GE Healthcare

S/5 System Interface

Datex-Ohmeda Record Specification

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1 Overview

1.1 About this document

Patient data measured by S/5 Network compatible monitors can be accessed by external applications through S/5 System Interface. The S/5 System Interface consists of a serial RS232 interface (called S/5 Computer Interface) that can be accessed directly by external applications, and S/5 Network Interface that can be accessed via S/5 Central/iCentral.

This document specifies the Datex-Ohmeda Record (later also DRI) parts that are visible through the S/5 System Interface. The information is valid to both the computer and the network interface with certain exceptions that are defined in this document.

There are two main parts in the document. The first part, chapter 2. Datex-Ohmeda Record covers the high-level structure of the DRI. The rest of the chapters describe the data structures in detail.

This document describes the details of the DRI protocol. It is intended to software designers who need to extract information from DRI records. It is recommended that the reader has basic knowledge about the C programming language. The notation of the C language has been used in many definitions.

1.2 Terms and abbreviations

Application Data Interface
: A monitor software module that provides external applications an interface to specific type of monitor data. For example, services for accessing physiological data make an ADI.

ADI
: Application Data Interface

DRI
: Datex-Ohmeda Record

Interface Level
: The level of the Datex-Ohmeda Record Interface the monitor supports, see 2.3. Supported DRI levels.

⇦
: Up to this DRI level.

⇨
: From this DRI level on.

For your notes:

2 Datex-Ohmeda Record

2.1 General

Datex-Ohmeda Record Interface specifies data formats and constants used in the communication between monitors connected to the S/5 Network and external devices. All data in all media types is transferred in the Datex-Ohmeda Record format. The general structure of the Datex-Ohmeda Record is outlined in chapter Structure of Datex-Ohmeda Record.

Literals used by the Datex-Ohmeda Record are shown in CAPITAL letters.

All data is in binary Intel format, which means that the byte order of the data is little endian. The lower byte of a 16-bit value is in lower address and higher byte in higher address. The lower word of a 32-bit value is in lower address and the higher word in higher address.

Sizes of integer and short integer are 32 bits and 16 bits, respectively.

Some commonly used data types are defined below:

```
typedef unsigned char       byte
typedef unsigned short      word
typedef unsigned long       dword
```

The size of boolean is 16 bits.

IMPORTANT: Fields within structures are aligned to **1-byte boundaries**.

NOTE: When transmitting data to the S/5 Monitor or Network Interface, all reserved fields must be set to 0 to ensure compatibility with future versions of monitors.

2.2 Structure of Datex-Ohmeda Record

At the highest level, a Datex-Ohmeda Record consists of a Datex-Ohmeda header and variable amount of data:

```
struct datex_record
{
   struct  datex_hdr   hdr;
   union
   {
       union   wf_srcrds   wf_rcrd;
       union   ph_srcrds   ph_rcrd;
       union   al_srcrds   al_rcrd;
       union   nw_srcrds   nw_rcrd;
       union   fo_srcrds   fo_rcrd;
       byte                data[1450];
   } rcrd;
};
```

The following table describes the contents of the Datex-Ohmeda Record fields:

Table 2-1 Datex-Ohmeda Record field contents

Record field	Contents
datex_hdr	Specifies the header information of the data.
union wf_srcrds	Specifies the waveform application data interface.

union ph_srcrds	Specifies the physiological data and trend download application data interface.
union al_srcrds	Specifies the alarm transmission application data interface.
union nw_srcrds	Specifies the network management data interface for accessing patient identification data and monitor login and logout information. Valid for network interface only.
union fo_srcrds	Specifies the event application data interface for accessing anesthesia record keeping data. Valid for network interface only.
byte data[1450]	The maximum record size.

The data area is divided into smaller blocks, subrecords, of variable size. There can be up to 8 subrecords in one Datex-Ohmeda Record. A subrecord contains a logical entity of S/5 monitor application data. See Figure 2-1.

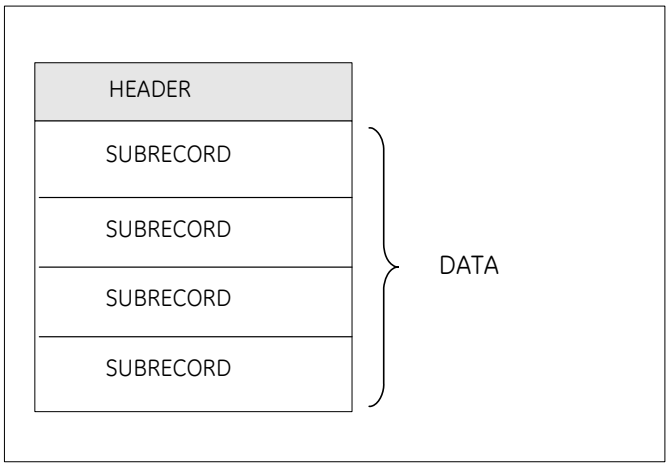


Figure 2-1 Data structure

2.2.1 Record header

The structure of the Datex-Ohmeda Record header is the following:

```
struct datex_hdr
{
    short               r_len;
    byte                r_nbr;
    byte                dri_level;
    word                plug_id;
    dword               r_time;
    byte                n_subnet;
    byte                reserved2;
    word                reserved3;
    short               r_maintype;
    struct sr_desc      sr_desc[8];
};
```

Table 2-2 Datex-Ohmeda Record header field contents

Header field	Contents
r_len	Equals the total length of the record, including the Datex-Ohmeda Record header.
r_nbr	Record number
dri_level	Indicates the Datex-Ohmeda Record Interface level the monitor supports (see 2.3. Supported DRI levels).
plug_id	Plug identifier number of the sending monitor.
r_time	Time when the record was transmitted. The time is defined as the number of seconds since 1.1.1970. NOTE: Some compilers and libraries use 1.1.1900 as the start moment of time.
n_subnet reserved2 reserved3	These fields are reserved. When transmitting data to the monitor these fields must be zeroed.
r_maintype	The main type of the record. Subrecord types are subtypes of the main type.
sr_desc	An array that describes the data in the subrecords.

2.2.2 Record main types

Table 2-3 Record main types

Record main type	Usage
DRI_MT_PHDB = 0	Physiological data and related transmission requests.
DRI_MT_WAVE = 1	Waveform data and related transmission requests.
DRI_MT_ALARM = 4	Alarm data and related transmission requests. Valid for network interface only.
DRI_MT_NETWORK = 5	Patient identification data (first name, middle name, last name and id of the patient), patient demographics (birth date, age, height, weight, BSA, gender)* and monitor login and logout information. Valid for network interface only. *NOTE: Patient demographics are supported starting from the interface level 8.
DRI_MT_FO = 8	Anesthesia record keeping event data (for example, fluids entry). Valid for network interface only.

2.2.3 Subrecord data description

```
struct sr_desc
{
   short   sr_offset;
   byte    sr_type;
};
```

Table 2-4 Subrecord field contents

Subrecord field	Contents
sr_offset	A relative pointer to the subrecord. The origin from where the offsets are calculated, is the start of the data area. Thus, the offset to the first subrecord is always 0.
sr_type	Contains the subrecord type. Valid subrecord types depend on the record main type. As the number of subrecords is not fixed, the value 0xFF as subrecord type indicates that there are no more subrecords in the record. Subrecord type to indicate end of subrecord list DRI_EOL_SUBR_LIST 0xFF

2.3 Supported DRI levels

The field DRI level (interface level) in the packet header indicates the Datex-Ohmeda Record Interface the monitor supports. The interface level indicates which fields are used in structures and which are not. Please refer to the bedside monitor's own user documentation for the parameters available in the monitor. DRI_LEVEL_93 = 0x00 and DRI_LEVEL_94 = 0x01 monitors are not supported.

Table 2-5 Supported DRI levels

Value	C- define name	Marketing name, used in the monitor	
2	DRI_LEVEL_95	1995	'95
3	DRI_LEVEL_97	1997	'97
4	DRI_LEVEL_98	1998	'98
5	DRI_LEVEL_99	1999	'99
6	DRI_LEVEL_00	2001	'01
7	DRI_LEVEL_01	2002	'02
8	DRI_LEVEL_02	2003	'03
9	DRI_LEVEL_03	2005	'05
10	DRI_LEVEL_04	2009	'09
11	DRI_LEVEL_05	2015	'15

NOTE: In order to enable communication between a patient monitor and a Central, the DRI level of the monitor must be within the supported range of the Central.

NOTE: In most S/5 monitors, the DRI level can be changed on the monitor to support older central versions, for details see Table 2-7 Supported monitor versions.

Table 2-6 Centrals and supported DRI levels

Central Version	Versions	Marketing name	Supported DRI level								
			'95	'97	'98	'99	'01	'02	'03	'05	'09
S-CNET99	1.0 - 1.3	H Central	Y	Y	Y	Y					
S-CNET01	2.0, 2.1	H+ Central	Y	Y	Y	Y	Y				
S-CNET02	2.2	H++ Central	Y	Y	Y	Y	Y	Y			
L-NET03	3.1 – 3.6	iCentral		Y	Y	Y	Y	Y	Y		
L-NET05	4.2 – 5.0.X	iCentral		Y	Y	Y	Y	Y	Y	Y	
L-NET05	5.1.X	iCentral					Y	Y	Y	Y	Y

The following monitors are supported by both the computer and the network interface (The DEVTYPE_XXX refers to the dri_net_conn_type enumeration, see 6.3.1. Monitor login message (DRI_NW_NGM_REGIST, nw_login_msg)):

Table 2-7 Supported monitor versions

Monitor SW Version	Device type	Supported DRI level
CARESCAPE B850 CSP 3.0	ALL	**'15**, only serial communication
CARESCAPE B450 CSP 3.1	ALL	**'15**, only serial communication
CARESCAPE B650 CSP 3.1	ALL	**'15**, only serial communication
CARESCAPE B850 CSP 3.1	ALL	**'15**, only serial communication

Monitor SW Version	Device type	Supported DRI level	
		'09	'15
CARESCAPE Monitor B850			
ESP 8ICU -1.0.X	DEVTYPE_ESP_ICU	Y	
ESP 8ORP -1.0.X	DEVTYPE_ESP_ANE	Y	
ESP 8NIC -1.0.X	DEVTYPE_ESP_NICU	Y	
ESP 8PAC -1.0.X	DEVTYPE_ESP_PACU	Y	
ESP 8ECP -1.0.X	DEVTYPE_ESP_ED	Y	
ESP 8ICU -2.X	DEVTYPE_ESP_ICU	Y	Y[1]

Monitor SW Version	Device type	Supported DRI level	
		'09	'15
ESP 8ORP -2.X	DEVTYPE_ESP_ANE	Y	Y[1]
ESP 8NIC -2.X	DEVTYPE_ESP_NICU	Y	Y[1]
ESP 8PAC -2.X	DEVTYPE_ESP_PACU	Y	Y[1]
ESP 8ECP -2.X	DEVTYPE_ESP_ED	Y	Y[1]
CARESCAPE Monitor B650			
ESP 6ICU -1.1.X	DEVTYPE_ESP_ICU	Y	
ESP 6ORP -1.1.X	DEVTYPE_ESP_ANE	Y	
ESP 6NIC -1.1.X	DEVTYPE_ESP_NICU	Y	
ESP 6PAC -1.1.X	DEVTYPE_ESP_PACU	Y	
ESP 6ECP -1.1.X	DEVTYPE_ESP_ED	Y	
ESP 6ICU -2.X	DEVTYPE_ESP_ICU	Y	Y[1]
ESP 6ORP -2.X	DEVTYPE_ESP_ANE	Y	Y[1]
ESP 6NIC -2.X	DEVTYPE_ESP_NICU	Y	Y[1]
ESP 6PAC -2.X	DEVTYPE_ESP_PACU	Y	Y[1]
ESP 6ECP -2.X	DEVTYPE_ESP_ED	Y	Y[1]
CARESCAPE Monitor B450			
ESP 4ICU -2.X	DEVTYPE_ESP_ICU	Y	Y[1]
ESP 4ORP -2.X	DEVTYPE_ESP_ANE	Y	Y[1]
ESP 4NIC -2.X	DEVTYPE_ESP_NICU	Y	Y[1]
ESP 4PAC -2.X	DEVTYPE_ESP_PACU	Y	Y[1]
ESP 4ECP -2.X	DEVTYPE_ESP_ED	Y	Y[1]

1 Monitors with host software version 2 with host build 2.0.8 or later. Only DRI serial supports DRI level '15.

Monitor SW Version	Device type	Supported DRI level								
		'95	'97	'98	'99	'01	'02	'03	'05	'09
S/5 monitors[1]										
S-STD95	DEVTYPE_ANE	Y								
S-ARK95	DEVTYPE_ANEARK	Y								
S-STD96	DEVTYPE_ANE	Y								
S-ARK96	DEVTYPE_ANEARK	Y								
S-ANE97	DEVTYPE_ANE		Y							

Monitor SW Version	Device type	Supported DRI level								
		'95	'97	'98	'99	'01	'02	'03	'05	'09
S-ARK97	DEVTYPE_ANEARK		Y							
S-ICU97	DEVTYPE_ICU		Y							
S-ANE98	DEVTYPE_ANE			Y						
S-ARK98	DEVTYPE_ANEARK			Y						
S-ICU98	DEVTYPE_ICU			Y						
S-00A05/06	DEVTYPE_ANE				Y					
L-ANE01(A)	DEVTYPE_ANE				Y	Y				
L-ANE02(A)	DEVTYPE_ANEARK				Y	Y				
L-ICU02(A)	DEVTYPE_ICU				Y	Y				
L-CANE02(A)	DEVTYPE_ANEARK				Y	Y	Y			
L-ANE03(A)	DEVTYPE_ANEARK				Y	Y		Y		
L-CANE03(A)	DEVTYPE_ANEARK					Y	Y	Y		
L-ANE05(A)	DEVTYPE_ANE					Y		Y	Y	
L-ICU05(A)	DEVTYPE_ICU					Y		Y	Y	
L-CANE05(A)	DEVTYPE_ANEARK				Y	Y	Y	Y	Y	
L-CICU05(A)	DEVTYPE_ICU				Y	Y	Y	Y	Y	
L-ANE06(A)	DEVTYPE_ANEARK				Y	Y		Y	Y	
L-ICU06(A)	DEVTYPE_ICU				Y	Y		Y	Y	
L-CANE06(A)	DEVTYPE_ANEARK				Y	Y	Y	Y	Y	
L-CICU06(A)	DEVTYPE_ICU				Y	Y	Y	Y	Y	
L-ANE07(A)	DEVTYPE_ANEARK				Y	Y		Y	Y	
L-ICU07(A)	DEVTYPE_ICU				Y	Y		Y	Y	
Light Monitor										
F-LMP1 (Light)	DEVTYPE_LM_ARRWS		Y							
S/5 FM										
L-FICU03(A)	DEVTYPE_FM					Y	Y	Y		

Monitor SW Version	Device type	Supported DRI level								
		'95	'97	'98	'99	'01	'02	'03	'05	'09
L-FICU04(A)	DEVTYPE_FM					Y	Y	Y		
L-FICU05L (FM Light)	DEVTYPE_LM					Y	Y	Y		
Cardiocap/5										
S-XANE01	DEVTYPE_XM_ANE					Y				
S-XCCA01	DEVTYPE_XM_ICU					Y				
B40 Patient Monitor										
VSP-A_1.X	DEVTYPE_FM					Y	Y	Y		
VSP-B_1.X[2]	DEVTYPE_PM_ICU									Y
VSP-B_1.X[3]	DEVTYPE_PM_ANE									Y
B30 Patient Monitor										
L-DICU08	DEVTYPE_FM					Y	Y	Y		
B20 Patient Monitor										
VSP-A_1.X	DEVTYPE_FM					Y	Y	Y		
B105 B125 Patient Monitor										
VSP-1.0.X.X[4]	DEVTYPE_PM_ICU									Y

1 In this table S/5 monitors refer to S/5 Anesthesia Monitor (S/L-ANEXX), S/5 Compact Anesthesia Monitor (L-CANEXX), S/5 Critical Care Monitor (S/L-ICUXX) and S/5 Compact Critical Care Monitor (L-CICUXX).

