GE Healthcare

S/5 Computer Interface

Specification

All specifications are subject to change without notice.

Document no. M1017617
3rd edition
18 May 2010

GE Healthcare Finland Oy
Kuortaneenkatu 2,
FI-00510 Helsinki
Finland
Tel: +358 10 39411
Fax: +358 9 1463310
www.gehealthcare.com

About this manual

This manual describes how to connect to the applicable patient monitor's serial port (called S/5 Computer Interface) in order to acquire or forward patient data from the patient monitors to other systems.

Responsibility

The developer is responsible for performing any necessary verification for the final product application in accordance with the intended use. The developer is responsible for compliance with local regulations that may apply depending on the product application intended use or use for diagnostic purposes.

Trademarks

Service Manual Language Information

WARNING (EN)	This service manual is available in English only. • If a customer's service provider requires a language other than English, it is the customer's responsibility to provide translation services. • Do not attempt to service the equipment unless this service manual has been consulted and is understood. • Failure to heed this warning may result in injury to the service provider, operator, or patient, from electric shock, mechanical or other hazards.
ПРЕДУПРЕЖДЕНИЕ (BG)	Това упътване за работа е налично само на английски език. • Ако доставчикът на услугата на клиента изиска друг език, задължение на клиента е да осигури превод. • Не използвайте оборудването, преди да сте се консултирали и разбрали упътването за работа. • Неспазването на това предупреждение може да доведе до нараняване на доставчика на услугата, оператора или пациент в резултат на токов удар или механична или друга опасност.
VAROVÁNÍ (CS)	Tento provozní návod existuje pouze v anglickém jazyce. • V případě, že externí služba zákazníkům potřebuje návod v jiném jazyce, je zajištění překladu do odpovídajícího jazyka úkolem zákazníka. • Nesnažte se o údržbu tohoto zařízení, aniž byste si přečetli tento provozní návod a pochopili jeho obsah. • V případě nedodržování této varování může dojít k poranění pracovníka prodejního servisu, obslužného personálu nebo pacientů vlivem elektrického proudu, respektive vlivem mechanických či jiných rizik.
ADVARSEL (DA)	Denne servicemanual findes kun på engelsk. • Hvis en kundes tekniker har brug for et andet sprog end engelsk, er det kundens ansvar at sørge for oversættelse. • Forsøg ikke at servicere udstyret medmindre denne servicemanual har været konsulteret og er forstået. • Manglende overholdelse af denne advarsel kan medføre skade på grund af elektrisk, mekanisk eller anden fare for teknikeren, operatøren eller patienten.
WARNUNG (DE)	Diese Serviceanleitung ist nur in englischer Sprache verfügbar. • Falls der Kundendienst eine andere Sprache benötigt, muss er für eine entsprechende Übersetzung sorgen. • Keine Wartung durchführen, ohne diese Serviceanleitung gelesen und verstanden zu haben. • Bei Zuwiderhandlung kann es zu Verletzungen des Kundendiensttechnikers, des Anwenders oder des Patienten durch Stromschläge, mechanische oder sonstige gefahren kommen.
ΠΡΟΕΙΔΟΠΟΙΗΣΗ (EL)	Το παρόν εγχειρίδιο σέρβις διατίθεται στα αγγλικά μόνο. • Εάν το άτομο παροχής σέρβις ενός πελάτη απαιτεί το παρόν εγχειρίδιο σε γλώσσα εκτός των αγγλικών, αποτελεί ευθύνη του πελάτη να παρέχει υπηρεσίες μετάφρασης. • Μην επιχειρήσετε την εκτέλεση εργασιών σέρβις στον εξοπλισμό εκτός εαν έχετε συμβουλευτεί και έχετε κατανοήσει το παρόν εγχειρίδιο σέρβις. • Εαν δε λάβετε υπόψη την προειδοποίηση αυτή, ενδέχεται να προκληθεί τραυματισμός στο άτομο παροχής σέρβις, στο χειριστή ή στον ασθενή από ηλεκτροπληξία, μηχανικούς ή άλλους κινδύνους.
ADVERTENCIA (ES)	Este manual de servicio sólo existe en inglés. • Si el encargado de mantenimiento de un cliente necesita un idioma que no sea el inglés, el cliente deberá encargarse de la traducción del manual. • No se deberá dar servicio técnico al equipo, sin haber consultado y comprendido este manual de servicio. • La no observancia del presente aviso puede dar lugar a que el proveedor de servicios, el operador o el paciente sufran lesiones provocadas por causas eléctricas, mecánicas o de otra naturaleza.

