Specification for HTPA16x16dL2.1M(PoE)

Rev.0: 2014.06.25 Schnorr

The HTPA16x16dL2.1M(PoE) is a fully calibrated, low cost thermopile array module, with fully digital UDP interface. The module delivers object temperatures. The power supply is done via Power over Ethernet according to IEEE802.3ab.

Order Code Example

HTPA32x31		L10 / 0.8	F8-14	Hi	M	(SPI)	[Si]

Type:

HTPA32x31	Please contact support for all available HTPA and module combinations.

Output:

d	HTPA sensor with digital output
Not declared	HTPA sensor with analogous output

Optics:

L	Focal length: In example L10 = 10.0 mm focal length
/	F-Number: In example /0.8
	For optics see also “HTPA standard optics”

Filter:

F	Filter characteristics. In example F8-14 (µm, Bandpass)
Not declared	Broad band ARC

Sensitivity:

Hi	Increased sensitivity
Not declared	Standard sensitivity

Version:

A	Application set: comes with GUI, housing, power supply. Always UDP Interface.
C	Calibrated sensor (only digital). Carries calibration constants on internal EEPROM
M	Module: HTPA sensor soldered to PCB, calibrated stream
S	HTPA sensor only. Raw voltage output, not calibrated

Interface:

SPI	SPI device; Two variants: Analog HTPA, 14bit ADC Digital HTPA, 12bit ADC
LC	SPI,Only Analogous HTPA. low speed, external processing required
UDP	Ethernet, CAT5 cable connection
PoE	Power over Ethernet, CAT5 connection, UDP protocol

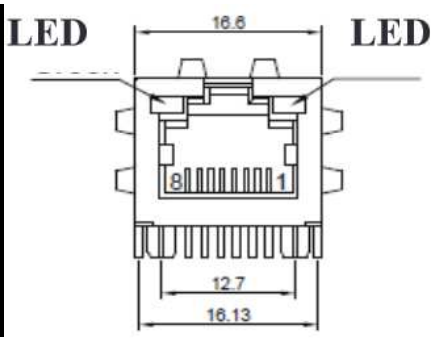
Lens Material:

Si	Silicon
Not declared	Germanium

Modules M(UART) and M(LC) are not recommended anymore. M(SPI) and M(UDP) offer a wider input voltage range, better ADC resolution and a wider measurement range.

Pinout:

Pin	Name	Description	Type
1	TX+	UDP communication	Digital Output
2	TX-	UDP communication	Digital Output
3	RX+	UDP communication	Digital Input
4	VDD	positive power supply voltage	Power
5	VDD	positive power supply voltage	Power
6	RX-	UDP communication	Digital Input
7	VSS	negative power supply voltage	Power
8	VSS	negative power supply voltage	Power



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Internet
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Ethernet-Interface:

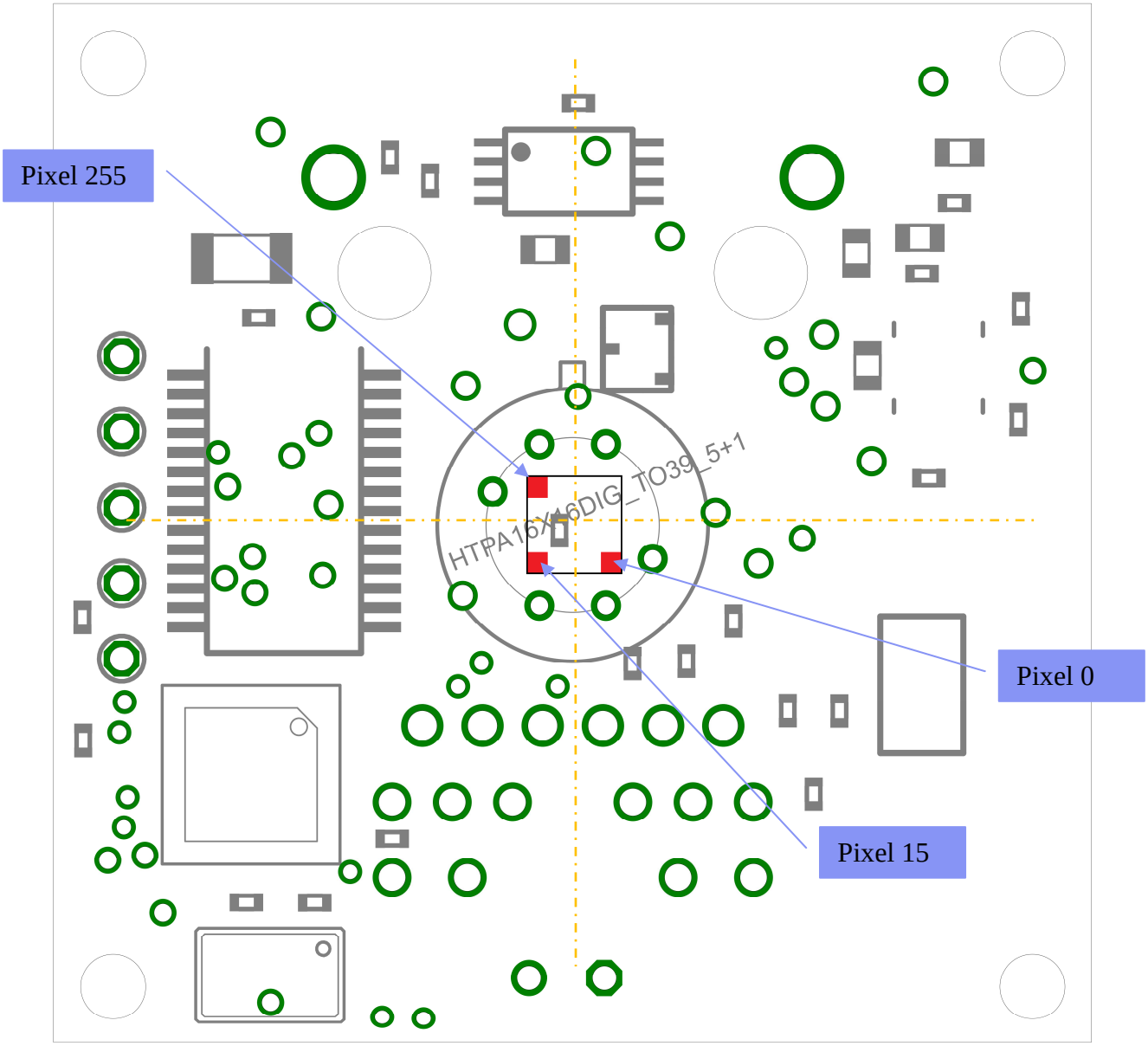
Protocol Specifications:

Protocol type:	UDP
All communication on Port:	30444

Electrical Specifications:

VDD:	Supply (+48V DC)
VSS	GND
IDD (Operating mode)	22 mA

HTPA16x16dL2.1M(PoE) Optical Orientation of Pixels:



Bottom View

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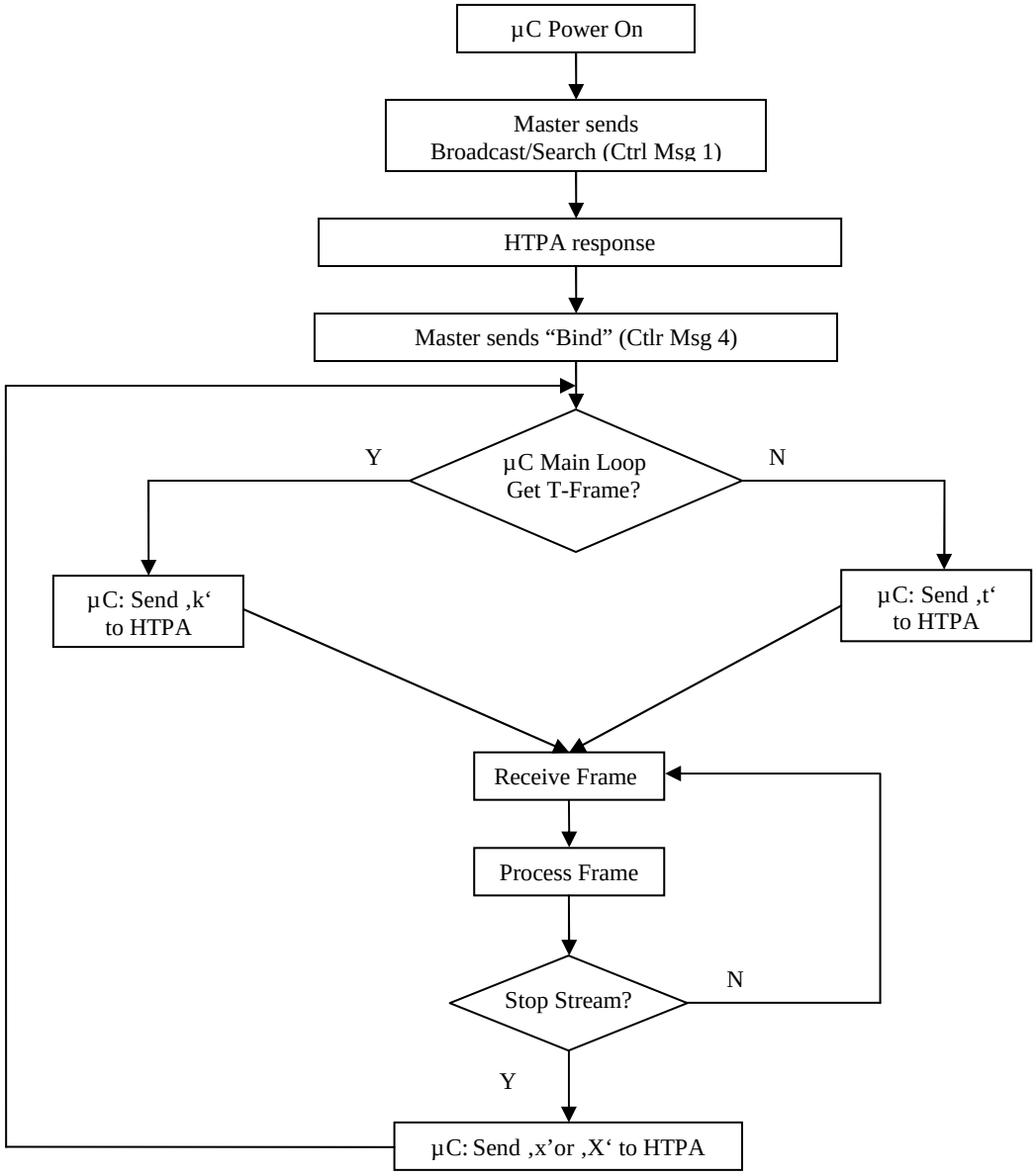
Communication and Timings:

Proposed flow chart of communication. (Master is referred as µC, Slave as HTPA module)



Communication:

Communication via UDP	
Sent Char	**Result/Received message**
'a'	Decreases the FPS of the array
'A'	Increases the FPS of the array
'c/C'	Capture single voltage frame. Use ADC of µC.
'h'	pushes binary EEDATA out
'J'	Toggle Amplification
'k'	Read single temperature frame. Output in binary format.
'K'	send continous binary temperature datastream(µC-ADC)[K*10] Output of a complete cycle ***For a detailed Description of the serial order see Table2.***
'l'	Get Ambient Temperature (Calculates the Ambient Temperature from the **last measured** Frame)
'M'	Shows current and calibration settings. Device prints the following stream: **"HTPA series responsed! I am Arraytype 1 MODTYPE 1"** **"16x16 PoE Firmware v.X.XX written by M.Schnorr; Heimann Sensor GmbH; YYYY-MM-DD"** Version information. **"I am running on XXXX.X kHz"** Actual MCLK-setting in kHz **"Amplification is X" Actual set amplification.** Possible strings for X: "500", "1000", "1500" or "2000" **"MAC-ID: X IP: Y DevID: Z\r\n"** X= MAC-ID of the device, i.e. "00.97.FF.00.10.08"; Y=current IP of the device, Z=user setable ID, range 00000…65535 **"PIXCvsTA *X* , BFL3 *X* , F8_14 *X* , THvsTA *X* IGNORE_ELOFF *X* ELOFF32 *X* SBY *Y* FC *X* TC X Z OPC X"** Possible strings: *X* ="true" or "false", *Y*="1" or "0", *Z* is the string of a 2 decimal places value, i. e. "3.47" **"THOM *A* , THOD *B* , TABLENUMBER *C* \r\n"** Possible strings for *A-C:* 2 digit decimals, i.e. "08" Remarks: A-D is used for internal calculations, VDM is the multiplier descibed in the chapter "Object Temperature".
'q'/'Q'	Allow Changes (required for Calibration)
't'	Continuous binary voltage data of the sensor is transmitted. Output of a complete cycle ***For a detailed Description of the serial order see Table2.***
'v'	Announce IP (Only Ethernet devices)
'w'	shows Calibration-constants
'W'	Calibration. ATTENTION! Old Dataset cannot be restored!
'x'	Stops Stream without prompt.
'X'	Stops Stream by sending "STOP!\r\n"