2 With option Non OR, the VSP-B monitor sends its software package type (device type in DRI terms) as DEVTYPE_PM_ICU(27).

3 With option OR, the VSP-B monitor sends its software package type (device type in DRI terms) as DEVTYPE_PM_ANE(26).

4 B1x5 monitor sends its software package type as DEVTYPE_PM_ICU(27). Note: B1x5 monitor does not support S/5 Network protocol.

2.4 Unsupported data

The following data is not provided through the S/5 Network Interface:

- Airway volume waveform data
- Tonometry catheter pressure waveform data
- Spirometry loop bit pattern data
- Entropy waveform data
- BIS waveform data
- 10 second trended numeric values of the physiological database

NOTE: Displayed numeric values and 60 second trended numeric values of the parameters listed above are provided in the physiological data.

The following data is not provided through the S/5 Computer Interface:

- NOTE: ST numeric values from all the 12 leads are provided in the physiological data
- Patient identification data, patient demographics, monitor login and logout information
- Anesthesia record keeping event data
- NOTE: Only CARESCAPE monitors support alarm data, other monitors do not.
- NOTE: Only CARESCAPE monitors with software version 3 or later support 12-lead ECG waveform data, other monitors do not.

For your notes:

3 Physiological Data ADI (DRI_MT_PHDB)

3.1 General

Physiological data ADI provides access to the S/5 monitor physiological database. The following **physiological data subrecord types** are available:

- Displayed values of the physiological database
- 10 second trended values of the physiological database. Valid for computer interface only.
- 60 second trended values of the physiological database
- Auxiliary Physiological Information

In addition, there are four different **physiological data record classes** for the displayed and trended values. For more details, see "Physiological subrecord classes".

Additionally there is a separate **auxiliary packet,** which contains the measurement time of NIBP, CO and PCWP, and the BSA value.

External application may request a single or periodic transmission of each subrecord type.

3.2 Physiological data structure

The union determining physiological data in the Datex-Ohmeda Record is **ph_srcrds.**

```
union ph_srcrds
{
   byte    ph_subrec[5 * sizeof(struct dri_phdb)];
};
```

Physiological database record is defined as a union of physiological database subrecords. One physiological database record accommodates up to five subrecords. The size of each subrecord is 278 bytes, except the size of an auxiliary information subrecord, which is 114 bytes.

The main type of physiological data ADI is **DRI_MT_PHDB**.

3.3 Subrecord types

The following values are used to describe the physiological database subrecords and related transmission request subrecords:

Table 3-1 Physiological database subrecord values and usage

Value	Usage	Notes/Version info
DRI_PH_DISPL = 1	Current (displayed) values of the physiological database	Interface level 1 ⇨ Subrecord: dri_phdb
DRI_PH_10S_TREND = 2	10 s trended values of the physiological database	Interface level 1 ⇨* Subrecord: dri_phdb *** Valid for computer interface only.**
DRI_PH_60S_TREND = 3	60 s trended values of the physiological database	Interface level 1 ⇨* Subrecord: dri_phdb
DRI_PH_AUX_INFO = 4	Auxiliary packet contains the measurement time of NIBP, CO and PCWP, and the BSA value.	Interface level 1 ⇨ Subrecord: aux_phdb_info

NOTE: The monitor does not send the 10s (DRI_PH_10S_TREND) or 60s (DRI_PH_60S_TREND) trended values of the physiological database data through the computer interface unless the automatic transmission of the displayed values (DRI_PH_DISPL) has been requested. The request for starting automatic transmission of displayed values with some interval (e.g. 60 seconds) has to be sent to the monitor before the request for the 10s or 60s trended values is sent. The monitor starts sending the trended values when the patient case is started in the monitor. If the patient case is ended the monitor stops sending the trended values until a new patient case is started. The requests have to be sent only once.

3.3.1 Physiological subrecord classes

In addition to subrecord types, there is another dimension of classification for physiological data records of type **DRI_PH_DISPL, DRI_PH_10S_TREND** or **DRI_PH_60S_TREND**: the physiological subrecord class.

All the physiological subrecords of types DRI_PH_DISPL, DRI_PH_10S_TREND and DRI_PH_60S_TREND have the same length and some common fields, like the time stamp of the record. However, the data contents of the record vary depending on the record class.

Table 3-2 Physiological subrecord data classes

Name	Usage	Notes/Version info
Basic	Basic physiological data: ECG, blood pressures, temperatures, SpO_2, gases, spirometry flow and volume, C.O., PCWP, NMT, SvO_2, etc.	Interface level 1 ⇨
Ext1	Arrhythmia analysis and ST analysis data, 12-lead ECG data, invasive blood pressure channels 7 and 8, 2nd SpO_2 channel, temperature channels 5 and 6.	Interface level 3 ⇨
Ext2	More NMT data, EEG, entropy , surgical pleth index data.	Interface level 3 ⇨
Ext3	More gas measurement data, gas exchange data, more spirometry parameters, tonometry, invasive pressure data, delta pressure, CPP and PiCCO data.	Interface level 3 ⇨

3.3.2 Specifying physiological data classes

Physiological subrecord classes have to be specified when physiological data transmission is requested from a monitor. The classes are specified by using a phdb_class_bf variable, which is a part of the physiological data request message used in the S/5 Computer Interface. In the S/5 Network Interface phdb_class_bf is a parameter of the DONI_SubscribePhdbs() function.

Table 3-3 Bit description for the phdb_class_bf

Value	Usage	Notes/Version info
DRI_PHDBCL_ REQ_BASIC_MASK = 0x0000	Enable sending of Basic physiological data class	Interface level 3 ⇨
DRI_PHDBCL_ DENY_BASIC_MASK = 0x0001	Disable sending of Basic physiological data class	Interface level 3 ⇨

DRI_PHDBCL_ REQ_EXT1_MASK = 0x0002	Enable sending of Ext1 physiological data class	Interface level 3 ⇨
DRI_PHDBCL_ REQ_EXT2_MASK = 0x0004	Enable sending of Ext2 physiological data class	Interface level 3 ⇨
DRI_PHDBCL_ REQ_EXT3_MASK = 0x0008	Enable sending of Ext3 physiological data class	Interface level 3 ⇨

The value of the phdb_class_bf is thus a 'logical or' function of the selected physiological subrecord class's bit masks.

3.3.3 Displayed, 10S Trend and 60S Trend values

The subrecords for displayed and trended values have identical internal structure.

```
struct dri_phdb
{
    dword                       time;
    union
    {
        struct basic_phdb           basic;
        struct ext1_phdb            ext1;
        struct ext2_phdb            ext2;
        struct ext3_phdb            ext3;
    }                           physdata;
    byte                        marker;
    byte                        reserved;
    word                        cl_drilvl_subt;
 };
```

Table 3-4 Physiological database subrecord contents

Field	Contents
time	Contains the time stamp of the record in Unix time, i.e., the number of seconds since 00:00:00 , 1.1.1970.
marker	Contains the number of the latest entered mark.
reserved	Reserved for future use.
cl_drilvl_subt	See Table 3-5 Usage of cl_drilvl_subt below.

Table 3-5 Usage of cl_drilvl_subt

Bit	Usage
0 to 7	Reserved for future extensions.

8 to 11	Class of the subrecord.
	`enum dri_phdb_class`
	`{`
	`DRI_PHDBCL_BASIC,`
	`DRI_PHDBCL_EXT1,`
	`DRI_PHDBCL_EXT2,`
	`DRI_PHDBCL_EXT3,`
	`};`

12 to 15	Reserved for future extensions.

3.3.4 Auxiliary Physiological Information

The Auxiliary Physiological Information has the following data structure:

struct aux_phdb_info

{

```
dword  nibp_time;
short  reserved1;
dword  co_time;
dword  pcwp_time;
short  pat_bsa;
byte   reserved[98];
```

};

Table 3-6 Auxiliary Physiological Information subrecord contents

Field	Unit:	Contents
nibp_time	1 second	It is the time of the latest NIBP measurement. The time is defined as seconds since 1.1.1970. If the time is not known, the value is 0.
reserved1		Reserved.
co_time	1 second	It is the time of the latest Cardiac Output measurement. The time is defined as seconds since 1.1.1970. If the time is not known, the value is 0.
pcwp_time	1 second	It is the time of the latest PCWP measurement. The time is defined as seconds since 1.1.1970. If the time is not known, the value is 0.
pat_bsa	1/100 m^2	It is the patient's body surface area.
reserved		Reserved.

3.4 Structure of measurement data

The data areas (union physdata) of the physiological database subrecords have been divided into smaller parameter-specific groups. A parameter group consists of a group header and 1 to 8 measurement values.

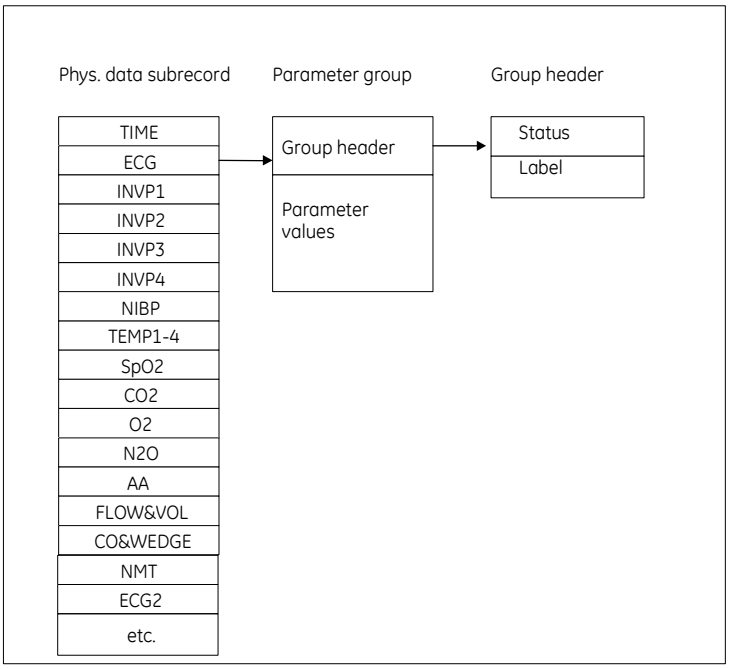


Figure 3-2 Measurement data structure

The group header contains parameter or measurement specific information.

```
struct group_hdr
{
    union phdb_status   status;
    word                label;
};
```

Table 3-7 Group header contents

Field	Contents

status	Holds up to 32 common and parameter-specific bits.
	`union phdb_status`
	`{`
	`  struct phdb_status_bits status_bits;`
	`  dword status_dw;`
	`  short stat_f[2];`
	`};`

label	Parameter-specific field. Its contents are discussed together with the contents of the measurement data.

The structure of general bits in group header (phdb_status_bits) is:

```
struct phdb_status_bits
{
    unsigned int exists         : 1;
    unsigned int active         : 1;
    unsigned int reserved       : 14;
    unsigned int reserved2      : 16;
};
```

Table 3-8 Usage of phdb_status_bits

Bit	Usage
0	Measurement module existence: TRUE, if the module exists.
1	Measurement activity: TRUE, if the measurement is active.
2 to 31	Reserved for future and parameter specific use. See parameter specific definitions for details.

All measurement data is represented as signed 16-bit values. Some control information is embedded into the measurement data by assigning special meaning to certain values. As values with special meaning start from -32001 downwards, the smallest valid value is always -32000.

