Test (RAW): 01**

**01:** Do Connection Test TRUE

## 4.3 Uplink Port 100 CONFIG

Byte Nr	Function	Remarks
0	Payload Version	UINT8
1	Status	Bit0-3 -> Battery Stand (From 0 to 10 in 10% Steps) Bit4-5 -> 00 for SML, 01 for IEC 62056-21 Mode B, 02 for IEC 62056-21 Mode C, 03 for Logarex Bit6 -> Registers configured (1 TRUE, 0 FALSE) Bit7 -> CONNECTION TEST (1 TRUE, 0 FALSE)
2-3	CONFIG MEAS INTERVAL	Time in minutes (max. 50000, UINT16, MSB First)

### 4.3.1 Example

**MEAS INTERVAL (RAW): 004A000F**

**00:** Payload Version

**4A:** Status -> Connection Test FALSE, Registers configured TRUE, SML Mode, Battery 100%

**000F:** Actual Meas interval set to 15 minutes

## 4.4 Downlink Port 100 CONFIG

Byte Nr	Function	Remarks
0-1	CONFIG MEAS INTERVAL	Time in minutes (max. 50000, UINT16, MSB First)

Note that changes in the settings will not take effect until the next uplink (due to Class A, RX only after TX).

### 4.4.1 Examples

**CONFIG MEAS INTERVAL (RAW): 000F**

**000F:** Meas interval set to 15 minutes

**CONFIG MEAS INTERVAL (RAW): 000A**

**000A:** Meas interval set to 10 minutes

## 4.5 Uplink Port 101 INFO

Byte Nr	Function	Remarks
0	Payload Version	UINT8
1	Status	Bit0-3    -> Battery Stand (From 0 to 10 in 10% Steps)  Bit4-5    -> 00 for SML, 01 for IEC 62056-21 Mode B, 02 for IEC 62056-21 Mode C, 03 for Logarex  Bit6    -> Registers configured (1 TRUE, 0 FALSE)  Bit7    -> CONNECTION TEST (1 TRUE, 0 FALSE)
2	APP Main Version	UINT8
3	APP Minor Version	UINT8

### 4.5.1 Example

Device INFO (RAW): 004A0003

00: Payload Version

4A: Status -> Connection Test **FALSE**, Registers configured **TRUE**, SML Mode, Battery **100%**

00: APP Main Version 00

03: APP Minor Version 03

## 4.6 Downlink Port 101 INFO

Byte Nr	Function	Remarks
0	GET DEVICE INFO	VALUE MUST BE TRUE -> any value != 0x00

Note that changes in the settings will not take effect until the next uplink (due to Class A, RX only after TX).

### 4.6.1 Example

Get Device INFO (RAW): 01

01: Get Device INFO TRUE

## 4.7 Uplink Port 103 REGISTER SEARCH

Byte Nr	Function	Remarks
0	Payload Version	UINT8
1	Status	Bit0-3 -> Battery Stand (From 0 to 10 in 10% Steps) Bit4-5 -> 00 for SML, 01 for IEC 62056-21 Mode B, 02 for IEC 62056-21 Mode C, 03 for Logarex Bit6 -> Registers configured (1 TRUE, 0 FALSE) Bit7 -> CONNECTION TEST (1 TRUE, 0 FALSE)
2	MESSAGE INDEX	UINT8
3	MESSAGE X/Y	4 MSBs -> Message Number 4 LSBs -> Total Messages
4-6	Register 1	Example -> If Register A -> 1.8.0 BYTE 4 -> 1 (UINT8 value, max 255) BYTE 5 -> 8 (UINT8 value, max 255) BYTE 6 -> 0 (UINT8 value, max 255) When last element is 0, both 1.8.0 and 1.8 are searched
7-9	Register 2	Example -> If Register B -> 2.8.0 BYTE 4 -> 2 (UINT8 value, max 255) BYTE 5 -> 8 (UINT8 value, max 255) BYTE 6 -> 0 (UINT8 value, max 255) When last element is 0, both 2.8.0 and 2.8 are searched
X-Y	Register X	Example -> If Register C -> 16.1 BYTE 4 -> 16 (UINT8 value, max 255) BYTE 5 -> 1 (UINT8 value, max 255) BYTE 6 -> 0 (UINT8 value, max 255) When last element is 0, both 16.1.0 and 16.1 are searched

(and so on)

### 4.7.1 Example

**Found Registers (RAW): 004AC011010800010802**

**00:** Payload Version

**4A:** Status -> Connection Test **FALSE**, Registers configured **TRUE**, **SML Mode**, Battery **100%**

**C011:** Message Index 192, Message 1 from 1

**010800:** Register 1.8.0 found

**010802:** Register 1.8.2 found

## 4.8 Downlink Port 103 REGISTER SEARCH

Byte Nr	Function	Remarks
0	SEARCH REGISTERS	VALUE MUST BE TRUE -> any value != 0x00

Note that changes in the settings will not take effect until the next uplink (due to Class A, RX only after TX).

