Interface Protocol

HD12xCT3
HM24PCT2
HR12PCT2
HW12PCT3
K1R87PCT2
KR87xCT2
LD86xCT3
LM89xCT2
LQ40PCT3
LW86xCT3
TM55xCT2
TQ66PCT3
TR55xCT2
UM55xCT2
XR96xCT2
YM22PCT2
YR24PCT2

Version 6

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1. Sensor List

The following Sensors are described in this data sheet:

- HD12xCT3
- HM24PCT2
- HR12PCT2
- HW12PCT3
- K1R87PCT2
- KR87xCT2
- LD86xCT3
- LM89xCT2
- LQ40PCT3
- LW86xCT3
- TM55xCT2
- TQ66PCT3
- TR55xCT2
- UM55xCT2
- XR96xCT2
- YM22PCT2
- YR24PCT2

2. Serial Interface

The Sensors can be addressed via V24-Protokoll. The Teach-In Input serves as an RxD line, and the Switching Output as a TxD line.

The Interface has to be set to 9600Baud,N,8,1.

2.1. TxD-Line

The Switching Output is implemented as a positive switching Output (P) against +Ub (PNP-version). The A232 Adapter Box must be interconnected for direct connection to the PC Interface. With direct Connection to a SPS-input, the Connection box is not necessary.

2.2. RxD Line

The Teach-In Input (pin 2) serves as an RxD line.
Recognition of a logical 1 at input pin 2: U_{Pin2} = +8 V to Ub
Recognition of a logical 0 at input pin 2: U_{Pin2} = 0 to +3 V

2.3. Transmission Format

A pause of greater than 300 ms must be included between each of the transmitted characters.
All characters are transmitted in ASCII format.
All data values are transmitted in hexadecimal format as ASCII characters.

2.4. Command Overview

Command	**Command Character**
Teach-In	/T
Activate Normal Teach-In (default setting)	/N
Activate Minimum Teach-In	/I
Activate Time Delay	/A
Set Register Pointer	/P
Change Register Content	/D
Delete Bit from Register	/R
Set Bit in Register	/S

Read out complete Register Content	/W

2.5. Teach-In

2.5.1. Teaching the Sensor /T

Signal to the Sensor:

	Date			Length
	ASCII	**Dez**	**Hex**	**Byte**
Start character	/	47	2F	1
Command character	T	84	54	1

Sensor response:

Sensor response:	Date			**Länge**
	ASCII	**Dec**	**Hex**	**Bytes**
Start character	/	47	2F	1
Command character	T	84	54	1
Teach-In status	1	49	31	1
Teach-In value 1		xx	xx	2
Separator	:	58	3A	1
Teach-In value 2		xx	xx	2
Terminator	.	46	2E	1
LF		10	0A	1
CR		13	0D	1

Example: Data to Sensor:/T ➔ Response from Sensor: /T1xx:xx.

2.5.2. Setting the Teach-In Mode

Activating Normal Teach-In /N

Signal to the Sensor:

Date			Remark
ASCII	Decimal	Hex	
/	47	2F	Start character
N	84	54	Command character

Sensor response:

Date			Remark
ASCII	Decimal	Hex	
/	47	2F	Start character
N	78	4E	Command character
.	46	2E	Stop character
	10	0A	LF
	13	0D	CR

Example: Data to Sensor: /N ➔ Response from Sensor: /N.

Activate Minimum Teach-In Mode /I

Signal to theSensor:

Date			Remark
ASCII	Decimal	Hex	
/	47	2F	Start character
I	73	49	Command character

Sensor response:

Date			Remark
ASCI	Decimal	Hex	

I			
/	47	2F	Start character
I	73	49	Command character
.	46	2E	Stop character
	10	0A	LF
	13	0D	CR

Example: Data to Sensor: /I ➔ Response from Sensor: /I.

2.5.3. Adjust switching threshold one digit /+ , /-

With this command, the Sensor's switching threshold (ONL(22h), OFFL(21h)) can be shifted up or down, one digit at a time.
Hysteresis (ONL-OFFL) remains unchanged.

