ELSYS.se

Application note
ELSYS uplink payload description

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All ELSYS sensors share a standard payload format with different measurement types implemented depending on what the device's set of internal/external sensors can measure.

Basic structure

A single transmission from the sensor can contain multiple measurements.
Depending on what queue settings are configured in the device, the transmission can contain multiple measurements of the same type.

Payload content			
Measurement 1	Measurement 2	….	Measurement n

Measurement format

Each measurement is composed of 1 byte representing the type of value.

The lower 6 bits of the first byte represent the type. The upper 2 bits are used when measurement timestamping is enabled.

Measurement	
Type	Value
1 byte (0 – 63)	1 to 65 bytes

See Appendix 1 – Timestamped measurements, page 7, for a description of timestamped measurements.

Defined types

Hex	Type	Data size	Range (Resolution)	Description
0x00	Reserved	–	–	Never transmitted from sensor.
0x01	Temperature	2	±3276.5 °C (0.1°C)	
0x02	Humidity	1	0 – 100% (1%)	Relative humidity
0x03	Acceleration	3	±127 = ±2 g	See Acceleration, page 3
0x04	Light	2	0 – 65535 lux (1 lux)	
0x05	Motion events (PIR)	1	0 – 255	Number of detected PIR motions
0x06	CO2	2	0 – 10000 ppm (1 ppm)	Fresh air: ~400 – 420 ppm
0x07	Internal battery voltage	2	0 – 65535 mV (1 mV)	
0x08	Analog1	2	0 – 65535 mV (1 mV)	External analog input voltage
0x09	Deprecated	6		Not used.
0x0A	Relative pulse count	2	0 – 65535	Relative value, reset every transmission
0x0B	Absolute pulse count	4	0 – 4294967295	Absolute value, never reset
0x0C	External temperature	2	±3276.5 °C (0.1°C)	
0x0D	External digital/button	1	0 – 1, binary	See External digital, page 3
0x0E	External distance	2	0 – 65535 mm (1 mm)	See External distance, page 4
0x0F	Acceleration events	1	0 – 255	See Acceleration, page 3
0x10	External IR temperature	4	±3276.5 °C (0.1°C)	See External IR temperature, page 4

0x11	Occupancy	1	0 – 2, state	See Occupancy, page 4
0x12	External water leak	1	0 – 255	See Waterleak, page 5
0x13	Room IR temperature	65	–	See Room IR temperature, page 5
0x14	Pressure	4	0 – 4294967295 (hPa)	
0x15	Sound	2	–	See Sound level, page 5
0x16	Relative pulse count 2	2	0 – 65535	Relative value, reset every transmission
0x17	Absolute pulse count 2	4	0 – 4294967295	Absolute value, never reset
0x18	Analog 2	2	0 – 65535 mV (mV)	External analog input voltage
0x19	External temperature 2	2	±3276.5 °C (0.1°C)	
0x1A	External digital 2	1	0 – 1, binary	See External digital
0x1B	External analog (uV)	4	±2147483648 uV (1 uV)	See External analog (uV), page 6
0x3D	Debug information	4	–	See Debug information, page 6
0x3E	Sensor settings	N/A	–	See Sensor settings, page 6

Detailed type descriptions

Acceleration

The acceleration value is composed of three 1-byte signed values in the following structure. The X, Y and Z values range from -127 to +127 representing a total range of -2 g-force to +2 g-force in the respective axis.

Type	X	Y	Z
0x03	±127	±127	±127

Example conversion:

$$X_{gforce} = \frac{X_{raw}}{63.5}$$

The sensor can also be configured with a threshold to count, and optionally trigger transmissions, when the threshold is exceeded.

This is sent with a 1-byte value representing the number of events.

Type	Events
0x0F	0-255

External digital

The external digital value represents the current state of the digital input monitored. A value of 1 represents a digital high level, i.e. a voltage higher than approximately 2 volts and a value of 0 represents a digital low level i.e. a voltage lower than approximately 1.3 volt. It is recommended to use signal levels of 0 volt and 3.3 - 3.6 volt.

Note: It is possible to configure a debounce time applied to the triggering on digital inputs to prevent double-triggering.