### 4.8.1 Example

Search Registers (RAW): **01**

**01**: Start Register Search **TRUE**

## 4.9 Uplink Port 104 REGISTER SET

Byte Nr	Function	Remarks
0	Payload Version	UINT8
1	Status	Bit0-3 -> Battery Stand (From 0 to 10 in 10% Steps) Bit4-5 -> 00 for SML, 01 for IEC 62056-21 Mode B, 02 for IEC 62056-21 Mode C, 03 for Logarex Bit6 -> Registers configured (1 TRUE, 0 FALSE) Bit7 -> CONNECTION TEST (1 TRUE, 0 FALSE)
2	ACTIVE FILTERS	Bit0 -> REGISTER FILTER 1 SET (1 TRUE, 0 FALSE) Bit1 -> REGISTER FILTER 2 SET (1 TRUE, 0 FALSE) Bit2 -> REGISTER FILTER 3 SET (1 TRUE, 0 FALSE) Bit3 -> REGISTER FILTER 4 SET (1 TRUE, 0 FALSE) Bits 4-7 -> reserved for future use
3-5	REGISTER FILTER 1	For formatting info, see 4.7
6-8	REGISTER FILTER 2	For formatting info, see 4.7
9-11	REGISTER FILTER 3	For formatting info, see 4.7
12-14	REGISTER FILTER 4	For formatting info, see 4.7

### 4.9.1 Examples

Set all 4 Register filters (RAW): **004A0F010800020800011D00021D00**

**00**: Payload Version

**4A**: Status -> Connection Test **FALSE**, Registers configured **TRUE**, **SML Mode**, Battery **100%**

**0F**: All 4 Register filters set

**010800**: Register Filter 1 -> 1.8.0

**020800**: Register Filter 2 -> 2.8.0

**011D00**: Register Filter 3 -> 1.29.0

**021D00**: Register Filter 4 -> 2.29.0

**Set 2 Register filters (RAW): 004A03010800020800000000000000**

**00:** Payload Version

**4A:** Status -> Connection Test **FALSE**, Registers configured **TRUE**, **SML Mode**, Battery **100%**

**03:** Register filters 1 & 2 set

**010800:** Register Filter 1 -> 1.8.0

**020800:** Register Filter 2 -> 2.8.0

**000000:** Register Filter 3 -> NOT SET

**000000:** Register Filter 4 -> NOT SET

## 4.10 Downlink Port 104 REGISTER SET

Byte Nr	Function	Remarks
0	ACTIVE FILTERS	Bit0 -> REGISTER FILTER 1 SET (1 TRUE, 0 FALSE) Bit1 -> REGISTER FILTER 2 SET (1 TRUE, 0 FALSE) Bit2 -> REGISTER FILTER 3 SET (1 TRUE, 0 FALSE) Bit3 -> REGISTER FILTER 4 SET (1 TRUE, 0 FALSE) Bits 4-7 -> reserved for future use
1-3	REGISTER FILTER 1	For formatting info, see 4.7 <b>IMPORTANT -&gt; Filter must always be filled from 1 to 4!</b>
4-6	REGISTER FILTER 2	For formatting info, see 4.7 <b>IMPORTANT -&gt; Filter must always be filled from 1 to 4!</b>
7-9	REGISTER FILTER 3	For formatting info, see 4.7 <b>IMPORTANT -&gt; Filter must always be filled from 1 to 4!</b>
10-12	REGISTER FILTER 4	For formatting info, see 4.7 <b>IMPORTANT -&gt; Filter must always be filled from 1 to 4!</b>

Note that changes in the settings will not take effect until the next uplink (due to Class A, RX only after TX).

### 4.10.1 Examples

**Set all 4 Register filters (RAW): 0F010800020800011D00021D00**

**0F:** All 4 Register filters set

**010800:** Register Filter 1 -> 1.8.0

**020800:** Register Filter 2 -> 2.8.0

**011D00:** Register Filter 3 -> 1.29.0

**021D00:** Register Filter 4 -> 2.29.0

**Set 2 Register filters (RAW): 03010800020800000000000000**

**03:** Register filters 1 & 2 set

**010800:** Register Filter 1 -> 1.8.0

**020800:** Register Filter 2 -> 2.8.0

**000000:** Register Filter 3 -> NOT SET

**000000:** Register Filter 4 -> NOT SET

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## 5 Tested Meters

The following meters have successfully been tested with the IR HEAD (Klax).

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### 5.1 German Meters (Formats -> SML or Logarex, Power Meters)

- Itron 3.HZ-AC-H4-A1
- Holley DTZ541-ZEBA & DTZ541-ZDBA
- Logarex LK13BE803039 & LK13BE803049
- efr SGM-C4-2A920L & SGM-C4-2A92TL
- comet DTZ541-ZEBA
- Norax 3D Apator
- ISKRA MT681-D4A51-K0p
- EMH eHZ-HW8E2A5L0EL1P & eHZ-GW8E2A500AX1
- Landis+Gyr E320-AM1D.A1A.A0-S1B-S1

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### 5.2 Swiss Meters (Formats IEC IEC 62056-21 B or C, Power & Heat Meters)

- Landis+Gyr E350, ZMD120AP, ZMD120AR, ZMB120, ZMD410
- Elster AS3000
- UltraHeat 50 (Landis+Gyr, Siemens & neovac)