Specification for HTPA64x62L10/0.8M(UDP)

Rev.0: 2014.03.21 Fg

The HTPA64x62L_/_M(UDP) is a fully calibrated, low cost thermopile array module, with fully digital UDP interface. The module delivers an electrical offset and ambient temperature compensated output stream, which can be already used for image processing, pattern recognition and presence detection purposes. Object temperatures can be easily obtained by this data stream.

Order Code Example

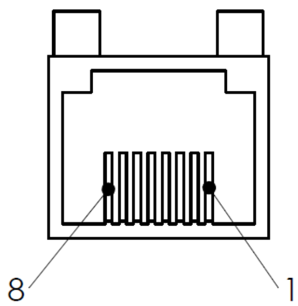
HTPA32x31		L10 / 0.8	F8-14	Hi	M	(SPI)	[Si]

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 L2,1 = 2,1 mm focal length
	/	F-Number: In example /0.85
		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.
	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
Lens Material:		
	Si	Silicon
	Not declared	Germanium

For 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 Assignment HTPA32x31M(UDP)			
Pin	**Name**	**Description**	**Type**
1	TPOut+	Differential Signal Output	Digital Output
2	VDD	Positive supply voltage	Power
3	TPOut-	Differential Signal Output	Digital Output
4	TPIn+	Differential Signal Input	Digital Input
5		not connected	
6	TPIn-	Differential Signal Input	Digital Input
7		not connected	
8	VSS	Ground reference	Power

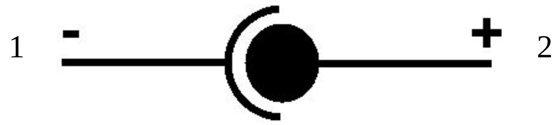


Ethernet-Interface:

Protocol Specifications:

Protocol type:	UDP
All communication on Port:	30444

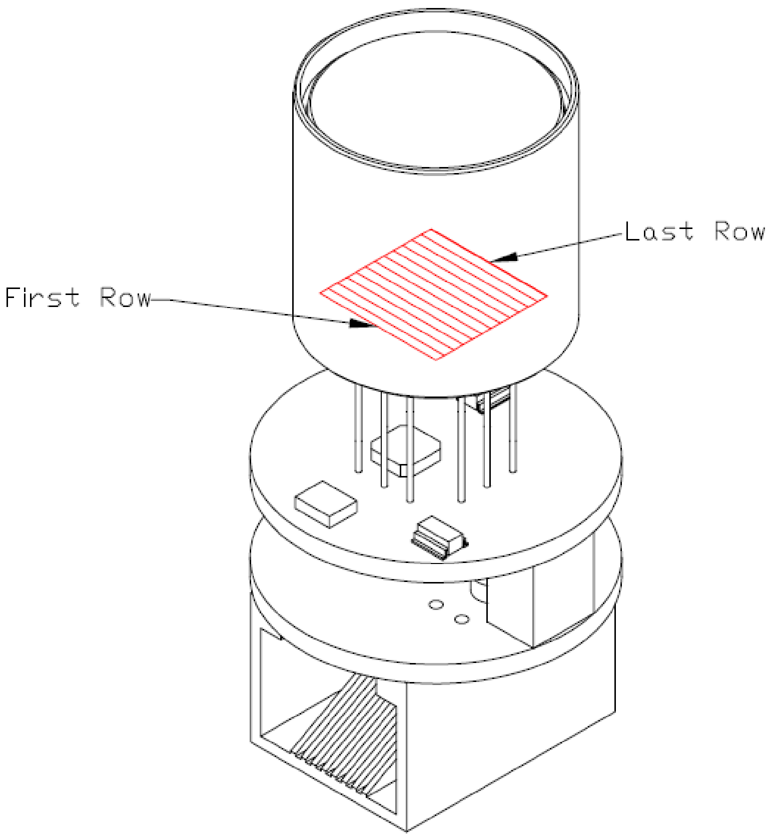
Power connection at Ethernet device:



1	VSS	(-)	GND
2	VDD	(+)	Supply (+3.3V DC)

Power Supply: **3.3** VDC +/- 5%, 300mA

HTPA64x62L10/0.8M(UDP) Optical Orientation of Pixels:



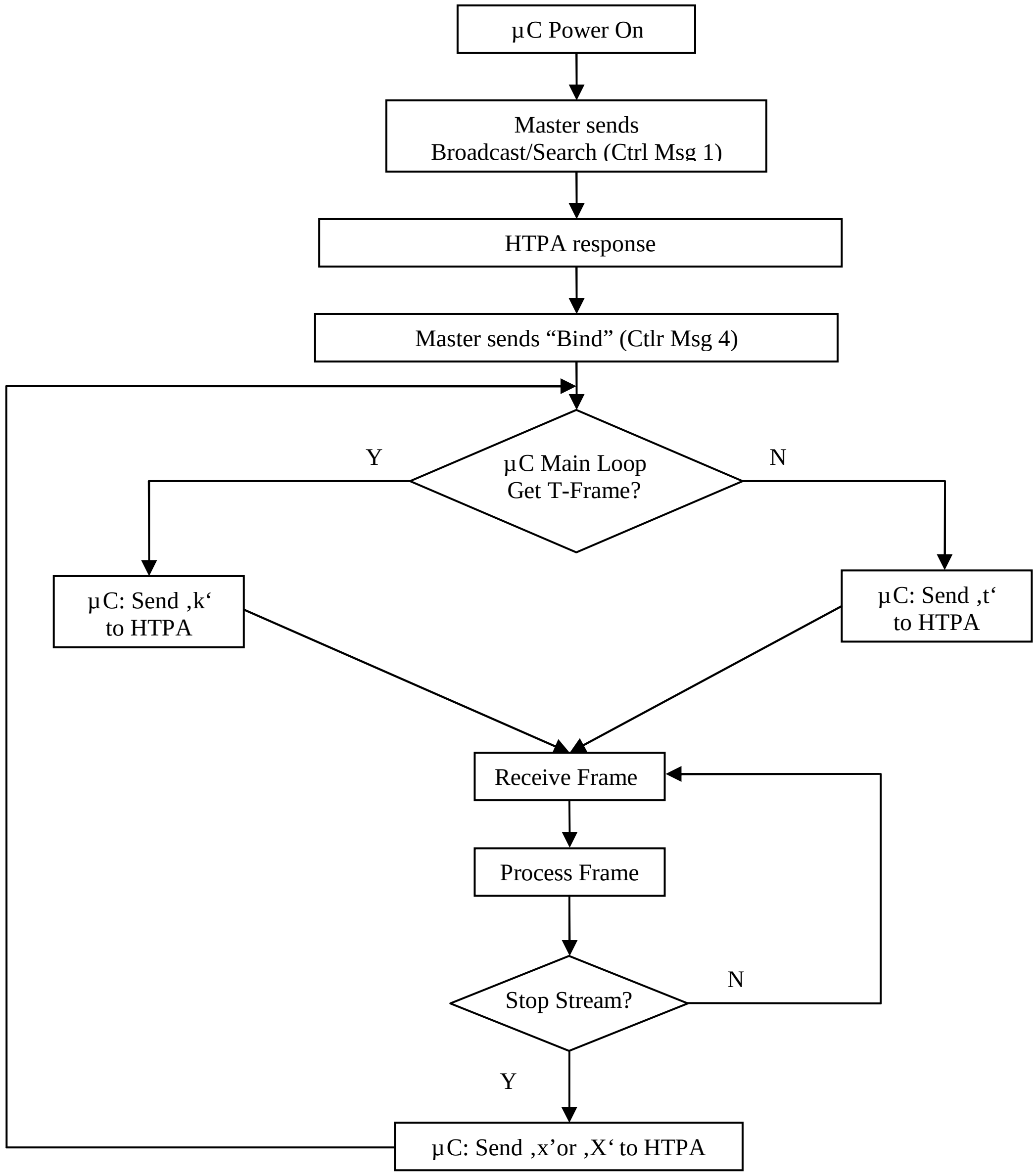
HEIMANN Sensor GmbH
Maria-Reiche-Str. 1
D-01109 Dresden / Germany

