Service Manual

DIAP
Communications Protocol

mindray
NORTH AMERICA

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1 *DIAP*

1.1 Introduction

This document defines the DIAP for new patient monitor external data communication design.

1.2 DIAP

The DIAP was designed to be simple, yet extensible for new features without compromising programs written by third parties.

1.2.1 Connection Type

The DIAP is a point-to-point, hierarchical (one or more into one host) protocol. All communications are initiated by the host. No common access media types, including serial multi-point connections, are supported.

It is a request/reply, non-continuous protocol. Only numeric data (no waveforms) are supported.

1.2.2 Physical Protocol

The physical interface for the DIAP is asynchronous serial, with a baud rate of 9600 and 19200, 8 bits, 1 stop bit, no parity.

1.2.3 Session Protocol

The messages must be/are encapsulated as follows:

First Character					Last Character	
HEADER	<	Command		>	CRC	LF
		Reply				
		%	Error			

- All Commands are case-insensitive ASCII.
- All Replies are mixed case as indicated in next section.
- Timeout: No reply for 10 seconds.
- Maximum message size for Commands is 255 total bytes.
- Maximum message size for Replies is 511 bytes.

Where:

Item	Description	Type	Length
HEADER	DIAPxxx where: xxx is a channel number from 000 to 999 - it is always 000 for a patient monitor - it is always 001 to 999 for a central monitor	literal ASCII character + ASCII decimal numeric	4+3
< , >	are delimiter characters	literal ASCII string	1, 1
CRC	is a cyclical redundancy check as described in the section beginning on page 2-1.	ASCII hex numeric	4
LF	is an ASCII line feed character.	literal ASCII character	1

1.2.4 Command/Reply Legend

This is the *legend* to the Command/Reply list. It indicates how the arguments for the Commands and Replies are defined. See “Commands and Replies”(section 1.3).

- Items designated as ‘ASCII decimal numeric’ are padded with leading (left) zeros.
- Items designated as ‘ASCII hex numeric’ are padded with leading (left) zeros.
- Items designated as ‘literal ASCII string’ are padded with trailing (right) spaces.
- Items designated as ‘ASCII string’ are padded with trailing (right) spaces.
- Items designated as ‘ASCII string’ will be truncated by the monitor/central as necessary.
- Items designated as ‘ASCII string’ may contain A-Z, a-z, 0-9, comma, period, dash, space, question mark.

Item	Description	Type	Length	Units
XXX	generic ASCII number	ASCII decimal numeric	3	-
S	numeric sign	ASCII ‘+’ or ‘-’	1	-
productName	Accutorr | Passport | Passport ST | VISA | Passport 2 | Spectrum | Spectrum OR |Trio| Passport V | Valiant* | VSeries * *Valiant = Accutorr V*	literal ASCII string	32	-
mVersion	monitor software version	ASCII string	3	-

mRevision	monitor software revision	ASCII decimal numeric	3	-
pVersion	protocol format version=000	ASCII decimal numeric	3	-
pRevision	protocol software revision** *** Valiant and Passport V = 000 VSeries = 000*	ASCII decimal numeric	3	-
patRoom1	patient room, line 1	ASCII string	4	-
patRoom2	patient room, line 2	ASCII string	4	-
patName1	patient name, line 1	ASCII string	32	-
patName2	patient name, line 2	ASCII string	32	-
unit Name	unit name	ASCII string	32	-
co2ins	co2 inspired value	ASCII decimal numeric	3	torr
co2et	co2 end-tidal value	ASCII decimal numeric	3	torr
o2ins	o2 inspired value (10x)	ASCII decimal numeric	4	%
o2et	o2 end-tidal value (10x)	ASCII decimal numeric	4	%
agtins	agent inspired value (100x)	ASCII decimal numeric	5	%
agtet	agent end-tidal value (100x)	ASCII decimal numeric	5	%
n2oins	n2o inspired value (10x)	ASCII decimal numeric	4	%
n2oet	n2o end-tidal value (10x)	ASCII decimal numeric	4	%
sys	systolic value	ASCII decimal numeric	3 + 1 sign	mmHg
dia	diastolic value	ASCII decimal numeric	3 + 1 sign	mmHg
map	map value	ASCII decimal numeric	3 + 1 sign	mmHg
status	status bits	ASCII hex numeric	4	-
heartRate Source	NONE | ECG | SpO_2 | NIBP | P1 | P2 | P3 | P4	literal ASCII string	16	-
Respiration Source	NONE | ECG | CO_2 | PAW | TV	literal ASCII string	16	-
beatType	NONE	literal ASCII string	16	-

rhythm	NONE	literal ASCII string	16	-
temp	temperature (10x) (100 X for Accutorr Plus)	ASCII decimal numeric	4 + 1 sign	°C
sec	seconds	ASCII decimal numeric	2	-
min	minutes	ASCII decimal numeric	2	-
hour	hours	ASCII decimal numeric	2	-
day	day of month	ASCII decimal numeric	2	-
month	month of year	ASCII decimal numeric	2	-
year	year	ASCII decimal numeric	4	-
weekday	Mon | Tue | Wed | Thu | Fri | Sat | Sun	literal ASCII string	3	-
timeInSecs	elapsed time (since midnight, 01-Jan-1990)	ASCII decimal numeric	10	-
Lo	low alarm value or “OFF”	ASCII decimal numeric or literal ASCII string	3 + 1 sign or 1 space	-
Hi	high alarm value or “OFF”	ASCII decimal numeric or literal ASCII string	3 + 1 sign or 1 space	-
pawpValue	pulmonary artery wedge pressure	ASCII decimal numeric	3 + 1 sign	mmHg
coValue	cardiac output value (100x)	ASCII decimal numeric	4	liters/min
ciValue	cardiac index value (10x)	ASCII decimal numeric	3	liters/min/m2
agentName	ISO | ENF | HAL | DES | SEV	literal ASCII string	3	-
stValue	ECG s-t value (10x)	ASCII decimal numeric	2 + 1 sign	mm
timeInMins	time in minutes	ASCII decimal numeric	3	minutes
apneaAlarm	alarm delay for Apnea or “OFF”	ASCII decimal numeric or literal ASCII string	3	seconds
histString1	Item#,Date,Time,Call (001,XX/XX/XX,24:00,Text)	ASCII String	4+9+6+13	-

