K M B systems, s. r. o.
Dr. Milady Horákové 559, 460 06
Liberec VII – Horní Růžodol
460 07 Liberec
Czech Republic
Tel. +420 485 130 314
E-mail: kmb@kmb.cz, Web: www.kmb.cz

App note 0038

Sampler

Document revision	Release date	For version		
		Hardware	Firmware	Software ENVIS
1.0	15.11.2024	ARTIQ, SMY G3, SMP G3	$\geq$ 4.0	$\geq$ 2.2

Contents

1 Sampler

The sampler is a function of selected devices with the extended firmware module activated, which allows sending individual samples of measured quantities. From the sent samples, it is possible to construct the waves or phasors of the given quantities. The data is sent over an Ethernet interface in the form of UDP packets.

The setup of the sampler is done in the *ENVIS.Daq* program, in the *Settings* window, on the *UDP Push* tab. UDP Push (UP) is the firmware module required for the sampler function, which enables the sending of UDP packets from the device. UP is automatically activated along with the sampler module.

1.1 Sampler settings

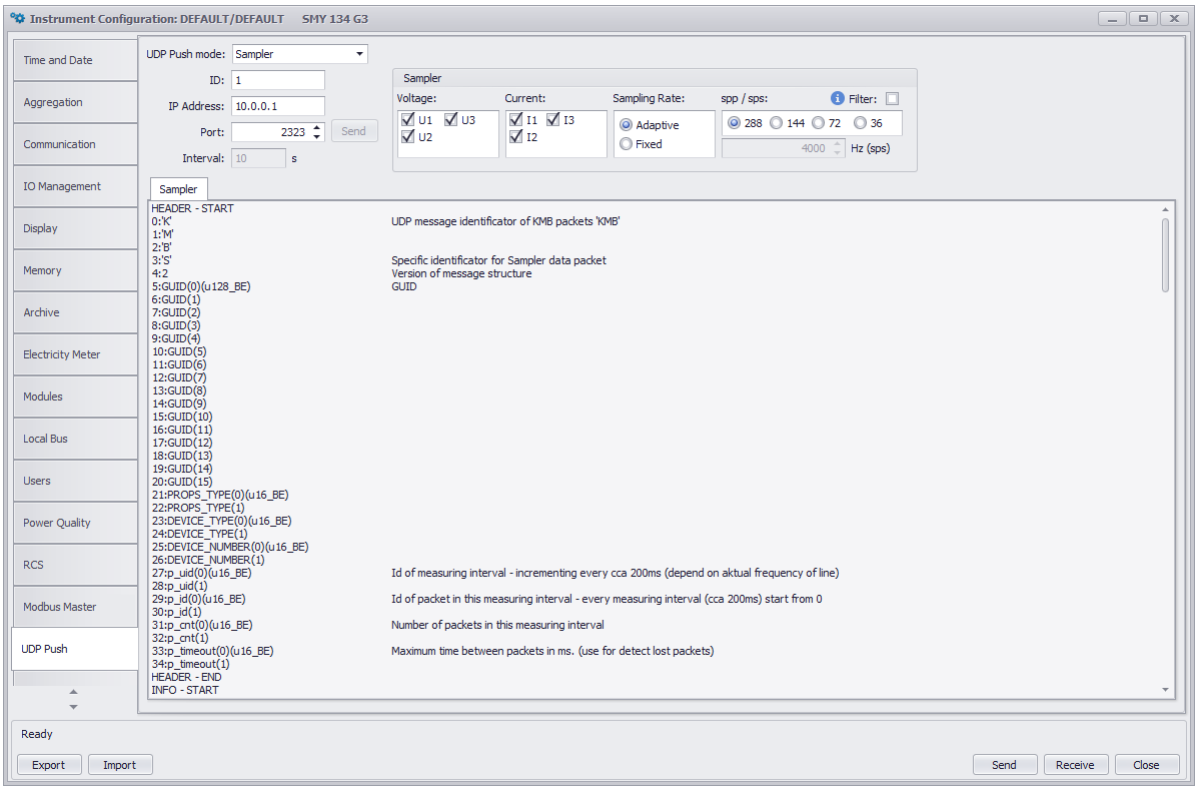

Figure 1: Settings of UDP Push and sampler via ENVIS.Daq program

UDP Push mode sets the data to be sent. To send data from the sampler, this option needs to be selected.

