User Guide

Vaisala K-PATENTS[®] Fieldbus Converter with Moxa UC-2112 hardware **PR-7112**



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1 Introduction

The Vaisala K-PATENTS[®] Fieldbus Converter is designed to make easier connections of Vaisala K-PATENTS[®] instrumentations to Fieldbus and Industrial Ethernet.

Note: The converter can only send data. E.g. it is not possible to change the parameters through the converter.

1.1 Disposal

When wishing to dispose of the converter or any parts thereof, please observe local and national regulations and requirements for the disposal of electrical and electronic equipment.



2 Connections

Fieldbus Converter helps to insert Vaisala K-PATENTS[®] refractometers into Modbus/TCP, Modbus RTU, Ethernet/IP, PROFIBUS, or PROFINET networks. The software runs on a MOXA UC-2112 LX computer PR-7112. The computer has two Ethernet connectors. The one marked as "LAN1" is connected to a Modbus/TCP, Ethernet/IP, or PROFINET capable device (if used in one of these modes), the other one ("LAN2") to a Vaisala K-PATENTS refractometer (or, in case of PR-23, the DTR transmitter). If used in Modbus RTU or PROFIBUS mode, serial port P1 is connected to a Modbus RTU or PROFIBUS network.

The converter gets the data from the refractometer via UDP/IP communication and forwards them via the configured fieldbus protocol. On the "LAN1" port the converter acts as a Modbus/TCP server, Ethernet/IP adapter, or PROFINET device. On serial port P1 the converter acts as Modbus RTU or PROFIBUS slave.

3 Communication protocols

3.1 Modbus/TCP, Modbus RTU modes

If used in Modbus mode, clients can connect and read the registers (use function code 3). The following table shows the Modbus registers.

NAME	ADDRESS	ТҮРЕ	FUNCTION
Sensor A LED	0	FLOAT	Refractometer LED value
Sensor A CCD	2	FLOAT	Image shadow edge position
Sensor A nD	4	FLOAT	Calculated refractive index value
Sensor A T	6	FLOAT	Process temperature
Sensor A Tsens	8	FLOAT	Refractometer internal temperature
Sensor A Traw	10	FLOAT	Process temperature (without bias)
Sensor A RHsens	12	FLOAT	Refractometer internal humidity
Sensor A CALC	14	FLOAT	Calculated concentration value
Sensor A CONC	16	FLOAT	Final concentration value
Sensor A PTraw	18	INT	Raw PT1000 value
Sensor A QF	20	FLOAT	Image quality factor
Sensor A mA	22	FLOAT	mA output value
Sensor A BGLight	24	INT	Background light level
Sensor A Seq	26	INT	Sequence number of measurement
Sensor A Timestamp	28	INT	Time since device start-up
Sensor A Status	30	INT	Refractometer status message
Sensor B LED	32	FLOAT	Refractometer LED value
Sensor B CCD	34	FLOAT	Image shadow edge position
Sensor B nD	36	FLOAT	Calculated refractive index value
Sensor B T	38	FLOAT	Process temperature
Sensor B Tsens	40	FLOAT	Refractometer internal temperature
Sensor B Traw	42	FLOAT	Process temperature (without bias)
Sensor B RHsens	44	FLOAT	Refractometer internal humidity
Sensor B CALC	46	FLOAT	Calculated concentration value
Sensor B CONC	48	FLOAT	Final concentration value
Sensor B PTraw	50	INT	Raw PT1000 value
Sensor B QF	52	FLOAT	Image quality factor
Sensor B mA	54	FLOAT	mA output value
Sensor B BGLight	56	INT	Background light level
Sensor B Seq	58	INT	Sequence number of measurement
Sensor B Timestamp	60	INT	Time since device start-up
Sensor B Status	62	INT	Refractometer status message
All stored values are 4	bytes in size	(either FLO	AT or SIGNED INT).

3

Table 3.1

Status values are transmitted as integers. These are the status messages to each value:

STATUS CODE	STATUS MESSAGE
-1	No status received
0	NORMAL OPERATION
1	EXTERNAL HOLD
2	EXTERNAL WASH STOP
3	HIGH SENSOR HUMIDITY
4	HIGH SENSOR TEMP
5	LOW IMAGE QUALITY
6	LOW TEMP WASH STOP
7	NO OPTICAL IMAGE
8	NO SAMPLE
9	NO SAMPLE/WASH STOP
10	NO SENSOR
11	NO SIGNAL
12	OUTSIDE LIGHT ERROR
13	OUTSIDE LIGHT TO PRISM
14	PRECONDITIONING
15	PRISM COATED
16	PRISM WASH
17	PRISM WASH FAILURE
18	RECOVERING
19	SHORT-CIRCUIT
20	STARTING UP
21	TEMP MEASUREMENT FAULT

Table 3.2

Note: The computer can't handle very frequent Modbus requests. As the refractometer values are updated once per second, it is recommended to request values once per second to avoid overloading the converter.

3.2 Ethernet/IP mode

When used in Ethernet/IP mode, the converter acts as an adapter, and waits for Ethernet/IP scanners to connect. Connection can be set up easily with the provided file "Converter.eds", or manually with the following parameters:

- Port: 0xAF12 (44818)
- 0->T:
 - instance number: 102
 - data size: 0
 - real time format: modeless
 - packet rate: 1000 ms
- T->0:
 - instance number: 101
 - data size: 128
 - real time format: modeless
 - packet rate: 1000 ms
 - connection type: point to point

Note: The *converter.eds* file is part of the converter configurator package (zip) that you can download at https://www.kpatents.com/support/document-downloads/software-for -connectivity-and-communications.