The most common special values are:

Table 3-9 Usage of special measurement values

Value	Usage
DATA_INVALID = -32767	Invalid data
DATA_NOT_UPDATED = -32766	Data not updated
DATA_UNDER_RANGE = -32764	Data under range
DATA_OVER_RANGE = -32763	Data over range
DATA_NOT_CALIBRATED = -32762	Data not calibrated

3.5 Basic Class (DRI_PHDBCL_BASIC, basic_phdb)

The data contents for subrecord class “basic” are specified below:

```
struct basic_phdb
{
    struct ecg_group            ecg;
    struct p_group              p1234[4];
    struct nibp_group           nibp;
    struct t_group              t[4];
    struct SpO2_pl_group        SpO2;
    struct co2_group            co2;
```

```
    struct o2_group             o2;
    struct n2o_group            n2o;
    struct aa_group             aa;
    struct flow_vol_group       flow_vol;
    struct co_wedge_group       co_wedge;
    struct nmt_group            nmt;
    struct ecg_extra_group      ecg_extra;
    struct svo2_group           svo2;
    struct p_group              p56[2];
    byte                        reserved[2];
};
```

3.5.1 ECG Group

```
struct ecg_group
{
    struct group_hdr    hdr;
    short               hr;
    short               st1;
    short               st2;
    short               st3;
    short               imp_rr;
};
```

Status field

Table 3-10 ECG status field bits usage

Bit	Usage	Version info
2	Asystole.	Interface level 1 ⇨
3 to 6	These bits indicate the heart rate source. Possible values are listed below.	Interface level 1 ⇨
7	Noise	Interface level 3 ⇨
8	Artifact	Interface level 3 ⇨
9	Learning	Interface level 3 ⇨
10	Pacer on	Interface level 3 ⇨
11	Channel 1 off	Interface level 3 ⇨
12	Channel 2 off	Interface level 3 ⇨
13	Channel 3 off	Interface level 3 ⇨
14 to 31	Reserved for future use.	

Table 3-11 Heart rate sources

Value	Heart rate source	DRI level
DRI_HR_SRC_UNKNOWN = 0	Not selected	
DRI_HR_SRC_ECG1 = 1	ECG	
DRI_HR_SRC_BP1 = 2	Invasive pressure channel 1	
DRI_HR_SRC_BP2 = 3	Invasive pressure channel 2	
DRI_HR_SRC_BP3 = 4	Invasive pressure channel 3	
DRI_HR_SRC_BP4 = 5	Invasive pressure channel 4	
DRI_HR_SRC_PLETH = 6	SpO_2	
DRI_HR_SRC_BP5 = 7	Invasive pressure channel 5	
DRI_HR_SRC_BP6 = 8	Invasive pressure channel 6	
DRI_HR_SRC_ECG = 9	ECG Mortara	
DRI_HR_SRC_BP7 =10	Invasive pressure channel 7	DRI_LEVEL_04 ⇨
DRI_HR_SRC_ BP8 =11	Invasive pressure channel 8	DRI_LEVEL_04 ⇨
DRI_HR_SRC_PLETH_2 =12	Secondary SpO_2 channel	DRI_LEVEL_04 ⇨
13 to 15	Reserved for future use.	

Label field

This field contains the lead configuration of each ECG channel. Four bits are used to describe each channel as follows:

Table 3-12 ECG label field usage

Bits	ECG channel
0 to 3	3
4 to 7	2
8 to 11	1
12 to 13	QRS source
14 to 15	Reserved for future use.

The values of the four bits used to describe the lead configuration are interpreted as follows:

Table 3-13 Values of ECG label field bits to define lead selection

Value	Lead
DRI_NOT_SELECTED = 0	NOT_SELECTED
DRI_ECG_I = 1	ECG_I
DRI_ECG_II = 2	ECG_II
DRI_ECG_III = 3	ECG_III
DRI_ECG_AVR = 4	ECG_AVR
DRI_ECG_AVL = 5	ECG_AVL
DRI_ECG_AVF = 6	ECG_AVF
DRI_ECG_V = 7	ECG_V
8 to 15	Reserved for future use.

Data fields

Table 3-14 ECG data fields

Field	Usage	Unit	Notes/Version info
hr	Heart rate	1/min	The heart rate value is not necessarily from the ECG measurement but is based on the monitor's heart rate source selection. See Table 3-10 ECG status field bits usage for details.
st1 st2 st3	ST level	1/100 mm	ST values are calculated from the currently selected user leads ECG1 to ECG3. Labels in header indicate the selected label. If label is V1 to V6, the label is always set to V. (Ext1 group includes 12-lead ST values, see section 3.6.2. ECG_12 Group).
imp_rr	Respiration rate	1/min	Based on measurement of ECG impedance. Interface level 2 ⇨

3.5.2 Invasive Pressure Group

```
struct p_group
{
    struct group_hdr    hdr;
    short               sys;
    short               dia;
    short               mean;
    short               hr;
};
```

Status field

Table 3-15 Invasive Pressure status field bits

Bit	Usage	Version info
2	Zeroing	Interface level 3 ⇨
3	Zeroed	Interface level 8 ⇨
4 to 31	Reserved for future use.	

Label field

The field contains the invasive pressure label, which is one of the following:

Table 3-16 Invasive pressure label field (word) values

Value	Label	Version info
DRI_DUMMY_NDX = 0	NOT DEFINED	
DRI_ART_NDX = 1	ART	
DRI_CVP_NDX = 2	CVP	
DRI_PA_NDX = 3	PA	
DRI_RAP_NDX = 4	RAP	
DRI_RVP_NDX = 5	RVP	
DRI_LAP_NDX = 6	LAP	
DRI_ICP_NDX = 7	ICP	
DRI_ABP_NDX = 8	ABP	
DRI_P1_NDX = 9	P1	
DRI_P2_NDX = 10	P2	
DRI_P3_NDX = 11	P3	
DRI_P4_NDX = 12	P4	
DRI_P5_NDX = 13	P5	
DRI_P6_NDX = 14	P6	
DRI_SP_NDX = 15	SP	DRI_LEVEL_04
DRI_FEM_NDX = 16	FEM	DRI_LEVEL_04
DRI_UAC_NDX = 17	UAC	DRI_LEVEL_04

Value	Label	Version info
DRI_UVC_NDX = 18	UVC	DRI_LEVEL_04
DRI_ICP2_NDX = 19	ICP2	DRI_LEVEL_04
DRI_P7_NDX = 20	P7	DRI_LEVEL_04
DRI_P8_NDX = 21	P8	DRI_LEVEL_04
DRI_FEMV_NDX = 22	FEMV	DRI_LEVEL_04
23 -	Reserved for future use.	

Data fields

Table 3-17 Invasive pressure data fields

Field	Usage	Unit	Notes/Version info
sys dia mean	Invasive pressure	1/100 mmHg	Interface level 1 ⇨
hr	Pulse rate	1/min	Interface level 1 ⇨

3.5.3 Non-Invasive Blood Pressure Group

```
struct nibp_group
{
    struct group_hdr    hdr;
    short               sys;
    short               dia;
    short               mean;
    short               hr;
};
```

NOTE: NIBP 10 second trended values are always equal to the displayed values.

Status field

No parameter specific bits are used. NIBP related status information is included in label field.

NOTE: These are bit fields, not unsigned integer (word) values.

Table 3-18 NIBP label field bits usage.

Bit	Usage	Unit	Notes/Version info
0 to 2	Reserved		
3	AUTO mode selected	1	Interface level 1 ⇨
4	STAT mode selected	1	Interface level 1 ⇨

Bit	Usage	Unit	Notes/Version info
5	Measuring	1	Interface level 1 ⇨
6	STASIS ON	1	Interface level 1 ⇨
7	Calibrating	1	Interface level 1 ⇨
8	Data is older than 60 seconds	1	Interface level 1 ⇨ This flag is set if the NIBP measurement ended more than 60 seconds ago. Exception: When the NIBP source is a PDM module, CARESCAPE Monitor B850 and B650 monitor SW versions 1.x.x set this flag if the NIBP measurement started more than 60 seconds ago.
9 to 15	Reserved for future use.		

Data fields

Table 3-19 NIBP data fields

Field	Usage	Unit	Notes/Version info
sys dia mean	Pressure	1/100 mmHg	Interface level 1 ⇨
hr	pulse rate	1/min	Interface level 1 ⇨

3.5.4 Temperature Group

```
struct t_group
{
    struct group_hdr    hdr;
    short               temp;
};
```

Status field

No parameter specific bits are used.

Label field

This field contains the temperature label, which is one of the following:

Table 3-20 Temperature label field (word) values

Value	Label	Version info
DRI_DEF_LABEL = 0	NOT USED	
DRI_ESO_LABEL = 1	ESO	
DRI_NASO_LABEL = 2	NASO	
DRI_TYMP_LABEL = 3	TYMP	
DRI_RECT_LABEL = 4	RECT	
DRI_BLAD_LABEL = 5	BLAD	
DRI_AXIL_LABEL = 6	AXIL	
DRI_SKIN_LABEL = 7	SKIN	
DRI_AIRW_LABEL = 8	AIRW	
DRI_ROOM_LABEL = 9	ROOM	
DRI_MYO_LABEL = 10	MYO	
DRI_T_1_LABEL = 11	T1	
DRI_T_2_LABEL = 12	T2	
DRI_T_3_LABEL = 13	T3	
DRI_T_4_LABEL = 14	T4	
DRI_CORE_LABEL = 15	CORE	
DRI_SURF_LABEL = 16	SURF	
DRI_T_5_LABEL = 17	T5	DRI_LEVEL_04 ⇨
DRI_T_6_LABEL =18	T6	DRI_LEVEL_04 ⇨

Data fields

Table 3-21 Temperature data fields

Field	Usage	Unit	Notes/Version info
temp	Temperature	1/100 °C	Interface level 1 ⇨

3.5.5 SpO_2 Group

```
struct SpO2_pl_group
{
    struct group_hdr    hdr;
    short               SpO2;
    short               pr;
    short               ir_amp;
    short               SvO2;
};
```

Status field

No parameter specific bits are used.

Label field

Table 3-22 SpO_2 label field (bits) usage

Bits	Usage	Version info
0 to 1	2-bit value containing the SpO_2 label.	Interface level 1 ⇨

SpO_2 labels

This field contains the saturation measurement type, which is one of the following:

Table 3-23 SpO_2 label values

Value	Label	Version info
DRI_SO2 = 0	SO2	⇦ DRI_LEVEL_03
DRI_SAO2 = 1	SaO2	⇦ DRI_LEVEL_03
DRI_SVO2 = 2	SvO2	⇦ DRI_LEVEL_03

Data fields

Table 3-24 SpO_2 data fields

Field	Usage	Unit	Notes/Version info
SpO2	Peripheral Oxygen Saturation	1/100 %	Interface level 1 ⇨
pr	Pulse rate	1 /min	Interface level 1 ⇨
ir_amp	Modulation	1/100 %	Interface level 1 ⇨ Plethysmograph amplitude
SvO2	SO_2, SvO_2 or SaO_2 value as specified by the label	1/100%	Interface level 1 ⇨ DRI_LEVEL_04 ⇨ This field is not used. The SvO_2 Group should be used for SvO_2 value.

3.5.6 CO_2 Group

```
struct co2_group
{
    struct group_hdr    hdr;
    short               et;
    short               fi;
    short               rr;
    short               amb_press;
};
```

Status field

Table 3-25 CO_2 status field bits

Bits	Usage	Notes/Version info
2	Apnea: CO_2	Interface level 1 ⇨
3	Calibrating sensor	Interface level 1 ⇨
4	Zeroing sensor	Interface level 1 ⇨
5	Occlusion	Interface level 1 ⇨
6	Air leak	Interface level 1 ⇨
7	Apnea from Resp	Interface level 1 ⇨
8	Apnea deactivated	Interface level 8 ⇨
9	WET condition (Dry is default)	Interface level 8 ⇨
10 to 31	Reserved for future use.	

Label field

Table 3-26 CO_2 label field bits usage

Bits	Usage	Notes/Version info
0 to 2	These bits indicate the respiration rate (RR) source. See Table 3-27 CO_2 RR sources.	Interface level 1 ⇨
3 to 5	These bits indicate the FI sources. See Table 3-28 CO_2 FI sources.	Interface level 1 ⇨
6 to 15	Reserved for future use.	

Respiration rate sources

Table 3-27 CO_2 RR sources

Value	RR source
DRI_NO_RR_SOURCE = 0	Not selected
DRI_CO2_RR_SOURCE = 1	CO2
DRI_IMPED_RR_SOURCE = 2	ECG, Impedance Resp.

Table 3-28 CO_2 FI sources

Value	FI source
DRI_NO_FI_CO2_SOURCE = 0	Not selected
DRI_CO2_FI_CO2_SOURCE = 1	FICO2
DRI_O2_FI_CO2_SOURCE = 2	FIO2

Data fields

Table 3-29 CO_2 data fields

Field	Usage	Unit	Notes
et	Expiratory concentration	1/100%	Interface level 1 ⇨
fi	Inspiratory concentration	1/100%	Interface level 1 ⇨
rr	Respiration rate	1/min	Interface level 1 ⇨ Based on measurement indicated in the label field. Interface level 8 ⇨ Value is not based on the measurement in the label field. The value is always measured from CO_2.
amb_press	Ambient pressure	1/10 mmHg	Interface level 1 ⇨

3.5.7 O_2 Group

```
struct o2_group
{
    struct group_hdr    hdr;
    short               et;
    short               fi;
};
```

Status field

Table 3-30 O_2 status field bits

Bits	Usage	Version info
2	Calibrating	Interface level 3 ⇨
3	Measurement off	Interface level 3 ⇨
4 to 31	Reserved for future use.	

Label field

Not used.

Data fields

Table 3-31 O_2 data fields

Field	Usage	Unit	Notes/Version info
et	Expiratory concentration	1/100%	Interface level 1 ⇨
fi	Inspiratory concentration	1/100%	Interface level 1 ⇨

3.5.8 N2O Group

```
struct n2o_group
{
    struct group_hdr    hdr;
    short               et;
    short               fi;
};
```

Status field

Table 3-32 N2O status field bits

Bits	Usage	Version info
2	Calibrating	Interface level 3 ⇨
3	Measurement off	Interface level 3 ⇨
4 to 31	Reserved for future use.	

Label field

Not used.

Data fields

Table 3-33 N2O data fields

Field	Usage	Unit	Notes/Version info
et	Expiratory concentration	1/100%	Interface level 1 ⇨
fi	Inspiratory concentration	1/100%	Interface level 1 ⇨

3.5.9 Anesthesia Agent Group

```
struct aa_group
{
    struct group_hdr    hdr;
    short               et;
    short               fi;
    short               mac_sum;
};
```

Status field

Table 3-34 Anesthesia Agent status field bits

Bits	Usage	Version info
2	Calibrating	Interface level 3 ⇨
3	Measurement off	Interface level 3 ⇨
4 to 31	Reserved for future use.	