Table1: Control Characters

Please be aware, that the source and destination port has to be 30444

Serial order of data in stream:

HTPA16x16 Temperature Mode	
Dataset	Value
0	Temperature of Pixel0 in K*10
1	Temperature of Pixel1 in K*10
2	Temperature of Pixel2 in K*10
3	Temperature of Pixel3 in K*10
…	…
255	Temperature of Pixel255 in K*10
256	el. Offset x | ((el. Frame&0xF)<<12)
257	el. Offset x+1
…	…
270	el. Offset x+15
271	TAmb
272	PTAT

HTPA16x16 Voltage Mode	
Dataset	Value
0	absolute Voltage of Pixel0 in digits
1	absolute Voltage of Pixel1 in digits
2	absolute Voltage of Pixel2 in digits
3	absolute Voltage of Pixel3 in digits
…	…
255	absolute Voltage of Pixel255 in digits
256	el. Offset x | ((el. Frame&0xF)<<12)
257	el. Offset x+1
…	…
270	el. Offset x+15
271	TAmb
272	PTAT

Table2: Serial order of data in stream

HTPA16x16 el. Offset	
el. Frame	Value of x
0	0
1	16
2	32
3	48

Table3: Serial order of el. Offset

Each dataset consists of a 16 bit value, first the low-Byte is send, then the high-Byte. The el. Offset consists of 64 values, four pixels share one amplifier and with that one el. Offset. With each frame the value for 16 el. Offsets are send, the value of the el. Frame represents the corresponding number of the el. Offset (see Table 3).

Packets (UDP, only Ethernet device):

Number of packets	Packet size [byte]	HTPA type	Comments
1	144	HTPA8x8	-
1	548	HTPA16x16	-
2	1058+1054	HTPA32x31	see below for details
8	1101+621	HTPA64x62	see below for details

Packet details for HTPA32x31		
Packet No.	Packet size	Packet contains
1	1058	Data of Pixel0 - Pixel528
2	1054	Data of Pixel529 to end of frame

Each dataset (except of packet index) consists out of a 16 bit value. For serial order of the datasets refer to section “serial order in Frame”.

Pixelmap:

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111
112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127
128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143
144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159
160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191
192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207
208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223
224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239
240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255

