



## ISO/IEEE 11073 Standards for Medical Device Communication

### Simple Event Report Message Example

An event report message is sent from a medical device when a change in operational status or a measured data item changes value. The following is an annotated example of a very simple message that may be sent when there is a change in a ventilator's *respiratory rate* and *inspiratory time* shown in an efficient "binary" format (the "0xNN" numbers) as well as English comments on the right-hand side (after the "/" characters)<sup>1</sup>:

```
// Event Report PDU (Protocol Data Unit)
A) 0xE1, 0x00, // MDAP_SPDU_SI
B) 0x00, 0x02, // Presentation Context ID
// -- ROSE Section
C) 0x00, 0x01, 0x00, 0x4C, // Invoke (ROIvapdu), length
D) 0x00, 0x09, 0x00, 0x01, 0x00, 0x46, // Invoke ID=9, cmipConfirmedEventReport(1), length
// -- CMDIP Section (EventReportArgument)
E) 0x00, 0x12, 0x00, 0x00, 0x00, 0x0B, // NOM_MOC_SCAN_CFG_EPI(18)/Handle=11
0x00, 0x00, 0x00, 0x00, // Relative Time Stamp for Report
0x0D, 0x16, 0x00, 0x38, // NOM_NOTI_UNBUF_SCAN_RPT(3350), length
// Episodic Scanner::ScanReportInfo Section
F) 0x00, 0x03, // scan-report-no = 3
0x00, 0x01, 0x00, 0xF8, // glb-scan-info = SEQ OF 1 SingleCtxtScan
0x00, 0x00, // context-id = 0x0000
0x00, 0x02 0x00, 0x2C, // scan-info = SEQ OF 2 Observation Scan
// Object Observation Scan 1: Respiratory Rate (Group: Metric Observed Value)
G) 0x01, 0x10, 0x00, 0x02, 0x00, 0x16, // Handle + AttributeList SEQ OF 2 AVA)
// -- Attribute 1: Nu-Observed-Value
H) 0x09, 0x50, 0x00, 0x0A, // NOM_ATTR_NU_VAL_OBS(2384), length
I) 0x50, 0x0A, 0x08, 0x00, // NOM_RESP_RATE (20490), state
J) 0x0A, 0xE0, // NOM_DIM_RESP_PER_MIN(2784)
K) 0xFF, 0x00, 0x00, 0x2D, // value= 4.5 RPM (i.e., 45 E-1)
// -- Attribute 2: Relative-Time-Stamp
L) 0x09, 0x91, 0x00, 0x04, // NOM_ATTR_TIME_STAMP_REL(2449), length
0x00, 0x00, 0x00, 0x00, // relative time stamp
// Object Observation Scan 2 Inspiratory Time (Group: Metric Observed Value)
M) 0x01, 0x12, 0x00, 0x02, 0x00, 0x16, // Handle + AttributeList (SEQ OF 2 AVA)
// -- Attribute 1: Nu-Observed-Value
N) 0x09, 0x50, 0x00, 0x0A, // NOM_ATTR_NU_VAL_OBS(2384), length
O) 0xF0, 0x12, 0x08, 0x00, // NOM_TIME_PD_INSP (61458), state
P) 0x08, 0x80, // NOM_DIM_SEC(2176)
0x00, 0x00, 0x00, 0x03, // value = 3.0 seconds
// -- Attribute 2: Relative-Time-Stamp
Q) 0x09, 0x91, 0x00, 0x04, // NOM_ATTR_TIME_STAMP_REL(2449), length
0x00, 0x00, 0x00, 0x00 // relative time stamp
```

Short explanations of each lettered line are provided on the next page. Omitted from this example is the transport message "wrapper" that is used to communicate the message using a reliable transport connection (i.e., reliable in the sense that transmission errors can be detected and recovery procedures executed), for example, IrDA-based protocols or TCP/IP).