Label field

This field contains the anesthesia agent label, which is one of the following:

Table 3-35 Anesthesia Agent label field (word) values

Label	Agent
DRI_UNKNOWN = 0	Unknown
DRI_NONE = 1	NONE
DRI_HAL = 2	HAL
DRI_ENF = 3	ENF
DRI_ISO = 4	ISO
DRI_DES = 5	DES
DRI_SEV = 6	SEV

Data fields

Table 3-36 Anesthesia Agent data fields

Field	Usage	Unit	Notes/Version info
et	Expiratory concentration	1/100%	Interface level 1 ⇨
fi	Inspiratory concentration	1/100%	Interface level 1 ⇨
mac_sum	Total Minimum Alveolar Concentration	1/100	

3.5.10 Flow & Volume Group

```
struct flow_vol_group
{
    struct group_hdr    hdr;
    short               rr;
    short               ppeak;
    short               peep;
    short               pplat;
    short               tv_insp;
    short               tv_exp;
    short               compliance;
    short               mv_exp;
};
```

Status field

Table 3-37 Flow & Volume status field bits

Bits	Usage	Version info
2	Disconnection	Interface level 1 ⇨
3	Calibrating	Interface level 1 ⇨
4	Zeroing	Interface level 1 ⇨
5	Obstruction.	Interface level 1 ⇨
6	Leak	Interface level 1 ⇨
7	Measurement off	Interface level 3 ⇨

8 to 9	TV measuring conditions:
	0: Atmospheric/ambient temperature and pressure, dry gas
	1: Normal temperature and pressure, dry gas
	2: Body temperature and pressure, saturated gas
	3: Standard temperature and pressure, dry gas
	enum dri_tv_base
	{
	DRI_ATPD = 0,
	DRI_NTPD = 1,
	DRI_BTPS = 2,
	DRI_STPD = 3,
	DRI_NR_TV_BASE = 4
	};
		Interface level 8 ⇨

10 to 31	Reserved for future use.	

Label field

Not used.

Data fields

Table 3-38 Flow & Volume data fields

Field	Usage	Unit	Notes/Version info
rr	Respiration rate	1/min	Interface level 1 ⇨ Based on spirometry
ppeak	Peak pressure	1/100 cmH2O	Interface level 1 ⇨
peep	Positive end expiratory pressure	1/100 cmH2O	Interface level 1 ⇨
pplat	Plateau pressure	1/100 cmH2O	Interface level 1 ⇨
tv_insp	Inspiratory tidal volume	1/10 ml	Interface level 1 ⇨
tv_exp	Expiratory tidal volume	1/10 ml	Interface level 1 ⇨
compliance	Compliance	1/100 ml / cmH2O	Interface level 1 ⇨
mv_exp	Expiratory minute volume	1/100 l/min	Interface level 1 ⇨

3.5.11 Cardiac Output & Wedge Pressure Group

```
struct co_wedge_group
{
    struct group_hdr    hdr;
    short               co;
    short               blood_temp;
    short               ref;
    short               pcwp;
};
```

Status field

No parameter specific bits are used.

NOTE: Bits in status field reflect the status of the Cardiac Output module.

Label field

Table 3-39 CO & PCWP label field bits usage

Bits	Usage
LBIT_CO_OVER_60S_OLD = 0	Age of CO reading is > 60 s
LBIT_PCWP_OVER_60S_OLD = 1	Age of PCWP reading is > 60 s
2 to 4	CO modes: 0 = No mode 1 = Bolus mode 2 = Continuous mode 3 = Reserved
5 to 15	Reserved for future use.

Data fields

Table 3-40 CO & PCWP data fields

Field	Usage	Unit	Notes/Version info
co	Cardiac output	ml/min	Interface level 1 ⇨
blood_temp	Blood temperature	1/100 °C	Interface level 1 ⇨
ref	Right heart ejection fraction	1/100 %	Interface level 2 ⇨
pcwp	Wedge pressure	1/100 mmHg	Interface level 1 ⇨

3.5.12 NMT Group

```
struct nmt_group
{
    struct group_hdr    hdr;
    short               t1;
    short               tratio;
    short               ptc;
};
```

Status field

Table 3-41 NMT status field bits

Bits	Usage	Notes/Version info

2 to 3	Stimulus mode:
	0: Train Of Four (TOF mode)
	1: Double Burst (DB mode)
	2: Single Twitch (ST mode)
	3: Post-tetanic count
	
	`enum stim_typ`
	`{`
	`TOF = 0,`
	`DBS = 1,`
	`ST_STIM = 2,`
	`PTC_STIM = 3,`
	`NR_STIM_TYPES = 4`
	`};`
		Interface level 2 ⇨

4 to 5	Pulse width
	0: not used
	1: 100 us
	2: 200 us
	3: 300 us
	
	`enum pulse_width_types`
	`{`
	`PULSE_NOT_USED = 0,`
	`PULSE_100 = 1,`
	`PULSE_200 = 2,`
	`PULSE_300 = 3,`
	`PULSE_NR = 4`
	`};`
		Interface level 2 ⇨

6	Supramax current found	Interface level 2 ⇨
7	Calibrated	Interface level 2 ⇨
8 to 31	Reserved for future use.	

Label field

Not used

Data fields

Table 3-42 NMT data fields

Field	Usage	Unit	Notes/Version info
t1	TOF Twitch 1	1/10 %	Interface level 2 ⇨
tratio	t4/t1 in TOF mode t2/t1 in DB mode	1/10 %	Interface level 2 ⇨
ptc	Split into a bit field, see Table 3-43 Bits in ptc field.		Interface level 2 ⇨

Table 3-43 Bits in ptc field

Bits	Usage	Notes/Version info
0 to 4	Post tetanic count, max. value 21. Has value 31 if count not available.	Interface level 2 ⇨ NOTE: DATA_INVALID_LIMIT is -31000. If the `ptc` value is less than or equal to -31000, do not check any part of the ptc field.
5 to 8	TOF count (0 to 4) in TOF mode DB count (0 to 2) in DB mode ST count (0 to 1) in ST mode	Interface level 2 ⇨ NOTE: The TOF.DB, and ST count (bits 5-8) is not valid in the trend packet (`DRI_PH_10S_TREND`, `DRI_PH_60S_TREND`). The `nmt2_group.count` should be used in EXT2 class.
9 to 15	Stimulus current, mA	Interface level 2 ⇨

3.5.13 ECG Extra Group

```
struct ecg_extra_group
{
    short hr_ecg;
    short hr_max;
    short hr_min;
};
```

NOTE: This group has no header. Status information is available in ecg_group.

Table 3-44 ECG Extra data fields

Field	Usage	Unit	Notes/Version info
hr_ecg	heart rate as derived from the ecg signal	1	Interface level 2 ⇨
hr_max	maximum heart rate	1	Interface level 2 ⇨
hr_min	minimum heart rate	1	Interface level 2 ⇨

3.5.14 SvO_2 Group

```
struct svo2_group
{
    struct group_hdr    hdr;
    short               svo2;
};
```

Status field

Table 3-45 SvO_2 status field bits

Bits	Usage	Notes/Version info
2	Calibrated over 24h ago (>24 h)	Interface level 8 ⇨
3	Faulty cable	Interface level 8 ⇨
4	No cable	Interface level 8 ⇨
5	Not calibrated	Interface level 8 ⇨
6	Re-calibrated	Interface level 8 ⇨
7	SvO_2 out of range	Interface level 8 ⇨
8	Check catheter position	Interface level 8 ⇨
9	Intensity shift	Interface level 8 ⇨
10 to 31	Reserved for future use.	

Label field

This field contains the saturation measurement type, which is one of the following:

Table 3-46 SpO_2 label values

Value	Label	Version info
DRI_SO2 = 0	SO2	DRI_LEVEL_04 ⇨
DRI_SAO2 = 1	SaO2	DRI_LEVEL_04 ⇨
DRI_SVO2 = 2	SvO2	DRI_LEVEL_04 ⇨

Data fields

Table 3-47 SvO_2 data field usage

Field	Usage	Unit	Notes/Version info
svo2	SvO2	1/100%	Interface level 3 ⇨

3.6 EXT1 Class (DRI_PHDBCL_EXT1, ext1_phdb)

The data contents for subrecord class “ext1” are specified in this section.

NOTE: Subrecord class “ext1” is available starting from interface level 3.

```
struct ext1_phdb
{
    struct arrh_ecg_group       ecg;
    struct ecg_12_group         ecg12;
    struct p_group              p78[2];
    struct SpO2_pl_group        SpO2_ch2;
    struct t_group              t56[2];
    byte                        reserved[134];
};
```

3.6.1 ARRH_ECG Group

```
struct arrh_ecg_group

{
    struct group_hdr    hdr;
    short               hr;
    short               rr_time;
    short               pvc;
    dword               arrh_status_bf;
    short               reserved[16];
};
```

Status field

Table 3-48 ARRH ECG status field bits

Bit	Usage	Version info
2	Asystole.	Interface level 3 ⇨
3 to 6	These bits indicate the heart rate source. Possible values are listed in section 3.5.1. ECG Group.	Interface level 3 ⇨
7	Noise	Interface level 3 ⇨
8	Artifact	Interface level 3 ⇨
9	Learning	Interface level 3 ⇨
10	Pacer on	Interface level 3 ⇨
11	Channel 1 off	Interface level 3 ⇨

Bit	Usage	Version info
12	Channel 2 off	Interface level 3 ⇨
13	Channel 3 off	Interface level 3 ⇨
14	Arrhythmia analysis source ARRWS	Interface level 3 ⇨
15 to 19	Level of arrhythmia analysis, Table 3-49 ARRH ECG level of arrhythmia analysis.	Interface level 3 ⇨
20	V1 lead is derived.	Interface level 10 ⇨
21	V2 lead is derived.	Interface level 10 ⇨
22	V3 lead is derived.	Interface level 10 ⇨
23	V4 lead is derived.	Interface level 10 ⇨
24	V5 lead is derived.	Interface level 10 ⇨
25	V6 lead is derived.	Interface level 10 ⇨
26 to 31	Reserved for future use.	

Level of arrhythmia analysis:

Table 3-49 ARRH ECG level of arrhythmia analysis

Value	Level of arrhythmia analysis
DRI_ASY_ONLY = 0	ASY_ONLY
DRI_SEVERE = 1	SEVERE (Asystole, V Fib, V Tachy)
DRI_EXTENDED = 2	EXTENDED (Asystole, V Fib, V Tachy, V Run >3, V Couplet, R on T PVC, V Bigeminy, V Trigeminy, Multif. PVCs, Missing Beat, Freq. PVCs
DRI_ADVANCED = 3	ADVANCED (Arrhythmia Workstation)
DRI_ARRY_OFF = 4	Arrhythmia is OFF. Note: DRI_LEVEL_04 =>
5 to 32	Reserved for future use.

Label fields

This field contains the lead configuration of each ECG channel. Four bits are used to describe each channel as follows:

Table 3-50 ECG label field usage

Bits	ECG channel
0 to 3	3
4 to 7	2
8 to 11	1

For the interpretation of the values of the four bits used to describe the lead configuration, see Table 3-13 “Values of ECG label field bits to define lead selection”.

Data fields

Table 3-51 ARRH ECG data fields

Field	Usage	Unit	Notes/Version info
hr	Heart rate	1/min	Interface level 3 ⇨
rr_time	R-to-R time	ms	Interface level 3 ⇨

Field	Usage	Unit	Notes/Version info
pvc	PVC rate	1/min	Interface level 3 ⇨
arrh_status_bf	0 = Asystole 1 = Ventricular fibrillation 2 = Rapid ventricular tachycardia 3 = Ventricular tachycardia 4 = Extreme bradycardia 5 = Extreme tachycardia 6 = PVC run > 3 7 = Long R-to-R interval 8 = PVC triplet 9 = PVC couplet 10 = R-on-T PVC 11 = Idioventricular rhythm 12 = Ventricular bigeminy 13 = Ventricular trigeminy 14 = Frequent PVCs 15 = Multifocal PVCs 16 = Supraventricular tachycardia 17 = Frequent SVCs 18 = Missing beat 19 = Unclassified arrhythmia 20 = Noisy ECG 21 = Problem QRS 22 = Low amplitude 23 = Salvo 24 = Pacer non-functional 25 = Pacer non-capture 26 = New QRS 27 = Bradycardia 28 = Tachycardia 29 = Ventricular bradycardia 30 = Arrhythmia OFF 31 = No telemetry.		
Reserved	Reserved for future use.		

3.6.2 ECG_12 Group

```
struct ecg_12_group

{
    struct group_hdr    hdr;
    short               stI;
```

```
    short               stII;
    short               stIII;
    short               stAVL;
    short               stAVR;
    short               stAVF;
    short               stV1;
    short               stV2;
    short               stV3;
    short               stV4;
    short               stV5;
    short               stV6;

};
```

Status field

Table 3-52 ECG 12 status field bits

Bit	Usage	Version info
2	Asystole.	Interface level 3 ⇨
3 to 6	These bits indicate the heart rate source. Possible values are listed in section 3.5.1. ECG Group.	Interface level 3 ⇨
7	Noise	Interface level 3 ⇨
8	Artifact	Interface level 3 ⇨
9	Learning	Interface level 3 ⇨
10	Pacer on	Interface level 3 ⇨
11	Channel 1 off	Interface level 3 ⇨
12	Channel 2 off	Interface level 3 ⇨
13	Channel 3 off	Interface level 3 ⇨
14	Arrhythmia analysis source ARRWS	Interface level 3 ⇨
15 to 19	Level of arrhythmia analysis, Table 3-49 ARRH ECG level of arrhythmia analysis.	Interface level 3 ⇨
20	V1 lead is derived.	Interface level 10 ⇨
21	V2 lead is derived.	Interface level 10 ⇨
22	V3 lead is derived.	Interface level 10 ⇨
23	V4 lead is derived.	Interface level 10 ⇨
24	V5 lead is derived.	Interface level 10 ⇨
25	V6 lead is derived.	Interface level 10 ⇨
26 to 31	Reserved for future use.	