Signal to Sensor for adjusting the switching threshold up:

Date			**Remark**
ASCII	**Decimal**	**Hex**	
/	47	2F	Start character
+	43	2B	Command

Response from Sensor:

Date			**Remark**
ASCII	**Decimal**	**Hex**	
/	47	2F	Start character
+	43	2B	Command echo
OFFLh	xh	xh	New content of OFFL (21h) OFFL = OFFLh *16+ OFFLl
OFFLl	xl	xl	
:	58	3A	Separator
ONLh	dh	dh	New content of ONL (22h) ONL = ONLh *16+ ONLl

ONLl	dl	dl	
.	46	2E	Stop character
	10	0A	LF
	13	0D	CR

Signal to Sensor for adjusting the switching threshold down:

Date			Remark
ASCII	**Decimal**	**Hex**	
/	47	2F	Start character
-	43	2B	Command

Response from Sensor:

Date			Remark
ASCII	**Decimal**	**Hex**	
/	47	2F	Start character
-	43	2B	Command echo
OFFLh	xh	xh	New content of OFFL (21h) OFFL = OFFLh *16+ OFFLl
OFFLl	xl	xl	
:	58	3A	Separator
ONLh	dh	dh	New content of ONL (22h) ONL = ONLh *16+ ONLl
ONLl	dl	dl	
.	46	2E	Stop character
	10	0A	LF
	13	0D	CR

2.6. Time Delay

2.6.1. Activating Time delay /A

Signal to the Sensor:

Date			Remark
ASCII	Decimal	Hex	
/	47	2F	Start character
A	65	41	Command

Response from Sensor:

Date			Remark
ASCII	Decimal	Hex	
/	47	2F	Start character
A	65	41	Command character
.	46	2E	Stop character
	10	0A	LF
	13	0D	CR

Example: Data to Sensor: /A ➔ Response from Sensor: /A.

2.6.2. Deactivating Time Delay /a

Signal to the Sensor:

Date			Remark
ASCII	Decimal	Hex	
/	47	2F	Start character
a	97	61	Command character

Response from Sensor:

Date			Remark
ASCII	Decimal	Hex	
/	47	2F	Start character
a	97	61	Command character
.	46	2E	Stop character
	10	0A	LF
	13	0D	CR

Example: Data to Sensor: /a ➔ Response from Sensor: /a.

2.7. Editing the Register Directly

2.7.1. Setting the Register Pointer /Pxx

A pointer can be set to the register in the Sensor with this command. Current register content is returned as an echo.
The register indexed with this command can then be edited using the following commands:

Re-describe register contents: /D
Delete bit from the register: /Rb (b = bit position 0 ... 7)
Set bit in the register: /Rb (b = bit position 0 ... 7)

Signal to the Sensor:

Date			Remark
ASCII	Decimal	Hex	
/	47	2F	Start character
P	87	57	Command
xh	x	x	Register address in hex
xl	x	x	R=xh*16+xl

Calculation of xx:

xx = R+16

Where R+16 > 255:

xx=R-240

Key: R = actual register address

Response from Sensor:

Date			Remark
ASCII	Decimal	Hex	
/	47	2F	Start character
P	87	57	Command echo
xh	xh	xh	Register address in hex
xl	xl	xl	R=xh*16+xl
:	58	3A	Separator
dh	dh	dh	Content of register in hex
dl	dl	dl	D=dh*16+dl
.	46	2E	Stop character
	10	0A	LF
	13	0D	CR

2.7.2. Changing Register Content /Dxx

The register addressed with /Pxx can be edited with this command.

Signal to the Sensor:

Date			Remark
A	Decimal	Hex	

S CI I			
/	47	2F	Start character
D	68	44	Command
dd	x	x	New register content

Calculation of dd:

dd = D+48

Where D+48 > 255:

dd=R-208

Example 1:

If date 0 is to be written to the memory location addressed with /P, dd is calculated as follows:

dd = 0 +48 = 48

➔ Command sequence to Sensor: /D0 (because 0 is ASCI 48)

Example 2:

If date 250 is to be written to the memory location addressed with /P, dd is calculated as follows:

dd = 250 +48 = 298 ➔ greater than 255 ! thus dd = 250 -208 = 42

➔ Command sequence to Sensor: /D* (because * is ASCI 42)

Key: D = actual register contents

Response from Sensor:

Date			Remark
A S CI I	**Decimal**	**Hex**	
/	47	2F	Start character
D	68	44	Command echo
xh	xh	xh	Register address in hex
xl	xl	xl	R=xh*16+xl
:	58	3A	Separator
dh	dh	dh	New register content
dl	dl	dl	D=dh*16+dl
.	46	2E	Stop character
	10	0A	LF
	13	0D	CR

2.7.3. Deleting a Bit from the Register /Rb

The register addressed with /Pxx can be deleted bit by bit with this command.