<sup>1</sup> The data indicated here is in hexadecimal notation (i.e., "0xNN" where NN is a value from 0–255 encoded using the digits 0-9 and the letters A-F). Actual IEEE 11073 messages are sent as "binary" data and not text strings.

- A) The Session Protocol Data Unit (SPDU) indicates the kind of message this is for: the negotiated session or connection. Message types include Data Transfer (this example), as well as, association/connection request, accept, reject, release, and abort. (based on ITU X.225/ISO 8327; ITU X.227/ISO 8650-1; ITU X.217/ISO 8649).
- B) Identifies the “presentation context” used for this message, namely how the following message is encoded, in this case using IEEE 1073.2.1.1 Medical Device Encoding Rules (MDER). Other formats could be HL7, DICOM, or ISO standard BER. The presentations context supported across an active connection are negotiated when the association is established (i.e., with the two systems connect and begin communication). (based on ITU X.226/ISO 8823)
- C) This begins the application Remote Operation Service Element (ROSE) message section. These message types include Invoke (this example), Result, Error, and Reject. (based on ITU X.880/ISO 13712; ISO 11188)
- D) This is the Common Medical Device Information Protocol (CMDIP) section of the message. These message types include confirmed Event Report (this example), object Create and Delete, object attribute Get and Set, and Action invoke. (based on ISO 9595 & 9596)
- E) This section of the message identifies the IEEE 1073 object (and identifier, #11) that generated the message, as well as the timestamp when the message was created (in 8KHz ticks), and the type of scan report which follows: Unbuffered Scan Report Notification.
- F) Each scan report is numbered (here it is #3). This allows for the detection of “dropped” scan reports and supports multiple reports to be sent before confirmations have been received. Additionally, the Medical Device System (MDS) context is identified (here #0), which contains the objects who’s attributes were scanned for changes in value. Finally, it indicates the number of “scans” which are included in the report – (2).
- G) This is the first scanned object whose attributes changed value. Only the object’s “handle” is reported, helping to reduce message length, along with the number of attributes included, here (2).
- H) Attribute that is being reported: a Numeric object’s ObservedValue attribute.
- I) This is the name of the value contained within the attribute: Respiratory Rate. Note: all the named items that are contained in the message are identified using “nomenclature” or numeric codes instead of text names. This helps shorten message length and eliminates international language dependencies.
- J) This field identifies the units of value for this attribute, namely Respirations (or breaths) per minute.
- K) The actual value, here using Medical Device Numeric Format (MDNF), which has been optimized for ease of processing in simple medical devices.
- L) This is the second attribute of the scanned Numeric (#0x0110), which is the timestamp when the respiratory rate value was updated (vs. eventually reported). Again a 32-bit timestamp in 8KHz ticks (1 tick = 125microseconds)
- M) Second Numeric object that contained a changed value (handle #0x0112).
- N) The first reported attribute for this Numeric object; again, the ObservedValue.
- O) The name of the parameter that is being communicated: Inspiration Time Period
- P) The units of the value, seconds (fractional) followed by the 32-bit value.
- Q) The second attribute (of this 2<sup>nd</sup> scanned object) being reported, namely the timestamp when the value changed

Note that throughout the message, there are “length” fields. This allows the message parser to skip over elements of the message that it doesn’t recognize or need. For example, if it knows about Inspiration Time but not the Respiratory Rate, then it can use the length value specified on line (G), to skip over that section and go directly to line (M).

The specific IEEE standards that would be needed to specify this example message include: (1) IEEE 1073.3.2 IrDA-Based Cable Connected Transport; (2) IEEE 1073.1.1.1 Nomenclature; (3) IEEE 1073.1.2.1 Domain Information Model; (4) CEN ENV13735 Interoperability Profiles (being moved to IEEE P1073.2.2.2 Baseline Profile); (5) IEEE 1073.2.1.1 Base Standard; and IEEE P1073.1.3.3 Ventilator.