Label fields

This field contains the lead configuration of each ECG channel. Four bits are used to describe each channel as follows:

Table 3-53 ECG 12 label field usage

Bits	ECG channel
0 to 3	3
4 to 7	2
8 to 11	1

For the interpretation of the values of the four bits used to describe the lead configuration, see Table 3-13 "Values of ECG label field bits to define lead selection".

Data fields

Table 3-54 ECG 12 data fields

Field	Usage	Unit	Notes/Version info
stI stII stIII stAVL stAVR stAVF stV1 stV2 stV3 stV4 stV5 stV6	St-level	1/100 mm	Interface level 5 ⇨

3.7 EXT2 Class (DRI_PHDBCL_EXT2, ext2_phdb)

The data contents for subrecord class "ext2" are specified in this section.

NOTE: Subrecord class "ext2" is available starting from interface level 3.

```
struct ext2_phdb
{
    struct nmt2_group       nmt2;
    struct eeg_group        eeg;
    struct eeg_bis_group    eeg_bis;
    struct entropy_group    ent;
    byte                    reserved[58];
    struct eeg2_group       eeg2;
    struct spi_group        spi;
    byte                    reserved[24];
};
```

3.7.1 NMT2 Group

```
struct nmt2_group
{
    struct group_hdr    hdr;
    short               count;
    short               nmt_t1;
    short               nmt_t2;
    short               nmt_t3;
    short               nmt_t4;
    short               nmt_resv1;
    short               nmt_resv2;
    short               nmt_resv3;
    short               nmt_resv4;
};
```

Status field

No parameter specific bits are used.

Label field

Not used.

Data fields

Table 3-55 NMT2 data field usage

Field	Usage	Unit	Notes/Version info
count	TOF count in TOF mode DB count in DB mode ST count in ST mode		Interface level 3 ⇨
nmt_t1	t1 absolute value		Interface level 3 ⇨
nmt_t2	t2 absolute value		Interface level 3 ⇨
nmt_t3	t3 absolute value		Interface level 3 ⇨
nmt_t4	t4 absolute value		Interface level 3 ⇨
nmt_resv1 .. nmt_resv4	Future extensions		

3.7.2 EEG Group

```
struct eeg_group
{
    struct group_hdr    hdr;
    short               femg;
    struct eeg_channel  eeg1;
    struct eeg_channel  eeg2;
    struct eeg_channel  eeg3;
    struct eeg_channel  eeg4;
};
struct eeg_channel
```

```
{
    short           ampl;
    short           sef;
    short           mf;
    short           delta_proc;
    short           theta_proc;
    short           alpha_proc;
    short           beta_proc;
    short           bsr;
 };
```

Status field

Table 3-56 EEG status field bits

Bit	Usage	Version info
0 to 1	Exists/active	Interface level 5 ⇨
2	Measurement on	Interface level 5 ⇨
3…5	Montage (in use: 0…7) 0 = Basic 1 = General 2 = AEP 3 … 7 = Mont4 …8, user can configure name freely.	Interface level 5 ⇨
6	Reserved, set to 0.	Interface level 5 ⇨
7	Headbox off	Interface level 5 ⇨
8	SSEP cable off	Interface level 5 ⇨
9	Channel 1 leads off	Interface level 5 ⇨
10	Channel 2 leads off	Interface level 5 ⇨
11	Channel 3 leads off	Interface level 5 ⇨
12	Channel 4 leads off	Interface level 5 ⇨
13	Channel 1 artifact	Interface level 5 ⇨
14	Channel 2 artifact	Interface level 5 ⇨
15	Channel 3 artifact	Interface level 5 ⇨
16	Channel 4 artifact	Interface level 5 ⇨
17	Channel 1 noise	Interface level 5 ⇨
18	Channel 2 noise	Interface level 5 ⇨
19	Channel 3 noise	Interface level 5 ⇨
20	Channel 4 noise	Interface level 5 ⇨
21	EP selection (AEP = 0, SSEP = 1)	Interface level 5 ⇨
22	Measurement type (referential = 0, bipolar = 1)	Interface level 5 ⇨
23…31	Reserved for future use.	

Label field

Not used.

Data fields

Table 3-57 EEG data fields

Field	Usage	Unit	Notes/Version info
femg	Frontal electromyography	1/10 μV	Interface level 5 ⇨
ampl	RMS amplitude	1/10 μV	Interface level 5 ⇨
sef	Spectral edge frequency	1/10 Hz	Interface level 5 ⇨
mf	Median frequency	1/10 Hz	Interface level 5 ⇨
delta_proc	Relative power spectral content in delta band	%	Interface level 5 ⇨
theta_proc	Relative power spectral content in theta band	%	Interface level 5 ⇨
alpha_proc	Relative power spectral content in alpha band	%	Interface level 5 ⇨
beta_proc	Relative power spectral content in beta band	%	Interface level 5 ⇨
bsr	Burst suppression ratio	%	Interface level 5 ⇨

3.7.3 EEG BIS Group

```
struct eeg_bis_group
{
    struct group_hdr    hdr;
    short               bis;
    short               sqi_val;
    short               emg_val;
    short               sr_val;
    short               reserved1;
};
```

Status field

Table 3-58 EEG BIS status field bits

Bit	Usage	Version info
0 to 1	Exists/active	Interface level 7 ⇨
2 to 31	Reserved for future use.	

Label Field

Not used.

Data fields

Table 3-59 EEG BIS data fields

Field	Usage	Unit	Notes/Version info
bis	BIS Bispectral Index		Interface level 7 ⇨
sqi_val	BIS Signal Quality Index	%	Interface level 7 ⇨
emg_val	BIS Electromyography	dB	Interface level 7 ⇨
sr_val	BIS Suppression Ratio	%	Interface level 7 ⇨
reserved	Reserved for future use.		

3.7.4 Entropy Group

```
struct entropy_group
{
    struct group_hdr    hdr;
    short               eeg_ent;
    short               emg_ent;
    short               bsr_ent;
    short               reserved[8];
};
```

Status field

Table 3-60 Entropy status field bits

Bit	Usage	Version info
0 to 1	Exists/active	Interface level 8 ⇨
2	Cable off	Interface level 8 ⇨
3	No sensor	Interface level 8 ⇨
4	Sensor off	Interface level 8 ⇨
5 to 10	Reserved	Interface level 8 ⇨
11	Starting up	Interface level 8 ⇨
12	Not an entropy sensor	Interface level 8 ⇨
13	Active BIS measurement	Interface level 8 ⇨
14 to 22	Reserved	Interface level 8 ⇨
23	Replace sensor	Interface level 8 ⇨
24	Isoelectric EEG	Interface level 8 ⇨
25	Automatic sensor check off	Interface level 8 ⇨
26 to 31	Reserved	Interface level 8 ⇨

Label Field

Not used.

Data fields

Table 3-61 Entropy data fields

Field	Usage	Unit	Notes/Version info
eeg_ent	State Entropy (SE)		Interface level 8 ⇨
emg_ent	Response Entropy (RE)		Interface level 8 ⇨
bsr_ent	Entropy Burst Suppression Ratio	%	Interface level 8 ⇨
reserved	Reserved for future use.		

3.7.5 EEG2 Group

```
struct eeg2_group
{
    struct group_hdr    hdr;
    byte                common_reference;
    byte                montage_label_ch_1_m;
    byte                montage_label_ch_1_p;
    byte                montage_label_ch_2_m;
    byte                montage_label_ch_2_p;
    byte                montage_label_ch_3_m;
    byte                montage_label_ch_3_p;
    byte                montage_label_ch_4_m;
    byte                montage_label_ch_4_p;
    byte                reserved_byte;
    short               reserved[8];
};
```

Status field

Not used.

Label Field

Not used.

Data fields

Table 3-62 EEG2 data fields

Field	Usage	Unit	Notes/Version info
common_reference	Common reference electrode label: 0: Montage NONE 1: Montage Fp1 2: Montage Fpz 3: Montage Fp2 4: Montage F7 5: Montage F3 6: Montage Fz 7: Montage F4 8: Montage F8 9: Montage A1 10: Montage T3 11: Montage C3 12: Montage Cz 13: Montage C4 14: Montage T4 15: Montage A2 16: Montage T5 17: Montage P3 18: Montage Pz 19: Montage P4 20: Montage T6 21: Montage 01 22: Montage 02 23: Montage C3a 24: Montage Cza 25: Montage C4a 26: Montage C5S 27: Montage ERB1 28: Montage ERB2 29: Montage T12S 30: Montage L3S 31: Montage POPLIT		Interface level 8 ⇨
montage_label_ch_1_m	Negative electrode label for channel 1. See values in common_reference		Interface level 8 ⇨

Field	Usage	Unit	Notes/Version info
montage_label_ch_1_p	Positive electrode label for channel 1. See values in common_reference above.		Interface level 8 ⇨
montage_label_ch_2_m	Negative electrode label for channel 2. See values in common_reference above.		Interface level 8 ⇨
montage_label_ch_2_p	Positive electrode label for channel 2. See values in common_reference above.		Interface level 8 ⇨
montage_label_ch_3_m	Negative electrode label for channel 3. See values in common_reference above.		Interface level 8 ⇨
montage_label_ch_3_p	Positive electrode label for channel 3. See values in common_reference above.		Interface level 8 ⇨
montage_label_ch_4_m	Negative electrode label for channel 4. See values in common_reference above.		Interface level 8 ⇨
montage_label_ch_4_p	Positive electrode label for channel 4. See values in common_reference above.		Interface level 8 ⇨
reserved	Reserved for future use.		

3.7.6 Surgical Pleth Index (SPI) Group

```
struct spi_group
{
    struct group_hdr    hdr;
    short               spiVal;
    short               reserved[4];
};
```

Status field

Table 3-63 Surgical Pleth Index (SPI) status field bits

Bit	Usage	Version info
0 to 1	Exists/active	Interface level 9 ⇨
2	Incompatible Probe	Interface level 9 ⇨
3	No Pleth	Interface level 9 ⇨
4	Arrhythmia	Interface level 9 ⇨
5	NIBP inflated	Interface level 9 ⇨
6	Noise	Interface level 9 ⇨
7	Learning	Interface level 9 ⇨

Bit	Usage	Version info
8	Unknown Probe	Interface level 9 ⇨
9	Reserved	Interface level 9 ⇨
10	SPI Frozen	Interface level 9 ⇨
11	Entropy High	Interface level 9 ⇨
12 to 31	Reserved	Interface level 9 ⇨

Label Field

Not used.

Data fields

Table 3-64 Surgical Pleth Index (SPI) data fields

Field	Usage	Notes/Version info
spiVal	Valid values:0-100, or DATA_INVALID.	Interface level 9 ⇨
reserved	Reserved for future use. Fill with less than DATA_INVALID_LIMIT.	Interface level 9 ⇨

3.8 EXT3 Class (DRI_PHDBCL_EXT3, ext3_phdb)

The data contents for subrecord class “ext3” are specified in this section.

NOTE: The subrecord class “ext3” is available starting from interface level 3.

```
struct ext3_phdb
{
    struct gasex_group          gasex;
    struct flow_vol_group2      flow_vol2;
    struct bal_gas_group        bal;
    struct tono_group           tono;
    struct aa2_group            aa2;
    struct delp_group           delp;
    struct cpp_group            cpp;
    struct cpp_group            cpp2;
    struct picco_group          picco;
    byte                        reserved[74];
;
```

Points to note:

CARESCAPE monitors with host software version 2 with host build 2.0.8 and later:

– There is only one CPP channel.

– ccp value takes the lowest IP channel with ICP label and the lowest IP channel with Art channel.

– If several IP channels have ICP label, only the lowest IP channel with ICP label will be sent with ICP label, the others are sent with Px label.

– Art label can be selected on the monitor to all 8 IP channels.

CARESCAPE monitors with software version 3 or later:

– ccp value always takes the lowest IP channel with ICP label and valid ICP mean value after that channel has been zeroed and working.
– ccp2 value always takes the second lowest IP channel with ICP label and valid ICP mean value after that channel has been zeroed and working.
– Art label can be selected on the monitor to all 8 IP channels.

3.8.1 Gas exchange measurements

```
struct gasex_group
{
    struct group_hdr    hdr;
    short               vo2;
    short               vco2;
    short               ee;
    short               rq;
};
```

Status field

Table 3-65 Gas exchange status field bits

Bit	Usage	Notes/Version info
0 to 1	Exists/active	
2	No VO2, FiO2> 85%	Interface level 8 ⇨
3	No VO2, FiN2O too high	Interface level 8 ⇨
4 to 31	Reserved for future use.	

Label field

Not used.

Data fields

Table 3-66 Gas exchange data fields

Field	Usage	Unit	Notes/Version info
vo2	Oxygen consumption	1/10 ml/ min	Interface level 3 ⇨
vco2	Carbon dioxide consumption	1/10 ml/ min	Interface level 3 ⇨
ee	Energy expenditure	1 kcal/ 24h	Interface level 3 ⇨
rq	Respiratory quotient	1/1000 ratio	Interface level 3 ⇨

3.8.2 Flow & Volume Group 2

```
struct flow_vol_group2
{
    struct group_hdr    hdr;
    short               ipeep;
```

```
    short               pmean;
    short               raw;
    short               mv_insp;
    short               epeep;
    short               mv_spont;
    short               ie_ratio;
    short               insp_time;
    short               exp_time;
    short               static_compliance;
    short               static_pplat;
    short               static_peepe;
    short               static_peepi;
    short               reserved[7];
};
```

Status field

No parameter specific bits are used.

Label field

Not used.