NAME	BYTES	TYPE	FUNCTION
Sensor A LED	0-3	REAL	Refractometer LED value
Sensor A CCD	4-7	REAL	Image shadow edge position
Sensor A nD	8-11	REAL	Calculated refractive index value
Sensor A T	12-15	REAL	Process temperature
Sensor A Tsens	16-19	REAL	Refractometer internal temperature
Sensor A Traw	20-23	REAL	Process temperature (without bias)
Sensor A RHsens	24-27	REAL	Refractometer internal humidity
Sensor A CALC	28-31	REAL	Calculated concentration value
Sensor A CONC	32-35	REAL	Final concentration value
Sensor A PTraw	36-39	DINT	Raw PT1000 value
Sensor A QF	40-43	REAL	Image quality factor
Sensor A mA	44-47	REAL	mA output value
Sensor A BGLight	48-51	DINT	Background light level
Sensor A Seq	52-55	DINT	Sequence number of measurement
Sensor A Timestamp	56-59	DINT	Time since device start-up
Sensor A Status	60-63	DINT	Refractometer status message
Sensor B LED	64-67	REAL	Refractometer LED value
Sensor B CCD	68-71	REAL	Image shadow edge position
Sensor B nD	72-75	REAL	Calculated refractive index value
Sensor B T	76-79	REAL	Process temperature
Sensor B Tsens	80-83	REAL	Refractometer internal temperature
Sensor B Traw	84-87	REAL	Process temperature (without bias)
Sensor B RHsens	88-91	REAL	Refractometer internal humidity
Sensor B CALC	92-95	REAL	Calculated concentration value
Sensor B CONC	96-99	REAL	Final concentration value
Sensor B PTraw	100-103	DINT	Raw PT1000 value
Sensor B QF	104-107	REAL	Image quality factor
Sensor B mA	108-111	REAL	mA output value
Sensor B BGLight	112-115	DINT	Background light level
Sensor B Seq	116-119	DINT	Sequence number of measurement
Sensor B Timestamp	120-123	DINT	Time since device start-up
Sensor B Status	124-127	DINT	Refractometer status message

The 128-byte data of the T->O instance contains the following values:

Table 3.3

Status values are transmitted as integers. Please see Table 3.2 on page 4 for status codes.

3.3 PROFIBUS mode

Please see Table 3.3 for the location of the measured values in the 128-byte wide data field. With only one refractometer configured in an Engineering Tool only the first 64 bytes are transmitted. With two refractometers configured in an Engineering Tool and one refractometer configured on Converter, the last 64 bytes are invalid (all fields are zero, except Sensor B Status = -1 - "No status").

		300 (Configuration) PROFIBUS						×
		rt <u>P</u> LC <u>V</u> iew <u>O</u> ptions <u>W</u> ind					-	Ξ×
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==(0)) UR						Find:	ntai
1		<u>^</u>						
2		315-2 PN/DP	PROF	BUS: DP mas	ter system (1)		Profile: Standard	•
X1 X2	PN-IC		1101	1003. 01 1103			E- # PROFIBUS DP	^
	P1 R Port 1			(3) FJB KP-		🖨 🧰 Additional Field Devices	
	P2 R Port 2						Gwitching Devices	
12		•		DP.	NORM		Gateway	
							⊞- 🚞 AS-I	
							DP/DP Coupler	
							DP/RS232C Link	
							E-FJB KP-7112	
							2 Bytes Out	
<						> ×	🚺 Ref1: 16 x 4 Bytes In	
-							Ref2: 16 x 4 Bytes In	
-) (3) FJB KP-711	12					i∃- ∰ NT 50 DP/DPS i∃- ∰ DP/DP Coupler, Release 2	
		,			1		Compatible PROFIBUS DP Slaves	
	DPID	Order Number / Designation	I Address	Q Address	Comment		GR Object	
$\frac{1}{2}$	161 147	2 Bytes Out Ref1: 16 x 4 Bytes In	256259	256257		_ ^	E Closed-Loop Controller	
$\frac{2}{3}$	147	-> Ref1: 16 x 4 Bytes In	280253			-	🗄 🧰 Configured Stations	
4	147	-> Ref1: 16 x 4 Bytes In	264267			-	DP V0 slaves DP/AS-i	
5	147	-> Ref1: 16 x 4 Bytes In	268271				DP/AS-1 DP/PA Link	
6	147	-> Reft: 16 x 4 Bytes In	272275			-		
7 8	147 147	-> Ref1: 16 x 4 Bytes In -> Ref1: 16 x 4 Bytes In	276279 280283			-	🕀 🧰 ET 200AL	
9	14:	-> Ref1: 16 x 4 Bytes In	284287			-	🗄 💼 ET 200B	
10	147	-> Ref1: 16 x 4 Bytes In	288291			-	ET 200C ET 200C ET 200co	
11	147	-> Ref1: 16 x 4 Bytes In	292295			_		
12	147	-> Rel1: 16 x 4 Bytes In	296299			-	ET 200iSP	
13	147 147	-> Rei1: 16 x 4 Bytes In -> Rei1: 16 x 4 Bytes In	300303 304307			-	🕀 🧰 ET 200L	
15	147	-> Ref1: 16 x 4 Bytes In	308311			-	ET 200M	
16	147	-> Reft: 16 x 4 Bytes In	312315			-		
17	147	-> Ref1: 16 x 4 Bytes In	316319				ET 2005	
18 19		_				-	ET 2005P	
20		-				-	🗄 🚞 ET 200U	
21						-	ET 200X	
22							E-C Function Modules	
23						-	I IPC	
24 25						-	🕀 🧰 NC	
26		-				-	Network Components	
27						-	E-CONTROL	
28							Bentron Bentron Bentron Bentron	
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Press F1	to get Help.							Chg /

Supported Baud rates: 9600, 19200, 45450, 93750, 187500.