histString100	Item#,Date,time,Call (100,XX/XX/XX,24:00,Text)	ASCII String	4+9+6+13	-
height	Height in centimeters (10x)	ASCII decimal numeric	4	cm
weight	Weight in kilograms (100x)	ASCII decimal numeric	5	kg
bsa	Body Surface Area using Dubois Algorithm BSA = height(cm)0.725 x weight(kg)0.425 x 0.007184 (1000x)	ASCII decimal numeric	5	Dubois Algorithm
cpp	Cerebral Perfusion Pressure calculated as the difference between the Art Mean and the ICP Mean pressure	ASCII decimal numeric	3 + 1 sign	mmHg
mode	Monitor mode of “Standby”, “Demo” or “Normal” is returned	ASCII string	8	-
vtValue	insp/exp Tidal Volume	ASCII decimal numeric	4	ml
mvValue	insp/exp Minute Volume (10x)	ASCII decimal numeric	3	ml
ieRatio	Ratio of insp time to exp time	ASCII string	5	-
pValue	Spirometry pressure	ASCII decimal numeric	3 + 1 sign or 1 space	cmH_2O
complValue	Dynamic Airway compliance value	ASCII decimal numeric	3	ml/ cmH_2O
macValue	Minimum Alveolar Concentration (10x)	ASCII decimal numeric	2	-
vtLo	low alarm value or "OFF" of Tidal Volume	ASCII decimal numeric or literal ACSII string	4	ml
vtHi	low alarm value or "OFF" of Tidal Volume	ASCII decimal numeric or literal ACSII string	4	ml
mvLo	low alarm value or "OFF" of Flow Minute Volume (10x)	ASCII decimal numeric or literal ACSII string	3 + 1 sign or 1 space	ml
mvHi	high alarm value or "OFF" of Flow Minute Volume (10x)	ASCII decimal numeric or literal ACSII string	3 + 1 sign or 1 space	ml
spSensorSize	Spirometry Sensor Size Adult | Ped | -----	Literal ACSII string	5	-
rawValue	Dynamic Airway Resistance	ASCII decimal numeric	2	cmH_2O/l/s

bissef	BIS Spectral Edge Frequency (10x)	ASCII decimal numeric	3	Hz
sbis	Standard Deviation of BIS (10x)	ASCII decimal numeric	3	N/A
semg	Standard Deviation of EMG (10x)	ASCII decimal numeric	3	dB
svi	Stroke Volume Index (10x)	ASCII decimal numeric	4	ml/m^2
edvi	End Diastolic Volume Index (10x)	ASCII decimal numeric	4	ml/m^2
esvi	End Systolic Volume Index (10x)	ASCII decimal numeric	4	ml/m^2
o2eii	Oxygen Extraction Index (10x)	ASCII decimal numeric	3	%

1.3 Commands and Replies

The following is a list of alternating **Commands** and **Replies**. They are encapsulated in the format above. There are no space characters within the **Commands** or **Replies** - they are indicated in the table for clarity only.

- Multiple **Commands** may be sent in one message; they must be separated by semi-colons (';'); the **Replies** will be returned in a single message separated by semi-colons. Having replies returned as a single message insures that the information in the replies are all synchronized with respect to one another (atomic transaction).

Example:

Command:
`DIAP000<t1;t2;deltaT>`

Reply:
`DIAP000<t1=42;t2=39;deltaT=3>`

The value for deltaT will reflect what the values were for t1 and t2 at the time the message was received.

Command:
`DIAP000<t1>`

Reply:
`DIAP000<t1=42>`

Command:
`DIAP000<t2>`

Reply:
`DIAP000<t2=39>`

Command:
`DIAP000<deltaT> (meanwhile, t1 changed from 42 to 40)`

Reply:
`DIAP000<deltaT=1>`

The value of deltaT reflects the most current temperature values and not necessarily those from previous commands.

- If a particular imbedded **Command** is invalid, the particular **Reply** will be “UNSUPPORTED FEATURE”.

Example

Command:
`DIAPØØØ<ecgHR;p3>`

Reply:
`DIAPØØØ<ecgHR=Ø81;p3=UNSUPPORTED FEATURE>`

- Command keywords ending with a colon (:) will control the DIAP slave.

Example

Command:
`DIAPØØ1<patient:A1Ø ,ICU3,John Doe ,>`

Reply:
`DIAPØØ1<patient=A1Ø ,ICU3,John Doe ,>`

-Indicating that the controlling Command has been accepted by the DIAP Slave.

NOTE: There are 24 trailing spaces after the name “John Doe”, for a total of 32 characters.

- The commands that are supported by a product are indicated by a checkmark () in the product’s column(s). All other commands will receive the **UNSUPPORTED FEATURE** reply.
- Protocol changes that affect Command or Reply or Message formats will cause **pVersion** to be changed; changes that affect whether a feature is supported on a given product will cause **pRevision** to change for that product.