Data fields

Table 3-67 Flow & Volume2 data fields

Field	Usage	Unit	Notes/Version info
ipeep	Intrinsic PEEP	1/100 cmH2O	Interface level 3 ⇨
pmean	Mean pressure	1/100 cmH2O	Interface level 3 ⇨
raw	Airway resistance	1/100 cmH2O/ L/s	Interface level 3 ⇨
mv_insp	Inspired minute volume	1/100 L/min	Interface level 3 ⇨
epeep	Extrinsic PEEP	1/100 cmH2O	Interface level 3 ⇨
mv_spont	Spontaneous expired minute volume	1/100 L/min	Interface level 3 ⇨
ie_ratio	Inspiration time-Exp time ratio	1/100 ratio	Interface level 5 ⇨
insp_time	Inspiration time	1/100 s	Interface level 5 ⇨
exp_time	Expiration time	1/100 s	Interface level 5 ⇨
static_compliance	Static compliance	1/100 ml/ cmH2O	Interface level 5 ⇨ only Mgas > 3.2 (not G-AiOV)

static_pplat	Static plateau pressure	1/100 cmH2O	Interface level 5 ⇨ only Mgas > 3.2 (not G-AiOV)
static_peepe	Static extrinsic peep	1/100 cmH2O	Interface level 5 ⇨ only Mgas > 3.2 (not G-AiOV)
static_peepi	Static intrinsic peep	1/100 cmH2O	Interface level 5 ⇨ only Mgas > 3.2 (not G-AiOV)
reserved	Reserved for future use.		

3.8.3 Balance Gas Group

```
struct bal_gas_group
{
    struct group_hdr    hdr;
    short               et;
    short               fi;
};
```

Status field

Table 3-68 Balance Gas status field bits

Bit	Usage	Notes/Version info
0 to 1	Exists/active	Interface level 5 ⇨
2	Measurement off	Interface level 5 ⇨
3 to 31	Reserved for future use.	

Label field

Not used.

Data fields

Table 3-69 Balance Gas data fields

Field	Usage	Unit	Notes/Version info
et	Expiratory concentration	1/100%	Interface level 5 ⇨
fi	Inspiratory concentration	1/100%	Interface level 5 ⇨

3.8.4 Tonometry Group

```
struct tono_group
{
    struct  group_hdr hdr;
    short   prco2;
    short   pr_et;
```

```
    short   pr_pa;
    short   pa_delay;
    short   phi;
    short   phi_delay;
    short   amb_press;
    short   cpma;
};
```

Status field

Table 3-70 TONO status field bit usage

Bits	Usage	Notes/Version info
2	Leak	Interface level 5 ⇨
3	volume dropped in catheter	Interface level 5 ⇨
4	technical failure	Interface level 5 ⇨
5	unable to fill catheter	Interface level 5 ⇨
6	PrCO2 over limit	Interface level 5 ⇨
7 to 31	Reserved for future use.	

Label field

Not used

Data fields

Table 3-71 TONO data field usage

Field	Usage	Unit	Notes
prco2	PrCO2 concentration	1/100 kPa	Interface level 5 ⇨
pr_et	P(r-Et)CO2 gap	1/100 kPa	Interface level 5 ⇨
pr_pa	P(r-a)CO2 gap	1/100 kPa	Interface level 5 ⇨
pa_delay	PaCO2 delay	min	Interface level 5 ⇨
phi	pHi value	1/100	Interface level 5 ⇨
phi_delay	pHi delay	min	Interface level 5 ⇨
amb_press	Ambient pressure	1/10 mmHg	Interface level 5 ⇨
cpma	Research data, 10 sec. Minimum catheter pressure	1/10 mbar	Interface level 5 ⇨

3.8.5 Anesthesia Agent 2 Group

```
struct aa2_group
{
    struct group_hdr    hdr;
    short               mac_age_sum;
    byte                reserved[16];
```

```
};
```

Status field

No parameter specific bits are used.

Label field

Not used.

Data fields

Table 3-72 Anesthesia Agent data fields

Field	Usage	Unit	Notes/Version info
mac_age_sum	Age corrected MAC value	1/100	Interface level 8 ⇨
reserved	Reserved for future use.		

3.8.6 Delta pressure Group

```
struct delp_group
{
    struct group_hdr    hdr;
    short               spv;
    short               ppv;
};
```

Status field

No parameter specific bits are used.

Label field

Not used.

Data fields

Table 3-73 Delta pressure data fields

Field	Usage	Unit	Notes/Version info
spv	Pressure Variation	1/100 mmHg	Interface level 10 ⇨
ppv	Delta Pressure Percent	1/100 %	Interface level 10 ⇨

3.8.7 CPP Group

```
struct cpp_group
{
    struct group_hdr    hdr;
    short               value;
};
```

Status field

No parameter specific bits are used.

Label field

Not used.

Data fields

Table 3-74 CPP data fields

Field	Usage	Unit	Notes/Version info
value	CPP value	1/100 mmHg	Interface level 10 ⇨

3.8.8 PiCCO Group

```
struct picco_group
{
    struct group_hdr    hdr;
    short               cci;
    short               cco;
    short               cfi;
    short               ci;
    short               co;
    short               cpi;
    short               cpo;
    short               dpmax;
    short               elwi;
    short               evlw;
    short               gedi;
    short               gedv;
    short               gef;
    short               itbi;
    short               itbv;
    short               ppv;
    short               pvpi;
    short               sv;
    short               svi;
    short               svr;
    short               svri;
    short               svv;
    short               tblood;
    short               tinj;
};
```

Status field

No parameter specific bits are used.

Label field

Not used.

Data fields

Table 3-75 PiCCO data fields

Field	Usage	Unit	Notes/Version info
cci	Continuous cardiac Index	ml/min/m2	Interface level 11 ⇨
cco	Continuous cardiac output	ml/min	Interface level 11 ⇨
cfi	Cardiac function index	1/100 /min	Interface level 11 ⇨
ci	Cardiac index	ml/min/m^2	Interface level 11 ⇨
co	Cardiac output	ml/min	Interface level 11 ⇨
cpi	Cardiac power index	mW/m^2	Interface level 11 ⇨
cpo	Cardiac power output	mW	Interface level 11 ⇨
dpmax	Index of Left Ventricular Contractility	mmHg/s	Interface level 11 ⇨
elwi	Extravascular Lung Water Index	1/10 ml/kg	Interface level 11 ⇨
evlw	Extravascular Lung Water	ml	Interface level 11 ⇨
gedi	Global End-Diastolic Volume Index	ml/m^2	Interface level 11 ⇨
gedv	Global End-Diastolic Volume	ml	Interface level 11 ⇨
gef	Global Ejection Fraction	1/10 %	Interface level 11 ⇨
itbi	Intrathoracic Blood Volume Index	ml/m^2	Interface level 11 ⇨
itbv	Intrathoracic Blood Volume	ml	Interface level 11 ⇨
ppv	Pulse Pressure Variation	1/10%	Interface level 11 ⇨
pvpi	Pulmonary Vascular Permeability Index	1/100	Interface level 11 ⇨
sv	Stroke Volume	1/10 ml	Interface level 11 ⇨
svi	Stroke Volume Index	1/10 ml/m^2	Interface level 11 ⇨
svr	Systemic Vascular Resistance	dyne*s/cm^5	Interface level 11 ⇨
svri	Systemic Vascular Resistance Index	dyne*s*m^2/cm^5	Interface level 11 ⇨
svv	Stroke Volume Variation	1/10 %	Interface level 11 ⇨
tblood	Blood temperature	1/100 °C	Interface level 11 ⇨
tinj	Injectate temperature	1/100 °C	Interface level 11 ⇨

4 Alarm Transmission ADI (DRI_MT_ALARM)

4.1 General

The alarm interface ADI provides access to S/5 monitor alarm status. The alarm data is sent according to the transmission requests issued by the external application.

CARESCAPE monitors support alarm transmission when requested. For details about the alarm request packet, see S/5 Computer Interface Specification. For other monitors ADI is available to applications residing in the S/5 network only – it is not available on the computer interface.

4.2 Structure of alarm data

The corresponding **union** determining alarm transmission in the Datex-Ohmeda Record is **al_srcrds**.

```
union al_srcrds
{
    struct dri_al_msg           dri_al_msg;
};
```

Main type of the alarm transmission record is **DRI_MT_ALARM.**

The alarm data status structure contains the data of active monitor alarm messages. Type for an alarm status subrecord is **DRI_AL_STATUS**.

Subrecord types are:

Table 4-1 Alarm subrecord values and usage

Subrecord type	Usage
DRI_AL_STATUS = 1	Alarm status subrecord.

4.2.1 Alarm status message (DRI_AL_STATUS, dri_al_msg)

The structure of the alarm status message consists of alarm box descriptors:

```
struct dri_al_msg
{
    short                   reserved;
    boolean                 sound_on_off;
    short                   reserved2;
    short                   reserved3;
    enum_dri_silence_info   silence_info;
    struct al_disp_al       al_disp[5];
    short                   reserved[5];
};
```

Field	Contents
reserved1	Reserved for future extensions.
sound_on_off	Indicates the on/off status of the alarm sound. 0 = off, 1 = on.
reserved2, reserved3	Reserved for future extensions.
silence_info	Indicates the alarm silence status at the monitor. See Table 4-2 Alarm silence information values.
al_disp	This array of the alarm messages is always sorted in descending order by the alarm color.
reserved	Reserved for future extensions.

Table 4-2 Alarm silence information values

Label	Agent
DRI_SI_NONE = 0	Alarms are not silenced at bedside.
DRI_SI_APNEA = 1	Apnea alarms have been silenced at bedside.
DRI_SI_ASY = 2	Asystole alarms have been silenced at bedside.
DRI_SI_APNEA_ASY = 3	Both apnea and asystole alarms have been silenced at bedside.
DRI_SI_ALL = 4	All alarms have been silenced at bedside.
DRI_SI_2MIN = 5	All alarms have been silenced at bedside for two minutes.
DRI_SI_5MIN = 6	All alarms have been silenced at bedside for five minutes.
DRI_SI_20S = 7	All alarms have been silenced at bedside for 20 seconds.

The contents of an alarm message are stored into the following structure:

```
struct al_disp_al
{
    char                    text[80];
    boolean                 text_changed;
    enum_dri_alarm_color    color;
    boolean                 color_changed;
    short                   reserved[6];
};
```

Table 4-3 Alarm message contents

Field	Contents
text[]	The actual alarm text displayed by the S/5 monitor, for example 'HR LOW'. **WARNING** The text is different in the different language versions of the monitor software. This means that the type of the alarm cannot be detected automatically based on the text.
text_changed	Is true if the alarm text in the text[] field has changed after the previous alarm data transmission.

color	The priority of the alarm.
	`enum dri_alarm_color`
	`{`
	`DRI_PR0 = 0, //No alarm`
	`DRI_PR1 = 1, //White`
	`DRI_PR2 = 2, //Yellow`
	`DRI_PR3 = 3 //Red`
	`};`
	Priority of the active and valid alarm is `DRI_PR1` or higher.

color_changed	Is true if the alarm color in the color field has changed after the previous alarm data transmission.
reserved	Reserved for future extensions.

For your notes:

5 Waveform ADI (DRI_MT_WAVE)

5.1 General

The Waveform ADI provides continuous sampling of selectable waveforms according to transmission requests issued by the external application.

A waveform packet is a collection of 1 to 8 waveform subrecords. Each subrecord contains a header and a variable number of samples of a waveform.

The 12-lead ECG waveform is an exception. It has a different waveform format, and it should be in a packet alone (no other waveforms in the same packet).

CARESCAPE monitors with software version 3 or later support up to 24 waveform subrecords. If 12-lead ECG is sent, the maximum number of waveforms is 17.

5.2 Structure of waveform data

The corresponding union determining waveform data in the Datex-Ohmeda record is wf_srcrds. Waveform data subrecords have no fixed structure.

```
union wf_srcrds
{
   short   *data;
};
```

The main type for waveform data is DRI_MT_WAVE.

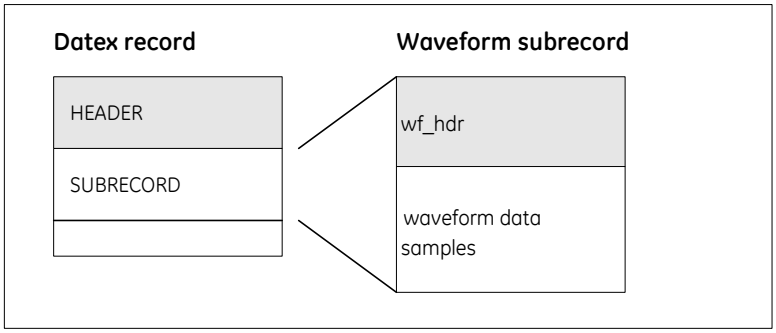
Valid waveform subrecord types are:

Subrecord type	Usage	Notes/Version info
DRI_WF_CMD = 0	Waveform request command	Interface level 3 ⇨ Valid for computer interface only.
DRI_WF_ECG1 = 1	ECG channel 1	Interface level 3 ⇨
DRI_WF_ECG2 = 2	ECG channel 2	Interface level 3 ⇨
DRI_WF_ECG3 = 3	ECG channel 3	Interface level 3 ⇨
DRI_WF_INVP1 = 4	Invasive Pressure channel 1	Interface level 3 ⇨
DRI_WF_INVP2 = 5	Invasive Pressure channel 2	Interface level 3 ⇨
DRI_WF_INVP3 = 6	Invasive Pressure channel 3	Interface level 3 ⇨
DRI_WF_INVP4 = 7	Invasive Pressure channel 4	Interface level 3 ⇨
DRI_WF_PLETH = 8	Plethysmograph	Interface level 3 ⇨

Subrecord type	Usage	Notes/Version info
DRI_WF_CO2 = 9	CO2	Interface level 3 ⇨
DRI_WF_O2 = 10	O2	Interface level 3 ⇨
DRI_WF_N2O = 11	N2O	Interface level 3 ⇨
DRI_WF_AA = 12	AA	Interface level 3 ⇨
DRI_WF_AWP = 13	Airway pressure	Interface level 3 ⇨
DRI_WF_FLOW = 14	Airway flow	Interface level 3 ⇨
DRI_WF_RESP = 15	ECG respiratory waveform	Interface level 3 ⇨
DRI_WF_INVP5 = 16	Invasive Pressure channel 5	Interface level 3 ⇨
DRI_WF_INVP6 = 17	Invasive Pressure channel 6	Interface level 3 ⇨
DRI_WF_EEG1 = 18	EEG channel 1	Interface level 5 ⇨
DRI_WF_EEG2 = 19	EEG channel 2	Interface level 5 ⇨
DRI_WF_EEG3 = 20	EEG channel 3	Interface level 5 ⇨
DRI_WF_EEG4 = 21	EEG channel 4	Interface level 5 ⇨
DRI_WF_ECG12 =22	12 lead ECG packet. This should be in a packet alone.	Interface level 5 ⇨
DRI_WF_VOL = 23	Airway volume	Interface level 5 ⇨ Valid for computer interface only.
DRI_WF_TONO_PRESS = 24	Tonometry catheter pressure	Interface level 5 ⇨ Valid for computer interface only.
DRI_WF_SPI_LOOP_STATUS = 29	Spirometry loop bit pattern	Interface level 5 ⇨ Valid for computer interface only.
DRI_WF_ENT_100 = 32	Entropy	Interface level 8 ⇨ Valid for computer interface only.