Figure 3.1 Engineering Tool PROFIBUS, one refractometer configuration display

HW	Config - [SIMATIC	300 (Configuration) PROFIBU	[Conv]						
<u>S</u> ta	ition <u>E</u> dit <u>I</u> nse	rt <u>P</u> LC <u>V</u> iew <u>O</u> ptions <u>W</u> ind	low <u>H</u> elp						- 8
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1						Eind	I.		<u>m</u> † 4
2	CPU	315-2 PN/DP				Profile	e: [Standard	
x1	MPI/		PROFIBUS: DF	master system (1)			,		
Х2	PN-IC))FIBUS DP Additional Field Devices	
	P1R Port 1			📸 (3) FJB KP-				Switching Devices	
<u>X2</u>	P2 R 🚦 Port 2	<u> </u>		DP-NORM				1/0	
4	I			DF-HORM			þ.	📄 Gateway	
			-					🗄 🛄 AS-I	
								DP/DP Coupler	
								Universal module	
						~		2 Bytes Out	
					>			🛛 🧧 Ref1:16 x 4 Bytes In	
-								📕 Ref2: 16 x 4 Bytes In	
	(3) FJB KP-71*	12						E T SO DP/DPS	
								DP/DP Coupler, Release 2 Compatible PROFIBUS DP Slaves	
ot	DPID .	Order Number / Designation	I Address Q Addr			-		CIR Object	
_	161	2 Bytes Out	25625	7	^			Closed-Loop Controller	
7	147	Ref1: 16 x 4 Bytes In	256259 280263			E	÷- 🧰	Configured Stations	
, ,	147	-> Ref1: 16 x 4 Bytes In	264267					DP V0 slaves	
5	147	-> Ref1: 16 x 4 Bytes In	268271					DP/AS-i	
ç	147	-> Reft: 16 x 4 Bytes In	272275					DP/PA Link ENCODER	
7	147	-> Reft: 16 x 4 Bytes In	276279					ET 200AL	
9	147	-> Ref1: 16 x 4 Bytes In	280283					ET 200B	
7	147 147	> Ref1: 16 x 4 Bytes In > Ref1: 16 x 4 Bytes In	284287 288291					ET 200C	
17	147	-> Ref1: 16 x 4 Bytes In	292295					ET 200eco	
12	147	-> Ref1: 16 x 4 Bytes In	296299					ET 200iS	
3	147	-> Ref1: 16 x 4 Bytes In	300303					ET 200iSP ET 200L	
4	147	-> Ref1: 16 x 4 Bytes In	304307					ET 200M	
15 16	<u>147</u> 147	-> Ref1: 16 x 4 Bytes In	308311					ET 200pro	
7	147	-> Ref1: 16 x 4 Bytes In -> Ref1: 16 x 4 Bytes In	312315 316319					ET 200R	
8	147	Ref2: 16 x 4 Bytes In	320323					ET 200S	
9	147	-> Rel2: 16 x 4 Bytes In	324327					ET 200SP ET 200U	
27	147	-> Rel2: 16 x 4 Bytes In	328331					ET 2000	
7	14.7	-> Rel2: 16 x 4 Bytes In	332335					Function Modules	
22	147 147	-> Rel2: 16 x 4 Bytes In	336339			B	÷ 🧰	IDENT	
33 14	147	-> Rel2: 16 x 4 Bytes In -> Rel2: 16 x 4 Bytes In	340343 344347				÷ 😐		
7 35	147	-> Ref2: 16 x 4 Bytes In	348351						
8	147	-> Rel2 16 x 4 Bytes In	352355					Network Components Sensor system	
37	147	-> Rel2: 16 x 4 Bytes In	356359					SENTRON	
8	14.7	-> Ref2: 16 x 4 Bytes In	382363					SIMADYN	
9 37	<u>147</u> 147	-> Rel2: 16 x 4 Bytes In	364367 368371			E	÷ 💼	SIMATIC	
7	147	-> Rel2: 16 x 4 Bytes In -> Rel2: 16 x 4 Bytes In	372375					SIMODRIVE	
22	147	-> Rel2: 16 x 4 Bytes In	376379				ŧ	SIMOREG	
23	147	-> Rel2: 16 x 4 Bytes In	387383						
34									-
5 I					~				
									Chq

Figure 3.2 Engineering Tool PROFIBUS, two refractometer configuration display

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1	able <u>E</u> dit		Variable View	Options Window	Help _ & ×
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1	Address	Symbol	Display format	Status value	Modify value
1	ID 256	"LED_1"	FLOATING_POINT	9.92	
2	ID 260	"CCD_1"	FLOATING_POINT	93.367	
3	ID 264	"ND_1"	FLOATING_POINT	1.298538	
4	ID 268	"T_1"	FLOATING_POINT	29.63	
5	ID 272	"TSENS_1"	FLOATING_POINT	34.5	
6	ID 276	"TRAW_1"	FLOATING_POINT	29.63	
7	ID 280	"RHSENS_1"	FLOATING_POINT	26.6	
8	ID 284	"CALC_1"	FLOATING_POINT	-25.30163	
9	ID 288	"CONC_1"	FLOATING_POINT	0.0	
10	ID 292	"PTRAW_1"	DEC	L#105240	
11	ID 296	"QF_1"	FLOATING_POINT	28.22266	
12	ID 300	"MA_1"	FLOATING_POINT	0.0	
13	ID 304	"BGLIGHT_1"	FLOATING_POINT	DW#16#0000003	
14	ID 308	"SEQ_1"	DEC	L#109764	
15	ID 312	"TIMESTMP_1"	DEC	L#10976424	
16	ID 316	"STATUS_1"	DEC	L#0	
17	ID 320	"LED_2"	FLOATING_POINT	9.92	
18	ID 324	"CCD_2"	FLOATING_POINT	93.367	
19	ID 328	"ND_2"	FLOATING_POINT	1.298538	
20	ID 332	"T_2"	FLOATING_POINT	29.63	
21	ID 336	"TSENS_2"	FLOATING_POINT	34.5	
22	ID 340	"TRAW_2"	FLOATING_POINT	29.63	
23	ID 344	"RHSENS_2"	FLOATING_POINT	26.6	
24	ID 348	"CALC_2"	FLOATING_POINT	-25.30163	
25	ID 352	"CONC_2"	FLOATING_POINT	0.0	
26	ID 356	"PTRAW_2"	DEC	L#105240	
27	ID 360	"QF_2"	FLOATING_POINT	28.22266	
28	ID 364	"MA_2"	FLOATING_POINT	0.0	
29	ID 368	"BGLIGHT_2"	FLOATING_POINT	DW#16#0000003	
30	ID 372	"SEQ2"	DEC	L#109764	
31	ID 376	"TIMESTMP_2"	DEC	L#10976424	
32	ID 380	"STATUS_2"	DEC	L#0	
33					

Figure 3.3 Engineering Tool, two refractometer measurement display

Note: The associated GSD file (VAI_4224.GSD) is part of the converter configurator package RefConverterAssistant_2_0 (.zip) that you can download at https://www.kpatents.com/support /document-downloads/software-for-connectivity-and-communications.

