HTPA32x32 Module Specifications and Transferprotocol

Rev.4: 2016.03.02 Lupp/Schnorr

Electrical Specifications:

VDD:	Supply (+5.0V DC via USB)
VSS	GND
Power Supply:	**5.0** VDC ± 10 %
IDD (Operating mode)	175 mA

Pinout:

No.	Function	Type
1	SCL	Input
2	VDD	Power
3	VSS	Power
4	SDA	Input/Output

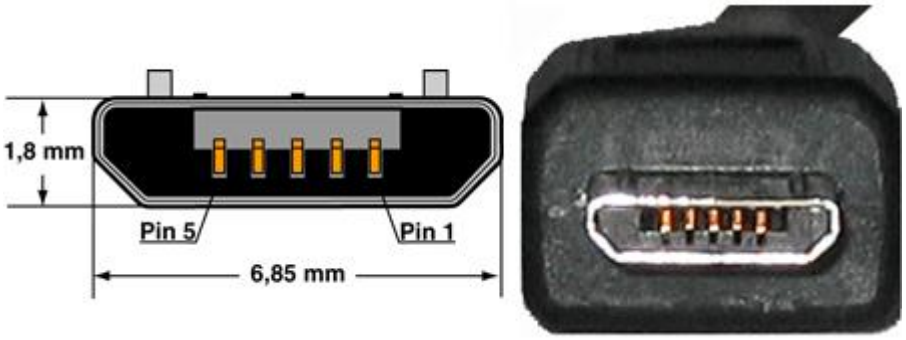
Connector layout: see drawings.

Ethernet-Interface:

Protocol Specifications:

Protocol type:	UDP
All communication on Port:	30444

Power connection at Ethernet device:



Pin 1	VDD	(+)	Supply (+5.0V DC ± 10 %)
Pin 5	VSS	(-)	GND

Ethernet-Interface:

Protocol Specifications:

Protocol type:	UDP
All communication on Port:	30444

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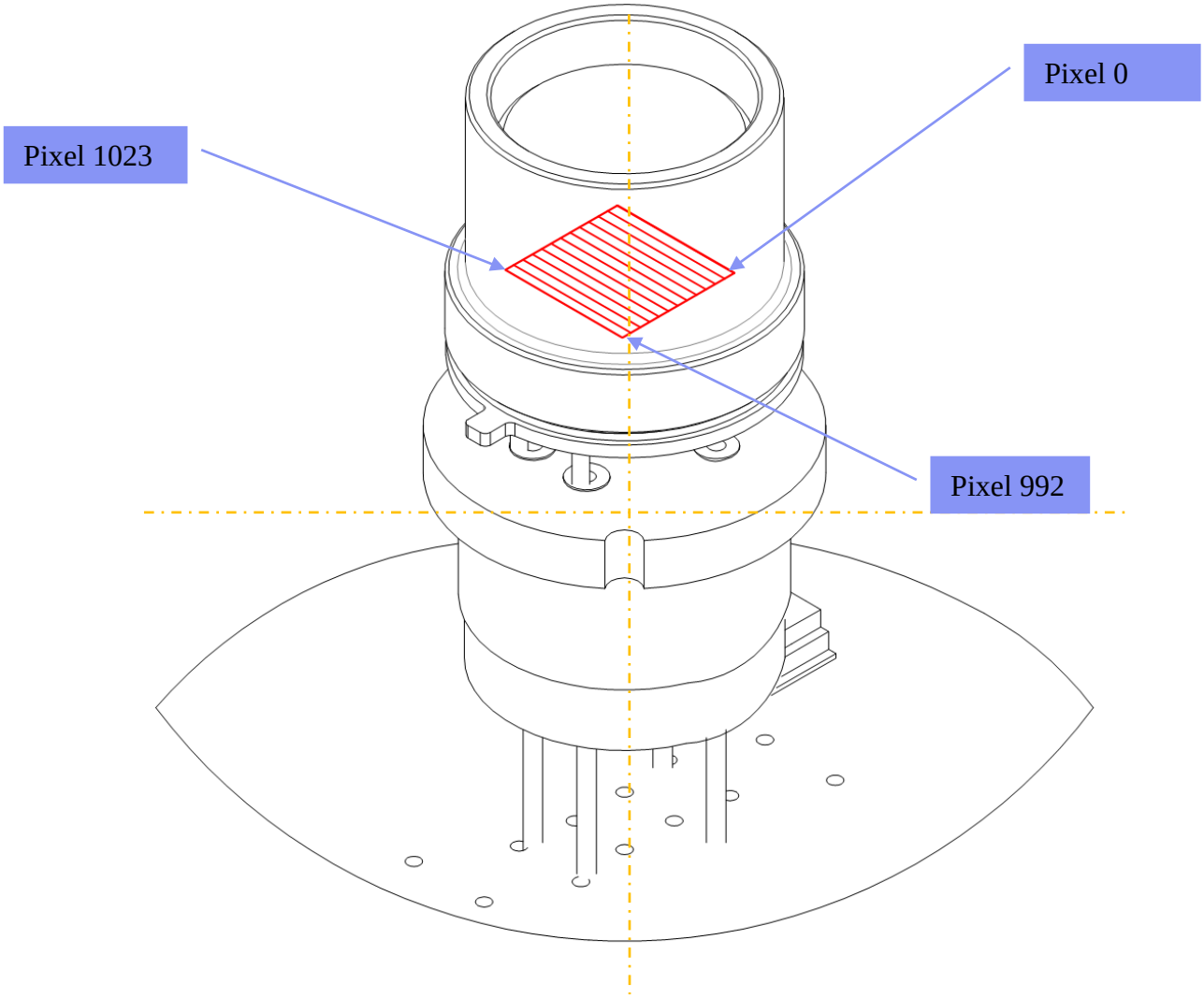
HTPA32x32d UDP Module Optical Orientation of Pixels:



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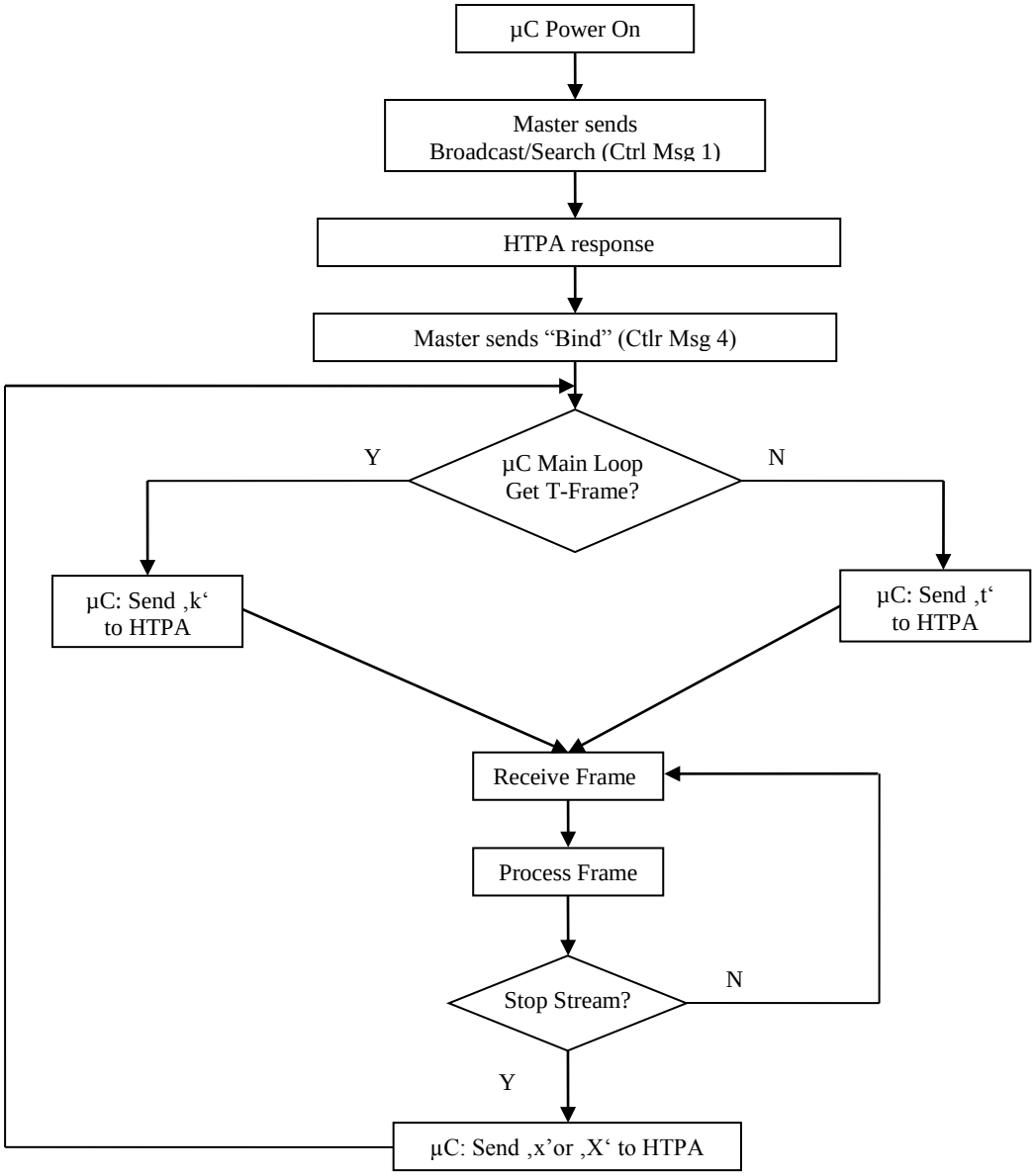
Communication and Timings:

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



Communication:

Communication via UDP	
Sent Char	**Result/Received message**
'a'/'A'	decreases / increases CLK setting
'b'	Measure VDD (referenced to VREF1225)
'c'	Capture single voltage frame. Use ADC of µC.
'f'	Toggle between sending raw and compensated voltages when sending 't'
'h'	pushes binary EEDATA out
'i'/'I'	decreases / increases BIAS setting
'j'/'J'	decreases / increases BPA setting
'G'	Shows current configuration settings (CLK, BIAS, BPA,…)
'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.***
'M'	Shows current and calibration settings. Device prints the following stream: **"HTPA series responsed! I am Arraytype 10 MODTYPE 5"** **"HTPA32x32d v.X.XX Heimann Sensor GmbH; written by M. Schnorr YYYY-MM-DD"** Version information. **"I am running on XXXX.X kHz"** Actual MCLK-setting in kHz **"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
'p'	toggle PU (pull-up) setting
o'/'O'	descreases / increases REFCAL setting
'q'/'Q'	Allow Changes (required for Calibration)
'r'/'R'	decreases / increases resolution
'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'	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:

HTPA32x32d 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
…	…
1023	Temperature of Pixel1023 in K*10
1024	el. Offset 0
1025	el. Offset 1
…	…
1279	el. Offset 255
1280	VDD
1281	TAmb
1282	PTAT0
1283	PTAT1
1284	PTAT2
1285	PTAT3
1286	PTAT4
1287	PTAT5
1288	PTAT6
1289	PTAT7

HTPA32x32d 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
…	…
1023	absolute Voltage of Pixel1023 in digits
1024	el. Offset 0
1025	el. Offset 1
…	…
1279	el. Offset 255
1280	VDD
1281	TAmb
1282	PTAT0
1283	PTAT1
1284	PTAT2
1285	PTAT3
1286	PTAT4
1287	PTAT5
1288	PTAT6
1289	PTAT7

Table2: Serial order of data in stream

Each dataset consists of a 16 bit value, first the low-Byte is send, then the high-Byte.

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
2	1292+1288	HTPA32x32d	see below for details
8	1101+621	HTPA64x62	see below for details
10	1282	HTPA80x64d	see below for details

Packet details for HTPA32x32d		
Packet No.	Packet size	Packet contains
1	1292	Data of Pixel0 - Pixel645
2	1288	Data of Pixel646 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
256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287
288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319
320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351
352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383
384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415
416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447
448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479
480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511
512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543
544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575
576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607
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640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671
672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703
704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735
736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767
768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799
800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831
832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863
864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895
896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927
928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959
960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991
992	993	994	995	996	997	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023

Table3: Pixelmap for 32x32

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 32x32d	*"10"*
HTPA 64x62	*"5"*
HTPA 80x64d	*"11"*

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

[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

[MODT] insert index of Moduletype in ASCII format, i.e.: 005

[ADCRES] insert ADC resolution in ASCII format, i.e.: "16" Range: 08…16

[EPSILON] insert 3 digit emissivity in ASCII format, i.e. "095" Range: 000…100

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**] MODTYPE **[MODT]**\r\n
ADC: **[ADCRES]**\r\n"
Firmware version, date and author information.
"I am running on **[MCLK]** kHz\r\n"
"MAC-ID: **[MACID]** IP: **[IP]** DevID: **[DEVID]**\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 HTPA32x31/32x32: 16384 byte; HTPA64x62: 65536 byte.
Answer:	"Write was successful.\n\r"

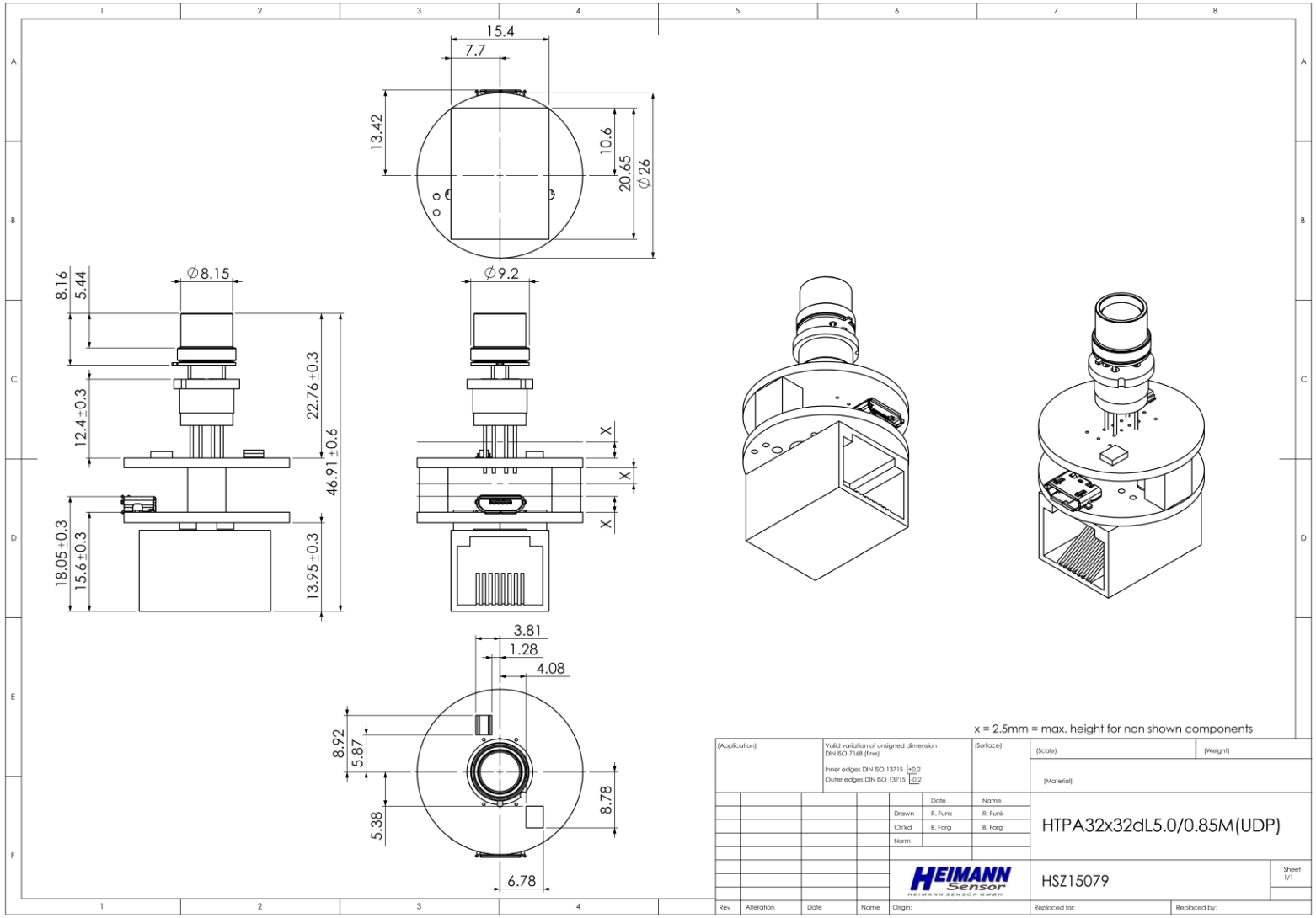
Message6:	"Set DeviceID to **[DEVID]**"
Result:	The given Device ID **[DEVID]** is written to EEPROM. This ID is shown on receive of 'M'. The Device ID can be used for customer specific purposes.
Answer:	"DeviceID changed to **[DEVID]**\r\n"

Message7:	"Set Emission to **[EPSILON]**"
Result:	The given emissivity **[EPSILON]** is written to the EEPROM. The emissivity can be used for customer specific purposes to compensate the radiation factor of different materials.
Answer:	"Emission changed to **[EPSILON]**%\r\n"

Temperature calculation:

The module is already transmitting calculated temperatures if character "k/K" was sent from the master. For details about the temperature calculation please see the datasheet of the sensor.

Module Dimension



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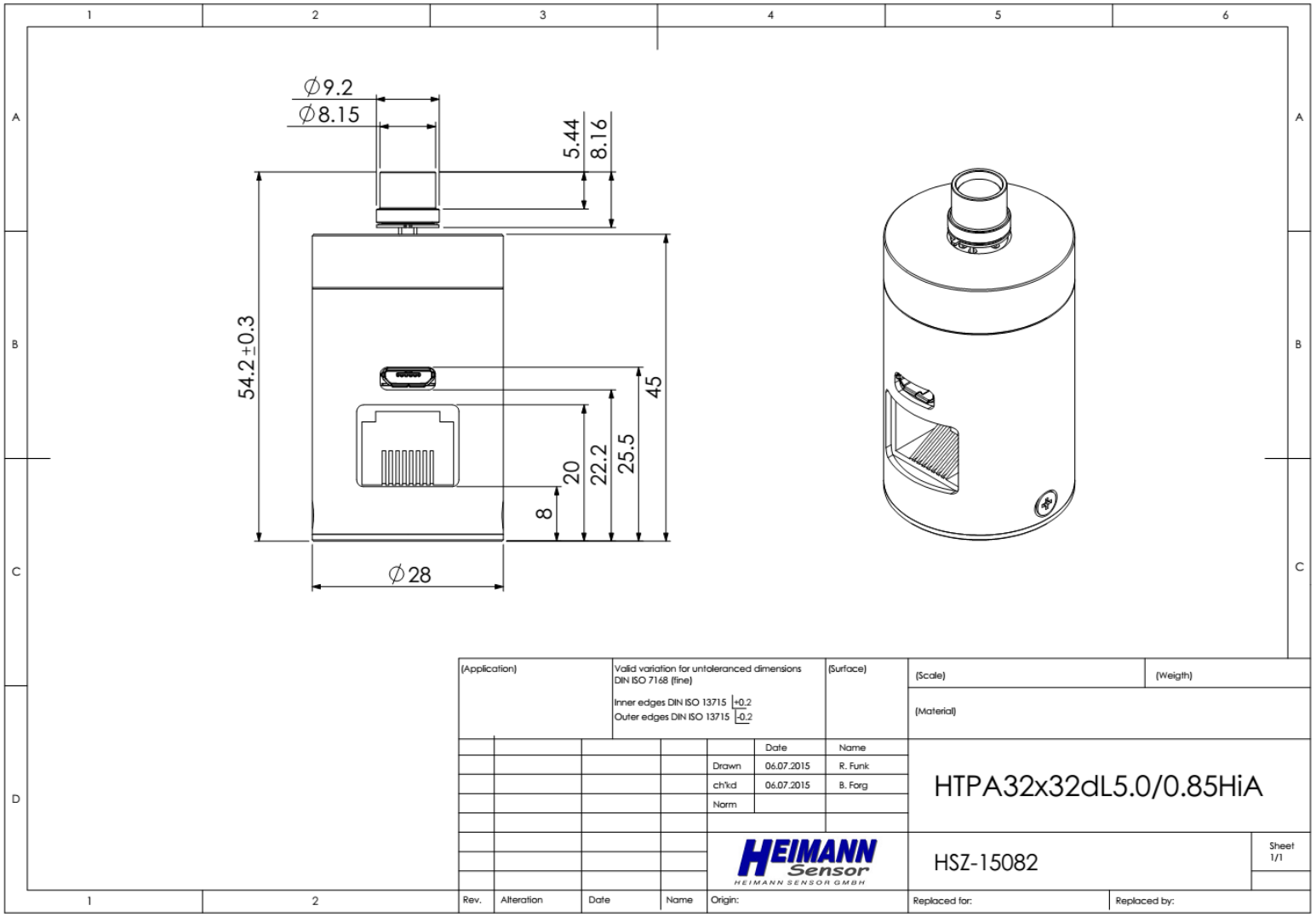

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