External distance

The external distance value is a 2-byte value representing the distance measured in millimetres. Depending on the model of distance sensor used (5 meter / 10 meter) the values can range from 300 to 5000 mm or 500 to 10000 mm.

A value of 5000 or 9999, depending on model, indicates that the ranging was successful, but no target was found.

All values outside this range indicate measurement problems and should be ignored. If the problems are persistent, check that the connections to the distance sensor are correct.

External IR temperature

The external IR temperature is transmitted with a 4-byte value containing two 2-byte signed values representing the temperature of the sensor and the target with a resolution of 0.1°C.

Type	Internal temp (2 bytes)	Target temp (2 bytes)
0x10	±3276.5 °C	±3276.5 °C

Note: This value is not sent unless raw measurement mode has been enabled.

Occupancy

The occupancy value is a 1-byte value representing the current occupancy state of either a desk/workplace or a room. The status is different depeding on the specific device logic:

Type	Occupancy status
0x11	0 – 2

ERS Desk and EMS Desk logic:

Status	Conditions
0	No detection, unoccupied
1	Pending detection (30 s timeout), entering/leaving
2	Confirmed detection, occupied

ERS Eye logic:

Status	Conditions
0	No detection
1	Detection by PIR (motion event)
2	Detection by heat signature

Waterleak

The waterleak value is a 1-byte value representing the current detection algorithm output.

There are two different implementations of water leak detection, one for the ELT series and one for the EMS series.

The ELT series and has the following output:

Type	Waterleak detection level
0x12	1 – 255

The level sent from the sensor needs to be measured when the installation is complete and a reasonable threshold level must be set on the server side. The level will never be zero with an installed waterleak cable, this is normal behavior.

The EMS series has the following output:

Type	Waterleak detection status
0x12	Combined count and current status

The output is a combined value which can contain up to 99 waterleak events which have occurred since the last period and a "marker" which is a value of 100 which is added to the number of events if the sensor is currently detecting water.

Example: A value of 101 represents 1 event since last measurement and the sensor is currently detecting water.

Room IR temperature

The room IR temperature is transmitted as a 65-byte payload with a reference temperature and 64 individual pixel values.

Type	Reference (1 byte)	Pixel value (1 byte, repeated 64 times)
0x13	0 – 255 °C	0 – 25.5 °C

The 8x8 temperature matrix is compressed by finding the lowest value and setting it as the reference. The pixel values represent the temperature offset of the individual pixel compared to the reference.

$$Temp_{pixel} = Temp_{reference} + \frac{Raw_{pixel}}{10}$$

Sound level

The sound level is sent as a 2-byte value with both the average and peak sound level measured in dB. Actual minimum and maximum levels depend on sensor model.

Type	Peak level (1 byte)	Average level (1 byte)
0x15	60 – 100 dB	32 – 75 dB

External analog (uV)

The external analog (uV) measurement is sent when the ELSYS ADC module is used and represents the measured voltage in microvolts.

Type	Analog voltage (4 bytes)
0x1B	±2147483648 uV

Debug information

The sensor will send debug information when a measurement fails. Both the type of measurement and the error codes are sent in the debug information. The error codes are specific to the measurement. Contact ELSYS support for more information.

Type	Source of error (1 byte)	Error code 1	Error code 2	Error code 3
0x3D	Type id of failed measurement	Specific to measurement, contact ELSYS support for information.		

Sensor settings

See **ELSYS Application note: OTA configuration description**.

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Appendix 1 – Timestamped measurements

Timestamped measurements can be enabled and the format for each measurement will be changed to the following:

Measurement			
Timestamp size	Type	Value	Timestamp
2 bits	6 bits	1 to 65 bytes	0 – 4 bytes

The timestamp value is the number of seconds before transmission when the measurement occurred.

The first 2 bits in byte number 1 determine the size of the timestamp appended after the value.

Timestamp bits	Timestamp size
b00	0 bytes
b01	1 byte
b10	2 bytes
b11	4 bytes

Examples

Temperature 20.5°C – 10 sec ago

Timestamp size & type	Value	Timestamp
0x41 (0b01 and 0x01)	0x00CD	0x0A

Temperature 20.5°C – 24 hours ago

Timestamp size & type	Value	Timestamp
0xC1 (0b10 and 0x01)	0x00CD	0x00015180