3.4 PROFINET mode

Please see Table 3.3 for the location of the measured values in the 128-byte wide data field. The Converter always send the whole 128-byte data field. With only one Refractometer configured the last 64 bytes are invalid (all fields are zero, except Sensor B Status = -1 -"No status").

The default station name stored in the GDSML file is "reffjb1", therefore it is advised to set this name in Refractometer Converter Assistant, because the engineering tools (eg.: TIA Portal) will use this name as default.

Note: The associated GSDML file (GSDML-V2.35-Vaisala-FJB-20190829.xml) is part of the converter configurator package RefConverterAssistant_2_0 (.zip) that you can download at https://www.kpatents.com/support/document-downloads/software-for-connectivity-and-communications.

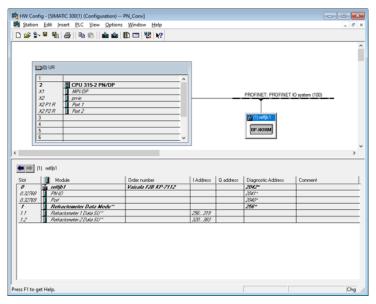


Figure 3.4 Engineering Tool PROFINET, two refractometers configuration display

- 1	Table Edit		Variable View	Options Window	
-12				× • • •	St et al et a
f	10.	Symbol	Display format	Status value	Modify value
1	ID 256	"LED_1"	FLOATING_POINT	9.92	
2	ID 260	"CCD_1"	FLOATING_POINT	93.367	
3	ID 264	"ND_1"	FLOATING_POINT	1.298538	
4	ID 268	"T_1"	FLOATING_POINT	29.63	
5	ID 272	"TSENS_1"	FLOATING_POINT	34.5	
6	ID 276	"TRAW_1"	FLOATING_POINT	29.63	
7	ID 280	"RHSENS_1"	FLOATING_POINT	26.6	
8	ID 284	"CALC_1"	FLOATING_POINT	-25.30163	
9	ID 288	"CONC_1"	FLOATING_POINT	0.0	
10	ID 292	"PTRAW_1"	DEC	L#105240	
11	ID 296	"QF_1"	FLOATING_POINT	28.22266	
12	ID 300	"MA_1"	FLOATING_POINT	0.0	
13	ID 304	"BGLIGHT_1"	FLOATING_POINT	DW#16#0000003	
14	ID 308	"SEQ_1"	DEC	L#109764	
15	ID 312	"TIMESTMP_1"	DEC	L#10976424	
16	ID 316	"STATUS_1"	DEC	L#0	
17	ID 320	"LED_2"	FLOATING_POINT	9.92	
18	ID 324	"CCD_2"	FLOATING_POINT	93.367	
19	ID 328	"ND_2"	FLOATING_POINT	1.298538	
20	ID 332	"T_2"	FLOATING_POINT	29.63	
21	ID 336	"TSENS_2"	FLOATING_POINT	34.5	
22	ID 340	"TRAW_2"	FLOATING_POINT	29.63	
23	ID 344	"RHSENS_2"	FLOATING_POINT	26.6	
24	ID 348	"CALC_2"	FLOATING_POINT	-25.30163	
25	ID 352	"CONC_2"	FLOATING_POINT	0.0	
26	ID 356	"PTRAW_2"	DEC	L#105240	
27	ID 360	"QF_2"	FLOATING_POINT	28.22266	
28	ID 364	"MA_2"	FLOATING_POINT	0.0	
29	ID 368	"BGLIGHT_2"	FLOATING_POINT	DW#16#0000003	
30	ID 372	"SEQ2"	DEC	L#109764	
31	ID 376	"TIMESTMP_2"	DEC	L#10976424	
32	ID 380	"STATUS_2"	DEC	L#0	
33					

Figure 3.5 Engineering Tool PROFINET, two refractometers measurement display

4 Configuration and testing

You may use the reset button to reset Converter to the factory settings. To execute a factory reset hold down the reset button for approximately 10 seconds. During this period the LED named 'User' will be blinking. After 10 seconds, the User LED lights continuously. At this point release the reset button. The device will reboot automatically.

You may connect to Converter at the LAN1 port with Refractometer Converter Assistant as soon as the User LED lights on.

Default IP Address is: 192.168.3.127.

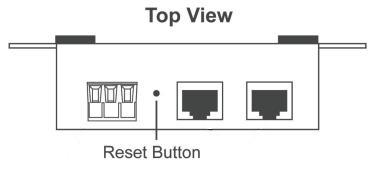


Figure 4.1 Reset button location

4.1 Configuring the fieldbus converter

To configure the fieldbus converter, use software tool "Vaisala Refractometer Converter Assistant". You can download it at https://www.kpatents.com/support/document-downloads /software-for-connectivity-and-communications.