Subrecord type	Usage	Notes/Version info
DRI_WF_EEG_BIS = 35	BIS	Interface level 8 ⇨ Valid for computer interface only.
DRI_WF_INVP7 = 36	Invasive Pressure channel 7	Interface level 9 ⇨
DRI_WF_INVP8 = 37	Invasive Pressure channel 8	Interface level 9 ⇨
DRI_WF_PLETH_2 = 38	Second Plethysmograph	Interface level 9 ⇨
DRI_WF_RESP_100 = 39	High resolution impedance respiration	Interface level 11 ⇨

Waveform samples are stored to locations following the header:



Each Datex-Ohmeda waveform record contains one or more subrecords, the types of which match the types specified in the waveform request. Depending on the total number of samples/second, the monitor sends a waveform packet every 1000 ms, 500 ms, 250 ms, 200 ms, 167 ms or 125 ms.

Waveform subrecords are of variable length. The actual length of the subrecord is included in the subrecord itself, but the length can be calculated using the subrecord offsets in the Datex-Ohmeda Record header as well.

Subrecord types of a waveform record are stored in Datex-Ohmeda Record header, see section 2.2. Structure of Datex-Ohmeda Record.

There is an additional waveform-related header at the start of each waveform subrecord:

```
struct wf_hdr
{
    short   act_len;
    word    status;
    word    label;
};
```

Table 5-1 Waveform header content

Field	Contents
act_len	The number of 16-bit waveform samples in the subrecord.
status	Handled as bitfield. See Status bits in status field.
reserved	Reserved for future use.

Status bits in status field

Table 5-2 Waveform status field bits

Bits	ECG channel
0	WF_STATUS_GAP 0x0001 gap in sampling, Sampling continuity flag which (if set) indicates that there has been a sampling gap. An undefined amount of waveform data has been lost. If WF_STATUS_GAP bit is 1, there has been a sampling gap between the first sample of this subrecord and the last sample of the previous subrecord of same type. The bit is normally set in the first subrecord following the reception of a waveform request.
1	Reserved
2	WF_STATUS_PACER_DET 0x0004 pacer detected
3	WF_STATUS_LEAD_OFF 0x0008 ecg channel is off
4 to 15	Reserved

5.2.1 Waveform samples

Waveform samples are stored to locations following the header. All samples are signed short integers (16 bits). Values less or equal to -32000 are no true measurement data but control codes.

Time between samples varies by subrecord type. Sampling speeds and units for various parameters are listed in the following table:

Table 5-3 Sampling rates per waveform subrecord

Subrecord	Samples/s	Unit
DRI_WF_ECGx	300	ECG x: µV
DRI_WF_ECG12	500	ECG x: µV Applicable only for CARESCAPE monitors with software version 3.X.
DRI_WF_INVPx	100	Invasive blood pressure x: 1/100 mmHg
DRI_WF_PLETH	100	Plethysmograph: modulation, 1/100%
DRI_WF_CO2	25	CO2 concentration: 1/100%
DRI_WF_O2	25	O2 concentration: 1/100%
DRI_WF_N2O	25	N2O concentration: 1/100%
DRI_WF_AA	25	Anesthesia agent: 1/100%

Subrecord	Samples/s	Unit
DRI_WF_AWP	25	Airway pressure: 1/10 cmH2O
DRI_WF_FLOW	25	Airway flow: 1/10 l/min
DRI_WF_VOL	25	Airway volume: 1 ml
DRI_WF_RESP	25	ECG impedance, 1/100 Ω
DRI_WF_EEGx	100	1/10 μV
DRI_WF_EEGx_200	200	1/10 μV Applicable only for CARESCAPE monitors with software version 3.X.
DRI_WF_TONO_PRESS	25	Tonometry catheter pressure: 1/10 mbar
DRI_WF_SPI_LOOP_STATUS	25	Spirometry loop bit pattern. Bit 0: loop_id low Bit 1: loop_id high Bit 2: autozero_cycle Bit 3: insp/exp Bit 4..15: reserved
DRI_WF_ENT_100	100	Entropy: 1/10 μV
DRI_WF_EEG_BIS	300	BIS: 1 μV

5.2.2 Waveform synchronization

The waveform samples in different subrecords inside the same waveform record represent the same time period. Because the different waveform types have different sample rates, only the first and last samples of different waveform types are in synchronization.

With the S/5 network interface, it is not guaranteed that the different types of the waveform subrecords are in the same record, and the requested waveforms may be split to separate records. For example, one record can contain waveform subrecords ECG1 and ECG2 and another record subrecord ECG3. This can happen, for example, if more than 8 waveforms are requested from one monitor. In this case the synchronization between the waveform subrecords can be implemented by using the r_time field defined in the Datex-Ohmeda Record header.

5.3 Structure of 12-lead ECG waveform data

CARESCAPE monitors with software version 3 or later support 12-lead ECG waveform data from DRI serial. All ECG waveform lead can be transferred with this waveform type.

EEG Parameter	Description
Subrecord type	`DRI_WF_ECG12`
Sample rate	500 samples / second

EEG Parameter	Description
Sample unit	1 micro volt [µV]
Sample encoding	It has a special DRI level depend waveform sample encoding. The "ecg12_wf" shows the subrecord structure.
wf_hdr.label	It is a bit field. For more details, refer to the next table.

Record name:	ecg12_wf	Size (bytes):	20 -	DRI_LEVELL_99->	
Field Name	**Type**		**Size**	**Offset**	**DRI level**
hdr	wf_hdr		6	0	
ext_hdr	dri_ext_wf_hdr		14	6	DRI_LEVEL_01->
data	byte[]			20	

ecg12_wf.hdr

This is the common waveform header.

ecg12_wf.hdr.label

Bits	Description [DRI_LEVEL_01->]	DRI level
0	It is set when the lead I is on.	
1	It is set when the lead II is on.	
2	It is set when the lead V1 is on.	
3	It is set when the lead V2 is on.	
4	It is set when the lead V3 is on.	
5	It is set when the lead V4 is on.	
6	It is set when the lead V5 is on.	
7	It is set when the lead V6 is on.	
8	It is set when the lead III is on.	DRI_LEVEL_01->
9-11	Artifact level 0 for no artifact and >0 artifact (maximum 7). Displayed in ECG1 waveform field. Does not discontinue computing HR and arrhythmia or ST analysis.	DRI_LEVEL_01->
12	Noise from module, if it is set.	DRI_LEVEL_01->

Bits	Description [DRI_LEVEL_01->]	DRI level
13	Noise from arrhythmia algorithm, if it is set.	DRI_LEVEL_01->
14	Quick Zero. Module has zeroed level due to DC drifting to edge of measurable range	
15	Noise (module or algorithm). The ”or” of bits 12 and 13. Discontinues HR computation and ST and arrhythmia analysis. Displayed in ECG1 waveform field when ”noise counter” reaches limit. After continuous noise of 5s, also activates alarm “Noisy ECG”	

ecg12_wf.ext_hdr

The extended waveform header is described in the “Extended waveform header” chapter.

ecg12_wf.data

The structure of the waveform data is described in the “Waveform data encoding” chapter.

5.3.1 Extended waveform header

Record name:	`dri_ext_wf_hdr`	Size (bytes):	14 -	DRI_LEVELL_01->	
Field Name	**Type**		**Size**	**Offset**	**DRI level**
size_in_bytes	`word`		2	0	
status_1	`word`		2	2	
status_2	`word`		2	4	
status_3	`word`		2	6	
status_4	`word`		2	8	
status_5	`word`		2	10	
status_6	`word`		2	12	

dri_ext_wf_hdr.size_in_bytes

This is the size of bytes the extended waveform header in bytes. The value is 14.

dri_ext_wf_hdr.status_1

This value is always 32768.

dri_ext_wf_hdr.status_2

This value is always 0x8000.

dri_ext_wf_hdr.status_3

The following table shows the setting.

Bits	Description DRI_LEVEL_02->
0	- 0 = cable on - 1 = cable off
1-3	ECG cable type - 0 = 3 wire ECG cable, DRI_ECG12_3_LEAD_CABLE - 1 = 5 wire ECG cable, DRI_ECG12_5_LEAD_CABLE - 3 = 10 wire ECG cable, DRI_ECG12_10_LEAD_CABLE
4-6	User selected V leads with 5 wire ECG cable: - 0 = not selected - 1 = V1 lead - 2 = V2 lead - 3 = V3 lead - 4 = V4 lead - 5 = V5 lead - 6 = V6 lead
7-9	Transferred lead with 3-lead measurement. - 1 = I lead - 2 = II lead - 3 = III lead
10-15	Number of words in each 10ms buffer of data, maximum is 32. The maximum amount is limited by Ethernet packet size.

dri_ext_wf_hdr.status_4

The following table shows the setting:

Bits	Description; ESP Monitor	DRI level
0-2	This ECG filter is in use on the monitor screen. The monitor did not make this filter before the ECG waveform is sent. See "dri_ext_wf_hdr.status_6" for filter that affect to waveform data itself. - 0 = unknown filter type - 1 = ESP monitor filter - 2 = Diagnostic Data (NO filtering). - 3 = moderate - 4 = max	DRI_LEVEL_04->
3-5	The pacemaker setting in use on the monitor. - 0 = hide - 1 = show - 2 = sensit - 3 = on R - 4 = not detected	DRI_LEVEL_04->
6-8	AD resolution, ESP monitor should use always 14 bit setting - 2 = 14 bit	DRI_LEVEL_04->
9-10	Sample rate, ESP monitor uses only 500 Hz sample rate. - 1 = 500 samples / second	DRI_LEVEL_04->
11-14	Delay caused by filters at bedside in 10 ms intervals, max 15=150 ms= 2 s 30 ms. It is set to zero.	DRI_LEVEL_04->
15	Diagnostic format, ESP monitor sends always true diagnostic format: - 1 = waveform data is in true diagnostic format§	DRI_LEVEL_04->

dri_ext_wf_hdr.status_5

Bits	Description	DRI level
0-3	User selected lead for 1st ECG channel: see "ECG selected lead".	DRI_LEVEL_02->
4-7	User selected lead for 2nd ECG channel: see "ECG selected lead".	DRI_LEVEL_02->
8-11	User selected lead for 3rd ECG channel: see "ECG selected lead".	DRI_LEVEL_02->
12-16	The sent differential value should be multiply with. The values are in the "Different value multiplier" table.	DRI_LEVEL_02->

ECG selected lead	Value	Description	DRI level
DRI_ECG12_LEAD_NONE	0	Not defined or cascade	DRI_LEVEL_02->
DRI_ECG12_LEAD_I	1	I lead	DRI_LEVEL_02->
DRI_ECG12_LEAD_II	2	II lead	DRI_LEVEL_02->
DRI_ECG12_LEAD_III	3	III lead	DRI_LEVEL_02->
DRI_ECG12_LEAD_AVR	4	aVR lead	DRI_LEVEL_02->
DRI_ECG12_LEAD_AVL	5	aVL lead	DRI_LEVEL_02->
DRI_ECG12_LEAD_AVF	6	aVF lead	DRI_LEVEL_02->
DRI_ECG12_LEAD_V1	7	V1 lead	DRI_LEVEL_02->
DRI_ECG12_LEAD_V2	8	V2 lead	DRI_LEVEL_02->
DRI_ECG12_LEAD_V3	9	V3 lead	DRI_LEVEL_02->
DRI_ECG12_LEAD_V4	10	V4 lead	DRI_LEVEL_02->
DRI_ECG12_LEAD_V5	11	V5 lead	DRI_LEVEL_02->
DRI_ECG12_LEAD_V6	12	V6 lead	DRI_LEVEL_02->
DRI_ECG12_LEAD_CASCADE	13	Waveform is cascade	DRI_LEVEL_02->

Different value multiplier	Value	Description	DRI level
DRI_ECG12_MULTIPLY_1	0	* 1	DRI_LEVEL_02->
DRI_ECG12_MULTIPLY_4	1	* 4	DRI_LEVEL_02->
DRI_ECG12_MULTIPLY_8	2	* 8	DRI_LEVEL_02->
DRI_ECG12_MULTIPLY_16	3	* 16	DRI_LEVEL_02->

dri_ext_wf_hdr.status_6

Bits	Description	DRI level
0-2	2 = Diagnostic (no filtering).	DRI_LEVEL_03->
3	It is set when V1 lead is derived.	DRI_LEVEL_04->
4	It is set when V2 lead is derived.	DRI_LEVEL_04->
5	It is set when V3 lead is derived.	DRI_LEVEL_04->
6	It is set when V4 lead is derived.	DRI_LEVEL_04->
7	It is set when V5 lead is derived.	DRI_LEVEL_04->
8	It is set when V6 lead is derived.	DRI_LEVEL_04->
9-15	Not in use. Fill it with zero.	

5.3.2 Waveform data encoding

The I, II, V1, V2, V3, V4, V5, and V6 ECG leads are transferred. The III, aVR, aVL and aVF ECG leads should be calculated.