Table3a: Pixelmap

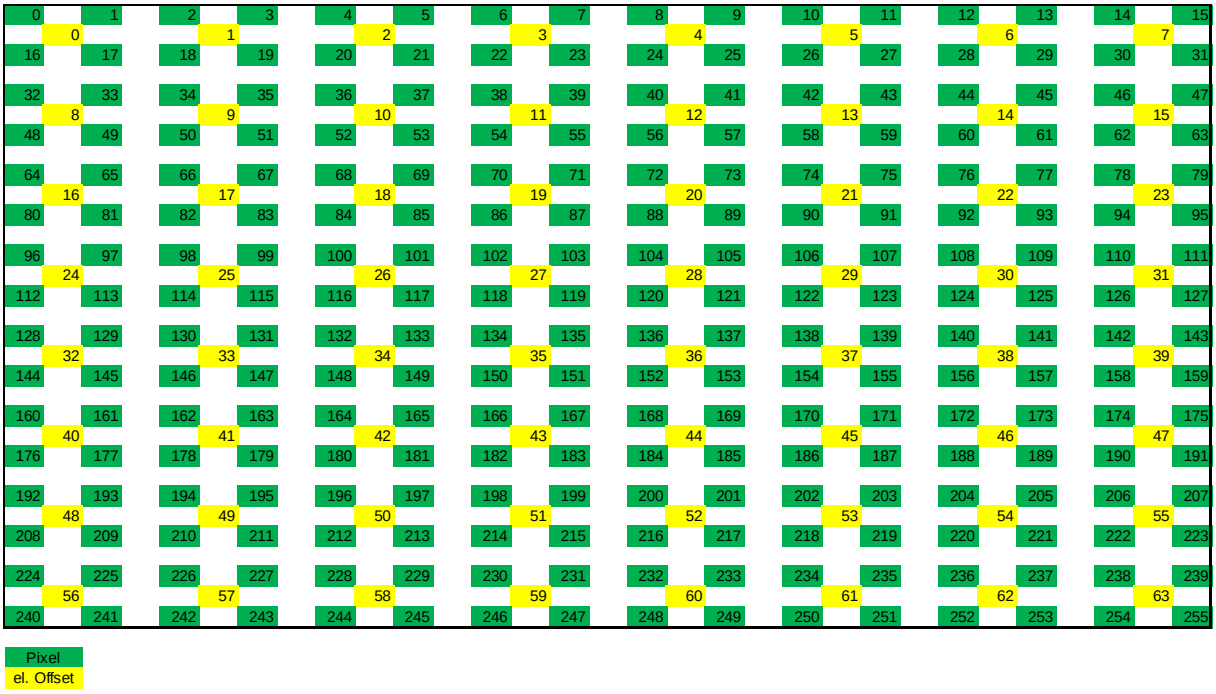


Table3b: Pixelmap with el. Offsets

Control Messages:

In the set of control messages, expressions in angled braces have to be substituted by following strings:

[IP] insert IP in ASCII format, i.e.: *"192.168.240.122"*

[MACID] insert MAC ID in ASCII format and hexadecimal, i.e.: *"00.1A.22.33.44.55"*

[AT] insert index of array types in ASCII format

Array type	Index
HTPA 8x8	*"0"*
HTPA 16x16	*"1"*
HTPA 32x31	*"3"*
HTPA 64x62	*"5"*

[MCLK] insert Frequency of MCLK in ASCII format and kHz, i.e.: *"1050.1"*

[AMP] insert state of amplification in ASCII format:

State	String
500	*"500"*
1000	*"1000"*
1500	*"1500"*
2000	*"2000"*

[MSK] insert subnet mask in ASCII format, i.e.: *"255.255.255.000"*

[DEVID] insert 5 digit device ID in ASCII format, i.e. *"00197"* Range: 00000… 65535

Set of control messages:

Message1: "Calling HTPA series devices" (only Ethernet device)
Conditions: Can be sent as Broadcast, or if device already known as normal packet.
Answer: "HTPA series responsed! I am Arraytype **[AT]**"
Firmware version, date and author information.
"I am running on **[MCLK]** kHz"
"Amplification is **[AMP]**\r\n"
"MAC-ID: **[MACID]** IP: **[IP]**\r\n"
A second packet with calibration depending information is send.

Message2: "x Release HTPA series device" (only Ethernet device)
Result: Device disables hardware IP filter. All packets except ARP's, DHCP requests, Broadcasts, Message1, Message3 and Message4 are discarded.
Answer: "HW-Filter released\r\n"

Message3: "HTPA device IP change request to **[IP].[MSK]**." (only Ethernet device)
Result: The device changes the IP and the subnet mask to the given value and writes it to EEPROM. The IP becomes the default IP, therefore the device will use it at the next reset, if no DHCP is found.
Answer: "Device changed IP to **[IP]**. and Subnet to **[MSK]**.\r\n"

Message4: "Bind HTPA series device" (only Ethernet device)
Result: Device enables hardware IP filter. Only packets from sender IP, ARP's, DHCP requests and Broadcasts are accepted. Device accepts now the control characters listed in **Table 1.**
Answer: "HW Filter is **[IP]** MAC **[MACID]**\n\r""
Insert in the above string the IP and MAC-ID of the Sender from Message4.