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Type	Command	Reply	Passport Rev. 009	VISA/ Ambulatory	VISA/ Passport	Accutorr Plus REV. G	Passport 2	Spectrum	Spectrum OR	Trio	Passport V Ver 1.03	Passport V Ver 1.04	Accutorr V	VSeries	Notes
Alarm	alarmHR	alarmHR=lo, hi	√	√	√	√	√	√	√	√	√	√	√	√	
Alarm	alarmSpo2	alarmSpo2=lo, hi	√		√	√	√	√	√	√	√	√	√	√	
Alarm	alarmP1Sys	alarmP1Sys=lo, hi	√		√		√	√	√	√	√	√		√	
Alarm	alarmP1Dia	alarmP1Dia=lo, hi	√		√		√	√	√	√	√	√		√	
Alarm	alarmP1Map	alarmP1Map=lo, hi					√	√	√	√	√	√		√	
Alarm	alarmP2Sys	alarmP2Sys=lo, hi			√		√	√	√		√	√		√	
Alarm	alarmP2Dia	alarmP2Dia=lo, hi			√		√	√	√		√	√		√	
Alarm	alarmP2Map	alarmP2Map=lo, hi	√		√		√	√	√		√	√		√	
Alarm	alarmP3Sys	alarmP3Sys=lo, hi						√	√					√	
Alarm	alarmP3Dia	alarmP3Dia=lo, hi						√	√					√	
Alarm	alarmP3Map	alarmP3Map=lo, hi						√	√					√	
Alarm	alarmP4Sys	alarmP4Sys=lo, hi						√	√					√	
Alarm	alarmP4Dia	alarmP4Dia=lo, hi						√	√					√	
Alarm	alarmP4Map	alarmP4Map=lo, hi						√	√					√	
Alarm	alarmP5Sys	alarmP5Sys=lo, hi												√	
Alarm	alarmP5Dia	alarmP5Dia=lo, hi												√	
Alarm	alarmP5Map	alarmP5Map=lo, hi												√	
Alarm	alarmP6Sys	alarmP6Sys=lo, hi												√	
Alarm	alarmP6Dia	alarmP6Dia=lo, hi												√	
Alarm	alarmP6Map	alarmP6Map=lo, hi												√	
Alarm	alarmP7Sys	alarmP7Sys=lo, hi												√	
Alarm	alarmP7Dia	alarmP7Dia=lo, hi												√	
Alarm	alarmP7Map	alarmP7Map=lo, hi												√	
Alarm	alarmP8Sys	alarmP8Sys=lo, hi												√	
Alarm	alarmP8Dia	alarmP8Dia=lo, hi												√	
Alarm	alarmP8Map	alarmP8Map=lo, hi												√	
Alarm	alarmICPxSys	alarmICPxSys=lo, hi													
Alarm	alarmICPxDia	alarmICPxDia=lo, hi													
Alarm	alarmICPxMap	alarmICPxMap=lo, hi													
Alarm	alarmNibpSys	alarmNibpSys=lo, hi	√		√	√	√	√	√	√	√	√	√	√	
Alarm	alarmNibpDia	alarmNibpDia=lo, hi	√		√	√	√	√	√	√	√	√	√	√	

Type	Command	Reply	Passport Rev. 009	VISA/ Ambulatory	VISA/ Passport	Accutorr Plus REV. G	Passport 2	Spectrum	Spectrum OR	Trio	Passport V Ver 1.03	Passport V Ver 1.04	Accutorr V	VSeries	Notes
Alarm	alarmNibpMap	alarmNibpMap=lo, hi				√	√	√	√	√	√	√	√	√	
Alarm	alarmT1	alarmT1=lo, hi					√	√	√	√	√	√		√	
Alarm	alarmT2	alarmT2=lo, hi						√	√	√				√	
Alarm	alarmT3	alarmT3=lo, hi												√	
Alarm	alarmICT	alarmICT=lo, hi													
Alarm	alarmDeltaT	alarmDeltaT=lo, hi						√	√					√	
Alarm	alarmResp	alarmResp=lo, hi	√		√		√	√	√	√	√	√		√	
Alarm	alarmCo2	alarmCo2=lo, hi	√		√					√					
Alarm	alarmCo2Et	alarmCo2Et=lo, hi					√3	√3	√3	√		√4		√	
Alarm	alarmCo2Ins	alarmCo2Ins=lo, hi					√3	√3	√3	√		√4		√	
Alarm	alarm02	alarm02=lo, hi								√					
Alarm	alarm02Et	alarm02Et=lo, hi					√	√	√	√		√		√	
Alarm	alarm02Ins	alarm02Ins=lo, hi					√	√	√	√		√		√	
Alarm	alarmAgent	alarmAgent=lo, hi								√					
Alarm	alarmHalIns	alarmHalIns=lo, hi					√	√	√	√		√4		√	
Alarm	alarmHalEt	alarmHalEt=lo, hi					√	√	√	√		√4		√	
Alarm	alarmIsoIns	alarmIsoIns=lo, hi					√	√	√	√		√4		√	
Alarm	alarmIsoEt	alarmIsoEt=lo, hi					√	√	√	√		√4		√	
Alarm	alarmEnflIns	alarmEnflIns=lo, hi					√	√	√	√		√4		√	
Alarm	alarmEnflEt	alarmEnflEt=lo, hi					√	√	√	√		√4		√	
Alarm	alarmSevoIns	alarmSevoIns=lo, hi					√	√	√	√		√4		√	
Alarm	alarmSevoEt	alarmSevoEt=lo, hi					√	√	√	√		√4		√	
Alarm	alarmDesIns	alarmDesIns=lo, hi					√	√	√	√		√4		√	
Alarm	alarmDesEt	alarmDesEt=lo, hi					√	√	√	√		√4		√	
Alarm	alarmN2o	alarmN2o=lo, hi					√	√	√	√		√		√	
Alarm	alarmApnea	alarmApnea=apneaAlarm	√		√		√	√	√	√	√	√		√	
Alarm	alarmTblood	alarmTblood=lo, hi						√	√					√	
Alarm	Baud Rate	9600	√	√	√	√	√	√	√	√		√	√		
Alarm	Baud Rate	19200					√	√	√	√		√			
Alarm	alarmvtinsp	alarmvtinsp=vtLo,vtHi							√						
Alarm	alarmvtexp	alarmvtexp=vtLo,vtHi							√						

