

K-PATENTS Refractometer Modbus/TCP, Modbus RTU, Ethernet/IP Converter

User Manual

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. 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 “LAN2” port the converter acts as a Modbus/TCP server or Ethernet/IP adapter. On serial port P1 the converter acts as Modbus RTU slave.

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	TYPE
Sensor A LED	0	FLOAT
Sensor A CCD	2	FLOAT
Sensor A nD	4	FLOAT
Sensor A T	6	FLOAT
Sensor A Tsens	8	FLOAT
Sensor A Traw	10	FLOAT
Sensor A RHsens	12	FLOAT
Sensor A CALC	14	FLOAT
Sensor A CONC	16	FLOAT
Sensor A PTraw	18	INT
Sensor A QF	20	FLOAT
Sensor A mA	22	FLOAT
Sensor A BGLight	24	INT
Sensor A Seq	26	INT
Sensor A Timestamp	28	INT
Sensor A Status	30	INT
Sensor B LED	32	FLOAT
Sensor B CCD	34	FLOAT
Sensor B nD	36	FLOAT
Sensor B T	38	FLOAT
Sensor B Tsens	40	FLOAT
Sensor B Traw	42	FLOAT
Sensor B RHsens	44	FLOAT
Sensor B CALC	46	FLOAT
Sensor B CONC	48	FLOAT
Sensor B PTraw	50	INT

Sensor B QF	52	FLOAT
Sensor B mA	54	FLOAT
Sensor B BGLight	56	INT
Sensor B Seq	58	INT
Sensor B Timestamp	60	INT
Sensor B Status	62	INT

All stored values are 4 bytes in size (either FLOAT or SIGNED INT).

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

The computer can't handle very frequent Modbus requests. It is recommended, that values are requested once every second, as refractometer values are also updated once per second.

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 EDS file, or manually with the following parameters:

- Port: 0xAF12 (44818)
- O->T:
 - instance number: 102
 - data size: 0
 - real time format: modeless
 - packet rate: 1000 ms
- T->O:

- instance number: 101
- data size: 128
- real time format: modeless
- packet rate: 1000 ms
- connection type: point to point

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

NAME	BYTES	TYPE
Sensor A LED	0-3	REAL
Sensor A CCD	4-7	REAL
Sensor A nD	8-11	REAL
Sensor A T	12-15	REAL
Sensor A Tsens	16-19	REAL
Sensor A Traw	20-23	REAL
Sensor A RHsens	24-27	REAL
Sensor A CALC	28-31	REAL
Sensor A CONC	32-35	REAL
Sensor A PTraw	36-39	DINT
Sensor A QF	40-43	REAL
Sensor A mA	44-47	REAL
Sensor A BGLight	48-51	DINT
Sensor A Seq	52-55	DINT
Sensor A Timestamp	56-59	DINT
Sensor A Status	60-63	DINT
Sensor B LED	64-67	REAL
Sensor B CCD	68-71	REAL
Sensor B nD	72-75	REAL
Sensor B T	76-79	REAL
Sensor B Tsens	80-83	REAL
Sensor B Traw	84-87	REAL
Sensor B RHsens	88-91	REAL
Sensor B CALC	92-95	REAL
Sensor B CONC	96-99	REAL
Sensor B PTraw	100-103	DINT
Sensor B QF	104-107	REAL
Sensor B mA	108-111	REAL
Sensor B BGLight	112-115	DINT
Sensor B Seq	116-119	DINT
Sensor B Timestamp	120-123	DINT
Sensor B Status	124-127	DINT

Status values are transmitted as integers. Please see the Modbus/TCP chapter for status codes.

Configuring the converter

Address	Name	Value
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To configure the converter, use the provided software tool “K-PATENTS 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).

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

In Modbus mode it is possible to test the converter’s connection to the refractometer with this tool. Press “Get Register Values” to get all values from the Modbus registers, or “Trace Register Values” to get them constantly updating.