HOIATUS (ET)	Käesolev teenindusjuhend on saadaval ainult inglise keeles. • Kui klienditeeninduse osutaja nõuab juhendit inglise keelest erinevas keeles, vastutab klient tõlketeenuse osutamise eest. • Ärge üritage seadmeid teenindada enne eelnevalt käesoleva teenindusjuhendiga tutvumist ja sellest aru saamist. • Käesoleva hoiatuse eiramine võib põhjustada teenuseosutaja, operaatori või patsiendi vigastamist elektrilöögi, mehaanilise või muu ohu tagajärjel.
VAROITUS (FI)	Tämä huolto-ohje on saatavilla vain englanniksi. • Jos asiakkaan huoltohenkilöstö vaatii muuta kuin englanninkielistä materiaalia, tarvittavan käännöksen hankkiminen on asiakkaan vastuulla. • Älä yritä korjata laitteistoa ennen kuin olet varmasti lukenut ja ymmärtänyt tämän huolto-ohjeen. • Mikäli tätä varoitusta ei noudateta, seurauksena voi olla huoltohenkilöstön, laitteiston käyttäjän tai potilaan vahingoittuminen sähköiskun, mekaanisen vian tai muun vaaratilanteen vuoksi.
ATTENTION (FR)	Ce manuel technique n'est disponible qu'en anglais. • Si un service technique client souhaite obtenir ce manuel dans une autre langue que l'anglais, il devra prendre en charge la traduction et la responsabilité du contenu. • Ne pas tenter d'intervenir sur les équipements tant que le manuel technique n'a pas été consulté et compris. • Le non-respect de cet avertissement peut entraîner chez le technicien, l'opérateur ou le patient des blessures dues à des dangers électriques, mécaniques ou autres.
UPOZORENJE (HR)	Ove upute za servisiranje dostupne su samo na engleskom jeziku. • Ukoliko korisnički servis zahtijeva neki drugi jezik, korisnikova je odgovornost osigurati odgovarajući prijevod. • Nemojte pokušavati servisirati opremu ukoliko niste konzultirali i razumjeli ove upute. • Nepoštivanje ovog upozorenja može rezultirati ozljedama servisnog osoblja, korisnika ili pacijenta prouzročenim električnim udarom te mehaničkim ili nekih drugih opasnostima.
FIGYELMEZTETÉS (HU)	Ez a szerviz kézikönyv kizárólag angol nyelven érhető el. • Ha a vevő szerviz ellátója angoltól eltérő nyelvre tart igényt, akkor a vevő felelőssége a fordítás elkészíttetése. • Ne próbálja elkezdeni használni a berendezést, amíg a szerviz kézikönyvben leírtakat nem értelmezték és értették meg. • Ezen figyelmeztetés figyelmen kívül hagyása a szerviz ellátó, a működtető vagy a páciens áramütés, mechanikai vagy egyéb veszélyhelyzet miatti sérülését eredményezheti.
AÐVÖRUN (IS)	Þessi þjónustuhandbók er eingöngu fáanleg á ensku. • Ef að þjónustuveitandi viðskiptamanns þarfnast annas tungumáls en ensku, er það skylda viðskiptamanns að skaffa tungumálaþjónustu. • Reynið ekki að afgreiða tækið nema að þessi þjónustuhandbók hefur verið skoðuð og skilin. • Brot á sinna þessari aðvörun getur leitt til meiðsla á þjónustuveitanda, stjórnanda eða sjúklings frá raflosti, vélrænu eða öðrum áhættum.
AVVERTENZA (IT)	Il presente manuale di manutenzione è disponibile soltanto in Inglese. • Se un addetto alla manutenzione richiede il manuale in una lingua diversa, il cliente è tenuto a provvedere direttamente alla traduzione. • Si proceda alla manutenzione dell'apparecchiatura solo dopo aver consultato il presente manuale ed averne compreso il contenuto. • Il non rispetto della presente avvertenza potrebbe far compiere operazioni da cui derivino lesioni all'addetto, alla manutenzione, all'utilizzatore ed al paziente per folgorazione elettrica, per urti meccanici od altri rischi.
警告 (JA)	このサービスマニュアルは英語版しかありません。 ・ サービスを担当される業者が英語以外の言語を要求される場合、翻訳作業はその業者の責任で行うものとさせていただきます。 ・ このサービスマニュアルを熟読し、十分に理解した上で装置のサービスを行ってください。 ・ この警告に従わない場合、サービスを担当される方、操作員あるいは患者が、感電や機械的又はその他の危険により負傷する可能性があります。

경고 (KO)	본 서비스 지침서는 영어로만 이용하실 수 있습니다 . • 고객의 서비스 제공자가 영어 이외의 언어를 요구할 경우 , 번역 서비스를 제공하는 것은 고객의 책임입니다 . • 본 서비스 지침서를 참고했고 이해하지 않는 한은 해당 장비를 수리하려고 시도하지 마십시오 . • 이 경고에 유의하지 않으면 전기 쇼크 , 기계상의 혹은 다른 위험으로부터 서비스 제공자 , 운영자 혹은 환자에게 위해를 가할 수 있습니다 .
ĮSPĖJIMAS (LT)	Šis eksploatavimo vadovas yra prieinamas tik anglų kalba. • Jei kliento paslaugų tiekėjas reikalauja vadovo kita kalba – ne anglų, numatyti vertimo paslaugas yra kliento atsakomybė. • Nemėginkite atlikti įrangos techninės priežiūros, nebent atsižvelgėte į šį eksploatavimo vadovą ir jį supratote. • Jei neatkreipsite dėmesio į šį perspėjimą, galimi sužalojimai dėl elektros šoko, mechaninių ar kitų pavojų paslaugų tiekėjui, operatoriui ar pacientui.
BRĪDINĀJUMS (LV)	Šī apkalpotāju rokasgrāmata ir pieejama tikai angļu valodā. • Ja apkalpo anas sniedzējam nepieciešama informācija citā, nevis angļu, valodā, klienta pienākums ir nodrošināt tās tulko anu. • Neveiciet aprīkojuma apkopi, neizlasot un nesaprotot apkalpotāju rokasgrāmatu. • Šī brīdinājuma neievērošana var radīt elektriskās strāvas trieciena, mehānisku vai citu risku izraisītu traumu apkopes sniedzējam, operatoram vai pacientam.
WAARSCHUWING (NL)	Deze service manual is alleen in het Engels verkrijgbaar. • Indien het onderhoudspersoneel een andere taal nodig heeft, dan is de klant verantwoordelijk voor de vertaling ervan. • Probeer de apparatuur niet te onderhouden voordat deze service manual geraadpleegd en begrepen is. • Indien deze waarschuwing niet wordt opgevolgd, zou het onderhoudspersoneel, de gebruiker of een patiënt gewond kunnen raken als gevolg van een elektrische schok, mechanische of andere gevaren.
ADVARSEL (NO)	Denne servicehåndboken finnes bare på engelsk. • Hvis kundens serviceleverandør trenger et annet språk, er det kundens ansvar å sørge for oversettelse. • Ikke forsøk å reparere utstyret uten at denne servicehåndboken er lest og forstått. • Manglende hensyn til denne advarselen kan føre til at serviceleverandøren, operatøren eller pasienten skades på grunn av elektrisk støt, mekaniske eller andre farer.
OSTRZEŻENIE (PL)	Niniejszy podręcznik serwisowy dostępny jest jedynie w języku angielskim. • Jeśli dostawca usług klienta wymaga języka innego niż angielski, zapewnienie usługi tłumaczenia jest obowiązkiem klienta. • Nie należy serwisować wyposażenia bez zapoznania się i zrozumienia niniejszego podręcznika serwisowego. • Niezastosowanie się do tego ostrzeżenia może spowodować urazy dostawcy usług, operatora lub pacjenta w wyniku porażenia elektrycznego, zagrożenia mechanicznego bądź innego.
AVISO (PT-BR)	Este manual de assistência técnica só se encontra disponível em inglês. • Se o serviço de assistência técnica do cliente não for GE, e precisar de outro idioma, será da responsabilidade do cliente fornecer os serviços de tradução. • Não tente reparar o equipamento sem ter consultado e compreendido este manual de assistência técnica. • O não cumprimento deste aviso pode por em perigo a segurança do técnico, operador ou paciente devido a choques elétricos, mecânicos ou outros.
AVISO (PT-PT)	Este manual técnico só se encontra disponível em inglês. • Se a assistência técnica do cliente solicitar estes manuais noutro idioma, é da responsabilidade do cliente fornecer os serviços de tradução. • Não tente reparar o equipamento sem ter consultado e compreendido este manual técnico. • O não cumprimento deste aviso pode provocar lesões ao técnico, ao utilizador ou ao paciente devido a choques eléctricos, mecânicos ou outros.

AVERTISMENT (RO)	Acest manual de service este disponibil numai în limba engleză. • Dacă un furnizor de servicii pentru clienți necesită o altă limbă decât cea engleză, este de datoria clientului să furnizeze o traducere. • Nu încercați să reparați echipamentul decât ulterior consultării şi înțelegerii acestui manual de service. • Ignorarea acestui avertisment ar putea duce la rănirea depanatorului, operatorului sau pacientului în urma pericolelor de electrocutare, mecanice sau de altă natură.
ПРЕДУПРЕЖДЕНИЕ (RU)	Настоящее руководство по обслуживанию предлагается только на английском языке. • Если сервисному персоналу клиента необходимо руководство не на английском, а на каком-то другом языке, клиенту следует обеспечить перевод самостоятельно. • Прежде чем приступать к обслуживанию оборудования, обязательно обратитесь к настоящему руководству и внимательно изучите изложенные в нем сведения. • Несоблюдение требований данного предупреждения может привести к тому, что специалисты по обслуживанию, операторы или пациенты получат удар электрическим током, механическую травму или другое повреждение.
VAROVANIE (SK)	Tento návod na obsluhu je k dispozícii len v angličtine. • Ak zákazníkov poskytovateľ služieb vyžaduje iný jazyk ako angličtinu, poskytnutie prekladateľských služieb je zodpovednosťou zákazníka. • Nepokúšajte sa o obsluhu zariadenia skôr, ako si neprečítate návod na obsluhu a neporozumiete mu. • Zanedbanie tohto varovania môže vyústiť do zranenia poskytovateľa služieb, obsluhujúcej osoby alebo pacienta elektrickým prúdom, mechanickým alebo iným nebezpečenstvom.
UPOZORENJE (SR)	Ovo servisno uputstvo je dostupno samo na engleskom jeziku. • Ako klijentov serviser zahteva neki drugi jezik, klijent je dužan da obezbedi prevodilacke usluge. • Ne pokušavajte da opravite uredaj ako niste procitali i razumeli ovo servisno uputstvo. • Zanemarivanje ovog upozorenja može dovesti do povredivanja servisera, rukovaoca ili pacijenta usled strujnog udara ili mehanickih i drugih opasnosti.
VARNING (SV)	Den här servicehandboken finns bara tillgänglig på engelska. • Om en kunds servicetekniker har behov av ett annat språk än engelska ansvarar kunden för att tillhandahålla översättningstjänster. • Försök inte utföra service på utrustningen om du inte har läst och förstår den här servicehandboken. • Om du inte tar hänsyn till den här varningen kan det resultera i skador på serviceteknikern, operatören eller patienten till följd av elektriska stötar, mekaniska faror eller andra faror.
UYARI (TR)	Bu servis kilavuzunun sadece ingilizcesi mevcuttur. • Eğer müşteri teknisyeni bu kilavuzu ingilizce dişinda bir başka lisandan talep ederse, bunu tercüme ettirmek müşteriye düşer. • Servis kilavuzunu okuyup anlamadan ekipmanlara müdahale etmeyiniz. • Bu uyariya uyulmamasi, elektrik, mekanik veya diğer tehlikelerden dolayi teknisyen, operatör veya hastanin yaralanmasina yol açabilir.
ЗАСТЕРЕЖЕННЯ (UK)	Дане керівництво з сервісного обслуговування постачається виключно англійською мовою. • Якщо сервісний інженер потребує керівництво іншою мовою, користувач забов'язаний забезпечити послуги перекладача. • Не намагайтеся здійснювати технічне обслуговування даного обладнання, якщо ви не читали, або не зрозуміли інформацію, надану в керівництві з сервісного обслуговування. • Недотримання цього застереження може призвести до травмування сервісного інженера, користувача даного обладнання або пацієнта внаслідок електричного шоку, механічного ушкодження або з інших причин невірного обслуговування обладнання.

警告 (ZH-CN)	本维修手册仅提供英文版本。 • 如果维修服务提供商需要非英文版本，客户需自行提供翻译服务。 • 未详细阅读和完全理解本维修手册之前，不得进行维修。 • 忽略本警告可能对维修人员，操作员或患者造成触电、机械伤害或其他形式的伤害。
警告 (ZH-TW)	本維修手冊只提供英文版。 • 如果客戶的維修人員有英語以外的其他語言版本需求，則由該客戶負責提供翻譯服務。 • 除非您已詳閱本維修手冊並了解其內容，否則切勿嘗試對本設備進行維修。 • 不重視本警告可能導致維修人員、操作人員或病患因電擊、機械因素或其他因素而受到傷害。

Table of contents

1 Introduction

The most important physiological values measured by the applicable patient monitors, waveforms and associated status information, can be accessed through the S/5 Computer Interface.

The system interface is based on the Datex-Ohmeda Record Interface format, see Reference section below, that specifies the data formats and constants used in the communication between the patient monitors and external devices. All data in all media types is transferred in the **Datex-Ohmeda Record** format.

The applicable patient monitors have an asynchronous serial interface (Computer Interface) that can be used for data acquisition. This document contains issues that are related specifically to the serial interface data acquisition. The actual data formats and constants are included in the Datex-Ohmeda Record Specification document.

Definitions

DRI	Datex-Ohmeda Record Interface
patient monitor(s)	Patient monitor is used to refer to the applicable monitors listed in this manual.

Reference

In the following chapters the "*S/5 System Interface Datex-Ohmeda Record Specification"* is referred to frequently. This specification can be requested by contacting a local distributor. In the text it is referred to as "*DRI specification.*"

Applicable monitors

S/5 Computer Interface described in this manual is available in the following monitors with specified monitor software or licenses:

CARESCAPE Monitor B850

CARESCAPE Monitor B650

S/5 Monitors:

- S-00A01/02/05/06
- L-00A03/04/07/08
- S-00C01/02/03/04

- L-ANE01(A)/02(A)/03(A)/04(A)/05(A)/06(A)/07(A)
- L-ICU01(A)/02(A)/03(A)/04(A)/05(A)/06(A)/07(A)
- L-CANE02(A)/03(A)/04(A)/05(A)/06(A)
- L-CICU02(A)/03(A)/04(A)/05(A)/06(A)
- L-FICU03(A)/04(A)/05L

Light Monitor

Cardiocap 5:

- S-XANE99/01
- S-XCCA99/01
- S-XANE04SL

AS/3 Anesthesia Monitor, AS/3 Compact Monitor:

- S-STD95/96
- S-ARK95/96/97/98
- S-ANE97/98/99(A)
- L-ARK99(A)

CS/3 Critical Care Monitor, CS/3 Compact Monitor:

- S-ICU97/98/99(A)

2 Using the computer interface

Line parameters

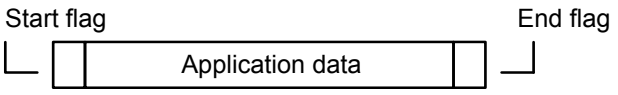
The interface uses the following serial communication line parameters:

19 200 bit/s transmission rate,
8 data bits
even parity
1 stop bit.
CTS/RTS hardware handshaking is used for communication control.

The line parameters cannot be changed.

Frame structure

All data from the monitor, and to the monitor, is transferred using flag-delimited frames. Each data frame starts and ends with a flag character. All application data is always located between these flags.



Data transparency

The value of the start and end flags is always **0x7E**. As the application data may contain an arbitrary number of bytes with the same value, the following algorithm is used to detect the start and end of a frame correctly:

A control character (**0x7D**) is used to indicate the start of a control sequence. At the transmitting end, each application data byte with value 0x7E (flag) or 0x7D (control character) is replaced with a control character and the original byte with the 5th (of bits 0-7) bit cleared. Therefore, the following conversions are possible:
0x7E -> 0x7D, 0x5E
0x7D -> 0x7D, 0x5D

This method guarantees that there are no flag characters in the outgoing application data stream.

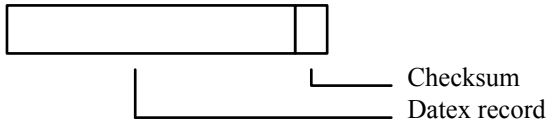
As a control character is received, it is not interpreted to be a part of the application data. The 5th bit of the **next** character must be set to restore the original value of the character. Therefore, the following conversions are possible:
0x7D, 0x5E -> 0x7E
0x7D, 0x5D -> 0x7D

This conversion method is similar to that represented in the standard ISO/EI 13239:2002.

Application data structure

As the start and end flags are removed and necessary conversions done, the application data can be further processed.

The application data consists of a Datex-Ohmeda record and a checksum.



The Datex-Ohmeda record has variable length. Its internal structure is defined in the DRI specification. The serial interface related issues are discussed in the following sections.

NOTE: When doing the conversion for the application data, the checksum byte must be included in the conversion.

Checksum

When interfacing through the serial interface, each record is followed by a checksum byte. The checksum is calculated by summing all bytes in the Datex-Ohmeda Record using 8 bit unsigned arithmetic.

Connector

The physical computer interface is a PC/AT style 9-pin male D-connector usually located at the rear panel of monitors, refer to the monitor's documentation. The following pins are used:

Pin	Usage
2	Rx Data
3	Tx Data
5	GND
7	RTS
8	CTS

NOTE: CARESCAPE Monitor B850 and CARESCAPE Monitor B650 require the use of the ATEN UC-232A USB to Serial Communication Device. The ATEN UC-232A should be connected to any of the USB connectors on the back of the monitor. The above pin out should then be followed to connect to the serial end of the device.

3 Access to patient monitor physiological data

This section describes how the physiological data can be accessed through the patient monitors' computer interface. For details of the actual physiological data formats, see DRI specification, section Physiological Data ADI.

Subrecord types

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

Value	Usage	Version info
0	Physiological data transmission requests	Interface level 2* ->
1	Current (displayed) values of the physiological database	Interface level 2*->
2	10 s trended values of the physiological database**	Interface level 2*->
3	60 s trended values of the physiological database**	Interface level 2*->

*See the DRI specification for more information on interface levels.
**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 the automatic transmission of the displayed values with an 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.

Subrecord structures

Transmission request (subtype 0)

The structure of a physiological data **transmission request subrecord** is

```
struct dri_phdb_req
{
        byte    phdb_rcrd_type;
        short   tx_ival;
        long    phdb_class_bf;
        short   reserved;
};
```

phdb_rcrd_type specifies the subrecord the interfacing device wishes to receive.
Valid values are listed in the table above.

tx_ival specifies the transmission interval in seconds. The following values can be used:

Value	Use	Version info
-1	To request a single transmission of a subrecord	Interface level: 2* ->
Any positive value together with subrecord type DRI_PH_10S_TREND	To start automatic transmission of that subrecord type using 10 s intervals. No further transmission requests are needed after this.	Interface level: 2*->
Any positive value together with subrecord type DRI_PH_60S_TREND	To start automatic transmission of that subrecord type using 60 s intervals. No further transmission requests are needed after this.	Interface level: 2*->
A positive value greater or equal to 5 together with subrecord type DRI_PH_DISPL.	To start automatic transmission of that subrecord type using the specified transmission interval. No further transmission requests are needed after this.	Interface level: 2*->
0	To cancel the automatic transmission of the specified subrecord	Interface level: 2*->

* See the DRI specification for more information on interface levels.

NOTE: If -1 is used for transmission interval, the minimum interval for requesting data from a patient monitors is 5 seconds. If the monitors receive two requests within 5 seconds, the latter request is ignored.

phdb_class_bf specifies physiological subrecord classes the interfacing device wishes to receive. The classes together with valid values for phdb_class_bf are listed in DRI specification, section Physiological Data ADI Subrecord Types.

See the DRI specification for more information on patient monitors' physiological data formats.

4 Access to waveform data

This section describes how the waveform data can be accessed through the DO monitors' computer interface. For details of the actual physiological data formats, see DRI specification, section Waveform ADI.

General

The S/5 Computer Interface provides limited access to the real-time waveform data produced by the monitor. Accessing the waveforms does not exclude access to the physiological data.

NOTE: The waveforms are available starting from the interface level 2 (software versions S-STD95/96 and S-ARK95/96.)

Maximum data transmission rate for real time waveform is 600 samples (1200 bytes) per second total. The maximum data transmission is shared with requested waveforms.

Waveform request

See the DRI specification for information on DO monitors' waveform data formats.

A subrecord of type DRI_WF_CMD (value 0) is used to carry transmission requests to the monitor. The subrecord has the following structure:

```
struct wf_req
{
        short   req_type;
        short   res;
        byte    type[8];
        short   reserved[10];
};
```

req_type is the waveform request specifier. The following values are valid for this field:

0	To start continuous transmission of the specified waveform
1	To stop transmission of the waveform. In this case monitor ignores all other fields of this structure

Waveform transmission request types:

```
enum dri_wf_req
{
        WF_REQ_CONT_START,
        WF_REQ_CONT_STOP
};
```

res and **reserved** are reserved for future use. This field must be set to 0 to ensure compatibility with future versions of the monitor.

type is an array of the requested waveform subrecords.

There is room for up to 8 waveforms, but the monitor sends only the waveforms that fit within the 600 samples/s limitation and ignores the rest.
If less than 8 waveforms are requested the type array must be terminated using the DRI_EOL_SUBR_LIST constant (0xFF).

The following example shows how fields are used as the CO_2 waveform is requested:

```
struct wf_req req;

req.req_type = WF_REQ_CONT_START;

req.res = 0;

req.type[0] = DRI_WF_CO2;

req.type[1] = DRI_EOL_SUBR_LIST; /* 0xFF */

memset(req.reserved, 0, sizeof(req.reserved));
```

About the use of the waveform requests

As the monitor receives a valid waveform request, data transmission is started within one second. Before that the monitor checks for the 600 samples/s limitation and ignores all waveform subrecords in the record that exceed this limit.

For example, if the request contains DRI_WF_ECG1 (300 samples/s), DRI_WF_ECG2 (300 samples/s) and DRI_WF_INVP1 (100 samples/s), the invasive pressure waveform is ignored as the two ECGs fill up the bandwidth. On the other hand, it is acceptable to request for all six invasive pressure waveforms (6 * 100 samples/s), or for 4 (4 * 100 samples/s) invasive pressures combined with 4 gas waveforms (4 * 25 samples/s), etc.
For details on sample rates, see the DRI specification.

The selected waveforms can be changed at any moment. If another waveform is needed, the currently active transmission needs not to be stopped.

Monitor keeps transmitting the waveform data as long as the serial line accepts it.

NOTE: If RTS/CTS handshaking disables data transmission for a time longer than 2 seconds, the monitor stops the transmission automatically.
A new waveform request is needed to restart transmission after this.

See the DRI specification for more information on DO monitors' waveform data formats.

For your notes:

APPENDIX A: Examples

How to request displayed values (DRI_PH_DISPL)

Example code for generating the request:

```
struct datex_record requestPkt;
struct dri_phdb_req *pRequest;

// Clear the packet
memset(&requestPkt, 0x00, sizeof(datex_record));

// Fill the header
requestPkt.hdr.r_len       = sizeof(datex_hdr) +
   sizeof(struct dri_phdb_req);
requestPkt.hdr.r_maintype  = DRI_MT_PHDB;

// The packet contains only one subrecord
// 0 = Physiological data transmission request
requestPkt.hdr.sr_desc[0].sr_type      = 0;
requestPkt.hdr.sr_desc[0].sr_offset    = (byte)0;
requestPkt.hdr.sr_desc[1].sr_type      =
   (short) DRI_EOL_SUBR_LIST;

// Fill the request
pRequest =
   (struct dri_phdb_req *)&(requestPkt.rcrd.ph_rcrd);
pRequest->phdb_rcrd_type   = DRI_PH_DISPL;
pRequest->tx_ival          = 10; // 10 = 10s interval
pRequest->phdb_class_bf    =
   DRI_PHDBCL_REQ_BASIC_MASK | DRI_PHDBCL_REQ_EXT1_MASK  |
   DRI_PHDBCL_REQ_EXT2_MASK  | DRI_PHDBCL_REQ_EXT3_MASK;
```

Hexadecimal representation of the request:

```
7e 31 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 ff 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 01 0a 00 0e 00 00 00
00 00 49 7e
```

How to stop displayed values (DRI_PH_DISPL)

Example code for generating the request:

```
struct datex_record requestPkt;
struct dri_phdb_req *pRequest;

// Clear the packet
memset(&requestPkt, 0x00, sizeof(datex_record));

// Fill the header
requestPkt.hdr.r_len       = sizeof(datex_hdr) +
   sizeof(struct dri_phdb_req);
requestPkt.hdr.r_maintype  = DRI_MT_PHDB;

// The packet contains only one subrecord
// 0 = Physiological data transmission request
requestPkt.hdr.sr_desc[0].sr_type      = 0;
requestPkt.hdr.sr_desc[0].sr_offset    = (byte)0;
requestPkt.hdr.sr_desc[1].sr_type      =
   (short) DRI_EOL_SUBR_LIST;

// Fill the request
pRequest =
   (struct dri_phdb_req *)&(requestPkt.rcrd.ph_rcrd);
pRequest->phdb_rcrd_type = DRI_PH_DISPL;
pRequest->tx_ival        = 0; // 0 = Stop sending the data
pRequest->phdb_class_bf  = 0;
```

Hexadecimal representation of the request:

```
7e 31 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 ff 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 01 00 00 00 00 00 00
00 00 31 7e
```

How to request 60 second trended values (DRI_PH_60S_TREND)

NOTE: The request for the automatic transmission of the displayed values (DRI_PH_DISPL) must be sent to the monitor before the 60 seconds trended values can be requested.

Example code for generating the request:

```
struct datex_record requestPkt;
struct dri_phdb_req *pRequest;

// Clear the packet
memset(&requestPkt, 0x00, sizeof(datex_record));

// Fill the header
requestPkt.hdr.r_len       = sizeof(datex_hdr)  +
sizeof(struct dri_phdb_req);
requestPkt.hdr.r_maintype  = DRI_MT_PHDB;

// The packet contains only one subrecord
// 0 = Physiological data transmission request
requestPkt.hdr.sr_desc[0].sr_type      = 0;
requestPkt.hdr.sr_desc[0].sr_offset    = (byte)0;
requestPkt.hdr.sr_desc[1].sr_type      =
   (short) DRI_EOL_SUBR_LIST;

// Fill the request.
pRequest =
   (struct dri_phdb_req *)&(requestPkt.rcrd.ph_rcrd);
pRequest->phdb_rcrd_type = DRI_PH_60S_TREND;
pRequest->tx_ival        = 60; // 60 = 60 second interval
pRequest->phdb_class_bf  =
   DRI_PHDBCL_REQ_BASIC_MASK | DRI_PHDBCL_REQ_EXT1_MASK |
   DRI_PHDBCL_REQ_EXT2_MASK  | DRI_PHDBCL_REQ_EXT3_MASK;
```

Hexadecimal representation of the request:

```
7e 31 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 ff 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 03 3c 00 0e 00 00 00
00 00 7d 5d 7e
```

How to stop 60 second trended values (DRI_PH_60S_TREND)

Example code for generating the request:

```
struct datex_record requestPkt;
struct dri_phdb_req *pRequest;

// Clear the packet
memset(&requestPkt, 0x00, sizeof(datex_record));

// Fill the header
requestPkt.hdr.r_len      = sizeof(datex_hdr) +
   sizeof(struct dri_phdb_req);
requestPkt.hdr.r_maintype = DRI_MT_PHDB;

// The packet contains only one subrecord
// 0 = Physiological data transmission request
requestPkt.hdr.sr_desc[0].sr_type      = 0;
requestPkt.hdr.sr_desc[0].sr_offset    = (byte)0;
requestPkt.hdr.sr_desc[1].sr_type      =
   (short) DRI_EOL_SUBR_LIST;

// Fill the request
pRequest =
   (struct dri_phdb_req *)&(requestPkt.rcrd.ph_rcrd);
pRequest->phdb_rcrd_type = DRI_PH_60S_TREND;
pRequest->tx_ival        = 0; // 0 = Stop sending the data
pRequest->phdb_class_bf  = 0;
```

Hexadecimal representation of the request:

```
7e 31 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 ff 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 03 00 00 00 00 00 00
00 00 33 7e
```

How to request waveform data

Example code for generating the request:

```
struct datex_record requestPkt;
struct wf_req *pRequest;

// Clear the packet
memset(&requestPkt, 0x00, sizeof(datex_record));

// Fill the header
requestPkt.hdr.r_len      = sizeof(datex_hdr) +
   sizeof(struct wf_req);
requestPkt.hdr.r_maintype = DRI_MT_WAVE;

// The packet contains only one subrecord
// 0 = Waveform data transmission request
requestPkt.hdr.sr_desc[0].sr_type      = 0;
requestPkt.hdr.sr_desc[0].sr_offset    = (byte)0;
requestPkt.hdr.sr_desc[1].sr_type      =
   (short) DRI_EOL_SUBR_LIST;

// Fill the request
pRequest = (wf_req *)&(requestPkt.rcrd.wf_rcrd);
pRequest->req_type = WF_REQ_CONT_START;

// Only one waveform type is requested
pRequest->type[0] = DRI_WF_ECG1;
pRequest->type[1] = DRI_EOL_SUBR_LIST;
```

Hexadecimal representation of the request:

```
7e 48 00 00 00 00 00 00 00 00 00 00 00 00 00 01
00 00 00 00 00 00 ff 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 01 ff 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 48 7e
```

How to stop waveform data

Example code for generating the request:

```
struct datex_record requestPkt;
struct wf_req *pRequest;

// Clear the packet
memset(&requestPkt, 0x00, sizeof(datex_record));

// Fill the header
requestPkt.hdr.r_len      = sizeof(datex_hdr) +
   sizeof(struct wf_req);
requestPkt.hdr.r_maintype = DRI_MT_WAVE;

// The packet contains only one subrecord
// 0 = Waveform data transmission request
requestPkt.hdr.sr_desc[0].sr_type      = 0;
requestPkt.hdr.sr_desc[0].sr_offset    = (byte)0;
requestPkt.hdr.sr_desc[1].sr_type      =
   (short) DRI_EOL_SUBR_LIST;

// Fill the request
pRequest = (wf_req *)&(requestPkt.rcrd.wf_rcrd);
pRequest->req_type = WF_REQ_CONT_STOP;
pRequest->type[0]  = DRI_EOL_SUBR_LIST;
```

Hexadecimal representation of the request:

```
7e 48 00 00 00 00 00 00 00 00 00 00 00 00 00 01
00 00 00 00 00 00 ff 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 01 00 00 00 ff 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 48 7e
```

Index