Type	Command	Reply	Passport Rev. 009	VISA/ Ambulatory	VISA/ Passport	Accutorr Plus REV. G	Passport 2	Spectrum	Spectrum OR	Trio	Passport V Ver 1.03	Passport V Ver 1.04	Accutorr V	VSeries	Notes
Alarm	alarmmvinsp	alarmmvinsp=mvLo,mvHi							√						
Alarm	alarmmvexp	alarmmvexp=mvLo,mvHi							√						
Alarm	alarmpplat	alarmpplat=lo,hi							√						
Alarm	alarmpeep	alarmpeep=lo,hi							√						
Alarm	alarmpip	alarmpip=lo,hi							√						
Alarm	alarmpmean	alarmpmean=lo,hi							√						
Alarm	alarmbis	alarmbis=lo,hi							√					√	
Alarm	alarmartsys	alarmartsys=lo,hi						√	√			√		√	
Alarm	alarmartdia	alarmartdia=lo,hi						√	√			√		√	
Alarm	alarmartmap	alarmartmap=lo,hi						√	√			√		√	
Alarm	alarmpasys	alarmpasys=lo,hi						√	√			√		√	
Alarm	alarmpadia	alarmpadia=lo,hi						√	√			√		√	
Alarm	alarmpamap	alarmpamap=lo,hi						√	√			√		√	
Alarm	alarmcvpsys	alarmcvpsys=lo,hi						√	√			√		√	
Alarm	alarmcvpdia	alarmcvpdia=lo,hi						√	√			√		√	
Alarm	alarmcvpmap	alarmcvpmap=lo,hi						√	√			√		√	
Alarm	alarmuasys	alarmuasys=lo,hi						√	√			√		√	
Alarm	alarmuadia	alarmuadia=lo,hi						√	√			√		√	
Alarm	alarmuamap	alarmuamap=lo,hi						√	√			√		√	
Alarm	alarmlvsys	alarmlvsys=lo,hi						√	√			√		√	
Alarm	alarmlvdia	alarmlvdia=lo,hi						√	√			√		√	
Alarm	alarmlvmap	alarmlvmap=lo,hi						√	√			√		√	
Alarm	alarmlasys	alarmlasys=lo,hi						√	√			√		√	
Alarm	alarmladia	alarmladia=lo,hi						√	√			√		√	
Alarm	alarmlamap	alarmlamap=lo,hi						√	√			√		√	
Alarm	alarmrasys	alarmrasys=lo,hi						√	√			√		√	
Alarm	alarmradia	alarmradia=lo,hi						√	√			√		√	
Alarm	alarmramap	alarmramap=lo,hi						√	√			√		√	
Alarm	alarmicpsys	alarmicpsys=lo,hi						√	√			√		√	
Alarm	alarmicpdia	alarmicpdia=lo,hi						√	√			√		√	
Alarm	alarmicpmap	alarmicpmap=lo,hi						√	√			√		√	

Type	Command	Reply	Passport Rev. 009	VISA/ Ambulatory	VISA/ Passport	Accutorr Plus REV. G	Passport 2	Spectrum	Spectrum OR	Trio	Passport V Ver 1.03	Passport V Ver 1.04	Accutorr V	VSeries	Notes
Alarm	alarmicpxsys	alarmicpxsys=lo,hi													
Alarm	alarmicpxdia	alarmicpxdia=lo,hi													
Alarm	alarmicpxmap	alarmicpxmap=lo,hi													
Alarm	alarmsvo2	alarmsvo2=lo,hi												√	
Alarm	alarmcco	alarmcco=lo,hi												√	
Alarm	alarmcci	alarmcci=lo,hi												√	
Alarm	alarmrso2c1	alarmrso2c1=lo,hi												√	
Alarm	alarmrso2c2	alarmrso2c2=lo,hi												√	
Alarm	alarmrso2c3	alarmrso2c3=lo,hi												√	
Alarm	alarmrso2c4	alarmrso2c4=lo,hi												√	
Control	patient:patRoom1, patRoom2, part Name1, partName2	patient=patRoom1,patRoom2, part Name1,partName2		√	√		Not Supported								available only when patient is discharged
Control	unit:unitName	unit=unitName		√	√										
Informational	htcm	htcm=XXXX						√	√		√	√		√	
Informational	wtkg	wtkg=XXXXX						√	√					√	
Informational	bsa	bsa=XXXXX Dubois						√	√					√	
Informational	connect	connect=productName, pVersion,pRevision	√	√	√	√	√	√	√	√	√	√	√	√	
Informational	disconnect	disconnect=	√	√	√	√	√	√	√	√	√	√	√	√	
Informational	product	product=productName, mVersion,mRevision		√	√										
Informational	patient	patient=patRoom1,patRoom2, patName1,patName2		√	√	√	√	√	√	√	√	√	√	√	
Informational	unit	unit=unitName		√	√										
Informational	Mode	Mode													Currently not implemented
Informational	spsensorsize	spsensorsize=spSenorSize							√						
Physiological	ecgResp	ecgResp=XXX								√				√	
Physiological	ecgSt1	ecgSt1=stValue					√1	√1	√1		√	√			
Physiological	ecgSt2	ecgSt2=stValue					√1	√1	√1		√	√			
Physiological	ecgST3	ecgST3=stValue					√1	√1	√1		√	√			
Physiological	ecgHR	ecgHR=XXX								√				√	

Type	Command	Reply	Passport Rev. 009	VISA/ Ambulatory	VISA/ Passport	Accutorr Plus REV. G	Passport 2	Spectrum	Spectrum OR	Trio	Passport V Ver 1.03	Passport V Ver 1.04	Accutorr V	VSeries	Notes
Physiological	ecgBeatType	ecgBeatType=beatTime								√					
Physiological	ecgRhythm	ecgRhythm=rhythm								√					
Physiological	co	co=coValue,ciValue, timeInSeconds						√	√					√	
Physiological	p1	p1=sys,dia,map	√		√		√	√	√	√	√	√		√	
Physiological	p1HR	p1HR=XXX												√	
Physiological	p2	p2=sys,dia,map	√		√		√	√	√		√	√		√	
Physiological	p2HR	p2HR=XXX												√	
Physiological	p3	p3=sys,dia,map						√	√					√	
Physiological	p3HR	p3HR=XXX												√	
Physiological	p4	p4=sys,dia,map						√	√					√	
Physiological	p4HR	p4HR=XXX												√	
Physiological	p5	p5=sys,dia,map												√	
Physiological	p5HR	p5HR=XXX												√	
Physiological	p6	p6=sys,dia,map												√	
Physiological	p6HR	p6HR=XXX												√	
Physiological	p7	p7=sys,dia,map												√	
Physiological	p7HR	p7HR=XXX												√	
Physiological	p8	p8=sys,dia,map												√	
Physiological	p8HR	p8HR=XXX												√	
Physiological	icpx	icpx=sys,dia,map													
Physiological	icpxHR	icpxHR=XXX													
Physiological	historyLine	historyLine=histStringX		√	√										most current line number
Physiological	historyFile	historyFile=histString1, histString2, ...histString100		√	√										All available lines
Physiological	pawp	Pawp=pawpValue, timeInSeconds					√	√	√	√				√	
Physiological	t1	t1=temp	√		√	√	√	√	√	√	√	√	√	√	
Physiological	t2	t2=temp						√	√	√				√	
Physiological	t3	t3=temp												√	
Physiological	ict	ict=temp													
Physiological	deltaT[2]	deltaT=temp						√	√					√	

Type	Command	Reply	Passport Rev. 009	VISA/ Ambulatory	VISA/ Passport	Accutorr Plus REV. G	Passport 2	Spectrum	Spectrum OR	Trio	Passport V Ver 1.03	Passport V Ver 1.04	Accutorr V	VSeries	Notes
Physiological	tBlood	tBlood=temp						√	√					√	
Physiological	hr	hr=XXX	√	√	√	√	√	√	√	√	√	√	√	√	
Physiological	hrSource	hrSource=heartRateSource	√	√	√	√	√	√	√	√	√	√	√	√	
Physiological	hrBeatType	hrBeatType=beatType								√					
Physiological	hrRythm	hrRythm=rhythm								√					
Physiological	nibp	nibp=sys, dia, map	√		√	√	√	√	√	√	√	√	√	√	
Physiological	nibpStatus	nibpStatus=status	√							√					
Physiological	nibpHr	nibpHr=XXX	√			√				√			√		
Physiological	nibpElapsedTime	nibpElapsedTime=timeInMins	√		√		√	√	√	√	√	√		√	
Physiological	nibpStartTime	nibpStartTime=timeInSecs													
Physiological	nibpStopTime	nibpStopTime=timeInSecs				√							√		
Physiological	resp	resp=XXX	√		√		√	√	√	√	√	√		√	
Physiological	respSource	respSource=respirationSource	√		√		√	√	√	√	√	√		√	
Physiological	co2	co2=co2Ins,co2Et	√		√		√	√	√	√		√4		√	co2Ins="- - -"
Physiological	co2Resp	co2Resp=XXX								√				√	
Physiological	spo2	spo2=XXX	√		√	√	√	√	√	√	√	√	√	√	
Physiological	spo2HR	spo2HR=XXX	√			√	√	√	√		√	√	√	√	
Physiological	o2	o2=o2Ins, o2Et					√	√	√	√	√	√		√	
Physiological	agent	agent=agtIns, agtEt					√	√	√	√	√	√		√	
Physiological	agentType	agentType=agentName					√	√	√	√	√	√		√	
Physiological	n2o	n2o=n2oIns, n2oEt					√	√	√	√	√	√		√	
Physiological	art	art=sys,dia,map						√	√			√		√	
Physiological	arthr	arthr=XXX						√	√		√	√		√	
Physiological	pa	pa=sys,dia,map						√	√			√		√	
Physiological	pahr	pahr=XXX						√	√		√	√		√	
Physiological	cvp	cvp=sys,dia,map						√	√			√		√	
Physiological	cvphr	cvphr=XXX						√	√		√	√		√	
Physiological	ua	ua=sys,dia,map						√	√			√		√	
Physiological	uahr	uahr=XXX						√	√		√	√		√	
Physiological	lv	lv=sys,dia,map						√	√			√		√	
Physiological	lvhr	lvhr=XXX						√	√		√	√		√	

Type	Command	Reply	Passport Rev. 009	VISA/ Ambulatory	VISA/ Passport	Accutorr Plus REV. G	Passport 2	Spectrum	Spectrum OR	Trio	Passport V Ver 1.03	Passport V Ver 1.04	Accutorr V	VSeries	Notes
Physiological	la	la=sys,dia,map						√	√			√		√	
Physiological	lahr	lahr=XXX						√	√					√	
Physiological	ra	ra=sys,dia,map						√	√			√		√	
Physiological	rahr	rahr=XXX						√	√					√	
Physiological	icp	icp=sys,dia,map						√	√			√		√	
Physiological	icphr	icphr=XXX						√	√					√	
Physiological	cpp	cpp=XXX						√	√			√		√	
Physiological	ci	ci=ciValue						√	√					√	
Physiological	vtinsp	vtinsp=vtValue							√						
Physiological	vtexp	vtexp=vtValue							√						
Physiological	mvinsp	mvinsp=mvValue							√						
Physiological	mvexp	mvexp=mvValue							√						
Physiological	ieratio	ieratio=ieRatio							√						
Physiological	pplat	pplat=pValue							√						
Physiological	peep	peep=pValue							√						
Physiological	compl	compl=complValue							√						
Physiological	pip	pip=pValue							√						
Physiological	pmean	pmean=pValue							√						
Physiological	mac	mac=macValue							√					√	
Physiological	bis	bis=XX							√					√	BIS Left Channel
Physiological	sqi	sqi=XX							√					√	BIS Left Channel
Physiological	emg	emg=XX							√					√	BIS Left Channel
Physiological	bislsr	bislsr=XX												√	
Physiological	bislbc	bislbc=XX												√	
Physiological	bislsef	bislsef=bissef												√	
Physiological	bisltp	bisltp=XX												√	
Physiological	sbisl	sbisl=sbis												√	
Physiological	semgl	semgl=semg												√	
Physiological	bisr	bisr=XX												√	
Physiological	sqir	sqir=XX												√	

Type	Command	Reply	Passport Rev. 009	VISA/ Ambulatory	VISA/ Passport	Accutorr Plus REV. G	Passport 2	Spectrum	Spectrum OR	Trio	Passport V Ver 1.03	Passport V Ver 1.04	Accutorr V	VSeries	Notes
Physiological	emgr	emgr=XX												√	
Physiological	bislsr	bislsr=XX												√	
Physiological	bisrbc	bisrbc=XX												√	
Physiological	bisrsef	bisrsef=bissef												√	
Physiological	bisrtp	bisrtp=XX												√	
Physiological	sbisr	sbisr=sbis												√	
Physiological	semgr	semgr=semg												√	
Physiological	bisasym	bisasym=XX												√	
Physiological	cco	cco=coValue												√	
Physiological	cci	cci=ciValue												√	
Physiological	svo2	svo2=XX												√	
Physiological	sv	sv=XXXX												√	
Physiological	svi	svi=svi												√	
Physiological	edv	edv=XXX												√	
Physiological	edvi	edvi=XXXX												√	
Physiological	ccostat	ccostat=coValue												√	
Physiological	ccistat	ccistat=ciValue												√	
Physiological	svr	svr=XXXX												√	
Physiological	svri	svrI=XXXX												√	
Physiological	ccosnr	ccosnr=XX												√	
Physiological	svv	svv=XX												√	
Physiological	rvef	rvef=XX												√	
Physiological	rvefstat	rvefstat=XX												√	
Physiological	edvstat	edvstat=XXX												√	
Physiological	edvistat	edvistat=XXXX												√	
Physiological	esv	esv=XXX												√	
Physiological	esvi	esvi=XXXX												√	
Physiological	svstat	svstat=XXXX												√	
Physiological	svistat	svistat=svi												√	
Physiological	rso2c1	rso2c1=XX												√	
Physiological	rso2bc1	rso2bc1=XX												√	

Type	Command	Reply	Passport Rev. 009	VISA/ Ambulatory	VISA/ Passport	Accutorr Plus REV. G	Passport 2	Spectrum	Spectrum OR	Trio	Passport V Ver 1.03	Passport V Ver 1.04	Accutorr V	VSeries	Notes
Physiological	rso2aucc1	rso2auc1=XX												√	
Physiological	rso2c2	rso2c2=XX												√	
Physiological	rso2bc2	rso2bc2=XX												√	
Physiological	rso2aucc2	rso2auc2=XX												√	
Physiological	rso2c3	rso2c3=XX												√	
Physiological	rso2bc3	rso2bc3=XX												√	
Physiological	rso2aucc3	rso2auc3=XX												√	
Physiological	rso2c4	rso2c4=XX												√	
Physiological	rso2bc4	rso2bc4=XX												√	
Physiological	rso2aucc4	rso2auc4=XX												√	
Physiological	pvcpermin	pvcpermin=XX												√	
Physiological	satseconds	satseconds=XX												√	
Physiological	perfusionindex	perfusionindex=XX												√	
Physiological	pausespermin	pausespermin=XX												√	
Physiological	app	app=XX												√	
Physiological	cepp	cepp=XX												√	
Physiological	stLeadI	stLeadI=stValue												√	
Physiological	stLeadII	stLeadII= stValue												√	
Physiological	stLeadIII	stLeadIII= stValue												√	
Physiological	stLeadAVR	stLeadAVR= stValue												√	
Physiological	stLeadAVF	stLeadAVF= stValue												√	
Physiological	stLeadAVL	stLeadAVL= stValue												√	
Physiological	stLeadV1	stLeadV1= stValue												√	
Physiological	stLeadV2	stLeadV2= stValue												√	
Physiological	stLeadV3	stLeadV3= stValue												√	
Physiological	stLeadV4	stLeadV4= stValue												√	
Physiological	stLeadV5	stLeadV5= stValue												√	
Physiological	stLeadV6	stLeadV6= stValue												√	
Physiological	stRefLeadI	stRefLeadI= stValue												√	
Physiological	stRefLeadII	stRefLeadII= stValue												√	
Physiological	stRefLeadIII	stRefLeadIII= stValue												√	

Type	Command	Reply	Passport Rev. 009	VISA/ Ambulatory	VISA/ Passport	Accutorr Plus REV. G	Passport 2	Spectrum	Spectrum OR	Trio	Passport V Ver 1.03	Passport V Ver 1.04	Accutorr V	VSeries	Notes
Physiological	stRefLeadAVR	stRefLeadAVR= stValue												√	
Physiological	stRefLeadAVF	stRefLeadAVF= stValue												√	
Physiological	stRefLeadAVL	stRefLeadAVL= stValue												√	
Physiological	stRefLeadV1	stRefLeadV1= stValue												√	
Physiological	stRefLeadV2	stRefLeadV2= stValue												√	
Physiological	stRefLeadV3	stRefLeadV3= stValue												√	
Physiological	stRefLeadV4	stRefLeadV4= stValue												√	
Physiological	stRefLeadV5	stRefLeadV5= stValue												√	
Physiological	stRefLeadV6	stRefLeadV6= stValue												√	
Physiological	do2	do2=XXXX													
Physiological	vo2	vo2=XX													
Physiological	scvo2	scvo2=XX												√	
Physiological	o2ei	o2ei=o2ei													
Physiological	raw	raw=rawValue							√						

1 In 12-Lead mode this is the absolute value otherwise this the delta value.
2 deltaT is defined as the abolute value of t1 - t2.
3 Not supported when using the Gas Module II.
4 Depends upon type of CO2 gas module installed

1.4 Error Handling

1.4.1 Field Level Errors

Invalid data fields in replies are represented by two, three, or more dashes (— or —-, etc.), based on the expected value length.

1.4.2 Command Level Errors

If an error occurs, an error reply is returned to the host in place of the normal reply.

These **Command Level Errors** are indicated below (literal ASCII string, prefaced with a %):

Error	Description
UNABLE TO CONNECT	The monitor cannot respond.
NO OPEN DELIMITER	The monitor could not find the character '<' (open delimiter) in the message received, making the message not interpretable (syntax error).
NO CLOSE DELIMITER	The monitor could not find the character '>' (close delimiter) in the message received, making the message not interpretable (syntax error).
NO LINE FEED	The monitor could not find the linefeed character in the message received, making the message not interpretable (syntax error).
INVALID CRC CHAR	The monitor detected a non-hexadecimal CRC character (syntax error).
UNDEFINED ERROR	The monitor detected an undefinable syntax error.
RESPONSE TOO LARGE	In a multiple command message, the response is greater than the maximum size response buffer. (Separate the multiple command message into two or more messages).
REQUEST CORRUPT	The monitor detected an invalid CRC.
CHANNEL OUT OF RANGE	The central monitor could not reply because the channel number requested is invalid.
BAD MSG HEADER	The message header did not contain ''DIAP'' as the first four characters
COMMAND TO LARGE	The message size exceeded the maximum of 255
IBP LABEL NOT APPLIED	The monitor cannot return a value because the requested IBP label has not been applied to IBP1, IBP2, IBP3 or IBP4.
IBP LABEL NOT CURRENT HR SOURCE	The monitor cannot return a value because the request IBP label has not been set as the current heart rate source.

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A *Appendix A*

A.1 CRC Algorithm

The algorithm used to create the CRC follows:

```
   const unsigned short crcTable[256] = {
```

0x0000,	0x0108,	0x0210,	0x0318,	0x0420,	0x0528,	0x0630,	0x0738,
0x0840,	0x0948,	0x0A50,	0x0B58,	0x0C60,	0x0D68,	0x0E70,	0x0F78,
0x1081,	0x1189,	0x1291,	0x1399,	0x14A1,	0x15A9,	0x16B1,	0x17B9,
0x18C1,	0x19C9,	0x1AD1,	0x1BD9,	0x1CE1,	0x1DE9,	0x1EF1,	0x1FF9,
0x2102,	0x200A,	0x2312,	0x221A,	0x2522,	0x242A,	0x2732,	0x263A,
0x2942,	0x284A,	0x2B52,	0x2A5A,	0x2D62,	0x2C6A,	0x2F72,	0x2E7A,
0x3183,	0x308B,	0x3393,	0x329B,	0x35A3,	0x34AB,	0x37B3,	0x36BB,
0x39C3,	0x38CB,	0x3BD3,	0x3ADB,	0x3DE3,	0x3CEB,	0x3FF3,	0x3EFB,
0x4204,	0x430C,	0x4014,	0x411C,	0x4624,	0x472C,	0x4434,	0x453C,
0x4A44,	0x4B4C,	0x4854,	0x495C,	0x4E64,	0x4F6C,	0x4C74,	0x4D7C,
0x5285,	0x538D,	0x5095,	0x519D,	0x56A5,	0x57AD,	0x54B5,	0x55BD,
0x5AC5,	0x5BCD,	0x58D5,	0x59DD,	0x5EE5,	0x5FED,	0x5CF5,	0x5DFD,
0x6306,	0x620E,	0x6116,	0x601E,	0x6726,	0x662E,	0x6536,	0x643E,
0x6B46,	0x6A4E,	0x6956,	0x685E,	0x6F66,	0x6E6E,	0x6D76,	0x6C7E,

```
0x7387,  0x728F,  0x7197,  0x709F,  0x77A7,  0x76AF,  0x75B7,  0x74BF,
0x7BC7,  0x7ACF,  0x79D7,  0x78DF,  0x7FE7,  0x7EEF,  0x7DF7,  0x7CFF,
0x8408,  0x8500,  0x8618,  0x8710,  0x8028,  0x8120,  0x8238,  0x8330,
0x8C48,  0x8D40,  0x8E58,  0x8F50,  0x8868,  0x8960,  0x8A78,  0x8B70,
0x9489,  0x9581,  0x9699,  0x9791,  0x90A9,  0x91A1,  0x92B9,  0x93B1,
0x9CC9,  0x9DC1,  0x9ED9,  0x9FD1,  0x98E9,  0x99E1,  0x9AF9,  0x9BF1,
0xA50A,  0xA402,  0xA71A,  0xA612,  0xA12A,  0xA022,  0xA33A,  0xA232,
0xAD4A,  0xAC42,  0xAF5A,  0xAE52,  0xA96A,  0xA862,  0xAB7A,  0xAA72,
0xB58B,  0xB483,  0xB79B,  0xB693,  0xB1AB,  0xB0A3,  0xB3BB,  0xB2B3,
0xBDCB,  0xBCC3,  0xBFDB,  0xBED3,  0xB9EB,  0xB8E3,  0xBBFB,  0xBAF3,
0xC60C,  0xC704,  0xC41C,  0xC514,  0xC22C,  0xC324,  0xC03C,  0xC134,
0xCE4C,  0xCF44,  0xCC5C,  0xCD54,  0xCA6C,  0xCB64,  0xC87C,  0xC974,
0xD68D,  0xD785,  0xD49D,  0xD595,  0xD2AD,  0xD3A5,  0xD0BD,  0xD1B5,
0xDECD,  0xDFC5,  0xDCDD,  0xDDD5,  0xDAED,  0xDBE5,  0xD8FD,  0xD9F5,
0xE70E,  0xE606,  0xE51E,  0xE416,  0xE32E,  0xE226,  0xE13E,  0xE036,
0xEF4E,  0xEE46,  0xED5E,  0xEC56,  0xEB6E,  0xEA66,  0xE97E,  0xE876,
0xF78F,  0xF687,  0xF59F,  0xF497,  0xF3AF,  0xF2A7,  0xF1BF,  0xF0B7,
0xFFCF,  0xFEC7,  0xFDDF,  0xFCD7,  0xFBEF,  0xFAE7,  0xF9FF,  0xF8F7,
```

```
};
unsigned short Crc (unsigned short lastCrc, unsigned long sizeOfBuffer,
unsigned char *buffer) {
unsigned long i;
unsigned char index;
for (i = 0L; i < sizeOfBuffer; i++) {
index = buffer[i] ^ ((unsigned char)(lastCrc & 0x00FF));
lastCrc = ((lastCrc >> 8) & 0x00FF) ^ (crcTable[index]);
}
 return (lastCrc);
}
```

A.2 CRC Test Program

The following program can be used to test the above:

```
#include <stdio.h>

int main(void) {

unsigned char buffer [] = {0, 0, 0, 0, 0, 0x77, 0xCF};

printf("CRC(Expected 0x73F3) = 0x%04X\n", Crc(0x0, 7, buffer));

return(0);

}
```

NOTE: For the example above, the value for the last CRC parameter should be initalized to zero (0).

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B *Appendix B*

B.1 DIAP Modem Support (Optional)

B.1.1 Overview

Optional support for a modem attached to a DIAP Slave is described here.

B.1.2 Physical Implementation

A standard external modem is connected to the DIAP Slave, such as a Passport, Point of View, VISA, etc. The same modem type is connected to a DIAP Master, such as a personal computer, workstation, minicomputer, etc. A public telephone switching system connects the modems.

B.1.3 DIAP Slave Requirements

The Mindray equipment must have the following additions made to implement DIAP Modem Support:

- Configuration Dialog for Modem Connected (yes/no choice, default no)
- Configuration Dialog for Modem Speaker On (yes/no choice, default no)
- User Dialog for Reset Modem (button)

Upon initialization, the DIAP Slave UART is set per section 1.2. The modem initialization string is them sent (section **Error! Reference source not found.**). The modem initialization string is re-sent anytime the Reset Modem button is depressed.

B.1.4 DIAP Slave Supported Modems

The DIAP Slave shall support the following V.32-compliant or higher modems:

- Hayes Accura 144

B.1.5 DIAP Slave Modem Initialization Strings

The DIAP Slave communicates with the modem as follows:

Slave Control	ASCII Strings Sent	Modem Returns	Description
configuration set to Modem Connected (yes)	(>1 sec pause) +++ (>1 sec pause)	(nothing)	“Force Command Mode” (Hayes standard for modem attention)
Modem Speaker On (no)	ATZ (carriage return)	OK	“Reset Modem”
	AT&F (carriage return)	OK	“Recall Factory Configuration”
and/or	AT&K4 (carriage return)	OK	“Enable XON/XOFF Local Flow Control”
Reset Modem active	ATM0 (carriage return)	OK	“Speaker Off”
	ATS0 = 1 (carriage return)	OK	“Answer in 1 Ring”

NOTE: The above assumes that the modem is new or reset to default factory configuration.

NOTE: If the configuration Modem Speaker On = ‘yes’, then do not send the ATM0 command above.

B.1.6 DIAP Master Requirements

The Master computer must initialize the local serial port (setting communications parameters per section 2.2) and initialize the locally- attached modem (including modem reset, setting up off-hook and telephone dialing to the DIAP Slave modem). It also configures the modem in a manner similar to the DIAP Slave modem (XON/XOFF flow control).

B.1.7 DIAP Master Supported Modems

The DIAP Master shall support any V.32-complaint or higher modem.

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