Contact / Customer Support
Phone 49 (0) 6123 60 50 30
Fax 49 (0) 6123 60 50 39

Internet
www.heimannsensor.com
mail: info@heimannsensor.com

Communication and Timings:

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



Communication:

Communication via Terminal / UDP

Sent Char	HTPA8x8	HTPA16x16	HTPA32x31 HTPA64x62	Result/Received message
'a'	X	X	X	Decreases the operating frequency of the array
'A'	X	X	X	Increases the operating frequency of the array
'b'	X	X	X	Measure VDD (referenced to VREF1225)
'C'	X	X		Capture single voltage frame. Use ADC of ASIC. Output via ASCII if sent via UART, binary if sent via UDP.
'c'	X	X	X	Capture single voltage frame. Use ADC of µC. Output via ASCII if sent via UART, binary if sent via UDP.
'd'/'D'	X	X		Toggle POR_N
'f'	X	X	X	Toggle Resetbit
'F'	X	X		Analog operating point is at start of AD-range, only positive signals convertable
'G'	X	X		Analog operating point is in the middle of AD-range, positive and negative signals convertable
'g'	X	X		Analog operating point is at end of AD-range, only negative signals convertable
'h'	X	X	X	pushes binary EEDATA out
'i'			X	Read single voltage frame. Output in ASCII format. Serial order: Pixeldata[K*10], el. Offsets, Ambient Temperature
'I'			X	Read single temperature frame. Output in ASCII format. Serial order: Pixeldata[K*10], el. Offsets, Ambient Temperature
'J'	X	X	X	Toggle Amplification
'k'	X	X	X	Read single temperature frame. Output in binary format.
'K'	X	X	X	send continous binary temperature datastream(µC-ADC)[K*10] Output of a complete cycle in this order: *HTPA 8x8 and HTPA16x16: Pixel0,Pixel1, ….PixelX, el.Offset0, el.Offset1,…, el.OffsetY,PTAT0,PTAT1,…,PTATZ* *HTPA32x31: see Table2.* ***For a detailed Description of the serial order see Table2.*** 16x16 Array: X=255; Y=7; Z=7 — 8x8 Array: X=63; Y=4; Z=4 One dataset has exactly 2 bytes: first the low-Byte is send, then the high-byte. Each Dataset contains the measured Temperature in Kelvin*10. The first 4 datasets *el.Offset0…el.Offset3* after the last Pixel voltage *PixelX* transmit additional the current VDD in the MSB's:

VDD and TAmb for HTPA8x8 and HTPA16x16:

Dataset	Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	…	Bit1	Bit0
elOff0	MSB VDD	…	…	Bit12 VDD	MSB elOff0	…	…	…	LSB elOff0
elOff1	Bit11 VDD	…	…	Bit8 VDD	MSB elOff1	…	…	…	LSB elOff1
elOff2	Bit7 VDD	…	…	Bit4 VDD	MSB elOff2	…	…	…	LSB elOff2
elOff3	Bit3 VDD	…	…	LSB VDD	MSB elOff3	…	…	…	LSB elOff3

The Sensor temperature is available in the datasets after *el.Offset3* :

Dataset	Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	…	Bit1	Bit0
elOff3+1	MSB TAmb	…	…	Bit12 TAmb	MSB elOff3+1	…	…	…	LSB elOff3+1
elOff3+2	Bit11 TAmb	…	…	Bit8 TAmb	MSB elOff3+2	…	…	…	LSB elOff3+2
elOff3+3	Bit7 TAmb	…	…	Bit4 TAmb	MSB elOff3+3	…	…	…	LSB elOff3+3
elOff3+4	Bit3 TAmb	…	…	LSB TAmb	MSB elOff3+4	…	…	…	LSB elOff3+4
elOff3+5	0	0	0	0	MSB elOff3+5	…	…	…	LSB elOff3+5