ID sets the identifier for the sent data, which can be used when receiving data from multiple devices.

IP Address of the receiver device / server, to which the measured data is sent.

Port specifies the UDP network port on which the device/server receives data.

Voltage / Current allows selection of the measured quantities (voltage and/or current) and their phases, whose values are sent by the measuring device.

Sampling Rate sets the type and frequency of data sampling.

The **Adaptive** mode has a variable sampling frequency and maintains a constant number of samples per period. The number of samples can be selected as the **spp** (samples per period) parameter.

The **Fixed** mode has a constant sampling frequency regardless of the frequency of the measured quantities. The sampling frequency is adjustable as the **sps** (samples per second) parameter.

2 Sent data

Packets with sampler data are sent by the device every 200 ms (10 periods). Each quantity and its phase has its own group of packets with the same layout. The description of the packets is also visible in the *ENVIS.Daq* program, where the sampler is configured.

2.1 Sampler data

2.1.1 Header

Byte 0-34

Byte 0-2: „KMB“, packet identifier.

Byte 3: „S“ for identify data from the sampler.

Byte 4: version of message structure, currently 2.

Byte 5-20: GUID – unique identifier of measurement device. Sent as 128-bit unsigned integer in big-endian format *(uint128-BE)*.

Byte 21-22: measuring device type family. Sent as 16-bit unsigned integer in big-endian format *(uint16-BE)*.

Byte 23-24: measuring device type. Sent as 16-bit unsigned integer in big-endian format *(uint16-BE)*.

Byte 25-26: serial number of the measuring device. Sent as 16-bit unsigned integer in big-endian format *(uint16-BE)*.

Byte 27-28: identifier of the measuring interval, for pairing packets with data of the same interval. Increases every 200ms (10 periods). Sent as 16-bit unsigned integer in big-endian format *(uint16-BE)*.

Byte 29-30: identifier (order) of the packet within measuring interval, for ordering packets (received values). Reset every 200ms (10 periods). Sent as 16-bit unsigned integer in big-endian format *(uint16-BE)*.

Byte 31-32: total count of packets within the actual measuring interval, for control receiving all packets. Sent as 16-bit unsigned integer in big-endian format *(uint16-BE)*.

Byte 33-34: maximal timeout [ms] between packets, for control lost packets. Sent as 16-bit unsigned integer in big-endian format *(uint16-BE)*.

2.1.2 Information

Byte 35-100

Byte 35: packet message type: 1 = sampler data.

Byte 36: version of data message structure, currently 3.

Byte 37-38: detect change in configuration of device. Sent as 16-bit unsigned integer in big-endian format *(uint16-BE)*.

Byte 39-42: error code of the device. Sent as 16-bit unsigned integer in big-endian format *(uint16-BE)*.

Byte 43-44: detected phase order. Sent as 16-bit unsigned integer in big-endian format *(uint16-BE)*.

Byte 45-48: actual measured frequency of this measuring interval (200ms / 10 periods). Sent as 32-bit signed number in big-endian format *(float-BE)*.

Byte 49-52: measured average frequency of 10s interval. Start of measuring is every 10s driven by RTC. Sent as 32-bit signed number in big-endian format *(float-BE)*.

Byte 53-54: clipping of measured values indicator. Sent as 16-bit unsigned integer in big-endian format *(uint16-BE)*.

Byte 55-58: measuring flags.
UIP: 0x01, 0x02, 0x04, 0x08
PST: 0x10, 0x20, 0x40, 0x80
PLT: 0x0100, 0x0200, 0x0400, 0x0800
frequency: 0x1000; FLEX: 0x2000
time adjustment: 0x4000; 10MinuteFirst: 0x8000
voltage disconnection: 0x00F0000

Byte 59-60: actual state of digital inputs of the device. Sent as 16-bit unsigned integer in big-endian format *(uint16-BE)*.

Byte 61-64: actual state of digital outputs of the device. Sent as 32-bit unsigned integer in big-endian format *(uint32-BE)*.

Byte 65-66: actual state of inner variables of the device used in IO management. Sent as 16-bit unsigned integer in big-endian format *(uint16-BE)*.

Byte 67-68: actual state of IO event. Sent as 16-bit unsigned integer in big-endian format *(uint16-BE)*.