Converter LAN1 IP Address	SW version 1.3		Trace Modbus Register V	alues: Stopped	
192.168.3.127	Connect	Get Modbus Register Values	Start		Stop
Mode		Address	Name	Value	
Modbus TCP Modbus RTU	Ethernet/IP O PROFIbus O PROFInet				
Number Of Sensors Connected					
One Sensor Two Sensors					
Refractometer 1 IP Address	Refractometer 1 Is Sensor "B"				
169.254.43.43	🔿 Yes 💿 No				
Refractometer 2 IP Address	Refractometer 2 Is Sensor "B"				
0.0.0.0	🔾 Yes 🔘 No				
Converter LAN1 Configuration (Modbus TCP / ENIP / PROFInet)	Converter LAN2 Configuration (Refractometer(s))				
IP Address	IP Address				
192.168.3.127	169.254.43.42				
Netmask	Netmask				
255.255.255.0	255.255.255.0				
Gateway	Gateway				
0.0.0.0	0.0.0.0				
MODBUS TCP, RTU					
Word Order (Modbus only)	Byte Order (Modbus only)				
High Word First	O High Byte First				
Low Word First	Low Byte First				
SERIAL (Modbus RTU, PROFIbus)					
Modbus Slave ID PROFIbus Address Baud Rate	Interface				
1 19200	✓ RS-232 ✓				
Parity Data Bits	Stop Bits				
None 🗸 8	✓ 1				
PROFInet					
Station Name		1			
dut	SET THIS CONFIGURATION				

Figure 4.2 Refractometer Converter Assistant

Connect the converter's LAN1 port to a Windows PC. The default IP address of the converter is 192.168.3.127. Configure the PC's Ethernet connection to have an IP address in the same range (192.168.3.x). **Note:** The connection will not work if the computer and the refractometer have exactly the same IP address.

At the top-left corner, enter the IP address of the converter, and press "Connect". The parameters in the left frame should now get automatically filled with the current settings of the converter. Modify according to your needs, and press "SET THIS CONFIGURATION". Now the fieldbus converter will adapt to the changes and restart automatically. This may take 30-60 seconds.

With this software tool you can test the converter's connection to the refractometer in Modbus/TCP mode. Press "Get Register Values" to get all values from the Modbus registers, or "Trace Register Values" to get them constantly updating. When pressing "Get Register Values" for a first time, location of the provided file "modbus daemon settings.json" will be asked for.

You can set the Refractometer and Converter LAN2 Configuration field accordingly to your Refractometer IP address. Please note that the Converter LAN2 IP address need to be in the same range with the Refractometer IP address. When the converter connects to a Vaisala K-PATENTS refractometer or to a DTR transmitter with a direct cable connection, use the netmask 255.255.255.0 for LAN2 as seen on the above image.

Figures 4.3 to 4.7 show the relevant fields for different fieldbus modes. The blue boxes contain the general fields that need to be filled for all the fieldbus modes. The red boxes contain the separate fields for each different fieldbus mode.

Vaisala Refractometer Converter Assist	ant 2.0			>
Converter LAN1 IP Address	SW version 1.3		Trace Modbus Register V	alues: Stopped
192.168.3.127	Connect	Get Modbus Register Values	Start	Stop
Mode		Address	Name	Value
Modbus TCP Modbus RTU Modbus RTU	Ethernet/IP O PROFIbus O PROFInet			
Number Of Sensors Connected				
One Sensor 🔘 Two Sensors				
Refractometer 1 IP Address	Refractometer 1 Is Sensor "B"			
169.254.43.43	🔿 Yes 💿 No			
Refractometer 2 IP Address	Refractometer 2 Is Sensor "B"			
169.254.43.44	🔿 Yes 🔘 No			
Converter LAN1 Configuration (Modbus TCP / ENIP / PROFINEt)	Converter LAN2 Configuration (Refractometer(s))			
IP Address	IP Address			
192.168.3.127	169.254.43.42			
Netmask	Netmask			
255.255.255.0	255.255.255.0			
Gateway	Gateway			
0.0.0.0	0.0.0.0			
MODBUS TCP, RTU				
Word Order (Modbus only)	Byte Order (Modbus only)			
O High Word First	High Byte First			
Low Word First	Low Byte First			
SERIAL (Modbus RTU, PROFIbus)				
Modbus Slave ID PROFIbus Address Baud Rate	Interface			
3 50	RS-485 2-wire			
Parity Data Bits	Stop Bits			
None 💛 8	✓ 1			
PROFInet				
Station Name				
	SET THIS CONFIGURATION			

Figure 4.3 Relevant fields for Modbus TCP mode

Modus TCP Modus RTP Produs TCP Modus RTP Number Of Sensors Connected PROFilus Ore Sensor The Sensors Refractometer 1 P Address Refractometer 1 Is Sensor "B" 159.254.43.43 Refractometer 2 Is Sensor "B" 159.254.43.44 Ves P Address Refractometer 2 Is Sensor "B" 159.254.43.44 Ves P Address 126.254.43.44 P Address 126.254.43.42 P Address 126.254.43.42 P Address 126.254.43.42 Ves No Ves No Ves No Stop Zota Na Refract Na Ves No Ves No Stop Zota Na No Nord Order (Modbus only) Hyla Pyle First Stikul (Modus RTU, PROTibus) Note First Nord Store (Modbus RTU, PROTibus) Note Stop Bis Nord Store (No Stop Bis Nord Source (No No Nord Store (No Stop Bis	Converter LAN1 IP Address	SW version 1.3		Trace Modbus Register V	alues: Stopped
Nume Modus TCP	192.168.3.127	Connect	Get Modbus Register Values	Start	Stop
195. 254.43.43 Ves No Refractometer 2 IP Address Refractometer 2 IS Sensor "B" 195. 254.43.44 Ves No Converter LANI Configuration (Modbus CTC / RHU / PROFILE) Ves No 255. 255. 0 0 160. 254.43.42 Netmask 150. 254.43.42 Netmask 255. 255. 0 0 160. 254.43.42 Netmask 150. 255.43.42 Netmask 255. 255. 0 0 Gateway 0.0.0 0.0.0 0.0.0 HODBUS TCP, RTU Word Order (Hodbus only) Byte Order (Hodbus only) 0.460 break 0.0.0 Word First ⊕ Low Byte First SERLA (Modes RTU, PROFIbus) Modbus Save ID Partifician Address 1 Stop Bits 1 None 8	Mode O Modbus TCP Modbus RTU	Ethernet/IP O PROFIbus O PROFInet	Address	Name	Value
Refractometer 1 IP Address Refractometer 1 IS Sensor "B" 159.254.43.43 Yes No Refractometer 2 IP Address Refractometer 2 IS Sensor "B" 159.254.43.44 Yes No Converter LAII Configuration (Hodbus TCP / FUIP / PROFInet) P Address 192.168.3.127 Converter LAI2 Configuration (Refractometer(S)) P Address 192.168.3.127 Iob 254.43.42 Netmask 255.255.05 Gateway Iob.0 Iob 200.0 Iob 200.0 Iob 200.0 Iob 200.0 Iob 200.0 Iob 200.0 Iob 200.0 Iob 20	Number Of Sensors Connected				
195.234.43.43 Ves No Refractometer 2 IP Address Refractometer 2 IS Sensor "B" 195.234.43.44 Ves No Concerter 141 Konfgueration Ves No Concerter 141 Konfgueration Converter 141 Konfgueration P Address 192.186.3.127 De Address 169.254.43.44 19.246.3.127 De Address 169.254.43.42 Netmask 125.255.255.0 Gateway 0.0.0 0.0.0 0.0.0 0.0.0 0.0.0 MODBUS TCP, RTU Byte Order (Modbus only) 0.0.0 Modure Server Bould Past Methade © Low Word First © Low Byte First SCRUAL (Modbus RTU, PROFIbus) Modure Server Bould Rate Interface 3 90 V E4385 20/WE V Parking Stop Bits I Nord Stop Bits I Nord Stop Bits I	One Sensor 🔘 Two Sensors				
Refractometer 2 IP Address Refractometer 2 Is Sensor "B" 190.234.43.44 Ves No Converter LANI Configuration (Kedractometer(s)) D P Address 192.168.3.127 Petmask 155.255.255.0 Gateway 156.254.4.3.42 Voor Order (Moluss only) Byte First 0.0.0 Byte First StRUAL (Modus RTU, PROFibus) Interface PROfibus Address Interface 3 S0 E-455.294.04 Profibus Address Baud Rate Interface Interface StRUAL (Modus RTU, PROFibus) Modus Silver [D Nord Ore (Totobus only) Interface String So Stop Bits Stop Bits Nore Baud Rate Interface Stop Bits	Refractometer 1 IP Address	Refractometer 1 Is Sensor "B"			
155.254.43.44 Ves No Concerter LMI Configuration (Nodubus TCP / EUP / PROFILE) PAdress De Adress 192.169.3.127 Baddess 60.254.43.42 Netmack 255.255.255.0 Gateway 0.0.0 0.0.0 0.0.0 HODBUS TCP, RTU Byte Order (Modbus only) Myter First 0.0.0 FROFEbus Address Sub System Struct (Modbus RTU, PROFEbus) Net First Struct Address Sub System 9 So Struct System 9 Data Bts Struct System 9 Struct System Struct System 9	169.254.43.43	🔾 Yes 💿 No			
Converter LANI Configuration (Hodbus TCP / EUIP / PROFINE) Converter LANIZ Configuration (Refractometer(s)) P Address 159.254.43.42 Netmask 159.254.43.42 Netmask 255.255.255.0 Gateway 0.0.0 0.0.0 0.0.0 Word Order (Hodbus only) Byte Order (Hodbus only) Own Order (Hodbus only) Byte Order (Hodbus only) Own Word First Image: Low Byte First SERIAL (Hodbus RTU, PROFIbus) Modus Save ID Modus Save ID Image: Low Byte First SERIAL (Hodbus RTU, PROFIbus) Image: Low Byte First Series So Image: Low Byte First SERIAL Maddress Baud Rate Image: Low Byte First SPROFIL Maddress Stop Bits Nene Baud Rate Image: Low Byte First String Stop Bits Nene Baud Pais Stop Bits Stop Bits Nene B Image: Low Bits Nene B Image: Low Bits	Refractometer 2 IP Address	Refractometer 2 Is Sensor "B"			
(Hodbus TCP / FUIP / PROFINE) (Refractometer(s)) P Address 192.168.3.127 P Address 169.254.43.42 Netmask 169.254.43.42 Netmask 255.255.255.0 Gateway 0.0.0 0.0.0 0.0.0 0.0.0 MODBUS TCP, RTU Byte Order (Hodbus only) 0.0.0 Myord Order (Hodbus only) Dyte Order (Hodbus only) 0.0.0 ○ Low Word First © Low Byte First SERIAL (Hodbus RTU, PROFIbus) Mediadses Modous Save (D Data Bits Noton 1 Prity Data Bits Stop Bits None 8 1 PROFIbus Address 1	169.254.43.44	🔿 Yes 🔘 No			
Netmask Pathodski 255. 255. 0 Gateway 0.0.0 Gateway 0.0.0 0.0.0 MODBUS TCP, RTU Byte Order (Modbus only) 0.0.0 Hyb Byte First © Low Word First © Low Byte First SERIAL (Modbus RTU, PROFIbus) Modbus Strup PROFIbus PRODEBus Address Baud Rate Prity Data Bits Stop Its Its None is I I	(Modbus TCP / ENIP / PROFInet)	(Refractometer(s))			
255.255.255.0 ISS.255.255.0 Gatemary 0.0.0 DODBUS TCP, RTU 0.0.0 WOOd Order (Modbus only) Byte Order (Modbus only) High Word First High Byte First Image: Comparison of the state of the s	192.168.3.127	169.254.43.42			
Gateway Gateway 0.0.0 Gateway 0.0.0 0.0.0 HODBUS TCP, RTU D.0.0 Word Order (Hodbus only) Byte Order (Modbus only) High Word First High Byte First SERIAL (Modbus RTU, PROFIbus) Modbus Glave [] Modbus Glave [] Baud Rate Interface 3 Jan Stop Bits None 8 Interface	Netmask	Netmask			
0.0.0.0 0.0.0.0 HODBUS TCP, RTU Byte Order (Hodbus only) Ord Order (Hodbus only) Byte Order (Hodbus only) High Word First High Byte First StRIAL (Hodbus RTU, PROFIbus) Modus Save (B) Modbus Save (B) Baud Rate Interface 50 3 50 Stript Stop Bits None 8 I V	255.255.255.0	255.255.255.0			
MODBUS TCP, RTU Byte Order (Modbus only) High Word First High Byte First © Low Word First © Low Byte First SERIAL (Kodbus RTU, PROFIbus) Modus Size U Modus Size U Baud Rate Interface 3 50 EASS 2: wire Prity Data Bits Stop Bits None 8 I	Gateway	Gateway			
Word Order (Modbus only) Byte Order (Modbus only) I High Word First High Byte First Low Byte First SERIAL (Modbus RTU, PROFIbus) Modbus Slave [] Baud Rate Interface So So Ref-HaSS 2-wire Prify Data Bits Stop Bits	0.0.0.0	0.0.0.0			
Word Order (Modbus only) Byte Order (Modbus only) I High Word First High Byte First @ Low Byte First @ Low Byte First SERIAL (Modbus RTU, PROFIbus) Modbus Save [] PROFIbus Address Baud Rate Interface 3 50 Es-H455 2-wire Parky Data Bits Stop Bits None 8 1					
High Word First High Byte First Bud Rets Low Byte First SERUAL (Hodbus RTU, PROFIbus) Modus Save ID PROFIbus Address Boud Rate Interface 3 Prity Data Bits PROFInet		Byte Order (Modbus only)			
Image: Construction of the state of the					
Modbus Gave ID Baud Rate Interface 3 50 RS-H85 2-wire Parity Data Bits Stop Bits None 8 1		-			
Maddus Save ID Baud Rate Interface 3 50 RS-H85 2-wire Parity Data Bits Stop Bits None 8 1	0	0 .			
1 50 × RS-H852-wire × Parity Data Bits Stop Bits None 8 1 PROFInet	Modbus Slave ID				
Prity Data Bits Stop Bits None V 8 V 1 V	FROI 1003 A001 C33				
None V 8 V 1 V PROFInet					
PROFInet					
	None V 8	· · ·			
Station Name					
SET THIS CONFIGURATION	Station Name		1		



Converter LAN1 IP Address	SW version 1.3		Trace Modbus Registe	r Values: Stopped
192.168.3.127	Connect	Get Modbus Register Values	Start	Stop
Mode		Address	Name	Value
🔿 Modbus TCP 🔵 Modbus RTU 💽	Ethernet/IP O PROFIbus O PROFInet			
Number Of Sensors Connected				
One Sensor Two Sensors				
Refractometer 1 IP Address	Refractometer 1 Is Sensor "B"			
169.254.43.43	🔿 Yes 🔘 No			
Refractometer 2 IP Address	Refractometer 2 Is Sensor "B"			
169.254.43.44	🔾 Yes 🔘 No			
Converter LAN1 Configuration (Modbus TCP / ENIP / PROFInet)	Converter LAN2 Configuration (Refractometer(s))			
IP Address	IP Address			
192.168.3.127	169.254.43.42			
Netmask	Netmask			
255.255.255.0	255.255.255.0			
Gateway	Gateway			
0.0.0.0	0.0.0.0			
MODBUS TCP, RTU				
Word Order (Modbus only)	Byte Order (Modbus only)			
High Word First	High Byte First			
Low Word First	Low Byte First			
SERIAL (Modbus RTU, PROFIbus)				
Modbus Slave ID PROFIbus Address Baud Rate	Interface			
	✓ RS-485 2-wire ✓			
Parity Data Bits	Stop Bits			
None V 8	~ 1 ~			
PROFInet				
Station Name				

Figure 4.5 Relevant fields for Ethernet/IP mode

erter LAN1 IP Address	SW version 1.3		Trace Modbus Register Values: S	topped
. 168.3.127	Connect	Get Modbus Register Values	Start	Stop
de Modbus TCP O Modbus RTU O E	themet/IP 🖲 PROFIbus 🔘 PROFInet	Address	Name Valu	Je -
mber Of Sensors Connected				
One Sensor 🔘 Two Sensors				
fractometer 1 IP Address	Refractometer 1 Is Sensor "B"			
9.254.43.43	🔿 Yes 🔘 No			
fractometer 2 IP Address	Refractometer 2 Is Sensor "B"			
9.254.43.44	🔿 Yes 💿 No			
nverter LAN1 Configuration Iodbus TCP / ENIP / PROFInet) Address	Converter LAN2 Configuration (Refractometer(s)) IP Address			
2.168.3.127	169.254.43.42			
tmask	Netmask			
5.255.255.0	255.255.255.0			
teway	Gateway			
0.0.0	0.0.0.0			
DDBUS TCP, RTU ord Order (Modbus only)	Byte Order (Modbus only)			
) High Word First	High Byte First			
) Low Word First	Low Byte First			
	Con Byternst			
rity Data Bits one 8	r Interface RS-4852-wire ↓ Stop Bits 1 ↓			
ROFInet ation Name	SET THIS CONFIGURATION			

Figure 4.6 Relevant fields for PROFIBUS mode

	Vaisala Refractometer Converter Assistan	nt 2.0			– 🗆 🗙
	Converter LAN1 IP Address	SW version 1.3		Trace Modbus Register Values:	Stopped
	192.168.3.127	Connect	Get Modbus Register Values	Start	Stop
	Mode		Address	Name Va	lue
	O Modbus TCP O Modbus RTU O Eth	hemet/IP O PROFIbus PROFInet			
١r	Number Of Sensors Connected				
Ш	One Sensor 🔘 Two Sensors				
	Refractometer 1 IP Address	Refractometer 1 Is Sensor "B"			
Ш	169.254.43.43	🔿 Yes 🔘 No			
Ш	Refractometer 2 IP Address	Refractometer 2 Is Sensor "B"			
Ш	169.254.43.44	🔾 Yes 🔘 No			
	Converter LAN1 Configuration (Modbus TCP / ENIP / PROFInet)	Converter LAN2 Configuration (Refractometer(s))			
I	IP Address	IP Address			
Ш	192.168.3.127	169.254.43.42			
Ш	Netmask	Netmask			
Ш	255.255.255.0	255.255.255.0			
Ш	Gateway	Gateway			
Ш	0.0.0.0	0.0.0.0			
Ľ	MODBUS TCP, RTU				
	Word Order (Modbus only)	Byte Order (Modbus only)			
	High Word First	High Byte First			
	Low Word First	Low Byte First			
	SERIAL (Modbus RTU, PROFIbus)				
	Modbus Slave ID PROFIbus Address Baud Rate	Interface			
	3 9600 ~	RS-485 2-wire \smallsetminus			
	Parity Data Bits	Stop Bits			
	None \vee 8 \vee	1 ~			
I	PROFInet				
	Station Name				
	reffjb 1	SET THIS CONFIGURATION			
L					

Figure 4.7 Relevant fields for PROFINET mode

4.2 Accessing the refractometer web interface

Configuring a refractometer is not possible through the fieldbus converter, because Converter provides only measurement and status data into fieldbus networks. The refractometer can be configured, verified and diagnosed by accessing its built-in web server homepage. The homepage is accessed by connecting a computer to the refractometer via a switch, a router or a direct cable connection. A connection between refractometer and Converter can be temporarily disconnected while changing refractometer parameters – the connection recovers automatically after the connection is restored. See the refractometer manual for details of its network settings.

4.3 Testing Modbus RTU connection with a PC

Modbus RTU connectivity can be tested with PC tools prior to installing the fieldbus converter to its final location. A suitable tool for this is ModbusTool which can be downloaded from https://github.com/graham22/modbustool. This program features a Modbus master and a client as well. As the converter works as a slave, we need to use the ModbusTool Master to communicate with it. Please follow the below steps:

- Connect the fieldbus converter to the PC via serial cable. You can use a built-in serial port on your PC, or a USB-serial converter (not provided by Vaisala). Please check the supported serial communication type (RS422 / RS485 2-wire / RS485 4-wire). Both the USB-serial converter and the cable must be chosen accordingly.
- 2. Set up the fieldbus converter to operate in the Modbus RTU mode, and set baud rate, data bits, flow control, parity, stop bits and interface.
- 3. Connect the fieldbus converter to the refractometer.
- 4. In ModbusTool Modbus Master, select:
 - a. Communication Mode: RTU
 - b. Port name: the port where you connected the serial cable
 - c. Baud, parity, data bits and stop bits should be the same as on converter
 - d. Start address: 0
 - e. Size: 64 (press Apply after these)
 - f. Press "Connect"
- 5. Press "Read holding register" to send a read request to the converter
- 6. At the bottom of the screen you should see the sent (TX) and received (RX) bytes, and the message "Read succeeded: Function code: 3.".

Communicatio	Master)
				DTI											
Mode	TCP	500		RTU											
О ТСР	Port	502		Por	rt Name =	COM4		1	Data Bits =	8 Bits				Disconnect	
	IP Address		127.0.0).1	Baud =	115200		5	Stop Bits =	1 Bit					
RTU					Parity =	None									
isplay Forma	at	Function	ns												
		Read	coils	Read holdir register	ng Wri	ite single coil	Write m			Slave	e ID	3	1		
Binary															
Hex		Rei discr		Read inpu register		ite single egister	Write m regist								
0 🗳.															
Start Addres	ss 0	Size	64	4								Apply		Clear	-
Start Addres	55 0	3126	0	<u>•</u>								- uppiy		Ciedi	
0	0xd7a3 12	0xcdcc	24	0x0000	36	0x12bd	48	0x87df	60	0x77ce	72	0×0000	84	0x0000	
1	0x9040 13	0x0441	25	0x0000	37	0xbc3f	49	0x8442	61	0x3206	73	0x0000	85	0x0000	
2	0x7368 14	0x8fe9	26	0x0000	38	0xf628	50	0x8294	62	0x0000	74	0x0000	86	0x0000	
3	0x1042 15	0x8442	27	0x0000	39	0xc441	51	0x0100		0x0000	75 [0x0000	87	0x0000	
4	0x0abf 16		28	0xdbce	40	0x48e1	52	0x0028		0x0000	76	0x0000	88		
· _		Oxfae0												0x0000	
5	0xbc3f 17	0x8442	29	0x3206	41	0xe641	53	0x2042		0×0000	77	0x0000	89	0x0000	
e	0x85eb 18	0x7994	30	0x0000	42	0xf628	54	0×0000	ee	0×0000	78	0x0000	90	0x0000	
7	0xc341 19	0x0100	31	0x0000	43	0xc441	55	0×0000	67	0x0000	79	0x0000	91	0x0000	
8	0x48e1 20	0x0098	32	0xec51	44	0x6666	56	0x0000	68	0×0000	80	0x0000	92	0x0000	
	Oxe641 21	0x1e42	33	0x9040	45	0x0641	57	0×0000	69	0×0000	81	0x0000	93	0x0000	
9	0x85eb 22	0x0000	34	0xfa7e	46	0xd7e2	58	0×0000	70	0×0000	82	0x0000	94	0x0000	
9	0x85eb 22				_				71	0x0000	_	0x0000	95	0x0000	

Figure 4.8 ModbusTool Modbus Master

5 Specifications

5.1 Converter environmental and electrical specs

Operating temperature	-10 to 60°C (14 to 140°F)					
Input voltage	12 to 48 VDC					
Input current	170 mA @ 24 VDC 340 mA @ 12 VDC					
Power consumption	4.5 W					



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