Signal to the Sensor:

Date			Remark
ASCII	Decimal	Hex	
/	47	2F	Start character
R	82	52	Command
b	x	x	Bit location to be deleted

allowed area from b : 0 (ASCII48) .. 7 (ASCII 55)

Example:

If bit 3 in the memory location previously addressed with /P is to be deleted, the following command sequence must be transmitted to the sensor:

➔ Command sequence to Sensor: /R3

Response from Sensor:

Date			Remark
ASCII	Decimal	Hex	
/	47	2F	Start character
R	82	52	Command echo
xh	xh	xh	Register address in hex
xl	xl	xl	R=xh*16+xl
:	58	3A	Separator
dh	dh	dh	New register content
dl	dl	dl	D=dh*16+dl
.	46	2E	Stop character
	10	0A	LF
	13	0D	CR

2.7.4. Setting a Bit in the Register /Sb

The register addressed with /Pxx can be set bit by bit with this command.

Signal to the Sensor:

Date	Remark

ASCII	Decimal	Hex	
/	47	2F	Start character
S	83	53	Command
b	x	x	Bit location to be deleted

Permissible range for b: 0 (ASCII48) to 7 (ASCII 55)

Example:

If bit 7 in the memory location previously addressed with /P is to be set, the following command sequence must be transmitted to the sensor:

➔ Command sequence to Sensor: /S3

Response from Sensor:

Date			Remark
ASCII	Decimal	Hex	
/	47	2F	Start character
S	83	53	Command echo
xh	xh	xh	Register address in hex
xl	xl	xl	R=xh*16+xl
:	58	3A	Separator
dh	dh	dh	New register content
dl	dl	dl	D=dh*16+dl
.	46	2E	Stop character
	10	0A	LF
	13	0D	CR

2.7.5. Selecting All Register Content /W

The Sensor reads out all register content via the serial port. Usable data are within a range of 20h to 38h.

Signal to the Sensor:

Date	Remark

ASCII	Decimal	Hex	
/	47	2F	Start character
W	87	57	Command

Response from Sensor:

Date			Remark
ASCII	Decimal	Hex	
/	47	2F	Start character
W	87	57	Command echo
8	56	38	Sensor version
6	52	34	
0	48	30	Sensor group
7	55	37	
0	48	30	Sensor type
1	49	31	
	10	0A	LF
	13	0D	CR
0	48	30	Register 00
0	48	30	
:	58	3A	Separator
x	x	x	Content of register 00
x	x	x	
	10	0A	LF
	13	0D	CR
0	48	30	Register 01
1	49	31	
:	58	3A	Separator
x	x	x	Content of register 01
x	x	x	
	10	0A	LF
	13	0D	CR
....			

Example: Data to Sensor: /W

➔ Response from Sensor: /W840701<CR><LF>
00:xx<CR><LF>

01:xx<CR><LF>
..
aa:dd<CR><LF>
..
FE:xx. <CR><LF>
FF:xx. <CR><LF>

Key:

aa: actual register address
dd: date of the corresponding register

2.7.6. Resetting the Sensor to its Factory Default Settings

If a value of 0 is written to the VERSION register (2Fh), the Sensor executes a reset which returns it to its factory default settings. The following command sequence, according to the above described procedure, is required:

xx = R+16 ➔ xx=2Fh+16_d=63 ➔ ASCII 63 = “?”

➔ Sequence to be sent: /P?

The address pointer is now set to the VERSION register (2Fh).

Write a new value to the register subsequently.

➔ Sequence to be sent: /D0

The VERSION register (2Fh) has now been set to 0.

It then transmits the following sequence once:

5.2.0107

The Sensor is reset to its factory default settings.

2.8. Examples

2.8.1. Example 1: Read out the Sensor's current set analog signal value

The SIGNAL register (34h) contains the Sensor's current analog signal value.

Set the register pointer to 34h.

➔34h +16d=52d+16d=**68d** ➔ ASCII 68 = „D“

To Sensor /PD transmit

The Sensor responds with /PD:dd.

Date of SIGNAL register (34h) is dd (hexadecimal format)

The Sensor's current analog value is dd.

2.8.2. Example 2: Query the Sensor's contamination warning:

The VERSC bit (bit 3) in the FLAGS2 register (38h) contains the status of the contamination warning.

Set the register pointer to 38h.
➔38h +16d=56d+16d=**72d** ➔ ASCII 72 = „H“

To Sensor /PH transmit

The Sensor responds with /PH:dd.

Date of FLAGS2 register is dd (hexadecimal format)

Evaluation of bit 3 from date dd

1 ➔ Contamination warning is activated.
0 ➔ Contamination warning is deactivated.