Byte 69-76: time of IO event. Sent as 64-bit unsigned integer in big-endian format *(uint64-BE)* in GMT KMB time format – milliseconds since 1.1.2000.

Byte 77-100: reserved.

2.1.3 Header of sample data

Byte 101-141

Byte 101: measured quantity in this packet: 1 = voltage; 2 = current.

Byte 102: phase of measured quantity in this packet: 0 = undefined; 1 = 1.phase ...

Byte 103: measuring filter: 0 = no filter; 1 = internal filter used.

Byte 104-111: time of the last sampled value. Sent as 64-bit unsigned integer in big-endian format *(uint64-BE)* in GMT KMB time format – milliseconds since 1.1.2000.

Byte 112-119: timestamp [ns] of the last sample in the measuring interval (200ms / 10 periods), for pairing packets with data of the same interval. Sent as 64-bit unsigned integer in big-endian format *(uint64-BE)*.

Byte 120-127: timestamp [ns] of the first sample of the measuring interval (200ms / 10 periods), for pairing packets with data of the same interval. Sent as 64-bit unsigned integer in big-endian format *(uint64-BE)*.

Byte 128-131: time offset of the samples in this packets from the first sample of the interval (see Bytes 120-127), for ordering packets (received values). Sent as 32-bit unsigned integer in big-endian format *(uint32-BE)*.

Byte 132-135: sampling rate [Hz]. Sent as 32-bit signed number in big-endian format *(float-BE)*.

Byte 136-139: total count of samples of the channel (quantity and phase) in this measuring interval (200ms / 10 periods). Sent as 32-bit unsigned integer in big-endian format *(uint32-BE)*.

Byte 140-141: count of samples in this packet. Sent as 16-bit unsigned integer in big-endian format (uint16-BE).

2.1.4 Sample data

Byte 142+

Byte 142-145: the first sample. Sent as 32-bit signed number in big-endian format *(float-BE)*.

Byte 146-149: the second sample. Sent as 32-bit signed number in big-endian format *(float-BE)*.

Byte 150-153: the third sample. Sent as 32-bit signed number in big-endian format *(float-BE)*.

...

2.2 Time stamps

Additional extension packets with timestamps.

2.2.1 Header

Byte 0-34 – Same as sampler data header.

Byte 0-2: „KMB“, packet identifier.

Byte 3: „S“ for identify data from the sampler.

Byte 4: version of message structure, currently 2.

Byte 5-20: GUID – unique identifier of measurement device. Sent as 128-bit unsigned integer in big-endian format *(uint128-BE)*.

Byte 21-22: measuring device type family. Sent as 16-bit unsigned integer in big-endian format *(uint16-BE)*.

Byte 23-24: measuring device type. Sent as 16-bit unsigned integer in big-endian format *(uint16-BE)*.

Byte 25-26: serial number of the measuring device. Sent as 16-bit unsigned integer in big-endian format *(uint16-BE)*.

Byte 27-28: identifier of the measuring interval, for pairing packets with data of the same interval. Increases every 200ms (10 periods). Sent as 16-bit unsigned integer in big-endian format *(uint16-BE)*.

Byte 29-30: identifier (order) of the packet within measuring interval, for ordering packets (received values). Reset every 200ms (10 periods). Sent as 16-bit unsigned integer in big-endian format *(uint16-BE)*.

Byte 31-32: total count of packets within the actual measuring interval, for control receiving all packets. Sent as 16-bit unsigned integer in big-endian format *(uint16-BE)*.

Byte 33-34: maximal timeout [ms] between packets, for control lost packets. Sent as 16-bit unsigned integer in big-endian format *(uint16-BE)*.

2.2.2 Information

Byte 0-34

Byte 35: packet message type: 2 = time stamp message.

Byte 36: version of timestamp message structure, currently 1.

2.2.3 Data

Byte 0-34

Byte 37-44: time of event triggering sampler. Sent as 64-bit unsigned integer in big-endian format *(uint64-BE)*.

Byte 45-52: offset of data caused by filter. Sent as 64-bit unsigned integer in big-endian format *(uint64-BE)*.

K M B systems, s. r. o.
Dr. Milady Horákové 559
Liberec VII - Horní Růžodol
460 07 Liberec, Czech Republic

Tel.: +420 485 130 314
E-mail: kmb@kmb.cz
Web: www.kmb.cz