Control Messages [continued]:

Message5:	"Set EEPROM data"
Conditions:	Only possible if Message 4 already successful sent. **ATTENTION!** Calibration data is overwritten!!!
Result:	Writes the next received packets into EEPROM, if packet size is equal to 1024 bytes. Device writes to EEPROM, until EEPROM is completely filled. EEPROM size depends on Device type: HTPA8x8, HTPA16x16 and HTPA32x31: 16384 byte; HTPA64x62: 65536 byte.
Answer:	"Write was successful.\n\r"

Message6:	"Set DeviceID to **[DEVID]**"
Result:	The given Device ID **[DEVID]** is written to EEPROM. This ID is shown on receive of 'M'. The Device ID can be used for customer specific purposes.
Answer:	"DeviceID changed to **[DEVID]**\r\n"

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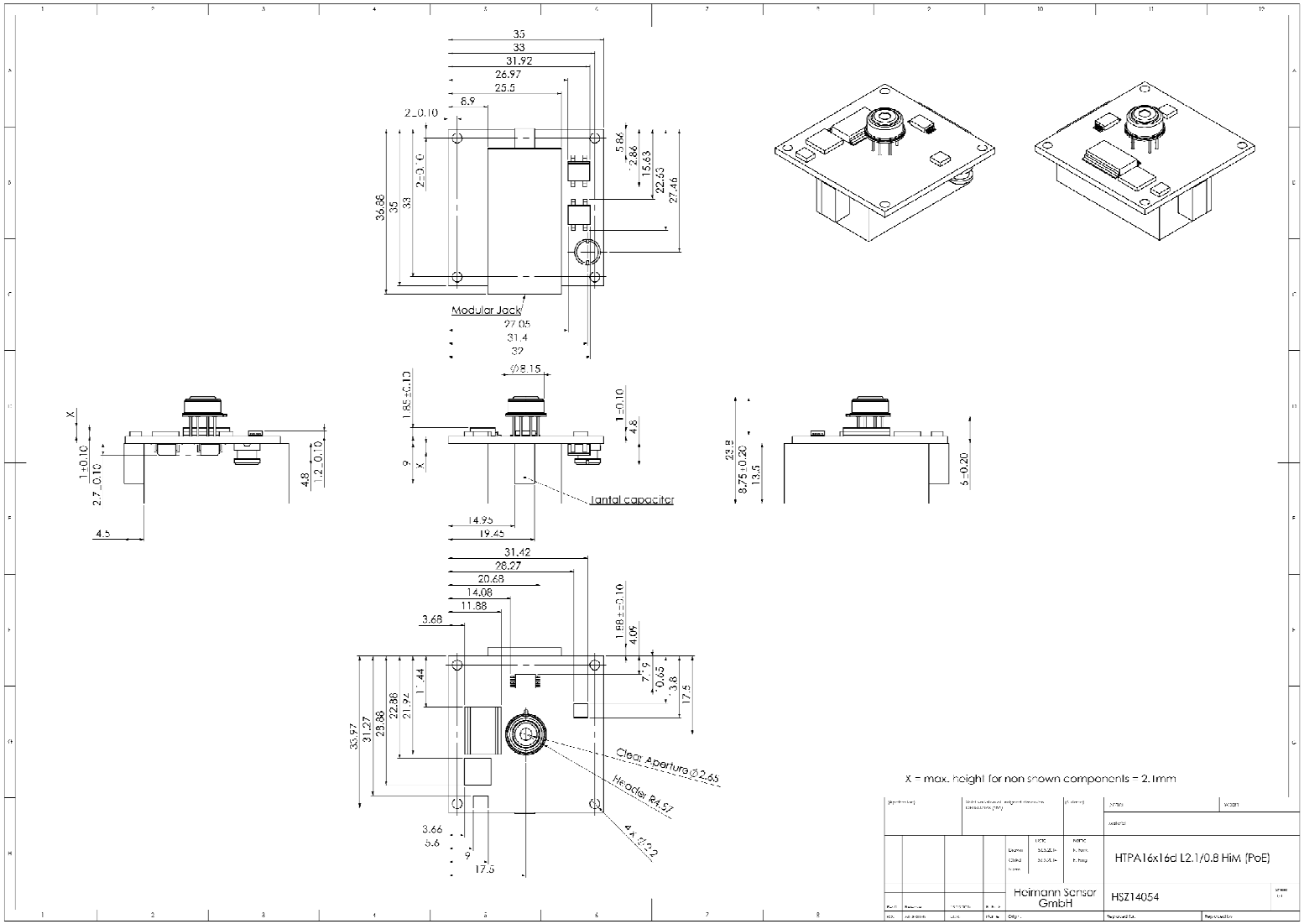
Dimensions:



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