500 samples / second with 10-wire ECG cable

Samples in waveform are in 16- or 8- bit form. Each waveform contains n * 10ms sample sets from which each is size of 56 bytes. Each 56 bytes set (10ms data set) contains samples from all transmitted channels as follows:

Waveform buffer sample (16 bit)	S1	S4	S7	S10	S13	S16	S19	S22
Number of bits	16	16	16	16	16	16	16	16
Channel (16 bit)	I	II	V1	V2	V3	V4	V5	V6
Sample no	1	1	1	1	1	1	1	1

Waveform buffer sample (16 bit)	S2		S5		S8		S11		S14		S17		S20		S23	
Number of bits	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Channel (8 bit)	dI (2)	dI (3)	dII (2)	dII (3)	dV1 (2)	dV1 (3)	dV2 (2)	dV2 (3)	dV3 (2)	dV3 (3)	dV4 (2)	dV4 (3)	dV5 (2)	dV5 (3)	dV6 (2)	dV6 (3)
Sample no	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3

Waveform buffer sample (16 bit)	S3		S6		S9		S12		S15		S18		S21		S24	
Number of bits	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Channel (8 bit)	dI (4)	dI (5)	dII (4)	dII (5)	dV1 (4)	dV1 (5)	dV2 (4)	dV2 (5)	dV3 (4)	dV3 (5)	dV4 (4)	dV4 (5)	dV5 (4)	dV5 (5)	dV6 (4)	dV6 (5)
Sample no	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5

Waveform buffer sample (16 bit)	S25	S26	S27		S28	
Number of bits	16	16	3	13	6	10
Channel (16 bit)	Sign1	Sign2	Pacer	Counter	Beat label	QRS Time
Sample no						

First sample in the 10 ms cycle is sent as a 16-bit signed value (short). The rest four samples are sent as difference to the next sample, reserving 8 bits + sign bit for the difference. The resolution on the bus is so that 1 bit corresponds to 4 µV.

S25 and S26 word contain the sign bits of the corresponding sample differences in the exactly same order, as are the differential bytes in the messages. For example, $dI(2) = |I(2) - I(1)|$ and the sign bit is the 15th bit in the sign word S25 (1 if difference is negative a 0 if non-negative (i.e. 0 or positive).

Similarly $dI(3) = |I(3) - I(2)|$ and the sign bit is the 14th bit in the sign word S25.

If the difference does not fit in 8 bytes, then the monitor software adds it to the next difference, for example, if $dI(3) = I(3) - I(2) = 257 - 0 = 257 > 2^8 - 1 = 255$, then the monitor software sets dI(3)=255 and adds 257-255=2 to the sample dI(4).

The next table shows the representation of sign bit-fields.

Bits	Sign1	Sign2
15	dI (2)	dI (4)
14	dI (3)	dI (5)
13	dII (2)	dII (4)
12	dII (3)	dII (5)
11	dV1 (2)	dV1 (4)
10	dV1 (3)	dV1 (5)
9	dV2 (2)	dV2 (4)
8	dV2 (3)	dV2 (5)
7	dV3 (2)	dV3 (4)
6	dV3 (3)	dV3 (5)
5	dV4 (2)	dV4 (4)
4	dV4 (3)	dV4 (5)
3	dV5 (2)	dV5 (4)
2	dV5 (3)	dV5 (5)
1	dV6 (2)	dV6 (4)
0	dV6 (3)	dV6 (5)

If one of the five samples is DATA_INVALID first non-packet sample is set to DATA_INVALID and all difference bytes are set to zero (0).

With 12-lead measurement all 8 leads are transmitted.

500 samples / second with 5-lead ECG cable

With 5-lead measurement leads I, II and one V-lead are transmitted. The one V-lead is always transmitted in V1. The true label for the V-lead can be read in the leads off field. The bit fields for other V-leads have an undefined value.

500 samples / second with 3-lead ECG cable

Waveform buffer sample (16 bit)	S1	S4	S7	S10	S13	S16	S19	S22
Number of bits	16	16	16	16	16	16	16	16
Channel (16 bit)	I	-	-	-	-	-	-	-
Sample no	1	1	1	1	1	1	1	1

Waveform buffer sample (16 bit)	S1	S4	S7	S10	S13	S16	S19	S22
Number of bits	16	16	16	16	16	16	16	16
Channel (16 bit)	-	II	-	-	-	-	-	-
Sample no	1	1	1	1	1	1	1	1

Waveform buffer sample (16 bit)	S1	S4	S7	S10	S13	S16	S19	S22
Number of bits	16	16	16	16	16	16	16	16
Channel (16 bit)	I=0	II=III	-	-	-	-	-	-
Sample no	1	1	1	1	1	1	1	1

Pacer information is given in 500 Hz sampling frequency. Counter can have values 0-8000. The counter tells the timing of each 10 ms waveform. 0=0ms, 1=10ms, 2=20ms, … , 8000=80000ms=80s, 0=80010ms, 1=80020ms, …

	Bits	**ECG channel**
S27	0 - 12	Counter 0-8191
	13 - 15	0=no pacer, 1=pacer in 1st sample, … , 5=pacer in 5th sample

	Bits	**Definition**
S28	0 - 5	Reserved for future use.
	6 - 15	Reserved for future use.

For your notes:

6 Network Management ADI (DRI_MT_NETWORK)

6.1 General

The Network Management ADI provides network management related information, i.e. patient name and id to the external application that resides on the network and monitor login and logout information.

The Network Management ADI is available to applications residing on the S/5 network only – it is not available on the computer interface.

6.2 Structure of network management data

The union determining network management data in the Datex-Ohmeda Record is **nw_srcrds**.

```
union nw_srcrds
{
    struct nw_login_msg         login_msg;
    struct nw_pat_descr         pat_descr;
};
```

The network management record is defined as a union of network management subrecords.

The main type of the network management data ADI is **DRI_MT_NETWORK**.

6.3 Subrecord types

The following values are used to describe the network management data subrecords:

Table 6-1 Network management data subrecord values and usage

Value	Usage	Notes/Version info
DRI_NW_NGM_REGIST = 0	Monitor login message informing that the monitor has connected to the Central/iCentral.	Interface level 1 ⇨
DRI_NW_PAT_DESCR = 6	Patient information message including patient name and id. Patient demographics including age, height, weight, BSA and gender.	Interface level 1 ⇨ Interface level 8 ⇨
DRI_NW_NGM_LOGOUT = 10	Monitor logout message informing that the monitor has disconnected from the Central/iCentral.	Interface level 6 ⇨

6.3.1 Monitor login message (DRI_NW_NGM_REGIST, nw_login_msg)

Monitor login message informs that the monitor has connected to the Central/iCentral. The structure of the message consists of the following fields:

```
struct nw_login_msg
{
    struct nw_dev_descr dev_descr;
};
```

Field	Contents
dev_desc	Device description of the monitor.

```
struct nw_dev_descr
{
    byte    ethernet_addr[6];
    short   dev_type;
    short   dri_level;
    short   reserved[10];
};
```

Field	Contents
ethernet_addr	The ethernet address of the monitor.

Field	Contents

dev_type	Indicates the type of the monitor software.
	`enum dri_net_conn_type`
	`{`
	`DEVTYPE_RESERVED1 = 1,`
	`DEVTYPE_ANE = 2, /* ANE monitor */`
	`DEVTYPE_ARK = 3, /* ANE monitor with Record Keeper */`
	`DEVTYPE_RESERVED2,`
	`DEVTYPE_RESERVED3,`
	`DEVTYPE_RESERVED4,`
	`DEVTYPE_RESERVED5,`
	`DEVTYPE_RESERVED6,`
	`DEVTYPE_LM = 9, /* Light monitor */`
	`DEVTYPE_ICU = 10, /* ICU monitor */`
	`DEVTYPE_RESERVED7,`
	`DEVTYPE_RESERVED8,`
	`DEVTYPE_CC5 = 13, /* Cardiocap 5 */`
	`DEVTYPE_RESERVED9,`
	`DEVTYPE_RESERVED10,`
	`DEVTYPE_RESERVED11,`
	`DEVTYPE_RESERVED12,`
	`DEVTYPE_RESERVED13,`
	`DEVTYPE_RESERVED14,`
	`DEVTYPE_RESERVED21,`
	`DEVTYPE_RESERVED15,`
	`DEVTYPE_RESERVED16,`
	`DEVTYPE_RESERVED17,`
	`DEVTYPE_RESERVED18,`
	`DEVTYPE_RESERVED19,`
	`DEVTYPE_RESERVED20,`
	`DEVTYPE_FM = 27, /* S/5 FM,B30,B40/B20, B1x5 */`
	`DEVTYPE_RESERVED21 to 34`
	`DEVTYPE_FM_LIGHT = 35, /* FM Light */`
	`DEVTYPE_ESP_ANE = 36, /* CARESCAPE B850/B650 configured to ANE monitor */`
	`DEVTYPE_ESP_ICU = 37, /* CARESCAPE B850/B650 configured to ICU monitor */`
	`DEVTYPE_ESP_NICU = 38, /* CARESCAPE B850/B650 configured to Neonatal ICU monitor */`
	`DEVTYPE_ESP_PACU = 39, /* CARESCAPE B850/B650 configured to Post ANE monitor */`
	`DEVTYPE_ESP_ED = 40 /* CARESCAPE B850/B650 configured to ED monitor */`
	`};`
	(see 2.3. Supported DRI levels).

dri_level	Indicates the Datex-Ohmeda Record Interface level the monitor supports (see 2.3. Supported DRI levels).
reserved	Reserved for future extensions.

6.3.2 Patient information message (DRI_NW_PAT_DESC, nw_pat_descr)

The Patient information message informs that a new patient has been admitted to the monitor. The structure of the message consists of the following fields:

```
struct nw_pat_descr
{
    char    pat_1stname[30];
    char    pat_2ndname[40];/
    char    pat_id[40];
    char    middle_name[30];
    short   gender;
    short   age_years;
    short   age_days;
    short   age_hours;
    short   height;
    short   height_unit;
    short   weight;
    short   weight_unit;
    short   year_birth_date;
    short   month_birth_date;
    short   day_birth_date;
    short   hour_birth_date;
    short   bsa;
    char    location[32];
    char    issuer[32];
    short   change_src;
    short   reserved[59];

};
```

Field	Contents	Notes/ Version info
pat_1stname	The first name of the patient admitted to the monitor.	Interface level 1 ⇨
pat_2ndname	The last name of the patient admitted to the monitor.	Interface level 1 ⇨
pat_id	The ID of the patient admitted to the monitor.	Interface level 1 ⇨
middle_name	The middle name of the patient admitted to the monitor.	Interface level 8 ⇨

Field	Contents	Notes/ Version info

gender	The gender of the patient admitted to the monitor:
	0: unknown
	1: male
	2: female (DRI_FEMALE)
	`enum dri_gender`
	`{`
	`DRI_GENDER_UNKNOWN = 0,`
	`DRI_MALE = 1,`
	`DRI_FEMALE = 2,`
	`DRI_NR_GENDER = 3`
	`};`
		Interface level 8 ⇨

age_years	The age of the patient admitted to the monitor. Default=0, range 0-65535[y]. If the birth date has been entered, the age is calculated according to the birth date. However, if only age is entered, the birth date will remain empty (or what ever was its initial value), i.e. the birth date is never calculated from the age. Accordingly, changing the age does not affect the birth date. NOTE: age_years, age_days and age_hours are cumulative fields. The 'total' age can be calculated by combining them. Also remember that in DRI, a month has 30 days and a year 360 days. An example of how the application interprets the data in the packet: If age_years = 5,age_days = 28 and age_hours = 5 then the 'total' age is 5 years 28 days and 5 hours. It depends on the application in which format it displays the age. See below for examples of how the data is set in the packet. Example 1: If the age of the patient is 4 months, then the age is set to packet as follows. age_years = 0, age_days=4*30, age_hours=0. (4[month]*30[day/month]) Example 2: If the age of the patient is 26 hours, then the age is set as follows: age_years=0, age_days=1, age_hours=2. (1d*24h/d+2h=26h)	Interface level 8 ⇨
age_days	See age_years above. Default=0, range 0-359[d].	Interface level 8 ⇨

Field	Contents	Notes/ Version info
age_hours	See age_years above. Default=0, range 0-23[h].	Interface level 8 ⇨
height	The height of the patient admitted to the monitor. The unit is 1 mm.	Interface level 8 ⇨

height_unit	The unit of the height that is used when the height is displayed:
	0: unknown
	1: centimeters
	2: inches
	
	`enum dri_height_unit`
	`{`
	`DRI_HEIGHT_UNKNOWN = 0,`
	`DRI_HEIGHT_CM = 1,`
	`DRI_HEIGHT_INCH = 2,`
	`DRI_NR_HEIGHT_UNIT = 3`
	`};`
		Interface level 8 ⇨

weight	The weight of the patient admitted to the monitor. The unit is 1/10 kg.	Interface level 8 ⇨

weight_unit	The unit of the weight that is used when the weight is displayed:
	0: unknown
	1: kilograms
	2: pounds
	
	`enum dri_weight_unit`
	`{`
	`DRI_WEIGHT_UNKNOWN = 0,`
	`DRI_WEIGHT_KG = 1,`
	`DRI_WEIGHT_LB = 2,`
	`DRI_NR_WEIGHT_UNIT = 3`
	`};`
		Interface level 8 ⇨

year_birth_date	The year when the patient admitted to the monitor was born. See age years above.	Interface level 8 ⇨
month_birth_date	The month when the patient admitted to the monitor was born. See age_years above.	Interface level 8 ⇨
day_birth_date	The day when the patient admitted to the monitor was born. See age_years above.	Interface level 8 ⇨

Field	Contents	Notes/ Version info
hour_birth_date	The hour when the patient admitted to the monitor was born. See age_years above.	Interface level 8 ⇨
bsa	Body surface area. The unit is 1/100 m2.	Interface level 8 ⇨
location	The name of the location where the patient information was entered.	Interface level 8 ⇨
issuer	The name of the person who entered the patient information.	Interface level 8 ⇨

change_src	Defines where the patient information was entered:
	0: unknown
	1: at the bedside
	2: remotely (e.g. from Central/iCentral)
	
	`enum dri_case_change_src`
	`{`
	`DRI_CASE_CHANGE_SRS_UNKNOWN = 0,`
	`DRI_CASE_CHANGE_SRS_BEDSIDE = 1,`
	`DRI_CASE_CHANGE_SRS_REMOTE = 2,`
	`DRI_NR_CHANGE_SRC = 3`
	`}`
		Interface level 8 ⇨

reserved	Reserved for future extensions.	

6.3.3 Monitor logout message (DRI_NW_NGM_LOGOUT)

Monitor logout message informs that the monitor has disconnected from the Central/iCentral. The message does not contain any data.

For your notes: