

Fieldbus converter PR-7112

Instruction Manual

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1 Introduction

The K-Patents Fieldbus Converter is designed to make easier connections of K-Patents instrumentations to Fieldbus and Industrial Ethernet through a Fieldbus converter.

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

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

The converter gets the data from the refractometer via UDP/IP communication and stores them in its Modbus registers and Ethernet/IP objects. On the "LAN1" port the converter acts as a Modbus/TCP server or Ethernet/IP adapter. On serial port P1 the converter acts as Modbus RTU 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 FLOAT or SIGNED INT).							

3

Table 3.1

Status values are transmitted as integers. The	hese are the status messages to each value:
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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/assets/files/downloads/manuals/software/28957 _RefConverterAssistant.zip.

NAME	BYTES	ТҮРЕ	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.

4 Configuration and testing

Warning! Never press the reset button on the converter. The reset button on top of the MOXA UC-7112 Plus computer (the converter) is **not** designed to hard reboot the computer. The Fieldbus converter is implemented as a proprietary application software running on the MOXA UC-7112 Plus computer. The application software will be permanently erased, if the reset button is pressed.



Figure 4.1 Reset button location

4.1 Configuring the fieldbus converter

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

K-PATENTS Refractometer Converte	r Assistant 1.0			
Converter LAN1 IP				
20.0.0.11	Connect	Get Modbus Registe	er Values	Trace Modb
Mode		Address Na	ime Value	
Modbus TCP Modbus RTU	C Ethernet/IP			
	O concinción			
Refractometer IP Address	Refractometer Model			
169.254.43.43	○ PR-33 / PR-43			
LAN1 (MODBUS TCP / ENIP)	LAN2 (REFRACTOMETER)			
IP Address	IP Address			
20.0.0.11	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				
Word Order (Modbus only)	Byte Order (Modbus only)			
O High Word First	O High Byte First			
Low Word First	Low Byte First			
SERIAL				
Slave ID				
1				
Baud Rate Data Bits	Flow Control			
19200 - 8	▼ None ▼			
Parity Stop Bits	Interface			
None 🔻 1	▼ RS-485 2-wire ▼			
	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.

When the converter connects to a 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.

4.2 Accessing the refractometer web interface

Configuring a refractometer is not possible through the fieldbus converter, because it provides only measurement and status data into Modbus/TCP, Modbus RTU or Ethernet/IP 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 a 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 K-Patents). 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 a 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.".

101													
Port	502		F	Port Name	= COM4			Data Bits =	8 Bits			1	Discourses
IP Address		127.0.0	1	Baud	= 115200			Stop Bite -	1 B#		1		Disconnect
				Parity	= None			Stop bits -	1 Dit				
Display Format Functions													
	Read coils Read		Read hol registe	ad holding Write single egister coil		Write multiple coils			Slav	e ID	31		
	Redisc	ad rete	Read in registe	put W	/rite single register	Write m regist	ultiple er						
is 0	Size	64	ł								Apply		Clear
0.47-2 12	Quadra	24	0.000	2 26	0.1254	40	0.074		0.77	72 [0.0000		0.0000
0x0/a3 12	0x00000	25	0x000) 37	0xhc3f	49	0x8/4	2] 60 [2] 61 [0x7706	73	0×0000	85	0×0000
0x7368 14	0x8fe9	26	0x000) 38	0x628	50 L	0x8294	1 62 [0x0000	74	0x0000	86	0x0000
0x1042 15	0x8442	27	0x000) 39	0xc441	51	0x0100) 63 [0x0000	75 [0x0000	87	0x0000
0x0abf 16	0xfae0	28	Oxdbce	40	0x48e1	52	0x0028	3 64 [0x0000	76	0×0000	88	0x0000
0xbc3f 17	0x8442	29	0x320	6 41	0xe641	53	0x2042	2 65	0x0000	77 [0x0000	89	0x0000
0x85eb 18	0x7994	30	0x000) 42	0xf628	54	0×0000	66	0x0000	78	0×0000	90	0x0000
0xc341 19	0x0100	31	0x000	43	0xc441	55	0×0000	67	0x0000	79	0×0000	91	0x0000
0x48e1 20	0x0098	32	0xec5	1 44	0x6666	56	0x0000	68	0x0000	80	0x0000	92	0x0000
0xe641 21	0x1e42	33	0x904) 45	0x0641	57	0×0000	69	0x0000	81	0×0000	93	0x0000
0x85eb 22	0x0000	34	0xfa7e	e 46	0xd7e2	58	0x0000	70	0x0000	82	0×0000	94	0x0000
0xc341 23	0x0000	35	0x104	2 47	0x8442	59	0×0000) 71	0x0000	83 [0x0000	95	0x0000
-													
n Log										[Pause		Clear
: 1f 03 88 ec 51 9 ad succeeded: Fu : 1f 03 00 00 00 4 : 1f 03 80 d7 a3 9	0 40 44 8b 1 nction code 0 47 84 0 40 56 8e 1	10 42 17 :3. 10 42 6f	bcbc3f7 bbbc3f00	o 14 c4 41) 00 c4 41	48 e1 e6 41 48 e1 e6 41	7b 14 c4	41 66 66 41 cd cc	06 41 d4 de 04 41 b5 dc	84 42 76 84 42 c5 e	e1 84 42 8 ee 84 42 7	во 94 01 00 (ъ 94 01 00 0	0 68 2 0 f0 20	21 42 00 00 00 0 42 00 00 00
	Port IP Address IP Address s 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Port SU2 IP Address IP Address IP Address Function Read Read Re Read s 0 s 0 Size Size 0x07a3 12 0x0401 3 0x0411 0x0441 0x7363 14 0x07e3 15 0x0441 0x8442 0x0401 16 0x643 17 0x6441 0 0x0341 19 0x0100 0x6442 0x6541 2 0x0200 0x0200 0x6541 23 0x0000 0x0000 0x0341 23 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000	Pott SUZ IP Address 127.0.0 IP Address 127.0.0 IP Address 127.0.0 IP Address 127.0.0 Read coils Read coils Coil Carlos Read coils Read coils Read coils Coil Carlos Carlos Coil Carlos Read coils Coil Carlos Reacoila Coil Carlos </td <td>Pott SUZ Read Indirector SUZ Read Indirector Read Indirector Read Indirector Read Indirector Read Indirector Read Indirector SUZ SUGO SUZ Read Indirector SUZ SUGO SUGO SUGO SUGO SUGO SUGO SUGO SUGO SUGO <th< td=""><td>Poit SUZ Poit Name IP Address 127.0.01 Baud Parity Functions Baud Read coils Read holding register V Read coils Read input register V s 0 Size 64 0x07a3 12 0xcdcc 24 0x0000 36 0x040 13 0x0441 25 0x0000 37 0x7368 14 0x6e9 26 0x0000 38 0x1042 15 0x6442 27 0x0000 39 0x0abr 16 0x6e0 28 0xdbce 40 0x6251 17 0x8442 29 0x3206 41 0x6451 17 0x8429 30 0x0000 43 0x6451 19 0x1000 31 0x4607 44 0x6451 12 0x0000 34 0x637 44 0x635b 13 0x0000 35 0x1042</td><td>Pott SUZ Pott Name LOMA IP Address 127.0.01 Baud 115200 Party = None Party = None IP Address 127.0.01 Party = None Party = None Party = None IP Address Functions Read nolding Write single register Read Read nolding Write single register Write single register s 0 Size 64 bx3040 13 0x0441 25 0x0000 37 0x0c37 0x7368 14 0x699 26 0x0000 38 0x628 0x1042 15 0x8442 27 0x0000 39 0x441 0x0561 17 0x8442 29 0x3206 41 0x6428 0x0451 19 0x0100 31 0x0000 42 0x628 0x6451 19 0x0100 31 0x0001 43 0x6466</td><td>Poit SUZ Poit Name = 00044 Out Name = 00444 Out Name = 004444 Out Name = 004444 Out Name = 0044444 Out Name = 0044444 Out Name = 00444444 Out Name = 004444444 Out Name = 0044444444 Out Name = 00444444444 Out Name = 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0bbc3 49 0x8442 61 0x7368 14 0x67e3 26 0x0000 38 0x6223 50 0x224 62 0x0421 15 0x6442 27 0x0000 39 0xc441 51 0x1000 63 0x6244 61 0x6442 61 0x6442 65 0x000</td><td>Poit Su2 Poit Name = COM4 Comparison Data Bits = B Bits IP Address 127.0.01 Baud = 115200 Stop Bits = I Bit Parity = None None Stop Bits = I Bit Parity = None Stop Bits = I Bit Parity = None Stop Bits = I Bit Pead colis Pead Indiang Write single Write multiple Stav Read colis Pead input Write single Write multiple Stav a 0 Size 64 0x67d2 60 0x77ce 0x0401 13 0x0441 25 0x0000 36 0x12ad 48 0x87d7 60 0x77ce 0x0401 13 0x0441 25 0x0000 37 0x0c34 49 0x8442 61 0x3206 0x0402 15 0x6442 27 0x0000 38 0x6224 62 0x0000 0x0404 13 0x0441 25 0x0000 38 0x6224 62 0x0000</td><td>Pot 302 Pot Name = 00/M4 Data Bits = 8 Bits IP Address 127.0.1 Baud = 115200 Stop Bits = 1 Bit Party = None Party = None Stop Bits = 1 Bit Functions Read colis Read inplut Write single Write multiple Read Read onling Write single Write multiple Store ID s 0 Size 64 Mo2200 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Dx02db1 16 Dr4ae0 28 Du0000 85 Du0000 76 Du0000 87</td></td<></td></th<></td>	Pott SUZ Read Indirector SUZ Read Indirector Read Indirector Read Indirector Read Indirector Read Indirector Read Indirector SUZ SUGO SUZ Read Indirector SUZ SUGO SUGO SUGO SUGO SUGO SUGO SUGO SUGO SUGO <th< td=""><td>Poit SUZ Poit Name IP Address 127.0.01 Baud Parity Functions Baud Read coils Read holding register V Read coils Read input register V s 0 Size 64 0x07a3 12 0xcdcc 24 0x0000 36 0x040 13 0x0441 25 0x0000 37 0x7368 14 0x6e9 26 0x0000 38 0x1042 15 0x6442 27 0x0000 39 0x0abr 16 0x6e0 28 0xdbce 40 0x6251 17 0x8442 29 0x3206 41 0x6451 17 0x8429 30 0x0000 43 0x6451 19 0x1000 31 0x4607 44 0x6451 12 0x0000 34 0x637 44 0x635b 13 0x0000 35 0x1042</td><td>Pott SUZ Pott Name LOMA IP Address 127.0.01 Baud 115200 Party = None Party = None IP Address 127.0.01 Party = None Party = None Party = None IP Address Functions Read nolding Write single register Read Read nolding Write single register Write single 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Figure 4.3 ModbusTool Modbus Master

5 Specifications

5.1 Converter environmental and electrical specs

Operating temperature	-10 to 60°C (14 to 140°F)
Maximum altitude	5000 meters
Input voltage	12 to 48 VDC
Input current	170 mA @ 24 VDC 340 mA @ 12 VDC
Power consumption	4.5 W

10



K-Patents Oy

P.O. Box 77 FI-01511 Vantaa, Finland tel. +358 207 291 570 fax +358 207 291 577 info@kpatents.com

K-Patents, Inc.

1804 Centre Point Circle, Suite 106 Naperville, IL 60653, USA tel. (630) 955 1545 fax (630) 955 1585 info@kpatents.com

K-Patents (Shanghai) Co., Ltd

Room 1509, Tomson Commercial Building, No.710 Dongfang RD Pudong District, Shanghai, China tel. +86 21 5087 0597/0598 fax +86 21 5087 0598

www.kpatents.com