Sent Char	HTPA8x8	HTPA16x16	HTPA32x31 HTPA64x62	Result/Received message
'l'	X	X	X	Get Ambient Temperature (Calculates the Ambient Temperature from the **last measured** Frame)
'm'	X	X	X	Toggle usage of µC-Buffer for el. Offsets (Stack depth = 64 for HTPA8x8 and HTPA16x16; Stack depth = 32 for HTPA32x31)
'M'	X	X	X	Shows current and calibration settings. Device prints the following stream: **"HTPA series responsed! I am Arraytype X"** Possible values for X: "0"=HTPA8x8, "1"=HTPA16x16, "3"=HTPA32x31 **"Firmware v.X.XX written by B.Forg; 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: "low" or "high" **"MAC-ID: X IP: Y DevID: Z\r\n"** (Only Ethernet devices show a MAC-ID, DevID is shown in any case) 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* EXP *Z* "**

Table 1a: Control Characters

Communication via Terminal / UDP				
Sent Char	**HTPA8x8**	**HTPA16x16**	**HTPA32x31 HTPA64x62**	**Result/Received message**
'o'		X	X	Use external reference voltages
'O'		X	X	Use internal reference voltages
'q'/'Q'	X	X	X	Allow Changes (required for Calibration)
't'	X	X	X	Continuous binary voltage data of the µC-ADC is transmitted. Output of a complete cycle in this order: *HTPA 8x8 and HTPA16x16: Pixel0,Pixel1, ….PixelX, el.Offset0, el.Offset1,…, el.OffsetY,PTAT0,PTAT1,…,PTATZ* *HTPA32x31: see Table2.* ***For a detailed Description of the serial order see Table2.*** 16x16 Array: X=255; Y=7; Z=7 8x8 Array: X=63; Y=4; Z=4 One dataset has exactly 2 bytes: first the low-Byte is send, then the high-byte. Each Dataset contains the ADC-Data in digits and The first 4 datasets *el.Offset0…el.Offset3* after the last Pixel voltage *PixelX* transmit additional the current VDD in the MSB's: **VDD for HTPA8x8 and HTPA16x16:**

Dataset	Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	…	Bit1	Bit0
elOff0	MSB VDD	…	…	Bit12 VDD	MSB elOff0	…	…	…	LSB elOff0
elOff1	Bit11 VDD	…	…	Bit8 VDD	MSB elOff1	…	…	…	LSB elOff1
elOff2	Bit7 VDD	…	…	Bit4 VDD	MSB elOff2	…	…	…	LSB elOff2
elOff3	Bit3 VDD	…	…	LSB VDD	MSB elOff3	…	…	…	LSB elOff3

Sent Char	HTPA8x8	HTPA16x16	HTPA32x31 HTPA64x62	Result/Received message
'T'	X	X		Continuous binary data of the ASIC-ADC is transmitted. Output order is equal to 't'.
'u'	X	X		Continuous binary data of the ASIC-ADC is transmitted. PTAT-Voltages are sampled with the uC-ADC. Output order is equal to 't'.
'U'	X	X		Capture single frame. Use ADC of ASIC. Output via ASCII. PTAT-Voltages are sampled with the uC-ADC.
'v'	X	X	X	Announce IP (Only Ethernet devices)
'V'	X	X	X	Device awaits control message (only non-Ethernet devices)
'w'	X	X	X	shows Calibration-constants
'W'	X	X	X	Calibration. ATTENTION! Old Dataset cannot be restored!
'x'	X	X	X	Stops Stream without prompt.
'X'	X	X	X	Stops Stream by sending "STOP!\r\n"
'y'	X	X	X	switch off ASIC-Supply (5V)
'Y'	X	X	X	switch on ASIC-Supply (5V)

Table 1b: Control Characters (continuation)

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

Serial order of data in stream:

HTPA64x62 Temperature Mode	
Dataset	Value
0	Temperature of Pixel0 in K*10
1	Temperature of Pixel32 in K*10
2	Temperature of Pixel1 in K*10
3	Temperature of Pixel33 in K*10
...	...
62	Temperature of Pixel31 in K*10
63	Temperature of Pixel63 in K*10
64	Temperature of Pixel64 in K*10
65	Temperature of Pixel96 in K*10
...	...
3967	Temperature of Pixel3967 in K*10
3968	elOff0 in digits
3969	elOff32 in digits
3970	elOff1 in digits
3971	elOff33 in digits
...	...
4030	elOff31 in digits
4031	elOff63 in digits
4032	least significant 12 bits of VDD
4033	most significant 4 bits of VDD
4034	least significant 12 bits of TAmb
4035	most significant 4 bits of TAmb
4036	no value, ignore
4037	no value, ignore
...	...
4047	no value, ignore
4048	PTAT0 in digits
4049	PTAT1 in digits
4050	PTAT2 in digits
...	...
4063	PTAT15 in digits
4064	no value, ignore
...	no value, ignore
4095	no value, ignore

HTPA64x62 Voltage Mode	
Dataset	Value
0	absolute Voltage of Pixel0 in digits
1	absolute Voltage of Pixel32 in digits
2	absolute Voltage of Pixel1 in digits
3	absolute Voltage of Pixel33 in digits
...	...
62	absolute Voltage of Pixel31 in digits
63	absolute Voltage of Pixel63 in digits
64	absolute Voltage of Pixel64 in digits
65	absolute Voltage of Pixel96 in digits
...	...
3967	absolute Voltage of Pixel3967 in digits
3968	elOff0 in digits
3969	elOff32 in digits
3970	elOff1 in digits
3971	elOff33 in digits
...	...
4030	elOff31 in digits
4031	elOff63 in digits
4032	least significant 12 bits of VDD
4033	most significant 4 bits of VDD
4034	no value, ignore
4035	no value, ignore
4036	no value, ignore
4037	no value, ignore
...	...
4047	no value, ignore
4048	PTAT0 in digits
4049	PTAT1 in digits
4050	PTAT2 in digits
...	...
4063	PTAT15 in digits
4064	no value, ignore
...	no value, ignore
4095	no value, ignore

Table 2: Serial order of data in stream

Each dataset consists of a 16 bit value. If a frame consists out of more than one packet, packets are appended.

Pixel Map:

0	1	2	3	…	63
64	65	66	67	…	127
128	129	130	131	…	191
…	…	…	…	…	…
3904	3905	3906	3907	…	3967

Table 3: Pixelmap

Packets (UDP, only Ethernet device):

Number of packets	Packet size [byte]	HTPA type	Comments
1	144	HTPA8x8	-
1	544	HTPA16x16	-
2	1058+1054	HTPA32x31	see below for details
8	1101+621	HTPA64x62	see below for details

Packet details for HTPA64x62		
Packet No.	Packet size	Packet contains
1	1101	Packet index 1 (8bit), data of Pixel0-Pixel550
2	1101	Packet index 2 (8bit), data of Pixel551-Pixel1101
3	1101	Packet index 3 (8bit), data of Pixel1102-Pixel1652
4	1101	Packet index 4 (8bit), data of Pixel1653-Pixel2203
5	1101	Packet index 5 (8bit), data of Pixel2204-Pixel2754
6	1101	Packet index 6 (8bit), data of Pixel2755-Pixel3305
7	1101	Packet index 7 (8bit), data of Pixel3306-Pixel3856
8	621	Packet index 8 (8bit), data of Pixel3857 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”.

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
Low	*"low"*
High	*"high"*

[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"

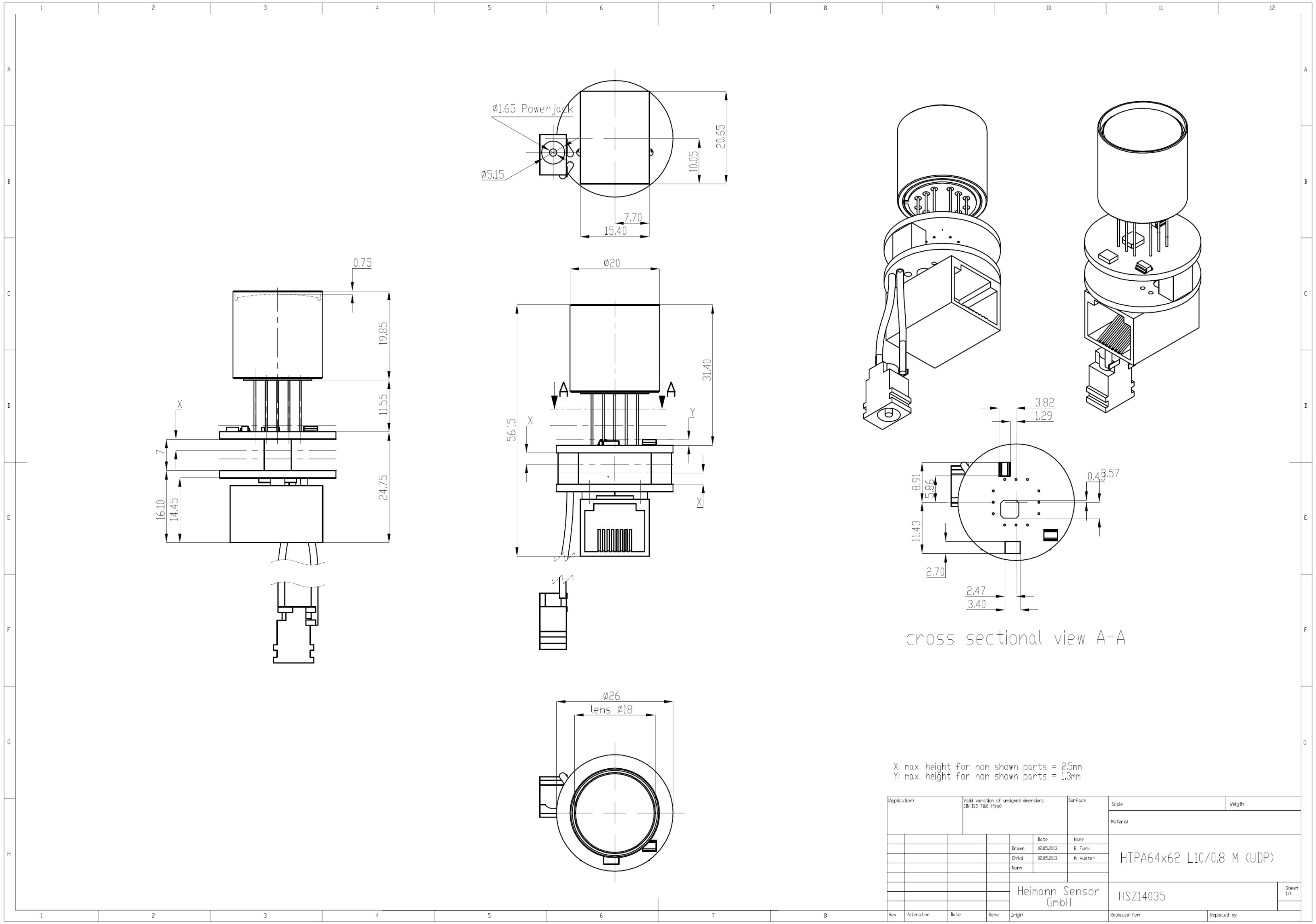
Message4: "Bind HTPA series device" (only Ethernet device)
Result: Device enables hardware IP filter. Only packets from sender IP, ARP's, DHCP requests and Broadcasts are accepted. Device accepts now the control characters listed in **Table 1.**
Answer: "HW Filter is **[IP]** MAC **[MACID]**\n\r""
Insert 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 eDevice ID can be used for customer specific purposes.
Answer:	"DeviceID changed to **[DEVID]**\r\n"

Dimensions:



HEIMANN Sensor GmbH
Maria-Reiche-Str. 1
D-01109 Dresden / Germany

Contact / Customer Support
Phone 49 (0) 6123 60 50 30
Fax 49 (0) 6123 60 50 39

Internet
www.heimannsensor.com
mail: info@heimannsensor.com