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Datex-Ohmeda Com Output Protocols

- Datex-Ohmeda Com 1.5 Serial Protocol
- Datex-Ohmeda Com 1.3 Serial Protocol
- Datex-Ohmeda Com 1.2 Serial Protocol
- Datex-Ohmeda Com 1.0 Serial Protocol

Version Q

Last Updated: May 26, 2011

Datex-Ohmeda Inc.
Madison, Wisconsin

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Released

1.0 PURPOSE	5
2.0 OHMEDA COM 1.0 SERIAL PROTOCOL (AESTIVA/AESPIRE 7900 & 7100 VENTILATORS)	5
2.1 ELECTRICAL INTERFACE	5
2.2 SOFTWARE INTERFACE	5
2.2.1 <i>Summary of Input Commands and Output Data</i>	6
2.3 DEVICE COMMANDS SENT BY EXTERNAL COMMUNICATIONS CONTROLLER	7
2.3.1 <i>Data Transmit Mode Select Commands</i>	7
2.3.2 <i>Data Request Command</i>	7
2.3.3 <i>Checksum Control Commands</i>	7
2.3.4 <i>Enable Waveform Data Mode Command</i>	7
2.3.5 <i>Enable Privileged Mode Command</i>	8
2.3.6 <i>Silence Alarms Command</i>	8
2.3.7 <i>Gas Composition Input Command</i>	8
2.4 DEVICE RESPONSES SENT BACK	9
2.4.1 <i>ACK Response</i>	9
2.4.2 <i>NAK Response</i>	9
2.4.3 <i>Alarm Silence Switch Pressed Response</i>	9
2.4.4 <i>Measured Data Response</i>	9
2.4.4.1 <i>Status Bytes Bitmaps</i>	10
2.4.5 <i>Status Data Response</i>	10
2.4.5.1 <i>Status Bytes Bitmaps</i>	12
2.4.6 <i>Setup Data Response</i>	14
2.4.7 <i>Waveform Data Response</i>	15
2.4.7.1 <i>Waveform Data Description</i>	15
2.5 EXAMPLE	16
3.0 DATEX-OHMEDA COM 1.2 SERIAL PROTOCOL (AVANCE & AISYS)	18
3.1 ELECTRICAL INTERFACE	18
3.2 SOFTWARE INTERFACE	18
3.2.1 <i>Summary of Input Commands and Output Data</i>	19
3.3 DEVICE COMMANDS SENT BY EXTERNAL COMMUNICATIONS CONTROLLER	19
3.3.1 <i>Data Transmit Mode Select Commands</i>	19
3.3.2 <i>Select Datex-Ohmeda Communications Protocol Command</i>	20
3.3.3 <i>Data Request Command</i>	20
3.3.4 <i>Checksum Control Commands</i>	20
3.3.5 <i>Enable Waveform Data Mode</i>	20
3.3.6 <i>Enable Privileged Mode Command</i>	22
3.3.7 <i>Silence Alarms Command</i>	23
3.3.8 <i>Synchronize Clock Command</i>	23
3.3.9 <i>Synchronize Demographic Data Command</i>	23
3.4 DEVICE RESPONSES SENT BACK	24
3.4.1 <i>ACK Response</i>	24
3.4.2 <i>NAK Response</i>	24
3.4.3 <i>Alarm Silence Switch Pressed Response</i>	24
3.4.4 <i>Measured Data Response</i>	24
3.4.4.1 <i>Status Bytes Bitmaps</i>	30
3.4.5 <i>Status Data Response</i>	31
3.4.5.1 <i>Setting Data Status Bitmap</i>	37
3.4.5.2 <i>Alarm Status Bytes Bitmaps</i>	38
3.4.6 <i>Setup Data Response</i>	42
3.4.7 <i>Waveform Data Response</i>	42
3.4.7.1 <i>Waveform Data Description</i>	43

Printed copies are for reference only.
Verify that this version is current before using.

3.4.8 Test Data Response.....	45
3.4.8.1 Test Status Bytes Bitmaps.....	47
3.5 EXAMPLE.....	49
4.0 DATEX-OHMEDA COM 1.3 SERIAL PROTOCOL (CENTIVA & ENGSTROM).....	51
4.1 ELECTRICAL INTERFACE.....	51
4.2 SOFTWARE INTERFACE.....	51
4.2.1 Summary of Input Commands and Output Data.....	51
4.3 DEVICE COMMANDS SENT BY EXTERNAL COMMUNICATIONS CONTROLLER.....	52
4.3.1 Data Transmit Mode Select Commands.....	52
4.3.2 Select Datex-Ohmeda Communications Protocol Command.....	52
4.3.3 Data Request Command.....	52
4.3.4 Checksum Control Commands.....	52
4.3.5 Enable Waveform Data Mode.....	52
4.3.6 Enable Privileged Mode Command.....	52
4.3.7 Silence Alarms Command.....	52
4.3.8 Synchronize Clock Command.....	53
4.3.9 Synchronize Demographic Data Command.....	53
4.4 DEVICE RESPONSES SENT BACK.....	53
4.4.1 ACK Response.....	53
4.4.2 NAK Response.....	53
4.4.3 Alarm Silence Switch Pressed Response.....	53
4.4.4 Measured Data Response.....	53
4.4.4.1 Status Bytes Bitmaps.....	59
4.4.5 Status Data Response.....	59
4.4.5.1 Setting Data Status Bitmap.....	65
4.4.5.2 Alarm Status Bytes Bitmaps.....	65
4.4.6 Setup Data Response.....	66
4.4.7 Waveform Data Response.....	66
4.4.7.1 Waveform Data Description.....	66
4.4.8 Test Data Response.....	66
4.4.8.1 Test Status Bytes Bitmaps.....	66
4.5 EXAMPLE.....	66
5.0 DATEX-OHMEDA COM 1.5 SERIAL PROTOCOL (ENGSTROM).....	68
5.1 ELECTRICAL INTERFACE.....	68
5.2 SOFTWARE INTERFACE.....	68
5.2.1 Summary of Input Commands and Output Data.....	68
5.3 DEVICE COMMANDS SENT BY EXTERNAL COMMUNICATIONS CONTROLLER.....	69
5.3.1 Data Transmit Mode Select Commands.....	69
5.3.2 Select Datex-Ohmeda Communications Protocol Command.....	69
5.3.3 Data Request Command.....	69
5.3.4 Checksum Control Commands.....	69
5.3.5 Enable Waveform Data Mode.....	70
5.3.10 Enable Spiro Dynamics Data Mode.....	70
5.3.11 Send Checkout Data.....	70
5.3.12 Enable Snapshot Notification.....	70
5.4 DEVICE RESPONSES SENT BACK.....	71
5.4.1 ACK Response.....	71
5.4.2 NAK Response.....	71
5.4.3 Alarm Silence Switch Pressed Response.....	71
5.4.4 Measured Data Response.....	71
5.4.4.1 Status Bytes Bitmaps.....	77
5.4.5 Status Data Response.....	77

Printed copies are for reference only.
Verify that this version is current before using.

Datex-Ohmeda Com Output Protocols – Version Q

Date: May 26, 2011

page 3 of 102

Released

5.4.5.1 Setting Data Status Bitmap.....	83
5.4.6 Alarm Status Data Response Bytes Bitmaps.....	83
5.4.6.1 Alarm Status Bytes Bitmaps.....	84
5.4.7 Setup Data Response	88
5.4.8 Waveform Data Response	88
5.4.8.1 Waveform Data Description.....	88
5.4.9 Spiro Dynamics Data Response.....	89
5.4.9.1 Waveform Data Description.....	90
5.4.10 Dynostatic Curve Data Response	90
5.4.10.1 Dynostatic Curve Data Description.....	92
5.4.11 Checkout Data Response.....	92
5.4.12 System Data Response.....	93
5.4.13 Procedure Status Data Response Bytes Bitmaps	93
5.4.13.1 Procedure Status Bytes Bitmaps	94
5.4.14 Data Transfer Configuration Response.....	95
5.4.15 Snapshot Notification Response.....	97
6. CHANGE LOG.....	98

Printed copies are for reference only.
Verify that this version is current before using.

Datex-Ohmeda Com Output Protocols – Version Q
Date: May 26, 2011

1.0 Purpose

The purpose of this document is to describe and give examples for the following Datex-Ohmeda Com output protocols:

- Datex-Ohmeda Com 1.5 Protocol
- Datex-Ohmeda Com 1.3 Protocol
- Datex-Ohmeda Com 1.2 Protocol
- Datex-Ohmeda Com 1.0 Protocol

2.0 Ohmeda Com 1.0 Serial Protocol (Aestiva/Aespire 7900 & 7100 ventilators)

The following section describes the Ohmeda Com 1.0 Protocol. This protocol is the **recommended** protocol to communicate with the Datex-Ohmeda 7900 and 7100 ventilators.

2.1 Electrical Interface

RS-232C signal standards.

(Aestiva/Aespire – 7900 & 7100) 15 pin female D connector – Data Communications Equipment configuration (DCE)

- pin 6 - receive data
- pin 13 - transmit data
- pin 5 - signal ground

Baud Rate: 19.2K
 Byte format: Start bit + 7 data bits + parity bit + stop bit
 Parity: ODD

2.2 Software Interface

Ohmeda Com 1.0 Communications Protocol

Notes:

1. All device commands (sent by communications controller) begin with the ASCII escape character (0x1b).
2. All device responses (sent by Datex-Ohmeda device) begin with the ASCII character “:”.
3. The next two bytes are the device designator. “VT” designates a ventilator.
4. All parameter fields consist of byte-wise 7 bit printable ASCII characters. All status fields consist of 7 bit bytes that may or may not be printable characters.
5. All numeric parameter fields are ASCII encoded decimals, right justified, with leading digits zeroed.
6. All waveform data fields are 3 digits of ASCII encoded hexadecimal (7 bit printable characters), right justified, with leading digits zeroed. If the requested waveform data is not available, data is zeroed.

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Datex-Ohmeda Com Output Protocols – Version Q
 Date: May 26, 2011

7. The checksum byte for the D-O communications protocol is defined as a 7-bit number which, when added to the accumulated sum of all the data bytes transmitted in a command or response (does not include the carriage return character following the checksum byte), causes the least significant 7 bits of the result to be zero. The checksum may or may not be a printable character.
8. All messages end with the ASCII carriage return (0x0d).
9. Use Auto Mode whenever possible. In Slave Mode, do not request Send All Data more than once per second.
10. Do not command Enable Waveform Data more than once per second.

2.2.1 Summary of Input Commands and Output Data

When the Datex-Ohmeda device is first turned ON, the default transmission mode is set to “Slave Mode”, the Checksum Mode is “Enabled” and Waveforms are disabled.

Command Headers:

<ESC>VTD	Disable Checksum Mode
<ESC>VTE	Enable Checksum Mode (this is the default mode)
<ESC>VTS	Slave Mode (this is the default mode – will reset auto mode)
<ESC>VTX	Auto Mode (see description of Measured Data and Status Data Responses)
<ESC>VTQ	Enable Compressed Data Format (this is the default mode – since printer data format is no longer supported, command is simply ACK’ed)
<ESC>VT\$	Send Setup Data
<ESC>VT?	Send All Data (will send one Status and Measured Data Response – not valid in Auto Mode)
<ESC>VTW	Enable Waveform Data (default is no waveforms enabled)
<ESC>VTM	Enable Privileged Mode (must be sent before using VTCS and VT% commands)
<ESC>VTCS	Silence Alarms (simulate alarm silence switch press, requires privileged mode)
<ESC>VT%	Gas Composition Input (only used in 7900 v3.5, requires privileged mode)

Response Headers:

:VTD	Measured Data Response
:VTM	Setup Data Response
:VTN	NACK (negative acknowledge)
:VTQ	Status Data Response
:VTR	Alarm Silence Switch Press Response
:VTW	Waveform Data Response
:VTY	ACK (positive acknowledge)

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Datex-Ohmeda Com Output Protocols – Version Q

Date: May 26, 2011

page 6 of 102

2.3 Device Commands Sent By External Communications Controller

2.3.1 Data Transmit Mode Select Commands

<ESC>VTXc<CR>	Auto Mode
<ESC>VTSc<CR>	Slave Mode

2.3.2 Data Request Command

<ESC>VT?c<CR>	Send All Data (Valid in Slave Mode only)
<ESC>VT\$c<CR>	Send Setup Data

2.3.3 Checksum Control Commands

<ESC>VTEc<CR>	Enable Checksum Mode
<ESC>VTDc<CR>	Disable Checksum Mode

2.3.4 Enable Waveform Data Mode Command

<ESC>VTWabc<CR>		
Send Waveform Data		
Bytes	Description	
a	any one of the following: (note1: order determines order of data in response packet) (note2: b valid only if a != 0)	
	'0'	turn waveform data OFF (this is the ASCII character <u>zero</u>)
	'P'	include Pressure Data
	'F'	include Flow Data
	'V'	include Volume Data
b	any one of the following: (note1: order determines order of data in response packet) (note2: b valid only if a != 0)	
	'0'	turn waveform data OFF (this is the ASCII character <u>zero</u>)
	'P'	include Pressure Data
	'F'	include Flow Data

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	'V'	include Volume Data
c	checksum	

2.3.5 Enable Privileged Mode Command

<ESC>VTMc<CR>	Enable Privileged Mode
---------------	------------------------

2.3.6 Silence Alarms Command

<ESC>VTCS<CR>	Silence Alarms (in privileged mode only)
---------------	--

2.3.7 Gas Composition Input Command

<ESC>VT%aaabbbdddeeefffgghhhiiijjc<CR>		
Gas Composition Input Data Must enable Privileged Mode before sending Gas Composition Input Data. Packet must be sent at least every 30 seconds or gas correction based on received data will halt. Only used in 7900 ventilator, software v3.5		
Bytes	Measured Data Name	Units and/or description
aaa	inspired oxygen conc.	% O ₂ , ?, -
bbb	expired oxygen conc.	% O ₂ , ?, -
ddd	inspired CO ₂ conc.	% CO ₂ , ?, -
eee	expired CO ₂ conc.	% CO ₂ , ?, -
fff	N ₂ O conc.	% N ₂ O, ?, -
g	anesthetic agent type	'0' Halothane
		'1' Isoflurane
		'2' Enflurane
		'3' no agent detected
		'4' set agent (unspecified agent detected, assume Halothane)
		'5' Desflurane
		'6' Sevoflurane
hhh	inspired anesthetic agent conc.	% AA*10, ?, -
iii	expired anesthetic agent conc.	% AA*10, ?, -
jjj	barometric pressure	mm Hg, ?, -

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c	checksum	
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2.4 Device Responses Sent Back

2.4.1 ACK Response

This response applies to the commands of VTD, VTE, VTS, VTX, VTQ, VTW, VTM, VTCS and VT%.

:VTYc<CR>	Positive Acknowledge Response
-----------	-------------------------------

2.4.2 NAK Response

:VTNc<CR>	Negative Acknowledge Response
-----------	-------------------------------

2.4.3 Alarm Silence Switch Pressed Response

:VTRc<CR>	Alarm Silence Switch Press Response (if no alarms are on or all displayed alarms are silenced)
-----------	---

2.4.4 Measured Data Response

In auto mode, the Measured Data Response will be transmitted at the end of a breath or 10 seconds from the last transmission, whichever occurs first.

:VTDaaaabbbbddddeeefffggghhhiiijc<CR>		
Measured Data Response Each entry is zero filled and right justified—ie. aaaa = 0095. “?” means bad data due to any technical problem(s). “-” filled means data not available due to system state.		
Bytes	Measured Data Name	Units and/or description
aaaa	measured expired tidal volume	mL, ?, -
bbbb	measured expired minute volume	L*100, ?, -
ddd	measured respiratory rate	/min, ?, -
eee	measured oxygen level	% O ₂ , ?, -
fff	measured max positive pressure	cm H ₂ O, ?
ggg	measured inspiratory plateau pressure	cm H ₂ O, ?, -

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hhh	measured mean pressure	cm H ₂ O, ?, -
iii	minimum pressure	cm H ₂ O, ?, -
j	measured data status	See section 2.4.4.1 Status Bytes Bitmaps .
c	checksum	

2.4.4.1 Status Bytes Bitmaps

The status byte has seven bits of data from D6 (MSB) to D0 (LSB).

Byte 1	
bit	Alarm/Status
D0	0 = 10 second data 1 = new breath data
D1	0
D2	0
D3	0
D4	0
D5	0
D6	1

2.4.5 Status Data Response

In auto mode, the Status Data Response will be transmitted every 1 second (if a change occurs in the status data) or a minimum of once every 10 seconds. Note that the status byte bit is set=1 for an active condition and 0 for an inactive condition.

:VTQaaaabbbddddeeffggghhijjjkkklmmnnnooprrrrrrrrrrrrrc<CR>		
Status Data Response Each entry is zero filled and right justified—ie. aaaa = 0095.		
Bytes	Status Data Name	Units and/or description
aaaa	set tidal volume	mL
bbb	set respiratory rate	/min
dddd	set I:E ratio	1:eee.e

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ee	inspiratory pause	% Pause
ff	set PEEP	cm H ₂ O
ggg	set peak pressure limit	cm H ₂ O
hh	set inspired pressure	cm H ₂ O
ii	set sustained pressure alarm limit	cm H ₂ O
jjj	high minute volume alarm limit	L*10
kkk	low minute volume alarm limit	L*10
lll	high Vte limit	ml/10
mmm	low Vte limit	ml/10
nnn	high oxygen alarm limit	% O ₂
ooo	low oxygen alarm limit	% O ₂
p	set mechanical ventilation mode	‘v’ volume control mode (VCV, CMV)
		‘p’ pressure control mode (PCV)
		‘b’ backup volume control mode Note: Only applicable to 7100 sw & 7900 3.5 sw.
		‘p’ PCV-VG
		‘p’ BiLevel-VG
		‘v’ SIMV, SIMV-VC
		‘p’ SIMV-PC
		‘p’ SIMV-PCVG
		‘p’ BiLevel
		‘p’ CPAP, CPAP/PSV
		‘p’ CPAP/Apnea
		‘p’ NIV
		‘p’ PSV-Pro
		‘-’ mechanical ventilation not available* Note: Please see section 2.4.5.1 (Status Bytes Bitmaps) byte 11, bit D6 ‘Mechanical Ventilation On’ for determining whether system is mechanically ventilating or not. *For Aisys and Avance, ‘-’ also means in bag mode.
rrrrrrrrrrrr	status bytes	See section 2.4.5.1 Status Bytes Bitmaps.

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c	checksum	
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2.4.5.1 Status Bytes Bitmaps

The status bytes are a string of 12 bytes, starting from left (byte 1) to the right (byte 12). Each byte has seven bits of data from D6 (MSB) to D0 (LSB).

Note that the bit is set=1 for an active condition (true) and 0 for an inactive condition (false).

Byte 1	
bit	Alarm/Status
D0	High O ₂
D1	Low O ₂
D2	1
D3	1
D4	1
D5	Check O ₂ Sensor
D6	O ₂ Calibration Error

Byte 2	
bit	Alarm/Status
D0	High Paw
D1	Low Paw
D2	Sustained Paw (shutdown)
D3	Sustained Paw
D4	Sub-Atmospheric Paw
D5	Pressure Mode Available
D6	1

Byte 3	
bit	Alarm/Status
D0	Pinspired Not Achieved
D1	PEEP Not Achieved
D2	No Pressure Mode/PEEP
D3	Manifold Pressure Sensor Failure
D4	Inspiratory Overshoot
D5	Inspiration Stopped
D6	High Pressure Limit Reached (min sys)

Byte 4	
bit	Alarm/Status
D0	Low VE
D1	High VE
D2	Low Vte
D3	High Vte
D4	Vt Not Achieved
D5	Volume Apnea
D6	Volume Apnea > 2 min

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Byte 5	
bit	Alarm/Status
D0	No Inspiratory Flow Sensor
D1	No Expiratory Flow Sensor
D2	Inspiratory Reverse Flow
D3	Expiratory Reverse Flow
D4	Check Flow Sensors
D5	Insp Vt/Vte Mismatch
D6	Vdel Mismatch

Byte 6	
bit	Alarm/Status
D0	Bellows Empty
D1	Flow Valve Failure
D2	Gas Inlet Valve Failure
D3	12 Hour Test
D4	Bootup Gas Inlet Valve Failure
D5	No O ₂ Pressure
D6	No Fresh Gas Flow

Byte 7	
bit	Alarm/Status
D0	+V analog Failure
D1	-V analog Failure
D2	+15V SIB Out-of-Range
D3	+15V Manifold Out-of-Range
D4	Display Voltage Out-of-Range
D5	Vaux_ref Out-of-Range
D6	Vext_ref Out-of-Range

Byte 8	
bit	Alarm/Status
D0	A/D Converter Failure
D1	CPU Failure
D2	Memory (EEPROM) Failure
D3	Memory (flash) Failure
D4	Memory (RAM) Failure
D5	Memory (video) Failure
D6	Bootup Memory Failure

Byte 9	
bit	Alarm/Status
D0	Software Watchdog Failure
D1	Hardware Watchdog Failure
D2	Internal Clock Too Fast
D3	Internal Clock Too Slow
D4	CPU Internal Error
D5	Memory (redundant storage) Fail
D6	Flow Sensor Cal Data Corrupt

Byte 10	
bit	Alarm/Status
D0	On Battery
D1	No Battery
D2	Low Battery Charge
D3	Low Battery
D4	Low Battery (shutdown)
D5	Battery Voltage Out Of Range
D6	Battery Current Out Of Range

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Byte 11		Byte 12	
bit	Alarm/Status	bit	Alarm/Status
D0	Circuit Auxiliary	D0	Volume Monitor Active
D1	Auxiliary Breathing Circuit	D1	Apnea Detect ON
D2	“no confirmation of changed setting”	D2	Apnea Alarm Silenced
D3	Control Settings Input Has Failed	D3	Low VE Limit Set
D4	Heliox Mode is ON	D4	Alarms Silenced
D5	Backup Volume Mode	D5	1
D6	Mechanical Ventilation On	D6	Service Calibrations Due

2.4.6 Setup Data Response

Only returned when a request for setup data is received.

:VTMaaaabddffghc<CR>		
Setup Data Response Each entry is zero filled and right justified—ie. aaaa = 0095.		
Bytes	Setup Data Name	Units and/or description
aaaa	software revision number	0001-9999 = 0.01-99.99
b	language	‘0’=English, ‘1’=Spanish, ‘2’=German, ‘3’=Kanji, ‘4’=Dutch, ‘5’=Swedish, ‘6’=French, ‘7’=Italian, ‘8’=Danish, ‘9’=Polish, ‘A’=Chinese, ‘B’=Czech, ‘C’=Hungarian, ‘D’=Russian, ‘E’=Portuguese, ‘F’=Other
dd	display contrast setting	1-64
e	alarm volume setting	1-5
ff	altitude setting	-4 to 36, in 100’s of meters
g	drive gas	‘O’ oxygen
		‘A’ air
h	model number	‘0’=7800, ‘1’=7810, ‘5’=7850, ‘6’=7900 (Excel, Aestiva, & Aespire), ‘8’=7100 (Aestiva & Aespire), ‘i’=iVent101

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c	checksum	
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2.4.7 Waveform Data Response

If Waveform Data Mode is enabled, a Waveform Data Response will be transmitted every 240 mS. 7900 and 7100 ventilators send one or two blocks as commanded of fifteen (15) data samples taken every 16 mS with each message. Each data value is a 3-digit, zero filled, right justified ASCII Hex representation of a 12 bit binary value. Avance and Aisys ventilators send two blocks of fifteen (15) data samples taken every 16 mS with each message. For Avance and Aisys, if the second block is not requested or if a block is requested with an invalid character, the waveform data values for that block are filled with zeroes.

:VTWaaabbb...nnnooo[aaabbb...nnnooo]c<CR>		
Waveform Data Response Each entry is zero filled and right justified--ie. aaa = 095. If the requested waveform data is not available, data is zeroed. For each waveform signal selected (maximum of two signals).		
Bytes	Waveform Data Name	Units and/or description
aaa	1st 16ms waveform sample	hexadecimal "000" – "FFF" (see section 2.4.7.1 Waveform Data Description)
bbb	2nd 16ms waveform sample	hexadecimal "000" - "FFF" (see section 2.4.7.1 Waveform Data Description)
.	.	.
.	.	.
.	.	.
nnn	14th 16ms waveform sample	hexadecimal "000" - "FFF" (see section 2.4.7.1 Waveform Data Description)
ooo	15th 16ms waveform sample	hexadecimal "000" - "FFF" (see section 2.4.7.1 Waveform Data Description)
c	checksum	

2.4.7.1 Waveform Data Description

Each waveform data sample shall be scaled as follows:

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Pressure		
Range: -20 to 120 cm H ₂ O		
Raw Data	Scaled Value	Transmitted
-20	0	“000”
0	512	“200”
120	3584	“E00”

Flow		
Range: -100 to 100 L/M		
Raw Data	Scaled Value	Transmitted
-100	512	“200”
0	2048	“800”
100	3584	“E00”

Volume ¹		
Range: 0 to 2000 mL		
Raw Data	Scaled Value	Transmitted
0	512	“200”
2000	3584	“E00”

¹Note: The volume waveform output from products with model 7900 and software version 4.x is incorrect and should not be used.

2.5 Example

The Ohmeda Com 1.0 serial protocol *default* is "Slave Mode" with "Checksum Enabled". So data **will not** automatically be sent out the serial port.

If an external communications controller wants the Datex-Ohmeda device to stay in "Slave Mode" it must send the <ESC>VT?c<CR> packet ("Send All Data") to receive one Status Data and one Measured Data packet. The external communications controller will then need to request sending all the data on a periodic basis. This method is not recommended because the external communications controller has the potential to request sending all the data faster than the Datex-Ohmeda device is capable of responding.

So, the preferred method is to use "Auto Mode" by sending the <ESC>VTXc<CR> packet. This will allow the Datex-Ohmeda device to send the measured data and status data whenever

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Datex-Ohmeda Com Output Protocols – Version Q
Date: May 26, 2011

changes occur, or every 10 seconds when changes do not occur. Using this method **will not** put a strain on the Datex-Ohmeda device and again is the preferred method to use.

Listed below is an example to get a Datex-Ohmeda device into auto mode with no checksum and pressure waveform enabled. Using this method the "c" [checksum] can be any character (including carriage return, <CR>) for all commands sent after the <ESC>VTDw<CR> command (in this example space, <SP>, is used).

<ESC>VTDw<CR>	- Disable checksum ("w" or 0x77 is the checksum value for this command)
<ESC>VTX<SP><CR>	- Set into Auto mode (<SP> used for checksum since checksum is disabled)
<ESC>VTWP0<SP><CR>	- Request pressure waveform data, no second waveform

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Datex-Ohmeda Com Output Protocols – Version Q
Date: May 26, 2011

page 17 of 102

Released

3.0 Datex-Ohmeda Com 1.2 Serial Protocol (Avance & Aisys)

The following section describes the Datex-Ohmeda Com 1.2 Protocol. This protocol is the **recommended** protocol to communicate with the Datex-Ohmeda Avance and Aisys anesthesia systems.

3.1 Electrical Interface

RS-232C signal standards.

(Avance) 15 pin female D connector - Data Communications Equipment configuration (DCE)

pin 6 - receive data
pin 13 - transmit data
pin 5 - signal ground

Baud Rate: 19.2K
Byte format: Start bit + 7 data bits + parity bit + stop bit
Parity: ODD

3.2 Software Interface

Datex-Ohmeda Com 1.2 Communications Protocol

Notes:

1. All device commands (sent by communications controller) begin with the ASCII escape character (0x1b).
2. All device responses (sent by Datex-Ohmeda device) begin with the ASCII character “:”.
3. The next two bytes are the device designator. “VT” designates a ventilator. Rightly or wrongly, the Datex-Ohmeda Avance and Aisys anesthesia workstation will use the “VT” designator.
4. All parameter fields consist of byte-wise 7 bit printable ASCII characters. All status fields consist of 7 bit bytes that may or may not be printable characters.
5. All numeric parameter fields are ASCII encoded decimals, right justified, with leading digits zeroed.
6. All waveform data fields are 3 digits of ASCII encoded hexadecimal (7 bit printable characters), right justified, with leading digits zeroed. If the requested waveform data is not available, data is zeroed.
7. The checksum byte for the D-O communications protocol is defined as a 7-bit number which, when added to the accumulated sum of all the data bytes transmitted in a command or response (does not include the carriage return character following the checksum byte), causes the least significant 7 bits of the result to be zero. The checksum may or may not be a printable character.
8. All messages end with the ASCII carriage return (0x0d).

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Datex-Ohmeda Com Output Protocols – Version Q
Date: May 26, 2011

page 18 of 102

Released

9. Use Auto Mode whenever possible. In Slave Mode, do not request Send All Data more than once per second.
10. Do not command Enable Waveform Data more than once per second.

3.2.1 Summary of Input Commands and Output Data

When the Datex-Ohmeda device is first turned ON, the default transmission mode is set to "Slave Mode", the Checksum Mode is "Enabled" and Waveforms are disabled.

Command Headers:

<ESC>VTD	Disable Checksum Mode
<ESC>VTE	Enable Checksum Mode (this is the default mode)
<ESC>VTS	Slave Mode (this is the default mode - will reset auto mode)
<ESC>VTX	Auto Mode (see description of Measured Data and Status Data Responses)
<ESC>VTQ	Enable Compressed Data Format (this is the default mode - since printer data format is no longer supported, command is simply ACK'ed)
<ESC>VT\$	Send Setup Data
<ESC>VT?	Send All Data (will send one Status and Measured Data Response - not valid in Auto Mode)
<ESC>VTO	Select Datex-Ohmeda Com Protocol
<ESC>VTw	Enable Waveform Data (default is no waveforms enabled)
<ESC>VTCC	Synchronize Real Time Clock
<ESC>VTM	Enable Privileged Mode (must be sent before using VTCS command)
<ESC>VTCS	Silence Alarms (simulate alarm silence switch press)
<ESC>VTCD	Synchronize Demographic Data

Response Headers:

:VTd	Measured Data Response
:VTm	Setup Data Response
:VTN	NACK (negative acknowledge)
:VTq	Status Data Response
:VTR	Alarm Silence Switch Press Response
:VTt	Test Data Response
:VTw	Waveform Data Response
:VTY	ACK (positive acknowledge)

3.3 Device Commands Sent By External Communications Controller

3.3.1 Data Transmit Mode Select Commands

<ESC>VTXc<CR>	Auto Mode*
---------------	------------

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<ESC>VTSc<CR>	Slave Mode*
----------------------------------	-------------

* same as Ohmeda Com 1.0

3.3.2 Select Datex-Ohmeda Communications Protocol Command

<ESC>VTOaac<CR>		
Select Datex-Ohmeda Com Protocol Note: This command must be used to enable the Datex-Ohmeda Com 1.2 protocol		
Bytes	Description	
aa	“10”	Ohmeda Com 1.0 protocol (see section 2.0 Ohmeda Com 1.0 Serial Protocol)
	“12”	Datex-Ohmeda Com 1.2 protocol
c	Checksum	

3.3.3 Data Request Command

<ESC>VT?c<CR>	Send All Data* (Valid in Slave Mode only)
<ESC>VT\$c<CR>	Send Setup Data*

* same as Ohmeda Com 1.0

3.3.4 Checksum Control Commands

<ESC>VTEc<CR>	Enable Checksum Mode*
<ESC>VTDc<CR>	Disable Checksum Mode*

* same as Ohmeda Com 1.0

3.3.5 Enable Waveform Data Mode

<ESc>VTwabdefgc<CR>		
Send Waveform Data Note1: Order of activated waveform selections determines order of data in response packet. Note2: Do not duplicate activated waveform selections. Note3: Use ASCII character zero to deactivate a waveform. Note4: Undefined selections are treated as ASCII character zero.		
Bytes	Description	
a	one of the following	
	‘0’	turn waveform data OFF (this is the ASCII character <u>zero</u>)
	‘P’	include Pressure Data

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	'F'	include Flow Data
	'V'	include Volume Data
	'X'	include Auxiliary Pressure Data
	'A'	include anesthetic agent
	'C'	include CO ₂ Data
	'O'	include O ₂ Data
b	one of the following	
	'0'	turn waveform data OFF (this is the ASCII character <u>zero</u>)
	'P'	include Pressure Data
	'F'	include Flow Data
	'V'	include Volume Data
	'X'	include Auxiliary Pressure Data
	'A'	include anesthetic agent
	'C'	include CO ₂ Data
	'O'	include O ₂ Data
d	one of the following (Note1: Order determines order of data in response packet) (Note2: Valid only if a != 0 and a != b != d != e != f != g)	
	'0'	turn waveform data OFF (this is the ASCII character <u>zero</u>)
	'P'	include Pressure Data
	'F'	include Flow Data
	'V'	include Volume Data
	'X'	include Auxiliary Pressure Data
	'A'	include anesthetic agent
	'C'	include CO ₂ Data
	'O'	include O ₂ Data
e	one of the following	
	'0'	turn waveform data OFF (this is the ASCII character <u>zero</u>)
	'P'	include Pressure Data
	'F'	include Flow Data

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	'V'	include Volume Data
	'X'	include Auxiliary Pressure Data
	'A'	include anesthetic agent
	'C'	include CO ₂ Data
	'O'	include O ₂ Data
f	one of the following	
	'0'	turn waveform data OFF (this is the ASCII character <u>zero</u>)
	'P'	include Pressure Data
	'F'	include Flow Data
	'V'	include Volume Data
	'X'	include Auxiliary Pressure Data
	'A'	include anesthetic agent
	'C'	include CO ₂ Data
	'O'	include O ₂ Data
g	one of the following	
	'0'	turn waveform data OFF (this is the ASCII character <u>zero</u>)
	'P'	include Pressure Data
	'F'	include Flow Data
	'V'	include Volume Data
	'X'	include Auxiliary Pressure Data
	'A'	include anesthetic agent
	'C'	include CO ₂ Data
	'O'	include O ₂ Data
c	Checksum	

3.3.6 Enable Privileged Mode Command

<ESC>VTMc<CR>	Enable Privileged Mode*
---------------	-------------------------

* same as Ohmeda Com 1.0

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3.3.7 Silence Alarms Command

<ESC>VTCS<CR>	Silence Alarms* (in privileged mode only)
---------------	---

* same as Ohmeda Com 1.0

3.3.8 Synchronize Clock Command

<ESC>VTCCaaaaaaabbbbc<CR>		
Synchronize Real Time Clock Each entry is zero filled and right justified--ie. aaaa = 0059.		
Bytes	Description	
aaaaaaa	date (yyyymmdd)	year, month, day (example: 20031231)
bbbb	time (hhmm)	hour (24 hour format), minutes (example: 2359)
c	checksum	

3.3.9 Synchronize Demographic Data Command

<ESC>VTCDabbbdddeefffgggggggggghhhhhiiiiiiic<CR>			
Synchronize Demographic Data Each numeric entry is zero filled and right justified--ie. aaaa = 0059.			
Bytes	Description		
a	set patient type	'a'	adult
		'n'	neonate
		'p'	pediatric
		'b'	ideal body weight (IBW)
bbb	set IBW set patient ideal body weight	kg, -	
ddd	set BSA set patient body surface area	m ² *100, -	
eee	set patient weight	kg, -	
fff	set patient height	cm, -	
gggggggggg	set patient ID	(limited to 7-bit ASCII characters)	
hhhhh	set patient bed location	(limited to 7-bit ASCII characters)	

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Datex-Ohmeda Com Output Protocols – Version Q

Date: May 26, 2011

page 23 of 102

Released

iiiiiii	set patient age in years, months, and days (yyyymmdd)	(use leading zeroes and zeroes that are significant, months or days fields that are not significant are dashed) (example: 000200-- = 2 years and 0 months, days are not significant)
c	checksum	

3.4 Device Responses Sent Back

3.4.1 ACK Response

This response applies to the commands of VTD, VTE, VTS, VTX, VTQ, VTO, VTW, VTM, VTCS, VTCC, and VTCD.

:VTYc<CR>	Positive Acknowledge Response*
-----------	--------------------------------

* same as Ohmeda Com 1.0

3.4.2 NAK Response

:VTNc<CR>	Negative Acknowledge Response*
-----------	--------------------------------

* same as Ohmeda Com 1.0

3.4.3 Alarm Silence Switch Pressed Response

:VTRc<CR>	Alarm Silence Switch Press Response* (if no alarms are on or all displayed alarms are silenced)
-----------	--

* same as Ohmeda Com 1.0

3.4.4 Measured Data Response

In auto mode, the Measured Data Response will be transmitted at the end of a breath (but not more than once every 0.5 seconds) or 10 seconds from the last transmission, whichever occurs first.

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Datex-Ohmeda Com Output Protocols – Version Q
Date: May 26, 2011

:VTdaaaabbbbbeeefffggghhhiiijjjkkkklllmmnnnooopqrrrrssssttttuuvvvwwwxxx
 yyyzAABBCCDDDEEEFFFGGGHHHIIJJJKKKLMMMNNNOPPPQQQRRSSSSTTTTUUU
 UVVVVWWWWXXXYZZZααββγγδδδεεζζζηηθθθλλλμμμνννξξξορςςς
 σστττττυυυφφ<CR>

Measured Data Response

Each entry is zero filled and right justified--ie. aaaa = 0095.

“?” means bad data due to any technical problem(s).

“-” filled means data not available due to system state or configuration.

Bytes	Measured Data Name	Units and/or description
aaaa	TVexp measured expiratory tidal volume (mechanical or spontaneous)	mL, ?, -
bbbb	MVexp measured total expiratory minute volume (mechanical + spontaneous)	L*100, ?, -
eee	RRtotal measured spirometry total respiratory rate (mechanical + spontaneous)	/min, ?, -
fff	circuit O ₂ (internal) measured circuit oxygen conc.	% O ₂ (volume), ?, -
ggg	Ppeak measured max positive airway pressure	cm H ₂ O, ?
hhh	Pplat measured inspiratory plateau airway pressure (requires inspiratory pause)	cm H ₂ O, ?, -
iii	Pmean measured mean airway pressure	cm H ₂ O, ?, -
jjj	Min pres measured minimum airway pressure	cm H ₂ O, ?, -
kkkk	MVexp spont measured spontaneous expiratory minute volume	L*100, ?, -
lll	RR spont measured spontaneous respiratory rate	/min, ?, -

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Datex-Ohmeda Com Output Protocols – Version Q

Date: May 26, 2011

mmm	PEEPi measured intrinsic PEEP	cm H ₂ O*10, ?, -	
nn	compliance measured compliance	mL/cm H ₂ O, ?, -	
ooo	Raw measured airway resistance	(cm H ₂ O/L/s)*10, ?, -	
p	Punits displayed pressure units	'm'	mbar
		'c'	cm H ₂ O
		'k'	kPa
		'h'	hPa
		'g'	mm Hg
q	Funits displayed flow units	'm'	'm' = L/min
		's'	L/s
		'c'	mL/s
rrrr	TVexp spont measured spontaneous expiratory tidal volume	mL, ?, -	
ssss	TVinsp measured inspiratory tidal volume (mechanical or spontaneous)	mL, ?, -	
tttt	MVinsp measured inspiratory minute volume (mechanical or spontaneous)	L*100, ?, -	
uuu	Paux Peak measured max positive auxiliary pressure	cm H ₂ O, ?	
vvv	Paux Mean measured mean auxiliary pressure	cm H ₂ O, ?	
www	Paux Min measured minimum auxiliary pressure	cm H ₂ O, ?	
xxx	PEEPe measured extrinsic PEEP	cm H ₂ O*10, ?, -	

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yyy	PEEP _{e+i} measured total PEEP (intrinsic + extrinsic)	cm H ₂ O*10, ?, -
zz	PEEP _i time intrinsic PEEP age (elapsed time since last maneuver)	minutes, ?, -
AA	P _{0.1} P _{0.1} airway opening pressure at 0.1 s (patient effort)	cm H ₂ O*10, ?, -
BB	P _{0.1} time P _{0.1} age (elapsed time since last maneuver)	minutes, ?, -
CCC	measured ambient pressure	mm Hg, ?, -
DDD	FiO ₂ (MGAS) measured Fi oxygen conc.	% O ₂ (volume), ?, -
EEE	etO ₂ measured end tidal oxygen conc.	% O ₂ (volume), ?, -
FFFF	FiO ₂ – etO ₂ measured oxygen conc. difference (FiO ₂ – etO ₂)	% O ₂ *10 (volume), ?, -
GGG	FiCO ₂ measured Fi CO ₂ conc.	% CO ₂ *10 (volume), ?, -
HHH	etCO ₂ measured end tidal CO ₂ conc.	% CO ₂ *10 (volume), ?, -
III	RRCO ₂ measured CO ₂ total respiratory rate (mechanical + spontaneous)	/min, ?, -
JJJ	FiAA measured Fi anesthetic agent conc.	% AA*10 (volume), ?, -
KKK	etAA measured end tidal anesthetic agent conc.	% AA*10 (volume), ?, -
L	AA id identified anesthetic agent	'0' Halothane
		'1' Isoflurane
		'2' Enflurane

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		'3'	no agent
		'5'	Desflurane
		'6'	Sevoflurane
MMM	FiAA 2 nd measured secondary Fi anesthetic agent conc.	% AA*10 (volume), ?, -	
NNN	etAA 2 nd measured secondary end tidal anesthetic agent conc.	% AA*10 (volume), ?, -	
O	AA id 2 nd identified secondary anesthetic agent	'0'	Halothane
		'1'	Isoflurane
		'2'	Enflurane
		'3'	no agent
		'5'	Desflurane
		'6'	Sevoflurane
PPP	FiN ₂ O measured Fi N ₂ O conc.	% N ₂ O*10 (volume), ?, -	
QQQ	etN ₂ O measured end tidal N ₂ O conc.	% N ₂ O*10 (volume), ?, -	
RR	MAC	no units*10, ?, -	
SSSS	VO ₂ measured patient oxygen consumption (VO ₂)	mL/min, ?, -	
TTTT	VO ₂ /m ² measured patient oxygen consumption per body surface area (VO ₂ /m ²)	(mL/min/m ²)*10, ?, -	
UUUU	VO ₂ /kg measured patient oxygen consumption per body weight (VO ₂ /kg)	(mL/min/kg)*10, ?, -	

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VVVV	VCO ₂ measured patient CO ₂ production (VCO ₂)	mL/min, ?, -	
WWWW	EE measured patient energy expenditure (EE)	kcal/day, ?, -	
XXX	RQ measured patient respiratory quotient (RQ)	no units*100, ?, -	
Y	CO ₂ units displayed CO ₂ units	'%'	% CO ₂ (volume)
		'k'	kPa
		'g'	mm Hg
ZZZ	O ₂ supply pres measured oxygen supply pressure	kPa, ?, -	
ααα	N ₂ O supply pres measured N ₂ O supply pressure	kPa, ?, -	
βββ	air supply pres measured air supply pressure	kPa, ?, -	
γγγ	O ₂ cylinder pres measured oxygen cylinder pressure	kPa*0.01, ?, -	
δδδ	O ₂ cylinder pres 2 nd measured secondary oxygen cylinder pressure	kPa*0.01, ?, -	
εεε	N ₂ O cylinder pres measured N ₂ O cylinder pressure	kPa*0.01, ?, -	
ζζζ	air cylinder pres measured air cylinder pressure	kPa*0.01, ?, -	
ηηη	Des flow measured Desflurane anesthetic agent flow rate	mL/hr, ?, -	
θθθ	Enf flow measured Enflurane anesthetic agent flow rate	mL/hr, ?, -	
ιιι	Iso flow measured Isoflurane anesthetic agent flow rate	mL/hr, ?, -	

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κκκ	Hal flow measured Halothane anesthetic agent flow rate	mL/hr, ?, -	
λλλ	Sevo flow measured Sevoflurane anesthetic agent flow rate	mL/hr, ?, -	
μμμμ	O ₂ measured flow measured oxygen flow rate	L/min*100, ?, -	
νννν	N ₂ O measured flow measured N ₂ O flow rate	L/min*100, ?, -	
ξξξξ	air measured flow measured air flow rate	L/min*100, ?, -	
ο	Paw source airway pressure measurement source	‘i’	internal
		‘m’	MGAS
π	flow measurement source	‘i’	internal
		‘m’	MGAS
ρ	O ₂ measurement source	‘i’	internal
		‘m’	MGAS
ςςς	inspiratory time measured inspiratory time	s*10, ?, -	
σσσ	expiratory time measured expiratory time	s*10, ?, -	
ττττ	measured I:E ratio	ratio (1:xx.xx), ?, -	
υυυ	fractional residual capacity	mL, ?, -	
φφ	measured data status	See section 3.4.4.1 Status Bytes Bitmaps .	
c	checksum		

3.4.4.1 Status Bytes Bitmaps

The measured data status bytes are a string of 2 bytes, starting from left (byte 1) to the right (byte 2). Each byte has seven bits of data from D6 (MSB) to D0 (LSB).

Note that a bit is set to 1 for an active condition (true) and to 0 for an inactive condition (false).

Byte 1	
bit	Alarm/Status
D0	0 = 10 second data refresh 1 = new breath data
D1	0 = nebulizer off 1 = nebulizer on
D2	0 = pre-oxygenate off 1 = pre-oxygenate on
D3	0 = suction off 1 = suction on
D4	0 = post-oxygenate off 1 = post-oxygenate on
D5	0 = new breath is non mechanical 1 = new breath is mechanical
D6	0 = new breath is not mech. sigh 1 = new breath is mech. sigh

Byte 2	
bit	Alarm/Status
D0	0 = new breath is not triggered 1 = new breath is triggered SIMV
D1	0 = new breath is not triggered 1 = new breath is triggered support
D2	
D3	
D4	
D5	
D6	

3.4.5 Status Data Response

In auto mode, the Status Data Response will be transmitted upon a status change (but not more than once every 1 second) or 10 seconds from the last transmission, whichever occurs first.

```

:VTqaaaabbbdddeeffggghhiijjkkklmmmmnnnooorssstttuuvvwxxxxyyzzzAA
BBCCDEEFFFGHHHHIIJJKKKLLLLLLLLLLLLMMMMMMNNOOPPPQQSSSTTTUUVVXXYYZZZ
ZααββγγδδεεζζζηηθθθιικκλλλμμνννξξξοππρρςςττυυφφφχχψψωωΣΣΣΦΦ
ΦΦΦΦΦΦΦΦΦΦΦΦΦΦΦΦ<CR>

```

Status Data Response

Each entry is zero filled and right justified -- ie. aaaa = 0095.

“-” filled means data not available due to system state or configuration.

Bytes	Status Data Name	Units and/or description
aaaa	set TV set tidal volume	mL, -
bbb	set RR set respiratory rate for controlled ventilation modes	/min, -
dddd	set I:E set I:E ratio	1:eee.e, - (For anesthesia ventilators such as Avance, the inverted I:E ratios are 2.0:1 = 1:000.5 and 1.5:1 = 1:000.6) (For critical care ventilators such as Centiva and Prism, consider using Datex-Ohmeda Com protocol 1.3)

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Datex-Ohmeda Com Output Protocols – Version Q

Date: May 26, 2011

ee	set Insp Pause % set inspiratory pause	% inspiratory time, -	
ff	set PEEP	cm H ₂ O, -	
ggg	set Plimit set peak pressure limit (For Aestiva, mechanical breath cycles to exhalation if patient airway pressure exceeds P _{limit} . For Prism, P _{limit} is the limiting pressure, without cycling to exhalation, for a controlled volume breath and P _{max} is the pressure at which a mechanical breath cycles to exhalation.)	cm H ₂ O, -	
hh	set P _{insp} set inspired pressure	cm H ₂ O, -	
ii	set Sust Pres alm set sustained pressure alarm limit	cm H ₂ O, -	
jjj	set Hi MVexp alm set high expired minute volume alarm limit	L*10, -	
kkk	set Lo MVexp alm set low expired minute volume alarm limit	L*10, -	
llll	set Hi TVexp alm set high Vte alarm limit	ml*0.1, -	
mmmm	set Lo TVexp alm set low Vte alarm limit	ml*0.1, -	
nnn	set Hi FiO ₂ alm set high Fi oxygen alarm limit	% O ₂ (volume), -	
ooo	set Lo FiO ₂ alm set low Fi oxygen alarm limit	% O ₂ (volume), -	
r	set mechanical ventilation mode	'v'	volume control mode (VCV, CMV)
		'p'	pressure control mode (PCV)
		'b'	backup volume control mode
		'g'	PCV-VG
		'G'	BiLevel-VG
		's'	SIMV, SIMV-VC
		'i'	SIMV-PC

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		'S'	SIMV-PCVG
		'B'	BiLevel
		'c'	CPAP, CPAP/PSV
		'a'	CPAP/Apnea
		'n'	NIV
		'o'	PSV-Pro
		'-'	In bag mode or mechanical ventilation not available Note: Please see section 2.4.5.1 (Status Bytes Bitmaps) byte 11, bit D6 'Mechanical Ventilation On' for determining whether system is mechanically ventilating or not.
sss	set bias flow	(L/min)*10, -	
ttt	set FiO ₂ set fresh gas Fi oxygen conc. (FG O ₂ in fresh gas mode, target EtO ₂ in expired gas mode)	% O ₂ (volume), -	
uu	set Pasb ???	???	
vv	set P _{supp} set support pressure	cm H ₂ O, -	
ww	set leakage alm set patient circuit leak alarm limit	(L/min)*10, -	
xxx	set P _{max} set mechanical ventilation peak pressure max (for Prism, mechanical breath cycles to exhalation if patient airway pressure exceeds P _{max})	cm H ₂ O, -	
yyy	set Hi RR alm set high respiratory rate alarm limit	/min, -	
zzz	set Lo RR alm set low respiratory rate alarm limit	/min, -	
AA	set apnea delay time	s, -	
BB	set ramp	???	
CC	set ASB ramp	???	

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D	set endotracheal tube type	‘e’	???
		‘t’	???
EE	set endotracheal tube size	mm, -	
FFF	set circuit compliance level	mL/cm H ₂ O, -	
G	set patient type	‘a’	adult
		‘p’	pediatric
		‘n’	neonate
		‘b’	ideal body weight (IBW)
HHH	set IBW set patient ideal body weight	kg, -	
III	set BSA set patient body surface area	m ² *100, -	
JJJ	set patient weight	kg, -	
KKK	set patient height	cm, -	
LLLLLLLL LL	set patient ID	(limited to 7-bit ASCII characters)	
MMMMM	set patient bed location	(limited to 7-bit ASCII characters)	
NN	set ASB end flow	(L/min)*10, -	
OO	set time window	s, -	
PPP	set Itime %	???	
QQ	set Iflow	???	
SSS	set rise rate	1-10, a=auto, -	
TTT	set PSV rise time	s*100, -	
UU	set flow trigger set flow threshold for triggering a mechanical SIMV and PSV inspiration	(L/min)*10, - Note: If setting greater than 2 digits, then value is truncated to 99.	
VV	set pres trigger set pressure drop threshold for triggering a mechanical SIMV and PSV inspiration	cm H ₂ O, -	

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Verify that this version is current before using.

XX	set trigger window set percent of breath period where threshold for triggering a mechanical SIMV and PSV inspiration is enabled	% breath period, -
YY	set end flow set percent of peak inspiratory flow threshold for ending a mechanical SIMV and PSV inspiration	% peak inspiratory flow, -
ZZZZ	set Tinsp set inspiratory time	s*10, -
αα	set %Pausetime	???
βββ	set FlowRise	???
γγ	set mech RR set mechanical respiration rate for spontaneous ventilation modes	/min, -
δδ	set PSV backup delay set time to wait since last PSV breath before switching from PSV ventilation mode to SIMV ventilation mode	s, -
εεε	set Hi etCO ₂ alm set high end tidal CO ₂ alarm limit	% CO ₂ *10 (volume), -
ζζζ	set Lo etCO ₂ alm set low end tidal CO ₂ alarm limit	% CO ₂ *10 (volume), -
ηηη	set Hi FiCO ₂ alm set high Fi CO ₂ alarm limit	% CO ₂ *10 (volume), -
θθθ	set Hi etAA alm set high end tidal anesthetic agent alarm limit	% AA*10 (volume), -
ιιι	set Lo etAA alm set low end tidal anesthetic agent alarm limit	% AA*10 (volume), -
κκκ	set Hi FiAA alm set high Fi anesthetic agent alarm limit	% AA*10 (volume), -

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λλλ	set Lo FiAA alm set low Fi anesthetic agent alarm limit	% AA*10 (volume), -	
μμμ	set Hi Ppeak alm set high max positive airway pressure alarm limit	cm H ₂ O, -	
ννν	set Lo Ppeak alm set low max positive airway pressure alarm limit	cm H ₂ O, -	
ξξξξ	set FG total flow set total fresh gas flow (FG flow in fresh gas mode, minimum FG flow in expired gas mode)	(L/min)*100, -	
ο	set bal gas type set balance gas type (fresh gas)	‘a’	air
		‘n’	N ₂ O
πππ	set AA % set controlled anesthetic agent conc. (FG AA % in fresh gas mode, target EtAA% in expired gas mode)	% AA*10 (volume), -	
ρ	set AA type set anesthetic agent type	‘0’	Halothane
		‘1’	Isoflurane
		‘2’	Enflurane
		‘3’	no agent
		‘5’	Desflurane
		‘6’	Sevoflurane
ς	set flow sensor type	‘d’	De-lite/D-lite+
		‘p’	Pedi-lite
		‘i’	internal (ventilator)
σ	set circuit type set patient breathing circuit type	‘c’	circle
		‘a’	non-circle ACGO
		‘s’	non-circle SCGO
τ	set gas control mode	‘f’	fresh gas control
		‘i’	IGC

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		'e'	EGC
vvv	set target FiO ₂ set target Fi oxygen conc. for controlled gas delivery	% O ₂ (volume), -	
φφφ	set target FiAA set target Fi anesthetic agent conc. for controlled gas delivery	% AA*10 (volume), -	
χχχ	set target etAA set target end tidal anesthetic agent conc. for controlled gas delivery	% AA*10 (volume), -	
ψψψψ	set neb volume set nebulizer volume	mL, -	
ω	setting data status	See section 3.4.5.1 Setting Data Status Bitmap.	
ΣΣΣΣ	error/status code	(ASCII encoded hexadecimal number)	
ΦΦΦΦΦΦΦ ΦΦΦΦΦΦΦ ΦΦΦΦΦΦ	alarm status bytes	See section 3.4.5.2 Alarm Status Bytes Bitmaps.	
c	checksum		

3.4.5.1 Setting Data Status Bitmap

The setting data status byte has seven bits of data from D6 (MSB) to D0 (LSB).

Note that a bit is set to 1 for an active condition (true) and to 0 for an inactive condition (false).

Byte 1	
bit	Alarm/Status
D0	0 = 10 second data refresh 1 = new setting data
D1	0 = 10 second data refresh 1 = new alarm data
D2	
D3	
D4	
D5	
D6	

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3.4.5.2 Alarm Status Bytes Bitmaps

The status bytes are a string of 19 bytes, starting from left (byte 1) to the right (byte 19). Each byte has seven bits of data from D6 (MSB) to D0 (LSB).

Note that the bit is set to 1 for an active condition (true) and to 0 for an inactive condition (false).

Byte 1	
bit	Alarm/Status
D0	High Circuit O ₂
D1	Low Circuit O ₂
D2	ARC on
D3	ASR on
D4	No O ₂ Cell Sensor
D5	Replace O ₂ Cell
D6	O ₂ Cell Calibration Error

Byte 2	
bit	Alarm/Status
D0	High Paw
D1	Low Paw
D2	High Paw Sustained
D3	Sustained Paw
D4	Sub-Atmospheric Paw
D5	Pmax Reached
D6	Plimit Reached

Byte 3	
bit	Alarm/Status
D0	Pinspired Not Achieved
D1	PEEP Not Achieved
D2	No Pressure Cntrl/PEEP
D3	Circuit Occluded
D4	MGAS APNEA
D5	Inspiration Stopped
D6	Other Priority Alarms (for high priority alarms not assigned a unique bit)

Byte 4	
bit	Alarm/Status
D0	Low VE
D1	High VE
D2	Low Vte
D3	High Vte
D4	Vt Not Achieved
D5	Volume Apnea
D6	Volume Apnea > 2 min

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Byte 5	
bit	Alarm/Status
D0	No Inspiratory Flow Sensor
D1	No Expiratory Flow Sensor
D2	Inspiratory Reverse Flow
D3	Expiratory Reverse Flow
D4	Check Flow Sensors
D5	Insp Vt/Vte Mismatch (VTE > Insp VT)
D6	Vdel Mismatch (System Leak)

Byte 6	
bit	Alarm/Status
D0	Bellows Empty
D1	Patient Circuit Leak
D2	Patient Circuit Leak Silenced
D3	12 Hour Test
D4	No VO ₂ , High FiN ₂ O
D5	No O ₂ Pressure
D6	No Fresh Gas Flow

Byte 7	
bit	Alarm/Status
D0	No N ₂ O Pressure
D1	No Air Pressure
D2	Low Drive Gas Pressure
D3	Low etO ₂
D4	High etO ₂
D5	Low FiO ₂
D6	High FiO ₂

Byte 8	
bit	Alarm/Status
D0	Low RR
D1	High RR
D2	Memory (EEPROM) Failure
D3	CO ₂ Apnea
D4	Low etCO ₂
D5	High etCO ₂
D6	High FiCO ₂

Byte 9	
bit	Alarm/Status
D0	Low etAA
D1	High et AA
D2	Low FiAA
D3	High FiAA
D4	No VO ₂ , Artifact
D5	No VO ₂ , High Bypass Flow
D6	Flow Sensor Cal Data Corrupt

Byte 10	
bit	Alarm/Status
D0	Running On Battery (No AC)
D1	No Battery
D2	Low Battery Charge
D3	Low Battery (No AC)
D4	MGAS ANE_WARMING_UP (5-minute warming up)
D5	Battery Failure
D6	Battery Charger Failure

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Byte 11	
bit	Alarm/Status
D0	Non Circle Circuit Selected
D1	Expiratory Flow Sensed with Non Circle Circuit
D2	MGAS WARMING_UP (2-minute warming up)
D3	Control Settings Failure
D4	Heliox Mode is ON
D5	Volume Compensation Locked (volume ventilation mode)
D6	Mechanical Ventilation On

Byte 12	
bit	Alarm/Status
D0	Volume Monitoring Active
D1	Apnea Detection ON
D2	Apnea Alarm Silenced
D3	Verify Low VE Limit
D4	Alarms Silenced
D5	Standby ON (set when anesthesia system is not in therapy mode or when respiratory care ventilator is in standby)
D6	Service Calibrations Due

Byte 13	
bit	Alarm/Status
D0	Therapy Computer Failure
D1	Monitoring Computer Failure
D2	Display Computer Failure
D3	System Error
D4	Mixer Failure
D5	Mixer Leak
D6	Mixer Control Failure

Byte 14	
bit	Alarm/Status
D0	Fan Failure
D1	Heater Failure
D2	Power Supply Failure
D3	Display Failure
D4	Breathing System Failure
D5	Button Failure
D6	No VO ₂ , FiO ₂ > 85%

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Datex-Ohmeda Com Output Protocols – Version Q
Date: May 26, 2011

Byte 15	
bit	Alarm/Status
D0	Alternate O ₂ ON
D1	Air Only Mode
D2	Vent Failure
D3	Mechanical Ventilation Disabled
D4	Sensor Interface Board Failure
D5	ACGO Failure
D6	SCGO Failure

Byte 16	
bit	Alarm/Status
D0	MGAS Failure
D1	MGAS Outlet Occluded
D2	MGAS Filter Blocked
D3	MGAS Sample Line Blocked
D4	MGAS No Sample Line
D5	MGAS Replace Water Trap
D6	Module Not Compatible

Byte 17	
bit	Alarm/Status
D0	Vaporizer Cassette Failure
D1	Vaporizer Cassette Agent Level Low
D2	No Vaporizer Cassette
D3	Vaporizer Failure
D4	Vaporizer Leak
D5	AA Control Failure
D6	AA Delivery Disabled

Byte 18	
bit	Alarm/Status
D0	Primary Audio Failure
D1	Backup Audio Failure
D2	Patient Detected (while in standby)
D3	High O ₂ Supply Pressure
D4	High Air Supply Pressure
D5	Nebulizer Failure
D6	No Nebulizer

Byte 19	
bit	Alarm/Status
D0	High Temperature (internal)
D1	Paw Cross Check
D2	Patient Disconnected
D3	Backup Mode Active
D4	No Gas Supply
D5	VO ₂ Out of Range
D6	VCO ₂ Out of Range

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3.4.6 Setup Data Response

Only returned when a request for setup data is received.

:VTmaaaabddffghiiiiiiiiiiic<CR>		
Setup Data Response Each entry is zero filled and right justified--ie. aaaa = 0095. “-” filled means data not available due to system state or configuration.		
Bytes	Setup Data Name	Units and/or description
aaaa	soft rev software revision number	0001-9999 = 0.01-99.99, -
b	language	‘0’=English, ‘1’=Spanish, ‘2’=German, ‘3’=Kanji, ‘4’=Dutch, ‘5’=Swedish, ‘6’=French, ‘7’=Italian, ‘8’=Danish, ‘9’=Polish, ‘A’=Chinese, ‘B’=Czech, ‘C’=Hungarian, ‘D’=Russian, ‘E’=Portuguese, ‘F’=Other, ‘G’=Greek, ‘H’=Finnish, ‘I’=Turkish, ‘J’=Norwegian
dd	reserved	
e	alarm loudness alarm volume setting	no units, -
ff	altitude setting	-4 to 36, in 100’s of meters, -
g	drive gas	‘O’ oxygen
		‘A’ air
		‘B’ both
h	model number	‘0’=7800, ‘1’=7810, ‘5’=7850, ‘6’=7900 (Excel, Aestiva, & Aespire), ‘8’=7100 (Aestiva & Aespire), ‘a’=S/5 Avance, ‘b’=S/5Aisys, ‘c’=Centiva, ‘e’=S/5 Engstrom, ‘i’=iVent101
iiiiiiiiiii i	system serial number	(limited to 7-bit ASCII characters)
c	checksum	

3.4.7 Waveform Data Response

If Waveform Data Mode is enabled, a Waveform Data Response will be transmitted every 400 mS. Six blocks of ten data samples taken every 40 mS will be sent with each message. Each data value is a 3-digit, zero filled, right justified ASCII Hex representation of a 12 bit binary

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Datex-Ohmeda Com Output Protocols – Version Q

Date: May 26, 2011

page 42 of 102

Released

value. If a block is requested with an invalid character, the waveform data values for that block are filed with zeroes.

:VTw aaabbb...jjjkkk aaabbb...jjjkkk aaabbb...jjjkkk aaabbb...jjjkkk aaabbb...jjjkkk lc<CR>		
Waveform Data Response Each entry is zero filled and right justified--ie. aaa = 095 Waveform Data Response always contains six waveform blocks (unlike Ohmeda Com 1.0) If the requested waveform data is not available, data is zeroed.		
Bytes	Waveform Data Name	Units and/or description
aaa	1 st 40ms waveform sample	hexadecimal "000" - "FFF" (see section 3.4.7.1 Waveform Data Description)
bbb	2 nd 40ms waveform sample	hexadecimal "000" - "FFF" (see section 3.4.7.1 Waveform Data Description)
.	.	.
.	.	.
.	.	.
jjj	9 th 40ms waveform sample	hexadecimal "000" - "FFF" (see section 3.4.7.1 Waveform Data Description)
kkk	10 th 40ms waveform sample	hexadecimal "000" - "FFF" (see section 3.4.7.1 Waveform Data Description)
.	.	.
.	.	.
.	.	.
l	breath end/start index index to waveform sample at start of spirometry loop	0-9, -

3.4.7.1 Waveform Data Description

Each waveform data sample shall be scaled as follows:

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Datex-Ohmeda Com Output Protocols – Version Q
Date: May 26, 2011

Pressure		
Range: -20 to 120 cm H ₂ O		
Raw Data	Scaled Value	Transmitted
-20	0	“000”
0	512	“200”
120	3584	“E00”

Flow		
Range: -100 to 100 L/M		
Raw Data	Scaled Value	Transmitted
-100	512	“200”
0	2048	“800”
100	3584	“E00”

Volume		
Range: 0 to 2000 mL		
Raw Data	Scaled Value	Transmitted
0	512	“200”
2000	3584	“E00”

Anesthetic Agent		
Range: 0 to 20 %		
Raw Data	Scaled Value	Transmitted
0	512	“200”
20	3584	“E00”

CO₂		
Range: 0 to 35 %		
Raw Data	Scaled Value	Transmitted
0	512	“200”
35	3584	“E00”

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Datex-Ohmeda Com Output Protocols – Version Q
Date: May 26, 2011

kkk	static Pplat measured static plateau airway pressure	cm H ₂ O*10, ?, -
llllllll	quick check date (yyyymmdd)	year, month, day (example: 20031231), -
mmmm	quick check time (hhmm)	hour (24 hour format), minutes (example: 2359), -
nnnnnnnn	vent check date (yyyymmdd)	year, month, day (example: 20031231), -
oooo	vent check time (hhmm)	hour (24 hour format), minutes (example: 2359), -
pppppppp	mixer check date (yyyymmdd)	year, month, day (example: 20031231), -
qqqq	mixer check time (hhmm)	hour (24 hour format), minutes (example: 2359), -
rrrrrrrr	compliance check date (yyyymmdd)	year, month, day (example: 20031231), -
ssss	compliance check time (hhmm)	hour (24 hour format), minutes (example: 2359), -
tttttttt	leak check date (yyyymmdd)	year, month, day (example: 20031231), -
uuuu	leak check time (hhmm)	hour (24 hour format), minutes (example: 2359), -
vvvvvvvv	agent delivery check date (yyyymmdd)	year, month, day (example: 20031231), -
www	agent delivery check time (hhmm)	hour (24 hour format), minutes (example: 2359), -
xxxxxxxx	checklist date (yyyymmdd)	year, month, day (example: 20031231), -
yyyy	checklist time (hhmm)	hour (24 hour format), minutes (example: 2359), -
zzzzzzzz	bypass check date (yyyymmdd)	year, month, day (example: 20031231), -
AAAA	bypass check time (hhmm)	hour (24 hour format), minutes (example: 2359), -
BBBBBBBB	start of case date (yyyymmdd)	year, month, day (example: 20031231), -
CCCC	start of case time (hhmm)	hour (24 hour format), minutes (example: 2359), -
DDDDDDDD D	end of case date (yyyymmdd)	year, month, day (example: 20031231), -
EEEE	end of case time (hhmm)	hour (24 hour format), minutes (example: 2359), -
FFF	Des consump case measured Desflurane anesthetic agent consumption, cumulative since beginning of case	mL, ?, -

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GGG	Enf consump case measured Enflurane anesthetic agent consumption, cumulative since beginning of case	mL, ?, -
HHH	Iso consump case measured Isoflurane anesthetic agent consumption, cumulative since beginning of case	mL, ?, -
III	Hal consump case measured Halothane anesthetic agent consumption, cumulative since beginning of case	mL, ?, -
JJJ	Sevo consump case measured Sevoflurane anesthetic agent consumption, cumulative since beginning of case	mL, ?, -
KKKKKKK	O ₂ consump case measured oxygen consumption, cumulative since beginning of case	L, ?, -
LLLLLLL	N ₂ O consump case measured N ₂ O consumption cumulative since beginning of case	L, ?, -
MMMMMM M	air consump case measured air consumption, cumulative since beginning of case	L, ?, -
NNNN	leak (manual bag) measured circuit leak in manual bag mode	mL/min, ?, -
OOOOOOO OOO	test status bytes	See section 3.4.8.1 Test Status Bytes Bitmaps .
c	checksum	

3.4.8.1 Test Status Bytes Bitmaps

The test status bytes are a string of 10 bytes, starting from left (byte 1) to the right (byte 10). Each byte has seven bits of data from D6 (MSB) to D0 (LSB).

Note that the bit is set to 1 for an active condition (true) and to 0 for an inactive condition (false).

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Byte 1	
bit	Alarm/Status
D0	
D1	
D2	
D3	
D4	
D5	
D6	

Byte 2	
bit	Alarm/Status
D0	
D1	
D2	
D3	
D4	
D5	
D6	

Byte 3	
bit	Alarm/Status
D0	
D1	
D2	
D3	
D4	
D5	
D6	

Byte 4	
bit	Alarm/Status
D0	
D1	
D2	
D3	
D4	
D5	
D6	

Byte 5	
bit	Alarm/Status
D0	
D1	
D2	
D3	
D4	
D5	
D6	

Byte 6	
bit	Alarm/Status
D0	
D1	
D2	
D3	
D4	
D5	
D6	

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Byte 7	
bit	Alarm/Status
D0	Bag/Vent Switch OK
D1	Gas Supplies OK
D2	AC Mains Power OK
D3	Battery Charge OK
D4	Manual Circuit Leak OK
D5	Vent Circuit Leak OK
D6	Flow Controls OK

Byte 8	
bit	Alarm/Status
D0	Low Pressure Leak OK
D1	Vent Delivery OK
D2	SCGO/ACGO OK
D3	Agent Delivery OK
D4	Circuit O ₂ Cell Checked
D5	Circuit Compliance OK
D6	Circuit Resistance OK

Byte 9	
bit	Alarm/Status
D0	Airway Pressure Sensor OK
D1	Barometric Pressure OK
D2	Safety Valve OK
D3	Exhalation Valve OK
D4	O ₂ Conc. Sensor OK
D5	O ₂ Flow Sensor OK
D6	Air Flow Sensor OK

Byte 10	
bit	Alarm/Status
D0	Expiratory Flow Sensor OK
D1	Inspiratory Flow Sensor OK
D2	
D3	
D4	
D5	
D6	

3.5 Example

The Datex-Ohmeda Com 1.2 serial protocol *default* is "1.0 Mode" protocol in "Slave Mode" with "Checksum Enabled". So data **will not** automatically be sent out the serial port.

Upon power up or a reset, the Datex-Ohmeda anesthesia system device communicates in the Ohmeda Com 1.0 protocol mode. This allows compatibility with older external communications controllers. If an external communications controller wants to communicate using the Datex-Ohmeda Com 1.2 protocol mode, it must send the <ESC>VTO12c<CR> packet ("Select Datex-Ohmeda Com Protocol"). The Datex-Ohmeda Com 1.2 protocol provides addition information which is not available in the Ohmeda Com 1.0 protocol.

If an external communications controller wants to stay in "Slave Mode" it must send the <ESC>VT?c<CR> packet ("Send All Data") to receive one Status Data and one Measured Data packet. The external communications controller will then need to request sending all the data on

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Datex-Ohmeda Com Output Protocols – Version Q
Date: May 26, 2011

a periodic basis. This method is not recommended because the external communications controller has the potential to request sending all the data faster than the Datex-Ohmeda device is capable of responding.

So, the preferred method is to use "Auto Mode" by sending the <ESC>VTXc<CR> packet. This will allow the Datex-Ohmeda device to send the measured data and status data whenever changes occur, or every 10 seconds when changes do not occur. Using this method **will not** put a strain on the Datex-Ohmeda device and again is the preferred method to use.

Listed below is an example to get a Datex-Ohmeda device into Datex-Ohmeda Com 1.2 auto mode with no checksum and pressure waveform output enabled. Using this method the "c" [checksum] can be any character (including carriage return, <CR>) for all commands sent after the <ESC>VTDw<CR> command (in this example space, <SP>, is used).

<ESC>VTDw<CR>	- Disable checksum ("w" or 0x77 is the checksum value for this command)
<ESC>VTO12<SP><CR>	- Select Datex-Ohmeda Com 1.2 protocol
<ESC>VTX<SP><CR>	- Set into Auto mode (<SP> used for checksum since checksum is disabled)
<ESC>VTwP00000<SP><CR>	- Request pressure waveform data, no 2 nd – 6 th waveform data

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Datex-Ohmeda Com Output Protocols – Version Q
Date: May 26, 2011

page 50 of 102

Released

4.0 Datex-Ohmeda Com 1.3 Serial Protocol (Centiva & Engstrom)

The following section describes the Datex-Ohmeda Com 1.3 Protocol. This protocol is the **recommended** protocol to communicate with the Datex-Ohmeda Centiva and Engstrom critical care ventilators.

4.1 Electrical Interface

Same as Datex-Ohmeda Com 1.2

4.2 Software Interface

Same as Datex-Ohmeda Com 1.2

4.2.1 Summary of Input Commands and Output Data

When the Datex-Ohmeda device is first turned ON, the default transmission mode is set to "Slave Mode", the Checksum Mode is "Enabled" and Waveforms are disabled.

Command Headers:

<ESC>VTD	Disable Checksum Mode
<ESC>VTE	Enable Checksum Mode (this is the default mode)
<ESC>VTS	Slave Mode (this is the default mode - will reset auto mode)
<ESC>VTX	Auto Mode (see description of Measured Data and Status Data Responses)
<ESC>VTQ	Enable Compressed Data Format (this is the default mode - since printer data format is no longer supported, command is simply ACK'ed)
<ESC>VT\$	Send Setup Data
<ESC>VT?	Send All Data (will send one Status and Measured Data Response - not valid in Auto Mode)
<ESC>VTO	Select Datex-Ohmeda Com Protocol
<ESC>VTw	Enable Waveform Data (default is no waveforms enabled)
<ESC>VTCC	Synchronize Real Time Clock
<ESC>VTM	Enable Privileged Mode (must be sent before using VTCS command)
<ESC>VTCS	Silence Alarms (simulate alarm silence switch press)
<ESC>VTCD	Synchronize Demographic Data

Response Headers:

:VTu	Measured Data Response
:VTm	Setup Data Response
:VTN	NACK (negative acknowledge)
:VTv	Status Data Response
:VTR	Alarm Silence Switch Press Response
:VTt	Test Data Response

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Datex-Ohmeda Com Output Protocols – Version Q

Date: May 26, 2011

page 51 of 102

Released

:VTw Waveform Data Response
 :VTY ACK (positive acknowledge)

4.3 Device Commands Sent By External Communications Controller

4.3.1 Data Transmit Mode Select Commands

Same as Datex-Ohmeda Com 1.2

4.3.2 Select Datex-Ohmeda Communications Protocol Command

<ESC>VTOaac<CR>		
Select Datex-Ohmeda Com Protocol Note: This command must be used to enable the Datex-Ohmeda Com 1.3 protocol		
Bytes	Description	
aa	"10"	Ohmeda Com 1.0 protocol (see section 2.0 Ohmeda Com 1.0 Serial Protocol)
	"12"	Datex-Ohmeda Com 1.2 protocol (see section 3.0 Datex-Ohmeda Com 1.2 Serial Protocol)
	"13"	Datex-Ohmeda Com 1.3 protocol
c	Checksum	

4.3.3 Data Request Command

Same as Datex-Ohmeda Com 1.2

4.3.4 Checksum Control Commands

Same as Datex-Ohmeda Com 1.2

4.3.5 Enable Waveform Data Mode

Same as Datex-Ohmeda Com 1.2

4.3.6 Enable Privileged Mode Command

Same as Datex-Ohmeda Com 1.2

4.3.7 Silence Alarms Command

Same as Datex-Ohmeda Com 1.2

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4.3.8 Synchronize Clock Command

Same as Datex-Ohmeda Com 1.2

4.3.9 Synchronize Demographic Data Command

Same as Datex-Ohmeda Com 1.2

4.4 Device Responses Sent Back**4.4.1 ACK Response**

Same as Datex-Ohmeda Com 1.2

4.4.2 NAK Response

Same as Datex-Ohmeda Com 1.2

4.4.3 Alarm Silence Switch Pressed Response

Same as Datex-Ohmeda Com 1.2

4.4.4 Measured Data Response

In auto mode, the Measured Data Response will be transmitted at the end of a breath (but not more than once every 0.5 seconds) or 10 seconds from the last transmission, whichever occurs first.

:VTuaaaabbbbddddeefffggghhhiiijjjkkklmmnnnopqqqrrrrsssstttvvvwwxxx yyyzzaABBBCCDDDEEFFFGGGHHHHIIJJJKKKLMMMNNNOPPPQQQRRSSSTTTTUUU UVVVVWWWWXXXYYZZZaaaββγγδδδεεζζζηηθθθιικκκλλλμμμννννξξξξορρςςς σσσττττττττττφφφ<CR>		
Measured Data Response Each entry is zero filled and right justified--ie. aaaa = 0095. “?” means bad data due to any technical problem(s). “-” filled means data not available due to system state or configuration.		
Bytes	Measured Data Name	Units and/or description
aaaa	TVexp measured expiratory tidal volume (mechanical or spontaneous)	mL, ?, -
bbbb	MVexp measured total expiratory minute volume (mechanical + spontaneous)	L*100, ?, -

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ddd	RRtotal measured spirometry total respiratory rate (mechanical + spontaneous)	/min, ?, -
eee	circuit O ₂ (internal) measured circuit oxygen conc.	% O ₂ (volume), ?, -
fff	Ppeak measured max positive airway pressure	cm H ₂ O, ?
ggg	Pplat measured inspiratory plateau airway pressure (requires inspiratory pause)	cm H ₂ O, ?, -
hhh	Pmean measured mean airway pressure	cm H ₂ O, ?, -
iii	Min pres measured minimum airway pressure	cm H ₂ O, ?, -
jjjj	MVexp spont measured spontaneous expiratory minute volume	L*100, ?, -
kkk	RR spont measured spontaneous respiratory rate	/min, ?, -
lll	PEEPi measured intrinsic PEEP	cm H ₂ O*10, ?, -
mm	compliance measured compliance	mL/cm H ₂ O, ?, -
nnn	Raw measured airway resistance	(cm H ₂ O/L/s)*10, ?, -
o	Punits displayed pressure units	'm' mbar
		'c' cm H ₂ O
		'k' kPa
		'h' hPa
		'g' mm Hg
p	Funits	'm' 'm' = L/min

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	displayed flow units	's'	L/s
		'c'	mL/s
qqqq	TVexp spont measured spontaneous expiratory tidal volume	mL, ?, -	
rrrr	TVinsp measured inspiratory tidal volume (mechanical or spontaneous)	mL, ?, -	
ssss	MVinsp measured inspiratory minute volume (mechanical or spontaneous)	L*100, ?, -	
ttt	Paux Peak measured max positive auxiliary pressure	cm H ₂ O, ?	
vvv	Paux Mean measured mean auxiliary pressure	cm H ₂ O, ?	
www	Paux Min measured minimum auxiliary pressure	cm H ₂ O, ?	
xxx	PEEPe measured extrinsic PEEP	cm H ₂ O*10, ?, -	
yyy	PEEPe+i measured total PEEP (intrinsic + extrinsic)	cm H ₂ O*10, ?, -	
zz	PEEPi time intrinsic PEEP age (elapsed time since last maneuver)	minutes, ?, -	
AA	P0.1 P _{0.1} airway opening pressure at 0.1 s (patient effort)	cm H ₂ O*10, ?, -	
BB	P0.1 time P _{0.1} age (elapsed time since last maneuver)	minutes, ?, -	
CCC	measured ambient pressure	mm Hg, ?, -	
DDD	FiO ₂ (MGAS) measured Fi oxygen conc.	% O ₂ (volume), ?, -	

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EEE	etO ₂ measured end tidal oxygen conc.	% O ₂ (volume), ?, -	
FFFF	FiO ₂ – etO ₂ measured oxygen conc. difference (FiO ₂ – etO ₂)	% O ₂ *10 (volume), ?, -	
GGG	FiCO ₂ measured Fi CO ₂ conc.	% CO ₂ *10 (volume), ?, -	
HHH	etCO ₂ measured end tidal CO ₂ conc.	% CO ₂ *10 (volume), ?, -	
III	RRCO ₂ measured CO ₂ total respiratory rate (mechanical + spontaneous)	/min, ?, -	
JJJ	FiAA measured Fi anesthetic agent conc.	% AA*10 (volume), ?, -	
KKK	etAA measured end tidal anesthetic agent conc.	% AA*10 (volume), ?, -	
L	AA id identified anesthetic agent	'0'	Halothane
		'1'	Isoflurane
		'2'	Enflurane
		'3'	no agent
		'5'	Desflurane
		'6'	Sevoflurane
MMM	FiAA 2 nd measured secondary Fi anesthetic agent conc.	% AA*10 (volume), ?, -	
NNN	etAA 2 nd measured secondary end tidal anesthetic agent conc.	% AA*10 (volume), ?, -	
O	AA id 2 nd identified secondary anesthetic agent	'0'	Halothane
		'1'	Isoflurane
		'2'	Enflurane
		'3'	no agent

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		'5'	Desflurane
		'6'	Sevoflurane
PPP	FiN ₂ O measured Fi N ₂ O conc.	% N ₂ O*10 (volume), ?, -	
QQQ	etN ₂ O measured end tidal N ₂ O conc.	% N ₂ O*10 (volume), ?, -	
RR	MAC	no units*10, ?, -	
SSSS	VO ₂ measured patient oxygen consumption (VO ₂)	mL/min, ?, -	
TTTT	VO ₂ /m ² measured patient oxygen consumption per body surface area (VO ₂ /m ²)	(mL/min/m ²)*10, ?, -	
UUUU	VO ₂ /kg measured patient oxygen consumption per body weight (VO ₂ /kg)	(mL/min/kg)*10, ?, -	
VVVV	VCO ₂ measured patient CO ₂ production (VCO ₂)	mL/min, ?, -	
WWWW	EE measured patient energy expenditure (EE)	kcal/day, ?, -	
XXX	RQ measured patient respiratory quotient (RQ)	no units*100, ?, -	
Y	CO ₂ units displayed CO ₂ units	'%'	% CO ₂ (volume)
		'k'	kPa
		'g'	mm Hg
ZZZ	O ₂ supply pres measured oxygen supply pressure	kPa, ?, -	
aaa	N ₂ O supply pres measured N ₂ O supply pressure	kPa, ?, -	

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βββ	air supply pres measured air supply pressure	kPa, ?, -
γγγ	O ₂ cylinder pres measured oxygen cylinder pressure	kPa*0.01, ?, -
δδδ	O ₂ cylinder pres 2 nd measured secondary oxygen cylinder pressure	kPa*0.01, ?, -
εεε	N ₂ O cylinder pres measured N ₂ O cylinder pressure	kPa*0.01, ?, -
ζζζ	air cylinder pres measured air cylinder pressure	kPa*0.01, ?, -
ηηη	SpiroD Low Compl measured low spiro dynamics compliance	mL/cmH ₂ O, ?, -
θθθ	SpiroD Mid Compl measured mid spiro dynamics compliance	mL/cmH ₂ O, ?, -
ιιι	SpiroD High Compl measured high spiro dynamics compliance	mL/cmH ₂ O, ?, -
κκκ	Hal flow measured Halothane anesthetic agent flow rate	mL/hr, ?, -
λλλ	Sevo flow measured Sevoflurane anesthetic agent flow rate	mL/hr, ?, -
μμμμ	O ₂ measured flow measured oxygen flow rate	L/min*100, ?, -
νννν	N ₂ O measured flow measured N ₂ O flow rate	L/min*100, ?, -
ξξξξ	air measured flow measured air flow rate	L/min*100, ?, -
ο	Paw source airway pressure measurement source	‘i’ internal
		‘m’ MGAS

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π	flow measurement source	'i'	internal
		'm'	MGAS
ρ	O ₂ measurement source	'i'	internal
		'm'	MGAS
$\zeta\zeta\zeta$	inspiratory time measured inspiratory time	s*10, ?, -	
$\sigma\sigma\sigma$	expiratory time measured expiratory time	s*10, ?, -	
$\tau\tau\tau\tau\tau$	measured I:E ratio	ratio (ii.i:ee.e), ?, -	
$\upsilon\upsilon\upsilon$	fractional residual capacity	ml/10, ?, -	
$\phi\phi$	measured data status	See section 3.4.4.1 Status Bytes Bitmaps.	
c	checksum		

4.4.4.1 Status Bytes Bitmaps

Same as Datex-Ohmeda Com 1.2

4.4.5 Status Data Response

In auto mode, the Status Data Response will be transmitted upon a status change (but not more than once every 1 second) or 10 seconds from the last transmission, whichever occurs first.

:VTvaabbbddddddeeffggghhiijjkkklmmmmnnnooopqqrrrssttuuxxyyyzzz AABBCCDEEFFFGHHHHIIJJKKKLLLLLLLLLLLLMMMMMNNNOOPPPQQSSSTTTUUVVXXYYZ ZZZaαββγγδδεεζζζηηθθθιικκκλλλμμνννξξξξοπππρςςτττφφφχχψψωΣΣΣΣ ΦΦΦΦΦΦΦΦΦΦΦΦΦΦΦΦΦΦc<CR>		
Status Data Response Each entry is zero filled and right justified -- ie. aaaa = 0095. “-” filled means data not available due to system state or configuration.		
Bytes	Status Data Name	Units and/or description
aaaa	set TV set tidal volume	mL, -
bbb	set RR set respiratory rate for controlled ventilation modes	/min, -
dddddd	set I:E set I:E ratio	ii.i:ee.e, -

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ee	set Insp Pause % set inspiratory pause	% inspiratory time, -	
ff	set PEEP	cm H ₂ O, -	
ggg	set Plimit set peak pressure limit (For Aestiva, mechanical breath cycles to exhalation if patient airway pressure exceeds P _{limit} . For Prism, P _{limit} is the limiting pressure, without cycling to exhalation, for a controlled volume breath and P _{max} is the pressure at which a mechanical breath cycles to exhalation.)	cm H ₂ O, -	
hh	set P _{insp} set inspired pressure	cm H ₂ O, -	
ii	set Sust Pres alm set sustained pressure alarm limit	cm H ₂ O, -	
jjj	set Hi MVexp alm set high expired minute volume alarm limit	L*10, -	
kkk	set Lo MVexp alm set low expired minute volume alarm limit	L*10, -	
llll	set Hi TVexp alm set high Vte alarm limit	ml*0.1, -	
mmmm	set Lo TVexp alm set low Vte alarm limit	ml*0.1, -	
nnn	set Hi FiO ₂ alm set high Fi oxygen alarm limit	% O ₂ (volume), -	
ooo	set Lo FiO ₂ alm set low Fi oxygen alarm limit	% O ₂ (volume), -	
p	set mechanical ventilation mode	'v'	volume control mode (VCV, CMV)
		'p'	pressure control mode (PCV)
		'b'	backup volume control mode
		'g'	PCV-VG
		'G'	BiLevel-VG
		's'	SIMV, SIMV-VC
		'i'	SIMV-PC

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		'S'	SIMV-PCVG
		'B'	BiLevel
		'c'	CPAP, CPAP/PSV
		'a'	CPAP/Apnea
		'n'	NIV
		'N'	nCPAP
		'V'	VG-PS
		'o'	PSV-Pro
		'P'	A/C pressure control
		'C'	A/C volume control
		'A'	A/C PRVC
		'R'	SIMV PRVC
		'D'	Adaptive BiLevel
		'L'	Adaptive BiLevel-VG
		'-'	mechanical ventilation not available Note: Please see section 2.4.5.1 (Status Bytes Bitmaps) byte 11, bit D6 'Mechanical Ventilation On' for determining whether system is mechanically ventilating or not.
qqq	set bias flow	(L/min)*10, -	
rrr	set FiO ₂ set fresh gas Fi oxygen conc.	% O ₂ (volume), -	
ss	set Pasb ???	???	
tt	set Psupp set support pressure	cm H ₂ O, -	
uu	set leakage alm set patient circuit leak alarm limit	(L/min)*10, -	
xxx	set Pmax set mechanical ventilation peak pressure max (for Prism, mechanical breath cycles to exhalation if patient airway pressure exceeds P _{max})	cm H ₂ O, -	

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yyy	set Hi RR alm set high respiratory rate alarm limit	/min, -
zzz	set Lo RR alm set low respiratory rate alarm limit	/min, -
AA	set apnea delay time	s, -
BB	set ramp	???
CC	set ASB ramp	???
D	set endotracheal tube type	'e' ???
		't' ???
EE	set endotracheal tube size	mm, -
FFF	set circuit compliance level	mL/cm H ₂ O, -
G	set patient type	'a' adult
		'p' pediatric
		'n' neonate
		'b' ideal body weight (IBW)
HHH	set IBW set patient ideal body weight	kg, -
III	set BSA set patient body surface area	m ² *100, -
JJJ	set patient weight	kg, -
KKK	set patient height	cm, -
LLLLLLLL LL	set patient ID	(limited to 7-bit ASCII characters)
MMMMM	set patient bed location	(limited to 7-bit ASCII characters)
NN	set ASB end flow	(L/min)*10, -
OO	set time window	s, -
PPP	set Itime %	???
QQ	set Iflow	???
SSS	set rise time	s*100, -
TTT	set PSV rise time	s*100, -

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UU	set flow trigger set flow threshold for triggering a mechanical SIMV and PSV inspiration	(L/min)*10, - Note: If setting greater than 2 digits, then value is truncated to 99.
VV	set pres trigger set pressure drop threshold for triggering a mechanical SIMV and PSV inspiration	cm H ₂ O, -
XX	set trigger window set percent of breath period where threshold for triggering a mechanical SIMV and PSV inspiration is enabled	% breath period, -
YY	set end flow set percent of peak inspiratory flow threshold for ending a mechanical SIMV and PSV inspiration	% peak inspiratory flow, -
ZZZZ	set T _{insp} set inspiratory time	s*10, -
αα	set %Pausetime	???
βββ	set FlowRise	???
γγ	set mech RR set mechanical respiration rate for spontaneous ventilation modes	/min, -
δδ	set PSV backup delay set time to wait since last PSV breath before switching from PSV ventilation mode to SIMV ventilation mode	s, -
εεε	set Hi etCO ₂ alm set high end tidal CO ₂ alarm limit	% CO ₂ *10 (volume), -
ζζζ	set Lo etCO ₂ alm set low end tidal CO ₂ alarm limit	% CO ₂ *10 (volume), -
ηηη	set Hi FiCO ₂ alm set high Fi CO ₂ alarm limit	% CO ₂ *10 (volume), -

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000	set Hi etAA alm set high end tidal anesthetic agent alarm limit	% AA*10 (volume), -	
111	set Lo etAA alm set low end tidal anesthetic agent alarm limit	% AA*10 (volume), -	
κκκ	set Hi FiAA alm set high Fi anesthetic agent alarm limit	% AA*10 (volume), -	
λλλ	set Lo FiAA alm set low Fi anesthetic agent alarm limit	% AA*10 (volume), -	
μμμ	set Hi Ppeak alm set high max positive airway pressure alarm limit	cm H ₂ O, -	
ννν	set Lo Ppeak alm set low max positive airway pressure alarm limit	cm H ₂ O, -	
ξξξξ	set FG total flow set total fresh gas flow	(L/min)*100, -	
o	set bal gas type set balance gas type (fresh gas)	'a'	air
		'n'	N ₂ O
πππ	set FG AA % set controlled anesthetic agent conc. (fresh gas)	% AA*10 (volume), -	
ρ	set AA type set anesthetic agent type	'0'	Halothane
		'1'	Isoflurane
		'2'	Enflurane
		'3'	no agent
		'5'	Desflurane
		'6'	Sevoflurane
ς	set flow sensor type	'd'	De-lite/D-lite+
		'p'	Pedi-lite
		'i'	internal (ventilator)

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		‘n’	neonatal
σ	set circuit type set patient breathing circuit type	‘c’	circle
		‘a’	non-circle ACGO
		‘s’	non-circle SCGO
		‘S’	single limb
		‘D’	dual limb
τ	set gas control mode	‘f’	fresh gas control
		‘i’	IGC
		‘e’	EGC
υυυ	set target FiO ₂ set target Fi oxygen conc. For controlled gas delivery	% O ₂ (volume), -	
φφφ	set target FiAA set target Fi anesthetic agent conc. For controlled gas delivery	% AA*10 (volume), -	
χχχ	set target etAA set target end tidal anesthetic agent conc. For controlled gas delivery	% AA*10 (volume), -	
ψψψψ	set neb volume set nebulizer volume	mL, -	
ω	setting data status	See section 3.4.5.1 Setting Data Status Bitmap .	
ΣΣΣΣ	error/status code	(ASCII encoded hexadecimal number)	
ΦΦΦΦΦΦΦΦ ΦΦΦΦΦΦΦΦ ΦΦΦΦΦΦ	alarm status bytes	See section 3.4.5.2 Alarm Status Bytes Bitmaps .	
C	checksum		

4.4.5.1 *Setting Data Status Bitmap*

Same as Datex-Ohmeda Com 1.2

4.4.5.2 *Alarm Status Bytes Bitmaps*

Same as Datex-Ohmeda Com 1.2

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4.4.6 Setup Data Response

Same as Datex-Ohmeda Com 1.2

4.4.7 Waveform Data Response

Same as Datex-Ohmeda Com 1.2

4.4.7.1 Waveform Data Description

Same as Datex-Ohmeda Com 1.2

4.4.8 Test Data Response

Same as Datex-Ohmeda Com 1.2

4.4.8.1 Test Status Bytes Bitmaps

Same as Datex-Ohmeda Com 1.2

4.5 Example

The Datex-Ohmeda Com 1.3 serial protocol *default* is “1.0 Mode” protocol in “Slave Mode” with “Checksum Enabled”. So data **will not** automatically be sent out the serial port.

Upon power up or a reset, the Datex-Ohmeda anesthesia system device communicates in the Ohmeda Com 1.0 protocol mode. This allows compatibility with older external communications controllers. If an external communications controller wants to communicate using the Datex-Ohmeda Com 1.3 protocol mode, it must send the <ESC>VTO13c<CR> packet (“Select Datex-Ohmeda Com Protocol”). The Datex-Ohmeda Com 1.2 protocol provides additional information which is not available in the Ohmeda Com 1.0 protocol.

If an external communications controller wants to stay in “Slave Mode” it must send the <ESC>VT?c<CR> packet (“Send All Data”) to receive one Status Data and one Measured Data packet. The external communications controller will then need to request sending all the data on a periodic basis. This method is not recommended because the external communications controller has the potential to request sending all the data faster than the Datex-Ohmeda device is capable of responding.

So, the preferred method is to use “Auto Mode” by sending the <ESC>VTXc<CR> packet. This will allow the Datex-Ohmeda device to send the measured data and status data whenever changes occur, or every 10 seconds when changes do not occur. Using this method **will not** put a strain on the Datex-Ohmeda device and again is the preferred method to use.

Listed below is an example to get a Datex-Ohmeda device into Datex-Ohmeda Com 1.3 auto mode with no checksum and pressure waveform output enabled. Using this method the “c”

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Datex-Ohmeda Com Output Protocols – Version Q
Date: May 26, 2011

page 66 of 102

Released

[checksum] can be any character (including carriage return, <CR>) for all commands sent after the <ESC>VTDw<CR> command (in this example space, <SP>, is used).

<ESC>VTDw<CR>

- Disable checksum (“w” or 0x77 is the checksum value for this command)

<ESC>VTO13<SP><CR>

- Select Datex-Ohmeda Com 1.3 protocol

<ESC>VTX<SP><CR>

- Set into Auto mode (<SP> used for checksum since checksum is disabled)

<ESC>VTwP00000<SP><CR>

- Request pressure waveform data, no 2nd – 6th waveform data

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Datex-Ohmeda Com Output Protocols – Version Q
Date: May 26, 2011

5.0 Datex-Ohmeda Com 1.5 Serial Protocol (Engstrom)

The following section describes the Datex-Ohmeda Com 1.5 Protocol. This protocol is the **recommended** protocol to communicate with the Engstrom critical care ventilator.

5.1 Electrical Interface

Same as Datex-Ohmeda Com 1.2

5.2 Software Interface

Same as Datex-Ohmeda Com 1.2

5.2.1 Summary of Input Commands and Output Data

When the Datex-Ohmeda device is first turned ON, the default transmission mode is set to “Slave Mode”, the Checksum Mode is “Enabled”, Waveforms are disabled, Spiro Dynamics Waveforms and Dynostatic Curve Data are disabled, and Snapshot Notifications are disabled.

Command Headers:

<ESC>VTD	Disable Checksum Mode
<ESC>VTE	Enable Checksum Mode (this is the default mode)
<ESC>VTS	Slave Mode (this is the default mode – will reset auto mode)
<ESC>VTX	Auto Mode (see description of Measured Data and Status Data Responses)
<ESC>VTQ	Enable Compressed Data Format (this is the default mode – since printer data format is no longer supported, command is simply ACK’ed)
<ESC>VT\$	Send Setup Data
<ESC>VT?	Send All Data (will send one Status and Measured Data Response – not valid in Auto Mode)
<ESC>VTO	Select Datex-Ohmeda Com Protocol
<ESC>VTw	Enable Waveform Data (default is no waveforms enabled)
<ESC>VTs	Enable Spiro Dynamics Data (default is no spiro dynamics enabled)
<ESC>VTc	Send Checkout Data
<ESC>VTZ	Send Data Transfer Configuration
<ESC>VTB	Enable Snapshot Notification

Response Headers:

:VTY	ACK (positive acknowledge)
:VTN	NACK (negative acknowledge)
:VTf	Measured Data Response
:VTg	Status Data Response
:Vta	Alarm Status Response
:VTx	Setup Data Response

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Datex-Ohmeda Com Output Protocols – Version Q

Date: May 26, 2011

page 68 of 102

:VTw	Waveform Data Response
:VTh	Spiro Dynamics Data Response
:VTk	Dynostatic Curve Data Response
:VTr	Checkout Data Response
:VTs	System Data Response
:VTp	Procedure Status Response
:VTz	Data Transfer Configuration Response
:VTb	Snapshot Notification Response

5.3 Device Commands Sent By External Communications Controller

5.3.1 Data Transmit Mode Select Commands

Same as Datex-Ohmeda Com 1.2

5.3.2 Select Datex-Ohmeda Communications Protocol Command

<ESC>VTOaac<CR>		
Select Datex-Ohmeda Com Protocol Note: This command must be used to enable the Datex-Ohmeda Com 1.5 protocol		
Bytes	Description	
aa	"10"	Ohmeda Com 1.0 protocol (see section 2.0 Ohmeda Com 1.0 Serial Protocol)
	"12"	Datex-Ohmeda Com 1.2 protocol (see section 3.0 Datex-Ohmeda Com 1.2 Serial Protocol)
	"13"	Datex-Ohmeda Com 1.3 protocol (see section 4.0 Datex-Ohmeda Com 1.2 Serial Protocol)
	"15"	Datex-Ohmeda Com 1.5 protocol
c	Checksum	

5.3.3 Data Request Command

Same as Datex-Ohmeda Com 1.2

5.3.4 Checksum Control Commands

Same as Datex-Ohmeda Com 1.2

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5.3.5 Enable Waveform Data Mode

Same as Datex-Ohmeda Com 1.2

5.3.10 Enable Spiro Dynamics Data Mode

<Esc>Vtsac<CR>		
Enable Spiro Dynamics Data Note1: Use ASCII character zero to deactivate spiro dynamic data. Note2: Undefined selections are treated as ASCII character zero.		
Bytes	Description	
a	one of the following	
	'0'	turn spiro dynamics and dynostatic curve data OFF (this is the ASCII character <u>zero</u>)
	'1'	turn spiro dynamics and dynostatic curve data ON (this is the ASCII character <u>one</u>)
c	Checksum	

5.3.11 Send Checkout Data

<ESC>VTcc<CR>	Send Checkout Data
----------------------------------	--------------------

5.3.12 Enable Snapshot Notification

<Esc>VTBac<CR>		
Enable Snapshot Notification Note1: Use ASCII character zero to deactivate snapshot notifications. Note2: Undefined selections are treated as ASCII character zero.		
Bytes	Description	
a	one of the following	
	'0'	turn snapshot notifications OFF (this is the ASCII character <u>zero</u>)
	'1'	turn snapshot notifications ON (this is the ASCII character <u>one</u>)
c	Checksum	

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bbb	Dynamic PEEPe (source dependent) measured dynamic extrinsic PEEP	cm H ₂ O, -
ddd	Pmean (source dependent) measured mean airway pressure	cm H ₂ O, -
eee	Pplat (source dependent) measured inspiratory plateau airway pressure (requires inspiratory pause)	cm H ₂ O, -
fff	Leak (vent only) measured circuit leak	%, -
gggg	Mvexp (source dependent) measured total expiratory minute volume (mechanical + spontaneous)	l/min*100, -
hhhhh	Tvexp (source dependent) measured expiratory tidal volume (mechanical or spontaneous)	ml*10, -
iii	Rrtotal (source dependent) measured spirometry total respiratory rate (mechanical + spontaneous)	/min, -
jjj	FiO ₂ (vent only) measured inspired O ₂	%, -
kkkk	Mvexp spont (vent only) measured spontaneous expiratory minute volume	l/min*100, -
lllll	Tvexp spont (vent only) measured spontaneous expiratory tidal volume	ml*10, -
mmm	RR spont (vent only) measured spontaneous respiratory rate	/min, -
nnn	RSBI (vent only) measured rapid shallow breathing index	/min/l, -

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oooo	Mvexp mech (vent only) measured mechanical expiratory minute volume	l/min*100, -
ppppp	Tvexp mech (vent only) Measured mechanical expiratory tidal volume	ml*10, -
qqq	RR mech (vent only) measured mechanical respiratory rate	/min, -
rrr	Paux Peak (vent only) measured max positive auxiliary pressure	cm H ₂ O, -
sss	Paux Mean (vent only) measured mean auxiliary pressure	cm H ₂ O, -
ttt	Paux Min (vent only) measured minimum auxiliary pressure	cm H ₂ O, -
uuu	EtCO ₂ (MGAS only) measured end tidal CO ₂ conc.	%*10, -
vvv	EtO ₂ (MGAS only) measured end tidal oxygen conc.	%, -
www	FiO ₂ (MGAS only) measured Fi oxygen conc.	% O ₂ (volume), -
xxxx	FiO ₂ – EtO ₂ (MGAS only) measured oxygen conc. Difference (FiO ₂ – etO ₂)	%*10, -
yyyy	Dynamic compliance (source dependent) measured dynamic compliance	ml/cm H ₂ O*10, -
zzz	Raw (source dependent) measured airway resistance	(cm H ₂ O/l/s, -
AAAA	Static compliance (MGAS only) measured static compliance	ml/cm H ₂ O*10, -
BBB	Static Pplat (MGAS only) measured static inspiratory plateau airway pressure	cm H ₂ O, -

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Verify that this version is current before using.

CCC	Static PEEPe (MGAS only) measured static extrinsic PEEP	cm H ₂ O, -
DDD	Static PEEPi (MGAS only) measured static intrinsic PEEP	cm H ₂ O, -
EEE	PEEPe+i (MGAS only) measured total PEEP (intrinsic + extrinsic)	cm H ₂ O, -
FFFF	EE (MGAS only) measured patient energy expenditure (EE)	kcal/day, -
GGG	RQ (MGAS only) measured patient respiratory quotient (RQ)	no units*100, -
HHH	VO ₂ (MGAS only) measured patient oxygen consumption (VO ₂)	ml/min, -
III	VCO ₂ (MGAS only) measured patient CO ₂ production (VCO ₂)	ml/min, -

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Verify that this version is current before using.

JJJJ	VO ₂ /m ² (MGAS only) measured patient oxygen consumption per body surface area (VO ₂ /m ²)	ml/min/m ² , -	
KKKK	VCO ₂ /m ² (MGAS only) measured patient CO ₂ consumption per body surface area (VO ₂ /m ²)	ml/min/m ² , -	
LLLL	VO ₂ /kg (MGAS only) measured patient oxygen consumption per body weight (VO ₂ /kg)	(mL/min/kg)*10, -	
MMMM	VCO ₂ /kg (MGAS only) measured patient CO ₂ consumption per body weight (VCO ₂ /kg)	(mL/min/kg)*10, -	
NNN	tVexp/wt (vent only) measured expiratory tidal volume per body weight	(ml/kg)*10, -	
OOOO	mVexp/wt (vent only) measured total expiratory minute volume per body weight	(l/min/kg)*1000, -	
PPP	PEEPi Dynamic (MGAS only) measured dynamic intrinsic PEEP	cm H ₂ O, -	
Q	Punits displayed pressure units	'm'	mbar
		'c'	cm H ₂ O
		'k'	kPa
R	Funits displayed flow units	'm'	l/min
		's'	l/s
S	CO ₂ units displayed CO ₂ units	'%'	% CO ₂ (volume)
		'k'	kPa
		'g'	mm Hg

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T	Gas Supply units display gas supply units	‘p’	psi
		‘k’	kPa
		‘b’	bar
U	EE units display energy expenditure units	‘c’	kcal/day
		‘j’	kJ/day
VVV	O ₂ supply pres (vent only) measured oxygen supply pressure	kPa, -	
WWW	air supply pres (vent only) measured air supply pressure	kPa, -	
X	Paw source airway pressure measurement source	‘i’	internal
		‘m’	MGAS
Y	flow measurement source	‘i’	internal
		‘m’	MGAS
Z	volume Source	‘i’	internal
		‘m’	MGAS
α	O ₂ measurement source	‘i’	internal
		‘m’	MGAS
βββ	Ambient Pressure (MGAS or based on set altitude) measured ambient pressure	mm Hg, -	
γγγ	RRCO ₂ (MGAS only) measured CO ₂ total respiratory rate (mechanical + spontaneous)	/min, -	
δδδδδ	tV _{insp} (source dependent) measured inspiratory tidal volume (mechanical or spontaneous)	ml*10, -	
εεεε	mV _{insp} (source dependent) measured total inspiratory minute volume (mechanical + spontaneous)	l/min*100, -	
ζζζζζζζζ	I:E (MGAS only) measured I:E ratio	ratio (iii.i:eee.e), -	
η	measured data status	See section 5.4.4.1 Status Bytes Bitmaps .	

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Verify that this version is current before using.

0000000000 0000000000 00	Reserved	
c	checksum	

5.4.4.1 Status Bytes Bitmaps

The measured data status bytes are a string of 1 byte. The byte has seven bits of data from D6 (MSB) to D0 (LSB).

Note that a bit is set to 1 for an active condition (true) and to 0 for an inactive condition (false).

Byte 1	
bit	Alarm/Status
D0	0 = 10 second data refresh 1 = new breath data
D1	0 = new breath is non mechanical 1 = new breath is mechanical
D2	0 = new breath not ctrl triggered 1 = new breath is ctrl triggered
D3	0 = new breath is not PSV triggered 1 = new breath is PSV triggered
D4	Reserved
D5	Reserved
D6	Reserved

5.4.5 Status Data Response

In auto mode, the Status Data Response will be transmitted upon a status change (but not more than once every 1 second) or 10 seconds from the last transmission, whichever occurs first.

:vTgabbbbbbdeeeeffgghhhiiijjkkllllllmmnnnooppqqrrrrssstttuuuvvvvwxxyyyzZAABBBBCCCCDDDEEEFFFGGGGGHHHHHHIIJJKKKLLLMMNNNOOOPPQQRRSSTTUUVVVWWXXYYZZZαββγγδεεζζζηηηθικκκκκκκκκλμμννξξξξωωπσσσσσσσσσσσσσσσσσσ<CR>			
Status Data Response Each entry is zero filled and right justified— ie. aaaa = 0095. “-” filled means data not available due to system state or configuration.			
Bytes	Status Data Name	Units and/or description	
a	set ventilation mode	‘v’	VCV

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Verify that this version is current before using.

		‘p’	PCV
		‘g’	PCV-VG
		‘G’	BiLevel-VG
		‘s’	SIMV-VC
		‘i’	SIMV-PC
		‘S’	SIMV-PCVG
		‘B’	BiLevel
		‘c’	CPAP/PSV
		‘n’	NIV
		‘N’	nCPAP
		‘V’	VG-PS
bbbb	set TV set tidal volume	ml*10, -	
dd	set PEEP	cm H ₂ O, -	
eeee	set T _{insp} set inspiratory time	s*100, -	
ff	set P _{insp} set inspired pressure	cm H ₂ O, -	
gg	set P _{supp} set support pressure	cm H ₂ O, -	
hhh	set P _{limit} set peak pressure limit (For Prism, P _{limit} is the limiting pressure, without cycling to exhalation, for a controlled volume breath and P _{max} is the pressure at which a mechanical breath cycles to exhalation.)	cm H ₂ O, -	
iii	set RR set respiratory rate for controlled ventilation modes	/min, -	
jjj	set mech RR set mechanical respiration rate for spontaneous ventilation modes	/min, -	
kk	set Inspiratory Pause % set inspiratory pause	%, -	

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Verify that this version is current before using.

llllllll	set I:E set I:E ratio	iii.i:eee.e, -
mm	set trigger window set percent of breath period where threshold for triggering a mechanical SIMV and PSV inspiration is enabled	%, -
nnn	set flow trigger set flow threshold for triggering a mechanical SIMV and PSV inspiration	(l/min)*100, - Note: If setting greater than 2 digits, then value is truncated to 99.
oo	set end flow set percent of peak inspiratory flow threshold for ending a mechanical SIMV and PSV inspiration	%, -
ppp	set bias flow	(l/min)*10, -
qqq	set pressure rise time	ms, -
rrr	set flow rise time	ms, -
ssss	set pres trigger set pressure drop threshold for triggering a mechanical SIMV and PSV inspiration	cm H ₂ O*100, -
ttt	set Pmax set mechanical ventilation peak pressure max (for Prism, mechanical breath cycles to exhalation if patient airway pressure exceeds P _{max})	cm H ₂ O, -
uuu	set PSV rise time	ms, -
vvvv	set Flow	l/min*10, -
w	set Vent Assist Control	'Y' on
		'N' off
xxxx	set Pause Time	s*100, -
yyy	set FiO ₂ set fresh gas Fi oxygen conc.	%, -
zz	set Phigh set high pressure	cm H ₂ O, -

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Verify that this version is current before using.

AA	set Plow set low pressure	cm H ₂ O, -
BBBB	set Thigh set time high	s*100, -
CCCC	set Tlow set time low	s*100, -
DDD	set Tsupp set support time	s*100, -

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Datex-Ohmeda Com Output Protocols – Version Q
Date: May 26, 2011

EEEE	set High mVexp alarm set high expired minute volume alarm limit	l/min*100, -
FFFF	set Low mVexp alarm set low expired minute volume alarm limit	l/min*100, -
GGGGG	set High tVexp alarm set high Vte alarm limit	ml*10, -
HHHHH	set Low tVexp alarm set low Vte alarm limit	ml*10, -
III	set High FiO ₂ alarm set high Fi oxygen alarm limit	%, -
JJ	set Low FiO ₂ alarm set low Fi oxygen alarm limit	%, -
KKK	set High RR alarm set high respiratory rate alarm limit	/min, -
LLL	set Low RR alarm set low respiratory rate alarm limit	/min, -
MMM	set High EtCO ₂ alarm set high end tidal CO ₂ alarm limit	%*10, -
NNN	set Low EtCO ₂ alarm set low end tidal CO ₂ alarm limit	%*10, -
OOO	set High Ppeak alarm set high max positive airway pressure alarm limit	cm H ₂ O, -
PP	set Low Ppeak alarm set low max positive airway pressure alarm limit	cm H ₂ O, -
QQQ	set High EtO ₂ alarm set high end tidal O ₂ alarm limit	%, -
RR	set Low EtO ₂ alarm set low end tidal O ₂ alarm limit	%, -
SS	set High PEEPe alarm	cm H ₂ O, -
TT	set Low PEEPe alarm	cm H ₂ O, -

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UU	set High PEEPi alarm	cm H ₂ O, -	
VVV	set High Paux alarm	cm H ₂ O, -	
WW	set apnea delay time	s, -	
XX	set circuit leak alarm set patient circuit leak alarm limit	%, -	
YY	set disconnect time	s, -	
ZZZ	set patient effort time	s, -	
α	set tube type	‘e’	Endotracheal tube
		‘t’	Tracheal tube
βββ	set tube size	mm*10, -	
γγγ	set ARC level	%, -	
δ	set patient type	‘a’	adult
		‘p’	pediatric
		‘n’	neonate
εεε	set BSA set patient body surface area	m ² *100, -	
ζζζ	set patient height	cm, -	
ηηηη	set patient weight	kg*10, -	
θ	set weight units	‘k’	Kg
		‘l’	lb
ι	set height units	‘c’	cm
		‘i’	inches
κκκκκκκκ κκ	set patient ID	(limited to 7-bit ASCII characters)	
λ	set flow sensor type	‘d’	De-lite/D-lite+
		‘p’	Pedi-lite
		‘i’	internal (ventilator)
		‘n’	Neonatal flow sensor
μμ	set Nebulizer Time	min, -	
νν	set Nebulizer Volume	ml*10, -	
ξξξξ	set Nebulizer Pause Time	min*10, -	

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ωω	set Nebulizer Cycles set nebulizer cycles	none, -
π	setting data status	See section 5.4.5.1 Setting Data Status Bitmap .
σσ σσ σσ	Reserved	
c	checksum	

5.4.5.1 Setting Data Status Bitmap

The setting data status byte has seven bits of data from D6 (MSB) to D0 (LSB).

Note that a bit is set to 1 for an active condition (true) and to 0 for an inactive condition (false).

Byte 1	
bit	Alarm/Status
D0	0 = 10 second data refresh 1 = new setting data
D1	Reserved
D2	Reserved
D3	Reserved
D4	Reserved
D5	Reserved
D6	Reserved

5.4.6 Alarm Status Data Response Bytes Bitmaps

In auto mode, the Alarm Status Data Response will be transmitted upon a status change (but not more than once every 1 second) or 10 seconds from the last transmission, whichever occurs first.

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Datex-Ohmeda Com Output Protocols – Version Q
Date: May 26, 2011

:vTabbbbbbbbbbbbbbbbbbbbc<CR>		
Alarm Status Data Response		
Bytes	Status Data Name	Units and/or description
bbbbbbbbb bbbbbbbbb bbb	Alarm status bytes	See section 5.4.6.1 Alarm Status Bytes Bitmap .
c	checksum	

5.4.6.1 Alarm Status Bytes Bitmaps

The status bytes are a string of 19 bytes, starting from left (byte 1) to the right (byte 19). Each byte has seven bits of data from D6 (MSB) to D0 (LSB).

Note that the bit is set to 1 for an active condition (true) and to 0 for an inactive condition (false).

Byte 1	
bit	Alarm/Status
D0	Backup Audio Failure
D1	Patient Connected?
D2	No Battery Backup?
D3	Temp High Shutdown Possible
D4	Primary Audio Failure
D5	Reserved
D6	Reserved

Byte 2	
bit	Alarm/Status
D0	Exp Flow Sensor Error
D1	Neo Flow Sensor Error
D2	Neo Flow Sensor Reversed
D3	Clean Neo Flow Sensor
D4	Replace Neo Flow Sensor
D5	Neo Flow Sensor Off
D6	Reserved

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Verify that this version is current before using.

Byte 3	
bit	Alarm/Status
D0	Negative Airway Pressure
D1	No Expiratory Flow Sensor
D2	No Neo Flow Sensor
D3	Exp Flow Sensor Failure
D4	O ₂ Sensor Failure
D5	Reserved
D6	Reserved

Byte 4	
bit	Alarm/Status
D0	Air Supply Pressure High
D1	Air Supply Pressure Low
D2	O ₂ Supply Pressure High
D3	O ₂ Supply Pressure Low
D4	No Gas Supply Pressure
D5	Pair Sensor Out of Range
D6	PO ₂ Sensor Out of Range

Byte 5	
bit	Alarm/Status
D0	Pinsp Sensor Out of Range
D1	Pexp Sensor Out of Range
D2	Paux Sensor Out of Range
D3	Reserved
D4	Reserved
D5	Reserved
D6	Reserved

Byte 6	
bit	Alarm/Status
D0	FiO ₂ Control Error
D1	Volume Delivery Error
D2	Air Temp Sensor Error
D3	O ₂ Temp Sensor Error
D4	Mixed Gas Temp Sensor Error
D5	Reserved
D6	Reserved

Byte 7	
bit	Alarm/Status
D0	Module Not Compatible
D1	Check Sample Gas Out
D2	Replace D-fend
D3	Sample Line Blocked
D4	Check D-fend
D5	Reserved
D6	Reserved

Byte 8	
bit	Alarm/Status
D0	Module Fail No CO ₂ , O ₂ Data
D1	No D-Lite Sensor?
D2	Controls Frozen Need Service
D3	Pressure Sensor Failure
D4	Connect Nebulizer
D5	Reserved
D6	Reserved

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Verify that this version is current before using.

Byte 9	
bit	Alarm/Status
D0	On Battery
D1	Low Internal Battery 20 Min
D2	Low Internal Battery 10 Min
D3	Low Internal Battery 5 Min
D4	Low Internal Battery 1 Min
D5	No Battery Backup
D6	Reserved

Byte 10	
bit	Alarm/Status
D0	Fans Require Service
D1	Relief Valve Failure
D2	Backup Mode Active
D3	SBT Ends < 2 Minutes
D4	Reserved
D5	Reserved
D6	Reserved

Byte 11	
bit	Alarm/Status
D0	Cannot Calculate FRC
D1	Missed Scheduled FRC
D2	FRC Series Stopped
D3	Display Fans Failed
D4	Reserved
D5	Reserved
D6	Reserved

Byte 12	
bit	Alarm/Status
D0	Ppeak High
D1	Relief Valve Opened
D2	Ppeak Low
D3	Sustained Paw
D4	Breathing Circuit Occlusion
D5	Circuit Leak
D6	Circuit Leak Alarm Off

Byte 13	
bit	Alarm/Status
D0	Patient Connection Leak
D1	Apnea
D2	Apnea Alarm Off
D3	mVexp Low
D4	mVexp High
D5	mVexp Low Alarm Off
D6	No Patient Effort

Byte 14	
bit	Alarm/Status
D0	RR Low
D1	RR High
D2	FiO ₂ Low
D3	FiO ₂ High
D4	tVexp Low
D5	tVexp High
D6	TV Not Achieved

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Verify that this version is current before using.

Byte 15	
bit	Alarm/Status
D0	EtO ₂ Low
D1	EtO ₂ High
D2	EtCO ₂ Low
D3	EtCO ₂ High
D4	Patient Disconnected
D5	Reserved
D6	Reserved

Byte 16	
bit	Alarm/Status
D0	PEEPe High
D1	PEEPe Low
D2	PEEPi High
D3	Paux High
D4	Plimit Reached
D5	Unable to Deliver TV
D6	Reserved

Byte 17	
bit	Alarm/Status
D0	VO ₂ Out of Range
D1	VCO ₂ Out of Range
D2	CO ₂ Over of Range
D3	O ₂ Over of Range
D4	No VO ₂ , FiO ₂ > 85%
D5	Artifact
D6	Bias Flow High

Byte 18	
bit	Alarm/Status
D0	Module Warming Up 2 Min
D1	Module Warming Up 5 Min
D2	Reserved
D3	Reserved
D4	Reserved
D5	Reserved
D6	Reserved

Byte 19	
bit	Alarm/Status
D0	Reserved
D1	Reserved
D2	Reserved
D3	Reserved
D4	Reserved
D5	Alarms Silenced
D6	0 = 10 second data refresh 1 = new setting data

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Verify that this version is current before using.

5.4.7 Setup Data Response

Only returned when a request for setup data is received.

:vTxaaaabdeefghhhhhhhhhhhhhiiiiic<CR>		
Setup Data Response Each entry is zero filled and right justified---ie. aaaa = 0095. “-” filled means data not available due to system state or configuration.		
Bytes	Setup Data Name	Units and/or description
aaaa	soft rev software revision number	0001-9999 = 0.01-99.99, -
b	language	‘0’=English, ‘1’=Spanish, ‘2’=German, ‘3’=Kanji, ‘4’=Dutch, ‘5’=Swedish, ‘6’=French, ‘7’=Italian, ‘8’=Danish, ‘9’=Polish, ‘A’=Chinese, ‘B’=Czech, ‘C’=Hungarian, ‘D’=Russian, ‘E’=Portuguese, ‘F’=Other, ‘G’=Greek, ‘H’=Finnish, ‘I’=Turkish, ‘J’=Norwegian
d	alarm loudness alarm volume setting	no units, -
ee	altitude setting	-4 to 36, in 100’s of meters, -
f	altitude unit	‘f’ feet
		‘m’ meters
g	model number	‘e’=S/5 Engstrom
hhhhhhh hhhhh	system serial number	(limited to 7-bit ASCII characters)
iiiiii	reserved	
c	checksum	

5.4.8 Waveform Data Response

Same as Datex-Ohmeda Com 1.2

5.4.8.1 Waveform Data Description

Same as Datex-Ohmeda Com 1.2

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5.4.9 Spiro Dynamics Data Response

If Spiro Dynamics Data Mode is enabled, a Spiro Dynamics Data Response will be transmitted every 400 mS. Two blocks of ten data samples taken every 40 mS will be sent with each message. Each data value is a 3-digit, zero filled, right justified ASCII Hex representation of a 12 bit binary value. If a block is requested with an invalid character, the waveform data values for that block are filled with ASCII zeroes.

:VTh aaabbb...jjjkkk lllmmm...tttuuuvwwwc<CR>		
Spiro Dynamics Data Response Each entry is zero filled and right justified--ie. aaa = 095 Spiro Dynamics Data Response always contains two waveform blocks If the requested Spiro Dynamics data is not available, data is zeroed.		
Bytes	Waveform Data Name	Units and/or description
aaa	1 st 40ms pressure waveform sample	hexadecimal--“000” - “FFF” (see section 5.4.9.1 Waveform Data Description)
bbb	2 nd 40ms pressure waveform sample	hexadecimal--“000” - “FFF” (see section 5.4.9.1 Waveform Data Description)
.	.	.
.	.	.
.	.	.
jjj	9 th 40ms pressure waveform sample	hexadecimal--“000” - “FFF” (see section 5.4.9.1 Waveform Data Description)
kkk	10 th 40ms pressure waveform sample	hexadecimal--“000” - “FFF” (see section 5.4.9.1 Waveform Data Description)
lll	1 st 40ms volume waveform sample	hexadecimal--“000” - “FFF” (see section 5.4.9.1 Waveform Data Description)
mmm	2 nd 40ms volume waveform sample	hexadecimal--“000” - “FFF” (see section 5.4.9.1 Waveform Data Description)
.	.	.
.	.	.
.	.	.
ttt	9 th 40ms volume waveform sample	hexadecimal--“000” - “FFF” (see section 5.4.9.1 Waveform Data Description)
uuu	10 th 40ms volume waveform sample	hexadecimal--“000” - “FFF” (see section 5.4.9.1 Waveform Data Description)

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Datex-Ohmeda Com Output Protocols – Version Q

Date: May 26, 2011

page 89 of 102

Released

v	Breath end index Index to waveform sample at end of spirometry loop	0-9,-
www	Sequence Number Number to be matched with the Dynostatic Curve	
c	checksum	

5.4.9.1 Waveform Data Description

Each waveform data sample shall be scaled as follows:

Paux		
Range: -20 to 120 cm H ₂ O		
Raw Data	Scaled Value	Transmitted
-20	0	“000”
0	512	“200”
120	3584	“E00”

Volume		
Range: 0 to 2000 mL		
Raw Data	Scaled Value	Transmitted
0	512	“200”
2000	3584	“E00”

5.4.10 Dynostatic Curve Data Response

If Spiro Dynamics Data Mode is enabled, a Dynostatic Curve Data Response will be transmitted every other breath. Two blocks of forty data samples will be sent with each message. Each data value is a 3-digit, zero filled, right justified ASCII Hex representation of a 12 bit binary value. Also included in the Dynostatic Curve Data Response are the three compliance values and a sequence number.

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Datex-Ohmeda Com Output Protocols – Version Q
Date: May 26, 2011

Dynostatic Curve Data Response

Each entry is zero filled and right justified--ie. aaa = 095
Dynostatic Curve Data Response always contains two data blocks
If the requested curve data is not available, data is zeroed.

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Date: May 26, 2011

5.4.10.1 Dynostatic Curve Data Description

Each dynostatic curve data sample shall be scaled as follows:

Paux		
Range: -20 to 120 cm H ₂ O		
Raw Data	Scaled Value	Transmitted
-20	0	“000”
0	512	“200”
120	3584	“E00”

Volume		
Range: 0 to 2000 mL		
Raw Data	Scaled Value	Transmitted
0	512	“200”
2000	3584	“E00”

5.4.11 Checkout Data Response

In auto mode, the Checkout Data Response will not automatically be transmitted. The Checkout Data Response will be transmitted in response to a Checkout Data Request.

:VTraaaaaaabbbbbddddddeeeffffgghhhhhhhc<CR>		
Checkout Data Response Each entry is zero filled and right justified--ie. aaaa = 0095. “-” filled means data not available due to system state or configuration.		
Bytes	Setup Data Name	Units and/or description
aaaaaaa	last checkout date (yyyymmdd)	year, month, day (example: 20031231), -
bbbbbb	last checkout time (hhmmss)	hour (24 hour format), minutes and seconds (example: 235959), -
dddd	breathing circuit leak	ml/min, -
eeee	breathing circuit compliance	ml/cmH ₂ O*100, -
ffff	breathing circuit resistance	cm H ₂ O*100, -

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Verify that this version is current before using.

g	checkout verdict	'p' – pass 'f' - fail
hhhhhhhh	reserved	
c	checksum	

5.4.12 System Data Response

In auto mode, the System Data Response will be automatically transmitted once per minute as well as any time the system state changes.

:VTsaaaaaaaaabbbbbbbdeeeeeeeec<CR>		
System Data Response		
Bytes	Setup Data Name	Units and/or description
aaaaaaaa	current date stamp (yyyymmdd)	year, month, day (example: 20031231), -
bbbbbb	current time stamp (hhmmss)	hour (24 hour format), minutes (example: 2359), seconds, -
d	system state	't' therapy state
		's' standby state
		'm' monitoring state
eeeeeeee	reserved	
c	checksum	

5.4.13 Procedure Status Data Response Bytes Bitmaps

In auto mode, the Procedure Status Data Response will be transmitted upon a status change (but not more than once every 1 second) or 10 seconds from the last transmission, whichever occurs first.

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Datex-Ohmeda Com Output Protocols – Version Q
Date: May 26, 2011

:VTpaaabbbdddeefffgggghhhhhiiiiiiic<CR>		
Procedure Status Data Response		
Bytes	Status Data Name	Units and/or description
aaa	Procedures status bytes	See section 5.4.13.1 Procedure Status Bytes Bitmap .
bbb	PEEPi measured intrinsic PEEP	cm H ₂ O, -
ddd	PEEPi Volume measured intrinsic PEEP volume	ml, -
ee	P0.1 P _{0.1} airway opening pressure at 0.1 s (patient effort)	cm H ₂ O, -
fff	Vital Capacity measured vital capacity	ml, -
ggg	NIF measured negative inspiratory force	cm H ₂ O, -
hhhh	FRC measured functional residual capacity	ml, -
iiiiiii	reserved	
c	checksum	

5.4.13.1 Procedure Status Bytes Bitmaps

The status bytes are a string of 2 bytes, starting from left (byte 1) to the right (byte 2). Each byte has seven bits of data from D6 (MSB) to D0 (LSB).

Note that the bit is set to 1 for an active condition (true) and to 0 for an inactive condition (false).

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Datex-Ohmeda Com Output Protocols – Version Q
Date: May 26, 2011

Byte 1	
bit	Alarm/Status
D0	0 = nebulizer off 1 = nebulizer on
D1	0 = pre-oxygenate off 1 = pre-oxygenate on
D2	0 = suction off 1 = suction on
D3	0 = post-oxygenate off 1 = post-oxygenate on
D4	0 = PEEPi Procedure off 1 = PEEPi Procedure on
D5	0 = inspiratory hold off 1 = inspiratory hold on
D6	0 = expiratory hold off 1 = expiratory hold on

Byte 2	
bit	Alarm/Status
D0	0 = SBT off 1 = SBT on
D1	0 = Oxygenation off 1 = Oxygenation on
D2	0 = P0.1 off 1 = P0.1 on
D3	0 = NIF off 1 = NIF on
D4	0 = vital capacity off 1 = vital capacity on
D5	0 = FRC off 1 = FRC on
D6	0 = PEEP Inview off 1 = PEEP Inview on

Byte 3	
bit	Alarm/Status
D0	0 = Lung Inview off 1 = Lung Inview on
D1	Reserved
D2	Reserved
D3	Reserved
D4	Reserved
D5	Reserved
D6	0 = 10 second data refresh 1 = new setting data

5.4.14 Data Transfer Configuration Response

One Data Transfer Configuration Response shall be sent in response to the Send Data Transfer Configuration command.

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Datex-Ohmeda Com Output Protocols – Version Q
Date: May 26, 2011

:VTzabdefghhhhhhhhhc<CR>		
Data Transfer Configuration Response		
Bytes	Status Data Name	Units and/or description
a	Data to Transfer	'v' – Vent Data 's' – Snapshots
b	Time Period	'0' – 15 Minutes '1' – 30 Minutes '2' – 1 Hour '3' – 2 Hour '4' – 4 Hour '5' – 8 Hour '6' – 12 Hour '7' – 1 Day '8' – 2 Day '9' – 3 Day 'A' – 4 Day 'B' – 5 Day 'C' – 6 Day 'D' – 7 Day
d	Sample Interval	'0' – Breath '1' – 1 Minute '2' – 5 Minutes '3' – 10 Minutes '4' – 15 Minutes '5' – 30 Minutes '6' – 60 Minutes
e	Waveforms	'0' – On '1' – Off

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f	Patients	‘0’ – All ‘1’ – Current
g	Transfer Media	‘0’ – USB ‘1’ – SD ‘2’ – Both
hhhhhhhh hh	Reserved	
c	checksum	

5.4.15 Snapshot Notification Response

One Snapshot Notification Response shall be sent each time the snapshot key is pressed on the display unit only after an Enable Snapshot Notification message has been received and acknowledged.

:VTbc<CR>		
Snapshot Notification Response		
Bytes	Status Data Name	Units and/or description
c	Checksum	

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6. Change Log

Section	Description	Revision / Date
Title Page	Changed version to letter Q.	Q 4 Mar 2011
Footer	Updated filename and date.	Q 4 Mar 2011
2.4.6	Added 'i' for iVent101 as a model number.	Q 4 Mar 2011
3.4.5	Corrected units from (mL/min)*100 to (L/min)*100	Q 16 May 2011
3.4.5	Added the note (FG flow in fresh gas mode, minimum FG flow in expired gas mode) to accommodate expired gas mode.	Q 16 May 2011
3.4.5	Added the note (FG O ₂ in fresh gas mode, target EtO ₂ in expired gas mode) to accommodate expired gas mode.	Q 26 May 2011
3.4.5	Changed set FG AA% to set AA%. Added the note (FG AA % in fresh gas mode, target EtAA% in expired gas mode) to accommodate expired gas mode.	Q 26 May 2011
3.4.6	Added 'i' for iVent101 as a model number.	Q 4 Mar 2011
4.4.5	Added vent modes 'P' for A/C pressure control, 'C' for A/C volume control, 'A' for A/C PRVC, 'R' for SIMV PRVC, 'D' for Adaptive BiLevel, and 'L' for Adaptive BiLevel-VG	Q 4 Mar 2011
4.4.5	Added circuit types 'S' for single limb and 'D' for dual limb.	Q 4 Mar 2011
4.4.5	Corrected units from (mL/min)*100 to (L/min)*100	Q 16 May 2011
Title Page	Changed version letter to P.	P 11/03/2010
2.4.7.1	Added note indicating volume waveform data is incorrect for model 7900 and software versions of 4.x, and should not be used.	1.0 O 03/24/2010
2.4.5	Corrected 'v' backup volume control mode to 'b'. Added note indicating this is only applicable to 7100 sw and 7900 3.5 sw.	1.0 O 03/24/2010
2.4.5	Changed "set ventilation mode" to read "set mechanical ventilation mode" to more accurately reflect the intended use.	1.0 O 03/24/2010
2.4.5	Changed "'-' bag mode" to read "'-' mechanical ventilation not available*" to more accurately reflect the intended use. Added note on how to determine if system is mechanically ventilating. Added	1.0 O 03/24/2010

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	note indicating ‘-‘ also means ‘in bag mode’ for Aisys & Avance.	
3.4.5	Changed “set ventilation mode” to read “set mechanical ventilation mode” to more accurately reflect the intended use.	1.2 O 03/24/2010
3.4.5	Changed “-‘ bag mode” to read “-‘ in bag mode or mechanical ventilation not available” to more accurately reflect the intended use. Added note on how to determine if system is mechanically ventilating.	1.2 O 03/24/2010
4.4.4	Corrected ‘MAC’ export to reflect value is scaled by ten (*10).	1.3 O 03/24/2010
4.4.5	Changed “set ventilation mode” to read “set mechanical ventilation mode” to more accurately reflect the intended use.	1.3 O 03/24/2010
4.4.5	Changed “-‘ bag mode” to read “-‘ mechanical ventilation not available” to more accurately reflect the intended use. Added note on how to determine if system is mechanically ventilating.	1.3 O 03/24/2010
2.4.5	Corrected ‘set ventilation mode.’ All volume modes export ‘v’ and all pressure modes export ‘p.’	1.0 N 02/15/2010
3.4.4	Corrected ‘MAC’ export to reflect value is scaled by ten (*10).	1.2 N 02/15/2010
4.4.4	Updated Des Flow, Enf Flow, and Iso Flow to be Low, Mid, and High Spiro Dynamics Compliance Values.	1.3 M 10/2/09
4.4.4	Fixed the scaling for the FRC value to be mL/10.	1.3 M 10/2/09
3.4.7	Fixed message typo from “Vt” to “VT” for Waveform Data Response.	1.3 M 10/2/09
3.4.6	Fixed message typo from “Vt” to “VT” for Setup Data Response.	1.3 M 10/2/09
4.4.5	Added VG-PS as a vent mode letter.	1.5 M 09/29/09
5.4.5	Added VG-PS as a vent mode letter.	1.5 M 09/29/09
5.4.6.1	Added Unable to Deliver TV alarm.	1.5 M 09/29/09
5.3.11	Added the Checkout Data Request command description.	1.5 L 07/31/08
5.0	Added Ohmeda COM protocol version 1.5	1.5 K 10/30/2007
4.4.5	Added new vent modes: NIV and nCPAP Added new Flow Sensor Type: neonatal flow sensor	1.3 K 10/30/2007
2.4.5	Added new vent modes: PCV-VG, BiLevel-VG, SIMV, SIMV-VC, SIMV-PC, SIMV-PCVG, BiLevel, CPAP, CPAP/PSV, CPAP/Apnea, NIV, PSV-Pro	1.3 J 06/12/2006
3.4.4, 4.4.4	Changed End Tidal Balance Gas to Fractional Residual Capacity.	1.3 I 05/25/2006
3.4.5, 4.4.5	Added three new vent modes: BiLevel, BiLevel-VG, and SIMV-PCVG.	1.3 I 05/25/2006

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Datex-Ohmeda Com Output Protocols – Version Q

Date: May 26, 2011

page 99 of 102

Released

3.4.5	Changed Rise Time to Rise Rate	1.3 I 05/25/2006
3.4.5, 4.4.5	Changed Fresh Gas Total Flow units from L/min * 10 to mL/min * 100.	1.3 I 05/25/2006
3.3.9	Added set patient age to Synchronize Demographic Data command.	1.3 H 5/16/2005
3.4.6, 4.4.6	Removed alarm loudness setting range. The Engstrom ventilator range changed from 1-5 to 1-6.	1.3 H 5/24/2005
2.0, 2.1, 2.4.6, 3.4.6	Added Aespire to names of anesthesia systems with 7900 ventilator.	1.3 G 4/6/2005
2.4.7, 3.4.7	Added clarification of how Avance and Aisys send waveform data.	1.3 G 4/6/2005
3.3.5	Corrected Note2 and added Note3 and Note4 to better explain how to activate/deactivate waveforms.	1.3 G 3/29/2005
3.4.5, 4.4.5	Clarified that set RR applies to controlled ventilation modes.	1.3 G 3/29/2005
3.4.5.2	Changed MGAS GAPNEA status bit to MGAS APNEA (Byte 3, bit D4) to resolve Anesthesia Monitor "Apnea deactivated" problem.	1.3 G 4/6/2005
3.4.5.2	Added Other Priority Alarms status bit to Byte 3 bit D6.	1.3 G 4/6/2005
3.4.7	Added comment that Waveform Data Response always contains six waveform blocks, unlike Ohmeda Com 1.0. Deleted incorrect comment.	1.3 G 3/29/2005
2.2, 3.2	Added definition of checksum byte.	1.3 F 3/15/2005
3.4.1	Added VTCD command to list of commands that are ACK'ed.	1.3 F 3/15/2005
3.4.5, 4.4.5	Set flow trigger values greater than 2 digits are truncated to 99.	1.3 F 3/15/2005
4.2.1	Added VTCD command to list of command headers.	1.3 F 3/15/2005
Title Page	Changed version letter to F.	1.3 F 2/18/2005
3.2.1, 3.3.9, 4.3.9	Added Synchronize Demographic Data command header and Synchronize Demographic Data command description.	1.3 F 2/18/2005
3.4.5, 4.4.5	Added "neonate" to patient type setting. Changed IBW designator from 'i' to 'b' to match Datex-OhmedaSerialProtocol1_3.xls file.	1.3 F 2/18/2005
Title Page	Changed version letter to E.	1.3 E 2/10/2005
3.0, 3.2, 3.4.6	Added Aisys to list of anesthesia systems that use protocol 1.2.	1.3 E 2/14/2005
3.4.5.2	Added MGAS GAPNEA status bit to Byte 3, bit D4. Added MGAS	1.3 E

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	WARMING_UP status bit to Byte 11, bit D2. Applies to Com 1.2 and Com 1.3 protocols. These changes should resolve problems where Anesthesia Monitor reports “EtCO2 low” and “Apnea deactivated”.	2/10/2005
3.4.5.2	Added MGAS ANE_WARMING_UP status bit to Byte 10, bit D4. Applies to Com 1.2 protocol, but may not be necessary for Com 1.3 protocol. This change should resolve problem where Anesthesia Monitor reports “Calibrating gas sensor”.	1.3 E 2/10/2005
3.4.5.2	Added comments to Standby ON. Anesthesia systems are now using this bit to indicate system is not in therapy mode.	1.3 E 2/10/2005
4.0	Added Engstrom to list of critical care ventilators that use protocol 1.3.	1.3 E 2/14/2005
Title Page	Changed version letter to D.	1.3 D 9/23/2004
3.4.4, 4.4.4	Changed units of RQ from “no units” to “no units*100”. Applies to Com 1.2 and Com 1.3 protocols.	1.3 D 9/23/2004
3.4.5	Added “No VO ₂ , High FiN ₂ O”, “No VO ₂ , Artifact”, “No VO ₂ , High Bypass Flow”, “No VO ₂ , FiO ₂ > 85%”, “VO ₂ Out of Range”, “VCO ₂ Out of Range” alarm status bits. Applies to Com 1.2 and Com 1.3 protocols.	1.3 D 9/28/2004
Title Page	Changed version letter to C.	1.3 C 7/26/2004
3.4.5, 4.4.5	Changed units of set BSA from m ² to m ² *100.	1.3 C 7/27/2004
3.4.5, 4.4.5	Changed units of set pres trigger from cm H ₂ O*10 to cm H ₂ O.	1.3 C 7/27/2004
Title Page	Changed version letter to B.	1.3 B 6/3/2004
2.5, 3.5, 4.5	Checksum character may be a carriage return.	1.3 B 6/3/2004
3.4.8	Changed measured static resistance units to (cm H ₂ O/L/s)*10. This matches measured airway resistance units.	1.3 B 6/3/2004
4.2.1	Changed response headers from “:VTv” to “:VTm” and from “:VTq” to “:VTm”	1.3 B 6/3/2004
4.5	Fixed typo from “<ESC>VTO12c<CR>” to “<ESC>VTO13c<CR>”	1.3 B 6/3/2004
Title Page	Renamed document to Datex-OhmedaSerialProtocol1_3.doc. Added Datex-Ohmeda Com 1.3 Serial Protocol. Restarted version numbering at letter A.	1.3 A 5/7/2004
3.4.4 4.4.4	Changed Raw units to (cm H ₂ O/L/s)*10.	1.3 A 5/7/2004
3.4.5	Changed description of set I:E ratio to describe inverted I:E ratios and to reference the 1.3 protocol for critical care ventilators.	1.3 A 5/7/2004
4 (all)	Added 1.3 protocol to fix I:E resolution and range problems for critical care ventilators. The 1.3 protocol is the same as the 1.2	1.3 A 5/7/2004

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	protocol except for the I:E ratio	
4.4.4 4.4.5	The I:E ratio to supports a range from 99.9:1 to 1:99.9 as needed by critical care ventilators. The Measured Data Response changed from :VTd to :VTu and Setup Data Response changed from :VTm to :VTv	1.3 A 5/7/2004

----- **End** -----

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Datex-Ohmeda Com Output Protocols – Version Q
Date: May 26, 2011

Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

	COM 1.0			COM 1.2				COM 1.3			7900 v4.x, COM1.0	Centiva/5, COM1.3	Aespire View, COM 1.0	Aespire View, COM 1.2	Avance, COM1.2
		# bytes	Pos		# bytes	Pos	applies to:		# bytes	Pos					
Setup data response	:VTM	4	0	:VTm	4	0		:VTm	4	0					
	soft rev	4	4	soft rev	4	4		soft rev	4	4	software revision	software revision	software revision	software revision	software revision
	language	1	8	language	1	8		language	1	8	set language	set language	set language	set language	set language
	display contrast setting	2	9	reserved	2	9		reserved	2	9	set display contrast		display brightness		
	alarm loudness	1	11	alarm loudness	1	11		alarm loudness	1	11	set alarm loudness	set alarm loudness	set alarm loudness	set alarm loudness	set alarm loudness
	altitude setting	2	12	altitude setting	2	12		altitude setting	2	12	set altitude	set altitude	set altitude	set altitude	set altitude
	drive gas	1	14	drive gas	1	14		drive gas	1	14	set drive gas	set drive gas	set drive gas	set drive gas	set drive gas
	model number	1	15	model number	1	15		model number	1	15	model number	model number	model number	model number	model number
	checksum	1	16	serial number	15	16		serial number	15	16			checksum		serial number
	<CR>	1	17	checksum	1	31		checksum	1	31				checksum	
			18	<CR>	1	32		<CR>	1	32					
						33				33					
Measured data response	:VTD	4	0	:VTd	4	0		:VTu	4	0					
	TV	4	4	TVexp	4	4		TVexp	4	4	expired tidal vol	expired tidal vol	TVexp	TVexp	expired tidal vol
	MV	4	8	MVexp	4	8		MVexp	4	8	expired minute vol	expired minute vol	MVexp	MVexp	expired minute vol
	RR	3	12	RRtotal	3	12		RRtotal	3	12	resp rate (m+s)	resp rate (m+s)	RR	RR	resp rate (m+s)
	FiO2	3	15	circuit O2 (internal)	3	15		circuit O2 (internal)	3	15	insp O2 (gas cell)	insp O2	O2%	O2%	insp O2 (gas cell)
	Max Pos Pres	3	18	Ppeak	3	18		Ppeak	3	18	peak pressure	peak pressure	Ppeak	Ppeak	peak pressure
	Plateau Pres	3	21	Pplat	3	21		Pplat	3	21	plateau pressure	plateau pressure	Pplat	Pplat	plateau pressure
	Mean AP	3	24	Pmean	3	24		Pmean	3	24	mean pressure	mean pressure	Pmean	Pmean	mean pressure
	Min Pres	3	27	Min Pres	3	27		Min Pres	3	27	min pres (PEEPe)	min pres (PEEPe)	PEEP	PEEP	
	meas data status	1	30	MVexp spont	4	30		MVexp spont	4	30	meas data status	spont expr min vol	meas data status	Mvexp spont	spont expr min vol
	checksum	1	31	RR spont	3	34		RR spont	3	34		spont resp rate	checksum	RR spont	spont resp rate
	<CR>	1	32	PEEPi	3	37		PEEPi	3	37		intrinsic PEEP			intrinsic PEEP (MGAS)
			33	compliance	2	40		compliance	2	40		compliance			compliance (MGAS)
				Raw	3	42		Raw	3	42		airway resistance			airway resistance (MGAS)
				Punits	1	45		Punits	1	45		displayed pres units		pressure units	displayed pres units
				Funits	1	46		Funits	1	46				flow units	displayed flow units
				TVexp spont	4	47 e+a		TVexp spont	4	47				TVexp spont	spont expr tidal vol
				TVinsp	4	51		TVinsp	4	51				TVinsp	inspired tidal vol
				MVinsp	4	55		MVinsp	4	55				MVinsp	inspired minute vol
				Paux Peak	3	59 e		Paux Peak	3	59					
				Paux Mean	3	62 e		Paux Mean	3	62					
				Paux Min	3	65 e		Paux Min	3	65					
				PEEPe	3	68 e+a		PEEPe	3	68					PEEPe (MGAS) PEEPe+I (Vent)
				PEEPe+i	3	71 e		PEEPe+i	3	71				measured total PEEP (PEEPe+i or extrinsic PEEP + intrinsic PEEP).	PEEPe+i (MGAS)
				PEEPi time (minutes)	2	74 e		PEEPi time (minutes)	2	74					
				P0.1	2	76		P0.1	2	76					
				P0.1 time (minutes)	2	78		P0.1 time (minutes)	2	78					
				ambient pres	3	80		ambient pres	3	80				measured ambient pressure (in mmHg, based on Altitude setting)	ambient pres (MGAS)

Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

	COM 1.0			COM 1.2				COM 1.3			7900 v4.x, COM1.0	Centiva/5, COM1.3	Aespire View, COM 1.0	Aespire View, COM 1.2	Avance, COM1.2
				FiO2 (MGAS)	3	83	e+a	FiO2 (MGAS)	3	83					FiO2 (MGAS)
				etO2	3	86	e+a	etO2	3	86					etO2 (MGAS)
				FiO2-etO2	4	89		FiO2-etO2	4	89					FiO2-etO2 (MGAS)
				FiCO2	3	93	e+a	FiCO2	3	93					FiCO2 (MGAS)
				etCO2	3	96	e+a	etCO2	3	96					etCO2 (MGAS)
				RRCO2	3	99	a	RRCO2	3	99					RR from CO2 (MGAS)
				FiAA	3	102	a	FiAA	3	102					FiAA (MGAS)
				etAA	3	105	a	etAA	3	105					etAA (MGAS)
				AA id	1	108	a	AA id	1	108					AA id (MGAS)
				FiAA 2nd	3	109	a	FiAA 2nd	3	109					FiAA 2nd (MGAS)
				etAA 2nd	3	112	a	etAA 2nd	3	112					etAA 2nd (MGAS)
				AA id 2nd	1	115	a	AA id 2nd	1	115					AA id 2nd (MGAS)
				FiN2O	3	116		FiN2O	3	116					FiN2O (MGAS)
				etN2O	3	119		etN2O	3	119					etN2O (MGAS)
				MAC	2	122	a	MAC	2	122					MAC
				VO2	4	124	e	VO2	4	124					VO2 (MGAS)
				VO2/m2	4	128	e	VO2/m2	4	128					
				VO2/kg	4	132	e	VO2/kg	4	132					VO2/kg (MGAS)
				VCO2	4	136	e	VCO2	4	136					VCO2 (MGAS)
				EE	4	140	e	EE	4	140					energy expnd (MGAS)
				RQ	3	144	e	RQ	3	144					resp quotient (MGAS)
				CO2 units	1	147	e+a	CO2 units	1	147					displayed CO2 units
				O2 supp pres	3	148		O2 supp pres	3	148					O2 pipeline pres
				N2O supp pres	3	151		N2O supp pres	3	151					N2O pipeline pres
				air supp pres	3	154		air supp pres	3	154					air pipeline pres
				O2 cyl pres	3	157		O2 cyl pres	3	157					1st O2 cylinder pres
				O2 cyl pres 2nd	3	160		O2 cyl pres 2nd	3	160					2nd O2 cylinder pres
				N2O cyl pres	3	163		N2O cyl pres	3	163					N2O cylinder pres
				air cyl pres	3	166		air cyl pres	3	166					air cylinder pres
				Des meas flow	3	169		SpiroD Low Compl	3	169					
				Enf meas flow	3	172		SpiroD Mid Compl	3	172					
				Iso meas flow	3	175		SpiroD High Compl	3	175					
				Hal meas flow	3	178		Hal meas flow	3	178					
				Sevo meas flow	3	181		Sevo meas flow	3	181					
				O2 meas flow	4	184		O2 meas flow	4	184				measured O2 flow	O2 measured flow
				N2O meas flow	4	188		N2O meas flow	4	188				measured N2O flow	N2O measured flow
				air meas flow	4	192		air meas flow	4	192				measured Air flow	air measured flow
				Paw source	1	196		Paw source	1	196				Paw source	airway pres source
				flow source	1	197		flow source	1	197				Flow source	airway flow source
				O2 source	1	198		O2 source	1	198				O2 measurement source	airway O2 source
				insp time	3	199		insp time	3	199					insp time (MGAS)
				exp time	3	202		exp time	3	202					exp time (MGAS)
				I:E (1:xx.xx)	4	205		I:E (xx.x:xx.x)	6	205					I:E (MGAS)
				endtidal bal gas	3	209		FRC	3	211					
				meas data status	2	212		meas data status	2	214		meas data status	measured data status bytes	measured data status bytes	meas data status
				checksum	1	214		checksum	1	216					
				<CR>	1	215		<CR>	1	217					

Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

	COM 1.0			COM 1.2				COM 1.3			7900 v4.x, COM1.0	Centiva/5, COM1.3	Aespire View, COM 1.0	Aespire View, COM 1.2	Avance, COM1.2
						216				218					
Meas Data Status Bitmap	Byte1			Byte1				Byte1							
bit-0	new breath/10sec data			new breath/10sec data				new breath/10sec data			new brth/10sec data	new brth/10sec data	new breath/10sec data	new breath/10sec data	new brth/10sec data
bit-1	0			Neb on/off		e		Neb on/off			0	Neb on/off			
bit-2	0			Pre-O2 on/off		e		Pre-O2 on/off			0	PreO2 on/off			
bit-3	0			Suction on/off		e		Suction on/off			0	Suction on/off			
bit-4	0			Post-O2 on/off		e		Post-O2 on/off			0	Post O2 on/off			
bit-5	0			mechanical breath				mechanical breath			0	mechanical breath			
bit-6	1			sigh breath		e		sigh breath			1				
				Byte2				Byte2							
bit-0				triggered SIMV breath				triggered SIMV breath							
bit-1				triggered support brth		e		triggered support brth							
bit-2				x		e		x							
bit-3				x		e		x							
bit-4				x		e		x							
bit-5				x				x							
bit-6				x		e		x							
Status data response	:VTQ	4	0	:VTq	4	0		:VTv	4	0					
	set TV	4	4	set TV	4	4		set TV	4	4	set tidal volume	set tidal volume	set TV	set TV	set TV
	set RR	3	8	set RR	3	8		set RR	3	8	set mech resp rate	set mech resp rate	set RR (VCV, PCV, PCV-VG)	set RR (VCV, PCV, PCV-VG)	set RR
	set I:E (1:xxx.x)	4	11	set I:E (1:xxx.x)	4	11		set I:E (xx.x:xx.x)	6	11	set I:E	set I:E	set I:E	set I:E	set I:E
	set Insp Pause %	2	15	set Insp Pause %	2	15		set Insp Pause %	2	17	set insp pause %	set insp pause %	set Tpause	set Tpause	set Tpause
	set PEEP	2	17	set PEEP	2	17		set PEEP	2	19	set PEEP	set PEEP	set PEEP	set PEEP	set PEEP
	set Peak Pres Limit	3	19	set Plimit	3	19		set Plimit	3	21	set peak pres limit	set peak pres limit	set Pmax	set Pmax	set Pmax
	set Insp. Pres	2	22	set PInsp	2	22		set PInsp	2	24	set insp pres	set insp pres	set PInsp	set PInsp	set PInsp
	set Sust Pres alm	2	24	set Sust Pres alm	2	24		set Sust Pres alm	2	26	set sustain pres alm		set Sust Pres alarm limit	set Sust Pres alarm limit	
	set Hi MV alm	3	26	set Hi MVexp alm	3	26		set Hi MVexp alm	3	28	set high exp MV alm	set high exp MV alm	High MV alarm limit	High MV alarm limit	set high exp MV alm
	set Lo MV alm	3	29	set Lo MVexp alm	3	29		set Lo MVexp alm	3	31	set low MV alm	set low exp MV alm	Low MV alarm limit	Low MV alarm limit	set low exp MV alm
	set Hi Vte alm	3	32	set Hi TVexp alm	4	32		set Hi TVexp alm	4	34	set high expr TV alm		High TV alarm limit	High TV alarm limit	set high expr TV alm
	set Lo Vte alm	3	35	set Lo TVexp alm	4	36		set Lo TVexp alm	4	38	set low expr TV alm		Low TV alarm limit	Low TV alarm limit	set low expr TV alm
	set Hi FiO2 alm	3	38	set Hi FiO2 alm	3	40		set Hi FiO2 alm	3	42	set high insp O2 alm	set high insp O2 alm	High O2 alarm limit	High O2 alarm limit	set high insp O2 alm
	set Lo FiO2 alm	3	41	set Lo FiO2 alm	3	43		set Lo FiO2 alm	3	45	set low insp O2 alm	set low insp O2 alm	Low O2 alarm limit	Low O2 alarm limit	set low insp O2 alm
	vent mode	1	44	set vent mode	1	46		set vent mode	1	48	set ventilation mode	set ventilation mode	Ventilation mode	Ventilation mode	set ventilation mode
	status bytes	12	45	set bias flow	3	47		set bias flow	3	49	status bytes	set bias (bypass) flow	status bytes		
	checksum	1	57	set FiO2	3	50		set FiO2	3	52		set insp O2			set O2 % (fresh gas)
	<CR>	1	58	set Pasb	2	53		set Pasb	2	55		set ASB pres			
			59	set Psupp	2	55		set Psupp	2	57				set Psupport	set Psupport
				set leakage alm	2	57		set leakage alm	2	59		set leakage alm			
				set Pmax	3	59		set Pmax	3	61		set max pres (alm?)			
				set Hi RR alm	3	62		set Hi RR alm	3	64		set high RR alm			set High RR alarm
				set Lo RR alm	3	65		set Lo RR alm	3	67		set low RR alm			set Low RR alarm
				set apnea delay	2	68		set apnea delay	2	70		set apnea delay		set Apnea delay time	set apnea time

Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

	COM 1.0			COM 1.2				COM 1.3			7900 v4.x, COM1.0	Centiva/5, COM1.3	Aespire View, COM 1.0	Aespire View, COM 1.2	Avance, COM1.2
				set ramp	2	70		set ramp	2	72		set ramp			
				set ASB ramp	2	72		set ASB ramp	2	74		set ASB ramp			
				set tube type	1	74		set tube type	1	76		set endo tube type			
				set tube size	2	75		set tube size	2	77		set endo tube size			
				set comp level	3	77		set comp level	3	79		set circuit compliance			
				set patient type	1	80		set patient type	1	82		set patient type			set patient type
				set IBW	3	81		set IBW	3	83		set ideal body weight			
				set BSA	3	84		set BSA	3	86					
				set patient weight	3	87		set patient weight	3	89					set patient weight
				set patient height	3	90		set patient height	3	92					
				set patient ID	10	93		set patient ID	10	95					
				set bed location	5	103		set bed location	5	105					
				set ASB end flow	2	108		set ASB end flow	2	110		set ASB end flow			
				set time window	2	110		set time window	2	112		set time window			
				set Itime %	3	112		set Itime %	3	114					
				set Iflow	2	115		set Iflow	2	117		set insp flow			
				set rise rate	3	117		set rise time	3	119				set Rise Rate	set rise rate
				set PSV rise time	3	120		set PSV rise time	3	122					
				set flow trigger	2	123		set flow trigger	2	125		set flow trigger		set Trigger	set Flow Trig
				set pres trigger	2	125		set pres trigger	2	127					
				set trigger window	2	127		set trigger window	2	129				set Trigger Window	set Trig Window
				set end flow	2	129		set end flow	2	131				set End of Breath	set End of Breath
				set Tinsp	4	131		set Tinsp	4	133				set Tinsp	set Tinsp
				set %Pausetime	2	135		set %Pausetime	2	137					
				set FlowRise	3	137		set FlowRise	3	139					
				set mech RR	2	140		set mech RR	2	142				set mech RR (SIMV/PSV, PSVPro, SIMV-PC)	set mech RR (SIMV)
				set PSV bckup delay	2	142		set PSV bckup delay	2	144				set Backup Mode Active	set Backup Time
				set Hi etCO2 alm	3	144		set Hi etCO2 alm	3	146					set high etCO2 alrm
				set Lo etCO2 alm	3	147		set Lo etCO2 alm	3	149					set low etCO2 alrm
				set Hi FiCO2 alm	3	150		set Hi FiCO2 alm	3	152					set high FiCO2 alrm
				set Hi etAA alm	3	153		set Hi etAA alm	3	155					set high etAA alrm
				set Lo etAA alm	3	156		set Lo etAA alm	3	158					set low etAA alrm
				set Hi FiAA alm	3	159		set Hi FiAA alm	3	161					set high FiAA alrm
				set Lo FiAA alm	3	162		set Lo FiAA alm	3	164					set low FiAA alrm
				set Hi Ppeak alm	3	165		set Hi Ppeak alm	3	167					
				set Lo Ppeak alm	3	168		set Lo Ppeak alm	3	170					
				set FG total flow	4	171		set FG total flow	4	173					set total fresh gas flw
				set bal gas type	1	175		set bal gas type	1	177					set bal gas type
				set FG AA %	3	176		set FG AA %	3	178					
				set AA type	1	179		set AA type	1	181					
				set flow sensor type	1	180		set flow sensor type	1	182				set Flow Sensor type	set flow sensor type
				set circuit type	1	181		set circuit type	1	183				set Circuit type	set circuit type
				set gas control mode	1	182		set gas control mode	1	184				set Gas Control Mode	set gas control mode
				set target FiO2	3	183		set target FiO2	3	185					
				set target FiAA	3	186		set target FiAA	3	188					
				set target etAA	3	189		set target etAA	3	191					

Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

	COM 1.0			COM 1.2				COM 1.3			7900 v4.x, COM1.0	Centiva/5, COM1.3	Aespire View, COM 1.0	Aespire View, COM 1.2	Avance, COM1.2
				set neb volume	4	192		set neb volume	4	194					
				setting data status	1	196		setting data status	1	198				setting data status byte	setting data status
				error/status code	4	197		error/status code	4	199		error/status code		error/status code	
				alarm status bytes	19	201		alarm status bytes	19	203		alarm status bytes		alarm status bytes	alarm status bytes
				checksum	1	220		checksum	1	222				checksum	
				<CR>	1	221		<CR>	1	223					
						222				224					
Setting Data Status bitmap				Byte1				Byte1							
bit-0				new setting/10 sec data				new setting/10 sec data						new setting/10 sec	new setting/10 sec
bit-1				new alarm/10 sec data				new alarm/10 sec data						new alarm/10 sec	new alarm/10 sec
bit-2				x				x							
bit-3				x				x							
bit-4				x				x							
bit-5				x				x							
bit-6				x				x							
Alarm Status Bytes Bitmaps	Byte1			Byte1				Byte1							
bit-0 High O2				High Circuit O2				High Circuit O2			"High O2"		"O2% high"	"O2% high"	"FiO2 high", gas cell, no MGAS
bit-1 Low O2				Low Circuit O2				Low Circuit O2			"Low O2"		"O2% low"	"O2% low"	"FiO2 low", gas cell, no MGAS
bit-2 1				ARC on				ARC on				arc on			
bit-3 1				ASR on				ASR on				asr on			
bit-4 1				No O2 Cell Sensor				No O2 Cell Sensor						"Connect O2 sensor"	
bit-5 Check O2 Sensor				Replace O2 Cell				Replace O2 Cell			"Replace O2 Sensor"	O2 sensor failure	"Replace O2 sensor"	"Replace O2 sensor"	"Replace O2 sensor"
bit-6 O2 Calibration Error				O2 Cell Calibration Error				O2 Cell Calibration Error			"Calibrate O2 Sensor"		"O2 Calibration Error"	"O2 Calibration Error"	"Calibrate O2 sensor"
	Byte2			Byte2				Byte2							
bit-0 High Paw				High Paw				High Paw			"High Paw"	presssure high	"Ppeak high"	"Ppeak high"	"Ppeak high"
bit-1 Low Paw				Low Paw				Low Paw			"Low Paw"	presssure low	"Ppeak low. Leak?"	"Ppeak low. Leak?"	"Ppeak low. Leak?"
bit-2 Sustained Paw (shutdown)				High Paw Sustained				High Paw Sustained			"Sustained Airway Pressure"				
bit-3 Sustained Paw				Sustained Paw				Sustained Paw			"Sustained Paw"	pressure sustained	"PEEP high. Blockage?"	"PEEP high. Blockage?"	"PEEP high. Blockage?"
bit-4 Sub-Atmospheric Paw				Sub-Atmospheric Paw				Sub-Atmospheric Paw			"Paw < -10 cmH2O		"Negative airway pressure"	"Negative airway pressure"	"Negative airway pressure"
bit-5 Pressure Mode Available				Pmax Reached				Pmax Reached							
bit-6 1				Plimit Reached				Plimit Reached				Plimit reached			
	Byte3			Byte3				Byte3							
bit-0 Pinspired Not Achieved				Pinspired Not Achieved				Pinspired Not Achieved							
bit-1 PEEP Not Achieved				PEEP Not Achieved				PEEP Not Achieved			"PEEP Not Achieved"				
bit-2 No Pressure Mode/PEEP				No Pressure Cntrl/PEEP				No Pressure Cntrl/PEEP			"Pres mode not avail"		"Vol vent only. No PEEP or PSV."	"Vol vent only. No PEEP or PSV."	"Vol mode only. No PEEP or PSV"
bit-3 Manifold Pressure Sensor Failure				Circuit Occluded				Circuit Occluded			"Manifold Pressure Sensor Failure", minimum system		"Manifold pressure sensor failure"		
bit-4 Inspiratory Overshoot				MGAS APNEA				MGAS APNEA							MGAS APNEA

Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

	COM 1.0			COM 1.2				COM 1.3			7900 v4.x, COM1.0	Centiva/5, COM1.3	Aespire View, COM 1.0	Aespire View, COM 1.2	Avance, COM1.2
bit-5	Inspiration Stopped			Inspiration Stopped				Inspiration Stopped			"Inspiration Stopped !"		"Inspiration stopped "	"Inspiration stopped "	"Inspiration stopped"
bit-6	High Pressure Limit Reached (min sys)			Other Priority Alarms				Other Priority Alarms			"Pressure Limit Switch Failure", minimum system	Other Priority Alarms	"Pressure limit switch failure"	Other Priority Alarms	Other Priority Alarms
	Byte4			Byte4				Byte4							
bit-0	Low VE			Low VE				Low VE			"Low VE"	MV low	"MVexp low"	"MVexp low"	"MVexp low"
bit-1	High VE			High VE				High VE			"High VE"	MV high	"MVexp high"	"MVexp high"	"MVexp high"
bit-2	Low Vte			Low Vte				Low Vte			"Low VTE"		"TVexp low"	"TVexp low"	"TVexp low"
bit-3	High Vte			High Vte				High Vte			"High VTE"		"TVexp high"	"TVexp high"	"TVexp high"
bit-4	Vt Not Achieved			Vt Not Achieved				Vt Not Achieved			"Vt Not Achieved"	Vt not delivered	"TV not achieved"	"TV not achieved"	"TV not achieved"
bit-5	Volume Apnea			Volume Apnea				Volume Apnea			"Volume Apnea"	apnea	"Apnea"	"Apnea"	"Apnea", volume
bit-6	Volume Apnea > 2 min			Apnea > 2 min				Apnea > 2 min			"Volume Apnea > 2 min"		"Apnea > 120 s"	"Apnea > 120 s"	"Apnea > 120 s", volume or CO2
	Byte5			Byte5				Byte5							
bit-0	No Inspiratory Flow Sensor			No Inspiratory Flow Sensor				No Inspiratory Flow Sensor			"No Insp Flow Sensor"		"No insp flow sensor"	"No insp flow sensor"	"No insp flow sensor"
bit-1	No Expiratory Flow Sensor			No Expiratory Flow Sensor				No Expiratory Flow Sensor			"No Exp Flow Sensor"		"No exp flow sensor"	"No exp flow sensor"	"No exp flow sensor"
bit-2	Inspiratory Reverse Flow			Inspiratory Reverse Flow				Inspiratory Reverse Flow			"Insp Reverse Flow"		"Reverse insp flow"	"Reverse insp flow"	"Reverse insp flow. Check valves OK?"
bit-3	Expiratory Reverse Flow			Expiratory Reverse Flow				Expiratory Reverse Flow			"Exp Reverse Flow"		"Reverse exp flow"	"Reverse exp flow"	"Reverse exp flow. Check valves OK?"
bit-4	Check Flow Sensors			Check Flow Sensors				Check Flow Sensors			"Check Flow Sensors !"		"Check flow sensors"	"Check flow sensors"	"Check flow sensors"
bit-5	Insp Vt/Vte Mismatch			Insp Vt/Vte Mismatch (VTE > Insp VT)				Insp Vt/Vte Mismatch (VTE > Insp VT)			"VTE > Insp VT"	sensor mismatch	"Dry or replace flow sensors"	"Dry or replace flow sensors"	"Volume sensors disagree"
bit-6	Vdel Mismatch			Vdel Mismatch (System Leak)				Vdel Mismatch (System Leak)			"System Leak?" or "Patient Circuit Leak?"		"System leak?"	"System leak?"	"System leak?"
	Byte6			Byte6				Byte6							
bit-0	Bellows Empty			Bellows Empty				Bellows Empty			"Cannot Drive Bellows"		"Unable to drive bellows"	"Unable to drive bellows"	"Unable to drive bellows"
bit-1	Flow Valve Failure			Patient Circuit Leak				Patient Circuit Leak			"Flow Valve (xxx) Failure", xxx = current or DAC, minimum system	leakage	"Flow valve (DAC) failure" and "Flow valve (current) failure"	"Circuit leak"	"Circuit leak"
bit-2	Gas Inlet Valve Failure			Circuit Leak Silenced				Circuit Leak Silenced			"Gas Inlet Valve Failure", shutdown			"Circuit leak audio off"	"Circuit leak silenced"
bit-3	12 Hour Test			12 Hour Test				12 Hour Test			"12 Hour Test !"		"12 hour test recommended"	"12 hour test recommended"	"Turn power Off and On for self tests"
bit-4	Bootup Gas Inlet Valve Failure			No VO2, High FiN2O				No VO2, High FiN2O							
bit-5	No O2 Pressure			No O2 Pressure				No O2 Pressure			"No O2 Pressure"	O2 supply failure	"No O2 pressure"	"No O2 pressure"	"O2 supply pressure low"
bit-6	No Fresh Gas Flow			No Fresh Gas Flow				No Fresh Gas Flow			"Select Gas Outlet"		"Select gas outlet"	"Select gas outlet"	
	Byte7			Byte7				Byte7							
bit-0	+Vanalog Failure			No N2O Pressure				No N2O Pressure							"N2O supply pressure low"
bit-1	-Vanalog Failure			No Air Pressure				No Air Pressure				air supply failure			"Air supply pressure low"

Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

	COM 1.0			COM 1.2				COM 1.3			7900 v4.x, COM1.0	Centiva/5, COM1.3	Aespire View, COM 1.0	Aespire View, COM 1.2	Avance, COM1.2
bit-2	+15V SIB Out-of-Range			Low Drive Gas Pressure				Low Drive Gas Pressure						"Ventilator has no drive gas"	"Ventilator has no drive gas"
bit-3	+15V Manifold Out-of-Range			Low etO2				Low etO2							"EtO2 low"
bit-4	Display Voltage Out-of-Range			High etO2				High etO2					"Display failure"		"EtO2 high"
bit-5	Vaux_ref Out-of-Range			Low FiO2				Low FiO2				O2 concentration low			"FiO2 low"
bit-6	Vext_ref Out-of-Range			High FiO2				High FiO2				O2 concentration high			"FiO2 high"
	Byte8			Byte8				Byte8							
bit-0	A/D Converter Failure			Low RR				Low RR				rate low			"RR low"
bit-1	CPU Failure			High RR				High RR				rate high			"RR high"
bit-2	Memory (EEPROM) Failure			Memory (EEPROM) Failure				Memory (EEPROM) Failure			"Memory (EEPROM) Failure"		"Memory (EEPROM) failure"	"Memory (EEPROM) failure"	"Memory (EEPROM) failure"
bit-3	Memory (flash) Failure			CO2 Apnea				CO2 Apnea							"Apnea", CO2
bit-4	Memory (RAM) Failure			Low etCO2				Low etCO2							"EtCO2 low"
bit-5	Memory (video) Failure			High etCO2				High etCO2							"EtCO2 high"
bit-6	Bootup Memory Failure			High FiCO2				High FiCO2							"FiCO2 high. Absorbent OK?"
	Byte9			Byte9				Byte9							
bit-0	Software Watchdog Failure			Low etAA				Low etAA			"Software Watchdog Failure", shutdown				"EtDES low" "EtENF low" "EtHAL low" "EtISO low" "EtSEV low"
bit-1	Hardware Watchdog Failure			High etAA				High etAA							"EtDES high" "EtENF high" "EtHAL high" "EtISO high" "EtSEV high"
bit-2	Internal Clock Too Fast			Low FiAA				Low FiAA							"FiDES low" "FiENF low" "FiHAL low" "FiISO low" "FiSEV low"
bit-3	Internal Clock Too Slow			High FiAA				High FiAA							"FiDES high" "FiENF high" "FiHAL high" "FiISO high" "FiSEV high"
bit-4	CPU Internal Error			No VO2, Artifact				No VO2, Artifact							
bit-5	Memory (redundant storage) Fail			No VO2, High Bypass Flow				No VO2, High Bypass Flow							
bit-6	Flow Sensor Cal Data Corrupt			Flow Sensor Cal Data Corrupt				Flow Sensor Cal Data Corrupt			"xxx Flow Sensor Fail", xxx = Insp or Exp		"Calibrate flow sensors", "Replace exp flow sensor", "Replace insp flow sensor"	"Calibrate flow sensors", "Replace exp flow sensor", "Replace insp flow sensor"	"Replace xxx flow sensor", xxx = insp or exp
	Byte10			Byte10				Byte10							

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Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

	COM 1.0			COM 1.2				COM 1.3			7900 v4.x, COM1.0	Centiva/5, COM1.3	Aespire View, COM 1.0	Aespire View, COM 1.2	Avance, COM1.2
bit-0	On Battery			On Battery (No AC)				On Battery (No AC)			"On Battery - Power OK?"	line supply fail	"Plug in power cable. On battery."	"Plug in power cable. On battery."	"Plug in power cable. On battery"
bit-1	No Battery			No Battery				No Battery			"Battery Failure Low"	battery failure	"Battery failure low", "Battery circuit failure"	"Battery failure low", "Battery circuit failure"	"No battery backup"
bit-2	Low Battery Charge			Low Battery Charge				Low Battery Charge			"Battery Charging !"		"Battery charging"	"Battery charging"	
bit-3	Low Battery			Low Battery (No AC)				Low Battery (No AC)			"Low Battery Voltage"	battery low	"Low battery voltage"	"Low battery voltage"	"Plug in power cable. On battery" "System shutdown in <x min"
bit-4	Low Battery (shutdown)			MGAS ANE_WARMING_UP				MGAS ANE_WARMING_UP							MGAS ANE_WARMING_UP (5-minute warming up)
bit-5	Battery Voltage Out Of Range			Battery Failure				Battery Failure			"Battery Failure High"		"Battery failure high"	"Battery failure high"	"No battery backup", battery cell shorted or sulfated
bit-6	Battery Current Out Of Range			Battery Charger Failure				Battery Charger Failure			"Battery Current High"		"Battery current high"	"Battery current high"	"No battery backup", current fault
	Byte11			Byte11				Byte11							
bit-0	Circuit Auxiliary			Non Circle Selected				Non Circle Selected			"Aux Gas Outlet On"		"ACGO on"	"ACGO on"	"Vol and Apnea monitoring off", ACGO, SCGO
bit-1	Auxiliary Breathing Circuit			Exp Flow w/ Non Circle				Exp Flow w/ Non Circle							"Check circuit connections", ACGO or SCGO
bit-2	"no confirmation of changed setting"			MGAS WARMING_UP				MGAS WARMING_UP							MGAS WARMING_UP (2-minute warming up)
bit-3	Control Settings Input Has Failed			Control Settings Failure				Control Settings Failure							"Display panel controls failure"
bit-4	Heliox Mode is ON			Heliox Mode is On				Heliox Mode is On			"Heliox Mode is On"		"Heliox mode is on"	"Heliox mode is on"	
bit-5	Backup Volume Mode			Vol Comp Locked				Vol Comp Locked					"Backup mode active"		volume comp locked
bit-6	Mechanical Ventilation On			Mech Ventilation On				Mech Ventilation On			mechanical ventilation on				mechanical ventilation on
	Byte12			Byte12				Byte12							
bit-0	Volume Monitor Active			Volume Monitor Active				Volume Monitor Active			"Vol Alarms On"		"MV TV alarms on"	"MV TV alarms on"	
bit-1	Apnea Detect ON			Apnea Detect ON				Apnea Detect ON			apnea standby = off		"Apnea Detection ON"	"Apnea Detection ON"	apnea detection on
bit-2	Apnea Alarm Silenced			Apnea Alarm Silenced				Apnea Alarm Silenced			"Circuit Leak Audio Off"		"Circuit leak audio off"		
bit-3	Verify Low VE Limit			Verify Low VE Limit				Verify Low VE Limit			"Adjust Low VE Limit"		"Increase low MV limit"	"Increase low MV limit"	"Adjust low MV limit"
bit-4	Alarms Silenced			Alarms Silenced				Alarms Silenced			alarm silence pressed	alarms silenced			
bit-5	1			Standby On				Standby On			1	standby on			Standby On (set when anesthesia system is not in therapy)
bit-6	Service Calibrations Due			Service Calibrations Due				Service Calibrations Due			"Service Calibration !"		"Service calibration"	"Service calibration"	"Service calibration advised"
				Byte13				Byte13							

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Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

	COM 1.0			COM 1.2				COM 1.3			7900 v4.x, COM1.0	Centiva/5, COM1.3	Aespire View, COM 1.0	Aespire View, COM 1.2	Avance, COM1.2
bit-0				Therapy Comp Failure				Therapy Comp Failure							"Internal problem prevents normal operation", anesthesia control board
bit-1				Monitor Comp Failure				Monitor Comp Failure							
bit-2				Display Comp Failure				Display Comp Failure							
bit-3				System Error				System Error				system error			
bit-4				Mixer Failure				Mixer Failure							"Set Alt O2 flow. Check agent setting"
bit-5				Mixer Leak				Mixer Leak							
bit-6				Mixer Control Failure				Mixer Control Failure							
				Byte14				Byte14							
bit-0				Fan Failure				Fan Failure				fan failure			"Cooling fan needs service. System OK"
bit-1				Heater Failure				Heater Failure				heater failure			"Cooling fans failed. May overheat"
bit-2				Power Supply Failure				Power Supply Failure				power pcb fail			"Internal failure. System may shut down"
bit-3				Display Failure				Display Failure				display failure		"Display failure"	
bit-4				Breathing System Fault				Breathing System Fault							
bit-5				Button Failure				Button Failure				button failure			
bit-6				No VO2, FiO2 > 85%				No VO2, FiO2 > 85%							
				Byte15				Byte15							
bit-0				Alternate O2				Alternate O2							alternate O2
bit-1				Air Only				Air Only							air only
bit-2				Vent Failure				Vent Failure						"Manifold pressure sensor failure", "Pressure limit switch failure", "Flow valve (DAC) failure", "Flow valve (current) failure", "Valve power failure"	vent failure
bit-3				Mech Vent Disabled				Mech Vent Disabled						"No insp flow sensor", "No exp flow sensor", "Replace exp flow sensor", "Replace insp flow sensor"	mech vent disabled
bit-4				Sensor Intf Brd Failure				Sensor Intf Brd Failure							
bit-5				ACGO Failure				ACGO Failure							
bit-6				SCGO Failure				SCGO Failure							
				Byte16				Byte16							
bit-0				MGAS Failure				MGAS Failure							"Module fail. No CO2, AA, O2 data"
bit-1				MGAS Outlet Occluded				MGAS Outlet Occluded							"Check sample gas outlet"
bit-2				MGAS Filter Blocked				MGAS Filter Blocked							"Replace D-Fend"

Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

	COM 1.0			COM 1.2				COM 1.3			7900 v4.x, COM1.0	Centiva/5, COM1.3	Aespire View, COM 1.0	Aespire View, COM 1.2	Avance, COM1.2
bit-3				MGAS Smpl Ln Blckd				MGAS Smpl Ln Blckd							"Sample line blocked"
bit-4				MGAS No Sample Line				MGAS No Sample Line							"Check D-Fend"
bit-5				MGAS Replace Trap				MGAS Replace Trap							
bit-6				Module Not Compatible				Module Not Compatible							"Module not compatible"
				Byte17				Byte17							
bit-0				Vap Cassette Failure				Vap Cassette Failure							
bit-1				Vap Cassette Level Low				Vap Cassette Level Low							
bit-2				No Vap Cassette				No Vap Cassette							
bit-3				Vaporizer Failure				Vaporizer Failure							
bit-4				Vaporizer Leak				Vaporizer Leak							
bit-5				Expired Gas Control Suspended				AA Control Failure							
bit-6				Expired Gas Control Exited				AA Delivery Disabled							
				Byte18				Byte18							
bit-0				Audio Failure				Audio Failure							
bit-1				Backup Audio Failure				Backup Audio Failure						"Loss of backup audio"	
bit-2				Patient Detected (Stndby)				Patient Detected (Stndby)							"No fresh gas flow!"
bit-3				High O2 Pressure				High O2 Pressure							
bit-4				High Air Pressure				High Air Pressure							
bit-5				Nebulizer Failure				Nebulizer Failure							
bit-6				No Nebulizer				No Nebulizer							
				Byte19				Byte19							
bit-0				High Temp				High Temp							
bit-1				Paw Cross Check				Paw Cross Check							
bit-2				Patient Disconnected				Patient Disconnected							
bit-3				Backup Mode Active				Backup Mode Active						"Backup mode active"	"Backup Mode active"
bit-4				No Gas Supply				No Gas Supply							
bit-5				VO2 Out of Range				VO2 Out of Range							
bit-6				VCO2 Out of Range				VCO2 Out of Range							
				Calibration Failures ?				Calibration Failures ?							
				Over Range / Under Range ?				Over Range / Under Range ?							

Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

	COM 1.0			COM 1.2				COM 1.3			7900 v4.x, COM1.0	Centiva/5, COM1.3	Aespire View, COM 1.0	Aespire View, COM 1.2	Avance, COM1.2
Test data response				:VTt	4	0		:VTt	4	0					
				date stamp (yyyymmdd)	8	4		date stamp (yyyymmdd)	8	4		current date			current date
				time stamp (hhmm)	4	12		time stamp (hhmm)	4	12		current time (hhmm)			current time (hhmm)
				time stamp (ss)	2	16		time stamp (ss)	2	16					current time (ss)
				leak (auto vent)	4	18		leak (auto vent)	4	18		leak			
				static compliance	3	22		static compliance	3	22		compliance			
				static resistance	3	25		static resistance	3	25		resistance			
				neb flow	3	28		neb flow	3	28		neb flow			
				static PEEPi	3	31		static PEEPi	3	31					
				static PEEPe	3	34		static PEEPe	3	34					
				static Pplat	3	37		static Pplat	3	37					static Pplat (MGAS)
				quick check date (yyyymmdd)	8	40		quick check date (yyyymmdd)	8	40		checkout date			Circuit Check date
				quick check time (hhmm)	4	48		quick check time (hhmm)	4	48		checkout time			Circuit Check time
				vent check date (yyyymmdd)	8	52		vent check date (yyyymmdd)	8	52					System Checkout date
				vent check time (hhmm)	4	60		vent check time (hhmm)	4	60					System Checkout time
				mixer check date (yyyymmdd)	8	64		mixer check date (yyyymmdd)	8	64					Mixer Check date
				mixer check time (hhmm)	4	72		mixer check time (hhmm)	4	72					Mixer Check time
				cmpl check date (yyyymmdd)	8	76		cmpl check date (yyyymmdd)	8	76					Compliance Check date
				cmpl check time (hhmm)	4	84		cmpl check time (hhmm)	4	84					Compliance Check time
				leak check date (yyyymmdd)	8	88		leak check date (yyyymmdd)	8	88					Low P Leak checkout date
				leak check time (hhmm)	4	96		leak check time (hhmm)	4	96					Low P Leak checkout time
				agt del check date (yyyymmdd)	8	100		agt del check date (yyyymmdd)	8	100					
				agt del check time (hhmm)	4	108		agt del check time (hhmm)	4	108					
				checklist date (yyyymmdd)	8	112		checklist date (yyyymmdd)	8	112					
				checklist time (hhmm)	4	120		checklist time (hhmm)	4	120					
				bypass check date (yyyymmdd)	8	124		bypass check date (yyyymmdd)	8	124		bypass checkout date			
				bypass check time (hhmm)	4	132		bypass check time (hhmm)	4	132		bypass checkout time			

Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

	COM 1.0			COM 1.2				COM 1.3			7900 v4.x, COM1.0	Centiva/5, COM1.3	Aespire View, COM 1.0	Aespire View, COM 1.2	Avance, COM1.2
				start of case date (yyyymmdd)	8	136		start of case date (yyyymmdd)	8	136					
				start of case time (hhmm)	4	144		start of case time (hhmm)	4	144					
				end of case date (yyyymmdd)	8	148		end of case date (yyyymmdd)	8	148					
				end of case time (hhmm)	4	156		end of case time (hhmm)	4	156					
				Des consump case	3	160		Des consump case	3	160					Des consump case
				Enf consump case	3	163		Enf consump case	3	163					Enf consump case
				Iso consump case	3	166		Iso consump case	3	166					Iso consump case
				Hal consump case	3	169		Hal consump case	3	169					Hal consump case
				Sevo consump case	3	172		Sevo consump case	3	172					Sevo consump case
				O2 consump case	7	175		O2 consump case	7	175					O2 consump case
				N2O consump case	7	182		N2O consump case	7	182					N2O consump case
				air consump case	7	189		air consump case	7	189					air consump case
				leak (manual bag)	4	196		leak (manual bag)	4	196					
				test status bytes	10	200		test status bytes	10	200		test status bytes			
				checksum	1	210		checksum	1	210					
				<CR>	1	211		<CR>	1	211					
						212				212					
Status Bytes Bitmaps				Byte1				Byte1							
bit-0				O2 sens failure				O2 sens failure				O2 sens failure			
bit-1				O2 valve or sens failure				O2 valve or sens failure				O2 valve or sens failure			
bit-2				O2 offset valve no react				O2 offset valve no react				O2 offset valve no react			
bit-3				O2 valves do not close				O2 valves do not close				O2 valves do not close			
bit-4				O2 2nd valve failure				O2 2nd valve failure				O2 2nd valve failure			
bit-5				O2 valve test failure				O2 valve test failure				O2 valve test failure			
bit-6				Low O2 supply				Low O2 supply				low O2 supply			
				Byte2				Byte2							
bit-0				Air sens failure				Air sens failure				air sens failure			
bit-1				Air valve or sens failure				Air valve or sens failure				air valve or sens failure			
bit-2				Air offset valve no react				Air offset valve no react				air offset valve no react			
bit-3				Air valves do not close				Air valves do not close				air valves do not close			
bit-4				Air 2nd valve failure				Air 2nd valve failure				air 2nd valve failure			
bit-5				Air valve test failure				Air valve test failure				air valve test failure			
bit-6				Low Air supply				Low Air supply				low Air supply			
				Byte3				Byte3							
bit-0				Pres Sens failure				Pres Sens failure				pres sens failure			
bit-1				Pres sens offset failure				Pres sens offset failure				pres sens offset failure			
bit-2				Pres sens malfunction				Pres sens malfunction				pres sens malfunction			

Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

	COM 1.0			COM 1.2				COM 1.3			7900 v4.x, COM1.0	Centiva/5, COM1.3	Aespire View, COM 1.0	Aespire View, COM 1.2	Avance, COM1.2
bit-3				Safety valve does not open				Safety valve does not open				safety valve does not open			
bit-4				No pres increase in system				No pres increase in system				no pres increase in system			
bit-5				leak in cct hi				leak in cct hi				leak in cct hi			
bit-6				Op valve malfunction				Op valve malfunction				op valve malfunction			
				Byte4				Byte4							
bit-0				exp res too hi				exp res too hi				exp res too hi			
bit-1				exp valve contl time too long				exp valve contl time too long				exp valve contl time too long			
bit-2				exp valve data do not match				exp valve data do not match				exp valve data do not match			
bit-3				exp valve <4 malfunction				exp valve <4 malfunction				exp valve <4 malfunction			
bit-4				OVP relief <65 cmH2O				OVP relief <65 cmH2O				OVP relief <65 cmH2O			
bit-5				OVP relief >85 cmH2O				OVP relief >85 cmH2O				OVP relief >85 cmH2O			
bit-6				exp flow sens defective				exp flow sens defective				exp flow sens defective			
				Byte5				Byte5							
bit-0				exp flow offset malf.				exp flow offset malf.				exp flow offset malf.			
bit-1				exp flow offset no react				exp flow offset no react				exp flow offset no react			
bit-2				exp flow lo with Air				exp flow lo with Air				exp flow lo with Air			
bit-3				exp flow hi with Air				exp flow hi with Air				exp flow hi with Air			
bit-4				exp flow hi with O2				exp flow hi with O2				exp flow hi with O2			
bit-5				exp flow lo with O2				exp flow lo with O2				exp flow lo with O2			
bit-6				O2 sens too lo				O2 sens too lo				O2 sens too lo			
				Byte6				Byte6							
bit-0				O2 sens too hi				O2 sens too hi				O2 sens too hi			
bit-1				Insp res too hi				Insp res too hi				Insp res too hi			
bit-2				Insp res out of range				Insp res out of range				Insp res out of range			
bit-3				x				x							
bit-4				x				x							
bit-5				x				x							
bit-6				x				x							
				Byte7				Byte7							
bit-0				Bag/Vent Switch OK				Bag/Vent Switch OK							
bit-1				Gas Supplies OK				Gas Supplies OK							
bit-2				AC Mains Power OK				AC Mains Power OK							
bit-3				Battery Charge OK				Battery Charge OK							
bit-4				Man Circuit Leak OK				Man Circuit Leak OK							
bit-5				Vent Circuit Leak OK				Vent Circuit Leak OK							
bit-6				Flow Controls OK				Flow Controls OK							
				Byte8				Byte8							
bit-0				Low Pres Leak OK				Low Pres Leak OK							

Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

	COM 1.0			COM 1.2				COM 1.3			7900 v4.x, COM1.0	Centiva/5, COM1.3	Aespire View, COM 1.0	Aespire View, COM 1.2	Avance, COM1.2
bit-1				Vent Delivery OK				Vent Delivery OK							
bit-2				SCGO/ACGO OK				SCGO/ACGO OK							
bit-3				Agent Delivery OK				Agent Delivery OK							
bit-4				Circuit O2 Cell Checked				Circuit O2 Cell Checked							
bit-5				Circuit Compliance OK				Circuit Compliance OK							
bit-6				Circuit Resistance OK				Circuit Resistance OK							
				Byte9				Byte9							
bit-0				Paw Sensor OK				Paw Sensor OK							
bit-1				Baro Pressure OK				Baro Pressure OK							
bit-2				Safety Valve OK				Safety Valve OK							
bit-3				Exhalation Valve OK				Exhalation Valve OK							
bit-4				O2 Conc Sensor OK				O2 Conc Sensor OK							
bit-5				O2 Flow Sensor OK				O2 Flow Sensor OK							
bit-6				Air Flow Sensor OK				Air Flow Sensor OK							
				Byte10				Byte10							
bit-0				Exp Flow Sensor OK				Exp Flow Sensor OK							
bit-1				Insp Flow Sensor OK				Insp Flow Sensor OK							
bit-2															
bit-3															
bit-4															
bit-5															
bit-6															
Waveform data response	:VTW	4	0	:VTw	4	0		:VTw	4	0					
	1st waveform block	45	4	1st waveform block	30	4		1st waveform block	30	4	1st waveform block	1st waveform block	1st waveform data type	1st waveform data type	1st waveform block
	2nd waveform block	45	49	2nd waveform block	30	34		2nd waveform block	30	34	2nd waveform block	2nd waveform block	2nd waveform data type	2nd waveform data type	2nd waveform block
	checksum	1	94	3rd waveform block	30	64		3rd waveform block	30	64			checksum	3rd waveform data type	3rd waveform block
	<CR>	1	95	4th waveform block	30	94		4th waveform block	30	94				4th waveform data type	4th waveform block
			96	5th waveform block	30	124		5th waveform block	30	124				5th waveform data type	5th waveform block
				6th waveform block	30	154		6th waveform block	30	154				6th waveform data type	6th waveform block
				breath end/start index	1	184		breath end/start index	1	184				checksum	breath end/start index
				checksum	1	185		checksum	1	185					
				<CR>	1	186		<CR>	1	186					
						187				187					

Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

Aisys, COM1.2	Engström, COM1.3	iVent101 COM1.3	Engström Display on iCentral	DIS	AM internal	AM MGAS	CCM internal	CCM MGAS	Note							
									X: Used with DIS							
software revision	software revision	software revision							T: value is trended							
set language	set language	set language							D: value is displayed							
									E: event to record							
set alarm loudness	set alarm loudness	set alarm loudness							Bold : available in Monitor sw Q1/2004							
set altitude	set altitude								<i>Italic</i> : Used in current N-DISAEST							
set drive gas																
model number	model number	model number		X					Used to identify the device							
serial number	serial number	Board SN														
expired tidal vol	expired tidal vol	Vt Exhale		X	T	D & T	T	D & T								
expired minute vol	expired minute vol	MV Exhale		X	T	D & T	T	D & T	Unsure if it is in N-DISAEST?							
resp rate (m+s)	resp rate (m+s)	Total Rate		X	T		T									
insp O2 (gas cell)	insp O2 (internal)	O2		X	T		T									
peak pressure	peak pressure	Peak Pressure		X	T	D & T	T	D & T								
plateau pressure	plateau pressure			X	T	D & T										
mean pressure	mean pressure			X			T	D & T								
spont expr min vol	spont expr min vol	Mvol spont		X			T	D & T								
spont resp rate	spont resp rate	rate spont		X			T	D & T								
intrinsic PEEP (MGAS)	intrinsic PEEP			X			T	D & T								
compliance (MGAS)	compliance	compliance		X	T	D & T	T	D & T								
airway resistance (MGAS)	airway resistance	Resistance		X	T	D & T	T	D & T								
displayed pres units	displayed pres units	displayed pres units														
displayed flow units	displayed flow units	displayed flow units														
spont expr tidal vol	spont expr tidal vol	kVtExhale		X			T	D & T								
inspired tidal vol	inspired tidal vol	Vt Inhale		X	T	D & T	T	D & T								
inspired minute vol	inspired minute vol	Mvol inhale		X	T	D & T	T	D & T								
	peak auxiliary pres															
	mean auxiliary pres															
	min auxiliary pres															
PEEPe (MGAS) PEEPe+I (Vent)	extrinsic PEEP			X			T	D & T								
PEEPe+i (MGAS)	total PEEP (e+i)	PEEP		X	T	D & T										
				X					Future, is there a need?							
	P0.1			X					Future, is there a need?							
				X					Future, is there a need?							
ambient pres (MGAS)	ambient pres (MGAS)			X					for internal use							

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Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

Aisys, COM1.2	Engström, COM1.3	iVent101 COM1.3	Engström Display on iCentral	DIS	AM internal	AM MGAS	CCM internal	CCM MGAS	Note							
FiO2 (MGAS)	FiO2 (MGAS)			X		D & T		D & T								
etO2 (MGAS)	etO2 (MGAS)			X		D & T		D & T								
FiO2-etO2 (MGAS)	FiO2-etO2 (MGAS)			X		D & T		D & T								
FiCO2 (MGAS)	FiCO2 (MGAS)			X		D & T		D & T								
etCO2 (MGAS)	etCO2 (MGAS)			X		D & T		D & T								
RR from CO2 (MGAS)	RR from CO2 (MGAS)			X		D & T		D & T								
FiAA (MGAS)				X		D & T										
etAA (MGAS)				X		D & T										
AA id (MGAS)				X		E										
FiAA 2nd (MGAS)				X		D & T										
etAA 2nd (MGAS)				X		D & T										
AA id 2nd (MGAS)				X		E										
FiN2O (MGAS)				X		D & T		D & T								
etN2O (MGAS)				X		D & T		D & T								
MAC				X		D & T										
VO2 (MGAS)	VO2 (MGAS)			X		D & T		D & T								
	VO2/m2 (MGAS)			X		D & T		D & T								
VO2/kg (MGAS)	VO2/kg (MGAS)			X		D & T		D & T								
VCO2 (MGAS)	VCO2 (MGAS)			X		D & T		D & T								
energy expnd (MGAS)	energy expnd (MGAS)			X		D & T		D & T								
resp quotient (MGAS)	resp quotient (MGAS)			X		D & T		D & T								
displayed CO2 units	displayed CO2 units															
O2 supply pres	O2 supply pres								Future, is there a need?							
N2O supply pres									Future, is there a need?							
air supply pres	air supply pres								Future, is there a need?							
1st O2 cylinder pres									Future, is there a need?							
2nd O2 cylinder pres									Future, is there a need?							
N2O cylinder pres									Future, is there a need?							
air cylinder pres									Future, is there a need?							
	SpiroD Low Compl			X		E			In ADU flow is used, Case value(=cumulative): event only in the end of the case?							
	SpiroD Mid Compl			X		E			In ADU flow is used, Case value(=cumulative): event only in the end of the case?							
	SpiroD High Compl			X		E			In ADU flow is used, Case value(=cumulative): event only in the end of the case?							
				X		E			In ADU flow is used, Case value(=cumulative): event only in the end of the case?							
				X		E			In ADU flow is used, Case value(=cumulative): event only in the end of the case?							
O2 measured flow				X		E		E	In ADU flow is used, Case value(=cumulative): event only in the end of the case?							
N2O measured flow				X		E		E	In ADU flow is used, Case value(=cumulative): event only in the end of the case?							
air measured flow				X		E		E	In ADU flow is used, Case value(=cumulative): event only in the end of the case?							
airway pres source	airway pres source			X					for internal use							
airway flow source	airway flow source			X					for internal use							
airway O2 source	airway O2 source			X					for internal use							
insp time (MGAS)		InspTime				D & T		D & T								
exp time (MGAS)		ExpTime				D & T		D & T								
I:E (MGAS)		I:E				D & T		D & T								
FRC																
meas data status	meas data status															

Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

Aisys, COM1.2	Engström, COM1.3	iVent101 COM1.3	Engström Display on iCentral	DIS	AM internal	AM MGAS	CCM internal	CCM MGAS	Note							
new brth/10sec data	new brth/10sec data	new brth/10sec data														
	Neb on/off															
		Mandatory assist														
		Assist														
		Spont														
set TV	set tidal volume	Vt		X												
set RR	set RR	Rate		X												
set I:E	set I:E	I:E		X												
set Tpause	set insp pause %			X												
set PEEP	set PEEP	PEEP		X												
set Pmax	set limit pres	Plimit		X												
set Pinsp	set insp pres	Pinsp		X												
set high exp MV alrm	set high exp MV alrm	High Mvol														
set low exp MV alrm	set low exp MV alrm	Low Mvol														
set high expr TV alrm	set high expr TV alrm															
set low expr TV alrm	set low expr TV alrm															
set high insp O2 alrm	set high insp O2 alrm	FiO2High														
set low insp O2 alrm	set low insp O2 alrm	FiO2Low														
set ventilation mode	set ventilation mode			X												
	set bias (bypass) flow			X												
set O2 % (fresh gas)	set insp O2			X												
set Psupport	set support pres			X												
	set max pres	PMax		X												
set high RR alrm	set high RR alrm	High Rate														
set low RR alrm	set low RR alrm	Low Rate														
set apnea delay	set apnea time	Apnea time														

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Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

Aisys, COM1.2	Engström, COM1.3	iVent101 COM1.3	Engström Display on iCentral	DIS	AM internal	AM MGAS	CCM internal	CCM MGAS	Note							
	set endo tube type			X												
	set endo tube size			X												
set patient type	set patient type															
	set patient BSA															
set patient weight	set patient weight															
	set patient height															
				X												
				X												
				X												
set rise rate	set rise time	rise time		X												
	set PSV rise time	rise time		X												
set Flow Trig	set flow trigger	kFTtrigger (unused by iVent)							Future, is there a need?							
	set pressure trigger	kPTtrigger (unused by iVent)							Future, is there a need?							
set Trig Window	set trigger window			X												
set End of Breath	set end flow	Esens		X												
set Tinsp	set inspiration time	Tinsp		X												
				X												
				X												
set mech RR (SIMV)	set mech RR (SIMV)			X												
set Backup Time									Aestiva?							
set high etCO2 alm	set high etCO2 alm															
set low etCO2 alm	set low etCO2 alm															
set high FiCO2 alm																
set high etAA alm																
set low etAA alm																
set high FiAA alm																
set low FiAA alm																
	set Pmax alm	High PIP														
	set low Ppeak alm	Low PIP														
set total fresh gas flw				X												
set bal gas type				X												
set fresh gas AA %				X												
set AA type				X												
set flow sensor type	set flow sensor type								Future, is there a need?							
set circuit type		one limb / dual limb							Future, is there a need?							
set gas control mode				X												
set target FiO2				X												
set target FiAA				X												
set target etAA				X												

Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

Aisys, COM1.2	Engström, COM1.3	iVent101 COM1.3	Engström Display on iCentral	DIS	AM internal	AM MGAS	CCM internal	CCM MGAS	Note							
	set neb volume															
setting data status	setting data status	setting data status														
				X					Is this result of the checkout?							
alarm status bytes	alarm status bytes	alarm status bytes														
new setting/10 sec	new setting/10 sec	new setting/10 sec														
new alarm/10 sec	new alarm/10 sec	new alarm/10 sec														
"FiO2 high", gas cell, no MGAS	"FiO2 high"	"FiO2 high"														
"FiO2 low", gas cell, no MGAS	"FiO2 low"	"FiO2 low"														
	arc on															
		O2 disconnect														
"Replace O2 sensor"	"O2 sensor failure"	"O2 sensor failure"														
"Calibrate O2 sensor"																
"Ppeak high"	"Ppeak high"	"Ppeak high"	Yes													
"Ppeak low. Leak?"	"Ppeak low"	"Ppeak low"	Yes													
"PEEP high. Blockage?"	Sustained Paw		Yes													
"Negative airway pressure"	"Negative airway pressure"		Yes													
	Plimit reached	Plimit reached														
		pat pressure not delivered														
"Vol mode only. No PEEP or PSV"		PEEP Line disconnected														
	Circuit Occluded	Circuit Occluded	Yes													
MGAS APNEA																

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Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

Aisys, COM1.2	Engström, COM1.3	iVent101 COM1.3	Engström Display on iCentral	DIS	AM internal	AM MGAS	CCM internal	CCM MGAS	Note							
"Inspiration stopped"																
Other Priority Alarms	Other Priority Alarms															
"MVexp low"	"MVexp low"		Yes													
"MVexp high"	"MVexp high"		Yes													
"TVexp low"	"TVexp low"		Yes													
"TVexp high"	"TVexp high"		Yes													
"TV not achieved"	"TV not achieved"	volume not delivered	Yes													
"Apnea", volume	"Apnea"		Yes													
"Apnea > 120 s", volume or CO2		"Apnea"														
"No insp flow sensor"																
"No exp flow sensor"	"No exp flow sensor"															
"Reverse insp flow. Check valves OK?"																
"Reverse exp flow. Check valves OK?"																
"Check flow sensors"																
"Volume sensors disagree"																
"System leak?"																
"Unable to drive bellows"																
"Circuit leak"	"Circuit leak"		Yes													
"Circuit leak silenced"																
"Turn power Off and On for self tests"																
"O2 supply pressure low"	"O2 supply pressure low"	"Low O2 pressure"	Yes													
"N2O supply pressure low"																
"Air supply pressure low"	"Air supply pressure low"		Yes													

Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

Aisys, COM1.2	Engström, COM1.3	iVent101 COM1.3	Engström Display on iCentral	DIS	AM internal	AM MGAS	CCM internal	CCM MGAS	Note							
"Ventilator has no drive gas"																
"EtO2 low"	"EtO2 low"		Yes													
"EtO2 high"	"EtO2 high"		Yes													
"FiO2 low"	"FiO2 low"	"FiO2 low"	Yes													
"FiO2 high"	"FiO2 high"	"FiO2 high"	Yes													
"RR low"	"RR low"	"Low Rate"	Yes													
"RR high"	"RR high"	"High Rate"	Yes													
"Memory (EEPROM) failure"																
"Apnea", CO2																
"EtCO2 low"	"EtCO2 low"		Yes													
"EtCO2 high"	"EtCO2 high"		Yes													
"FiCO2 high. Absorbent OK?"																
"EtDES low" "EtENF low" "EtHAL low" "EtISO low" "EtSEV low"																
"EtDES high" "EtENF high" "EtHAL high" "EtISO high" "EtSEV high"																
"FiDES low" "FiENF low" "FiHAL low" "FiISO low" "FiSEV low"																
"FiDES high" "FiENF high" "FiHAL high" "FiISO high" "FiSEV high"																
	"Mgas Artifact"															
	"Mgas bypass flow high"															
"Replace xxx flow sensor", xxx = insp or exp																

Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

Aisys, COM1.2	Engström, COM1.3	iVent101 COM1.3	Engström Display on iCentral	DIS	AM internal	AM MGAS	CCM internal	CCM MGAS	Note							
"Plug in power cable. On battery"	"On battery"	"AC power disconnect"	Yes - Applies to all Battery times													
"No battery backup"	"No battery backup"	"Integrated battery failure"														
"Plug in power cable. On battery" "System shutdown in <x min"	"System shutdown in <10 min" or "System shutdown in <1 min"	"Low Battery"														
MGAS ANE_WARMING_UP (5-minute warming up)																
"No battery backup", battery cell shorted or sulfated	"No battery backup"	"Integrated battery failure"														
"No battery backup", current fault	"No battery backup"															
"Vol and Apnea monitoring off", ACGO, SCGO																
"Check circuit connections", ACGO or SCGO																
MGAS WARMING_UP (2-minute warming up)	MGAS WARMING_UP (2-minute warming up)	MGAS WARMING_UP (2-minute warming up)														
"Display panel controls failure"	"Controls frozen. Need service."	"Controls frozen. Need service."														
volume comp locked																
mechanical ventilation on																
apnea detection on																
"Adjust low MV limit"																
	Alarms Silenced	Alarms Silenced														
Standby On (set when anesthesia system is not in therapy)	Standby On (Applies when vent is placed in standby)	"Standby status"	Yes - Applies when vent is placed in standby													
"Service calibration advised"	Service Calibration Due	"Sensor calibration required"														

Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

Aisys, COM1.2	Engström, COM1.3	iVent101 COM1.3	Engström Display on iCentral	DIS	AM internal	AM MGAS	CCM internal	CCM MGAS	Note							
"Internal problem prevents normal operation", anesthesia control board	Therapy Comp Failure															
	Monitor Comp Failure															
	Display Comp Failure															
"Set Alt O2 flow! Check agent setting!" "Set Alt O2 flow! Agent delivery off!"																
"Cooling fan needs service. System OK" "Cooling fans failed. May overheat"	"Fans require service"	"Fans failure"														
"Internal failure. System may shut down"																
	"No VO2, FiO2>85%"															
alternate O2																
air only																
vent failure		"Waiting to Vent to connect"														
mech vent disabled																
"Module fail. No CO2, AA, O2 data"	"Module fail. No CO2, O2 data."															
"Check sample gas outlet"	"Check sample gas out"															
"Replace D-Fend"	"Replace D-fend"															

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Aisys, COM1.2	Engström, COM1.3	iVent101 COM1.3	Engström Display on iCentral	DIS	AM internal	AM MGAS	CCM internal	CCM MGAS	Note							
"Sample line blocked"	"Sample line blocked"															
"Check D-Fend"	"Check D-fend"															
"Module not compatible"	"Module not compatible"															
vap cassette failure																
"Cassette almost empty"																
"Insert Cassette" when cassette pulled during use																
vaporizer failure																
Expired Gas Control Suspended																
Expired Gas Control Exited																
	"Alarm confirm failure"															
	"Backup audio failure"															
"No fresh gas flow!"	"Patient connected?"		Yes													
	"O2 supply pressure high"															
	"Air supply pressure high"															
	"Connect nebulizer"															
	"Air temp high" or "Temp high. Shutdown possible"	"High Temprature"														
	"Pressure sensor failure"		Yes													
	"Patient disconnected"	"Patient disconnected"	Yes													
"Backup Mode active"	"Backup mode active"	"Open loop"	Yes													
	"No gas supply pressure"		Yes													
	"Out of range"															
	"Out of range"															

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Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

Aisys, COM1.2	Engström, COM1.3	iVent101 COM1.3	Engström Display on iCentral	DIS	AM internal	AM MGAS	CCM internal	CCM MGAS	Note							
current date	current date	current date														
current time (hhmm)	current time (hhmm)	current time (hhmm)														
current time (ss)	current time (ss)	current time (ss)														
	static compliance (MGAS)			X		D & T		D & T								
	static intrinsic PEEP (MGAS)			X		D & T		D & T								
	static extrinsic PEEP (MGAS)			X		D & T		D & T								
static Pplat (MGAS)	static Pplat (MGAS)			X		D & T		D & T								
Circuit Check date																
Circuit Check time																
System Checkout date	vent checkout date															
System Checkout time	vent checkout time															
Mixer Check date																
Mixer Check time																
Compliance Check date																
Compliance Check time																
Low P Leak checkout date																
Low P Leak checkout time																
agt del checkout data																
agt del checkout time																

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	COM 1.5				Engström, COM1.5	Engström Display on iCentral	DIS	AM internal	AM MGAS	CCM internal	CCM MGAS
		# bytes	Pos	applies to:							
Setup data response	:VTx	4	0								
	soft rev	4	4		software revision		X				
	language	1	8		set language		X				
	alarm loudness	1	9		set alarm loudness		X				
	altitude setting	2	10		set altitude		X				
	altitude unit	1	12		set altitude unit		X				
	model number	1	13		model number		X				
	serial number	13	14		serial number		X				
	reserved	6	27		reserved						
	checksum	1	33								
	<CR>	1	34								
			35								
Measured data response	:VTf	4	0								
	Ppeak	3	4		peak pressure		X			T	D & T
	Dynamic PEEPe	3	7		dynamic PEEPe		X			T	D & T
	Pmean	3	10		mean pressure		X			T	D & T
	Pplat	3	13		plateau pressure		X				
	Leak	3	16		circuit leak		X				
	MVexp	4	19		expired minute volume		X			T	D & T
	TVexp	5	23		expirted tidal volume		X			T	D & T
	RR total	3	28		RR total		X			T	
	FiO2	3	31		FiO2 (internal)		X			T	
	MVexp spont	4	34		MVexp spont		X			T	D & T
	TVexp spont	5	38		TVexp spont		X			T	D & T
	RR spont	3	43		RR spont		X			T	D & T
	RSBI	3	46		RSBI		X				
	MVexp mech	4	49		MVexp mech		X				
	TVexp mech	5	53		TVexp mech		X				
	RR mech	3	58	e+a	RR mech		X				
	Paux Peak	3	61		peak auxiliary pres		X				
	Paux Mean	3	64		mean auxiliary pres		X				
	Paux Min	3	67	e	min auxiliary pres		X				
	etCO2	3	70	e	etCO2		X				D & T
	etO2	3	73	e	etO2		X				D & T
	FiO2 (MGAS)	3	76	e+a	FiO2 (MGAS)		X				D & T
	FiO2 - EtO2	4	79	e	FiO2 - EtO2		X				D & T
	dynamic compliance	4	83	e	dynamic compliance		X			T	D & T
	Raw	3	87		airway resistance		X			T	D & T
	static compliance	4	90		static compliance		X				
	static Pplat	3	94		static Pplat		X				
	static PEEPe	3	97	e+a	static PEEPe		X				
	static PEEPi	3	100	e+a	static PEEPi		X				
	PEEPe+I	3	103		PEEPe+I		X				

Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

	COM 1.5				Engström, COM1.5	Engström Display on iCentral	DIS	AM internal	AM MGAS	CCM internal	CCM MGAS
	EE	4	106	e+a	energy expnd (MGAS)		X				D & T
	RQ	3	110	e+a	resp quotient (MGAS)		X				D & T
	VO2	3	113	a	VCO2 (MGAS)		X				D & T
	VCO2	3	116	a	VCO2 (MGAS)		X				D & T
	VO2/m2	4	119	a	VO2/m2 (MGAS)		X				D & T
	VCO2/m2	4	123	a	VCO2/m2 (MGAS)		X				
	VO2/kg	4	127	a	VO2/kg (MGAS)		X				D & T
	VCO2/kg	4	131	a	VCO2/kg (MGAS)		X				
	TVexp/wt	3	135	a	TVexp/wt		X				
	MVexp/wt	4	138		MVexp/wt		X				
	dynamic PEEPi	3	142		dynamic PEEPi		X				
	pressure units	1	145	a	pressure units		X				
	flow units	1	146	e	flow units		X				
	CO2 units	1	147	e	co2 units		X				
	gas supply units	1	148	e	gas supply units		X				
	EE units	1	149	e	energy expend units		X				
	O2 supply pressure	3	150	e	O2 supply pressure		X				
	air supply pressure	3	153	e	air supply pressure		X				
	Paw source	1	156	e+a	airway pressure source		X				
	flow source	1	157		airway flow source		X				
	volume source	1	158		volume source		X				
	O2 source	1	159		airway O2 source		X				
	ambient pressure	3	160		ambient pressure		X				
	RRCO2	3	163		CO2 total resp rate		X				D & T
	Tvinsp	5	166		inspired TV		X				
	Mvinsp	4	171		inspired MV		X				
	I:E (xxx.x:xxx.x)	8	175		I:E ratio		X				D & T
	meas data status	1	183		meas data status		X				
	reserved	20	184								
	checksum	1	204								
	<CR>	1	205								
			206								
Meas Data Status Bitmap	Byte1										
bit-0	new breath/10sec data				new brth/10sec data						
bit-1	mechanical breath				mech/non-mech breath						
bit-2	ctrl triggered breath				ctrl triggered/non-ctrl triggered breath						
bit-3	PSV triggered breath				PSV triggered/non-PSV triggered breath						
bit-4	reserved			e							
bit-5	reserved										
bit-6	reserved			e							
Status data response	:VTg	4	0								

Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

	COM 1.5				Engström, COM1.5	Engström Display on iCentral	DIS	AM internal	AM MGAS	CCM internal	CCM MGAS
	set vent mode	1	4		set vent mode		X				
	set TV	5	5		set TV		X				
	set PEEP	2	10		set PEEP		X				
	set Tinsp	4	12		set insp time		X				
	set Pinsp	2	16		set insp pressure		X				
	set Psupp	2	18		set support pressure		X				
	set Plimit	3	20		set peak pressure limit		X				
	set RR	3	23		set resp rate		X				
	set mech RR	3	26		set mech resp rate		X				
	set insp pause	2	29		set inspiratory pause		X				
	set I:E (xxx.x:xxx.x)	8	31		set I:E ratio		X				
	set trigger window	2	39		set trigger window		X				
	set flow trigger	3	41		set flow trigger		X				
	set end flow	2	44		set end flow		X				
	set bias flow	3	46		set bias (bypass) flow		X				
	set pressure rise time	3	49		set pressure rise time		X				
	set flow rise time	3	52		set flow rise time		X				
	set pressure trigger	4	55		set pressure trigger		X				
	set Pmax	3	59		set maximum pressure		X				
	set PSV rise time	3	62		set PSV rise time		X				
	set flow	4	65		set flow		X				
	set vent assist control	1	69		set vent assist control		X				
	set pause time	4	70		set pause time		X				
	set FiO2	3	74		set FiO2		X				
	set Phigh	2	77		set Phigh		X				
	set Plow	2	79		set Plow		X				
	set Thigh	4	81		set time high		X				
	set Tlow	4	85		set time low		X				
	set Tsupp	3	89		set support time		X				
	set high MVexp limit	4	92		set high MVexp limit		X				
	set low MVexp limit	4	96		set low MVexp limit		X				
	set high TVexp limit	5	100		set high TVexp limit		X				
	set low TVexp limit	5	105		set low TVexp limit		X				
	set high FiO2 limit	3	110		set high FiO2 limit		X				
	set low FiO2 limit	2	113		set low FiO2 limit		X				
	set high RR limit	3	115		set high RR limit		X				
	set low RR limit	3	118		set low RR limit		X				
	set high EtCO2 limit	3	121		set high EtCO2 limit		X				
	set low EtCO2 limit	3	124		set low EtCO2 limit		X				
	set high Ppeak limit	3	127		set high Ppeak limit		X				
	set low Ppeak limit	2	130		set low Ppeak limit		X				
	set high EtO2 limit	3	132		set high EtO2 limit		X				
	set low EtO2 limit	2	135		set low EtO2 limit		X				
	set high PEEPe limit	2	137		set high PEEPe limit		X				
	set low PEEPe limit	2	139		set low PEEPe limit		X				
	set high PEEPi limit	2	141		set high PEEPi limit		X				

Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

	COM 1.5				Engström, COM1.5	Engström Display on iCentral	DIS	AM internal	AM MGAS	CCM internal	CCM MGAS
	set high Paux limit	3	143		set high Paux limit		X				
	set apnea delay time	2	146		set apnea delay time		X				
	set circuit leak limit	2	148		set circuit leak limit		X				
	set disconnect time	2	150		set disconnect time		X				
	set patient effort time	3	152		set patient effort time		X				
	set tube type	1	155		set tube type		X				
	set tube size	3	156		set tube size		X				
	set ARC level	3	159		set ARC level		X				
	set patient type	1	162		set patient type		X				
	set BSA	3	163		set BSA		X				
	set patient height	3	166		set patient height		X				
	set patient weight	4	169		set patient weight		X				
	set weight units	1	173		set weight units		X				
	set height units	1	174		set height units		X				
	set patient ID	10	175		set patient ID		X				
	set flow sensor type	1	185		set flow sensor type		X				
	set nebulizer time	2	186		set nebulizer time		X				
	set nebulizer volume	2	188		set nebulizer volume		X				
	set nebulizer pause time	4	190		set nebulizer pause time		X				
	set nebulizer cycles	2	194		set nebulizer cycles		X				
	setting data status	1	196		settind data status		X				
	reserved	20	197								
	checksum	1	217								
	<CR>	1	218								
			219								
Setting Data Status bitmap	Byte1										
bit-0	new setting/10 sec data				new setting/10 sec						
bit-1	x										
bit-2	x										
bit-3	x										
bit-4	x										
bit-5	x										
bit-6	x										
Status data response	:Vta	4	0								
	alarm status bytes	19	4								
	checksum	1	23								
	<CR>	1	24								
			25								
Alarm Status Bytes Bitmaps	Byte1										
bit-0	Backup Buzzer POST				"Backup audio failure"						
bit-1	Patient Connected				"Patient connected?"						
bit-2	No Battery Backup				"No Battery Backup"						
bit-3	Temp High				"Air temp high"						

Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

	COM 1.5				Engström, COM1.5	Engström Display on iCentral	DIS	AM internal	AM MGAS	CCM internal	CCM MGAS
bit-4	Primary Audio Failure				"Primary Audio Failure"						
bit-5	reserved				"O2 sensor failure"						
bit-6	reserved										
	Byte2										
bit-0	Exp Flow Sensor Error				"Exp flow sensor error"						
bit-1	Neo Flow Sensor Error				"Neo flow sensor error"						
bit-2	Neo Flow Sensor Reversed				"Neo flow sensor reversed"						
bit-3	Neo Flow Sensor Contaminated				"Clean neo flow sensor"						
bit-4	Replace Neo Flow Sensor				"Replace ne flow sensor"						
bit-5	Neo Flow Sensor Off				"Neo flow sensor off"						
bit-6	reserved										
	Byte3										
bit-0	Negative Airway Pressure				"Negative airway pressure"						
bit-1	No Exp Flow Sensor				"No exp flow sensor"						
bit-2	No Neo Flow Sensor				"No neo flow sensor"						
bit-3	Exp Flow Sensor Failure				"Exp flow sensor error"						
bit-4	O2 Sensor Failure				"O2 sensor error"						
bit-5	reserved										
bit-6	reserved										
	Byte4										
bit-0	Air Supply Pressure High				"Air supply pressure high"						
bit-1	Air Supply Pressure Low				"Air supply pressure low"						
bit-2	O2 Supply Pressure High				"O2 supply pressure high"						
bit-3	O2 Supply Pressure Low				"O2 supply pressure low"						
bit-4	No Gas Supply Pressure				"No gas supply pressure"						
bit-5	Pair Sensor Out of Range				"Pair sensor out of range"						
bit-6	PO2 Sensor Out of Range				"P02 sensor out of range"						
	Byte5										
bit-0	Pinsp Sensor Out of Range				"Pinsp sensor out of range"						
bit-1	Pexp Sensor Out of Range				"Pexp sensor out of range"						
bit-2	Paux Sensor Out of Range				"Paux sensor out of range"						
bit-3	reserved										
bit-4	reserved										
bit-5	reserved										
bit-6	reserved										
	Byte6										
bit-0	FiO2 Control Error				"FiO2 control error"						
bit-1	Volume Delivery Error				"Volume delivery error"						
bit-2	Air Temp Sensor Error				"Air temp sensor error"						
bit-3	O2 Temp Sensor Error				"O2 temp sensor error"						
bit-4	Mixed Gas Temp Sensor Error				"Mixed gas temp sensor error"						

Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

	COM 1.5				Engström, COM1.5	Engström Display on iCentral	DIS	AM internal	AM MGAS	CCM internal	CCM MGAS
bit-5	reserved										
bit-6	reserved										
	Byte7										
bit-0	Modlue Not Compatible				"Module not compatible"						
bit-1	Check Sample Gas Out				"Check sample gas out"						
bit-2	Replace D-Fend				"Replace D-fend"						
bit-3	Sample Line Blocked				"Sample line blocked"						
bit-4	Check D-Fend				"Check D-Fend"						
bit-5	reserved										
bit-6	reserved										
	Byte8										
bit-0	MGAS Failure				"Module fail. No CO2, O2 data"						
bit-1	No D-Lite Sensor				"No D-lite sensor?"						
bit-2	Front Panel Comm Failure				"Controls frozen. Need service."						
bit-3	Pressure Sensor Failure				"Pressure sensor failure"						
bit-4	Nebulizer Not Connected				"Connect nebulizer"						
bit-5	reserved										
bit-6	reserved										
	Byte9										
bit-0	On Battery				"On battery"						
bit-1	Low Internal Battery - 20 min				"System shutdown in < 20 min"						
bit-2	Low Internal Battery - 10 min				"System shutdown in < 10 min"						
bit-3	Low Internal Battery - 5 min				"System shutdown in < 5 min"						
bit-4	Low Internal Battery - 1 min				"System shutdown in < 1 min"						
bit-5	No Battery				"No battery backup"						
bit-6	reserved										
	Byte10										
bit-0	Fan Fail				"Fans require service"						
bit-1	Relief Valve Failure				"Relief valve failure"						
bit-2	Backup Mode Active				"Backup mode active"						
bit-3	SBT < 2 min				"SBT ends < 2 min"						
bit-4	reserved										
bit-5	reserved										
bit-6	reserved										
	Byte11										
bit-0	Cannot Calculate FRC				"Cannot calculate FRC"						
bit-1	Missed Scheduled FRC				"Missed scheduled FRC"						
bit-2	FRC Series Stopped				"FRC series stopped"						
bit-3	Display Fans Failed				"Display fans failed"						
bit-4	reserved										
bit-5	reserved										

Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

	COM 1.5				Engström, COM1.5	Engström Display on iCentral	DIS	AM internal	AM MGAS	CCM internal	CCM MGAS
bit-6	reserved										
	Byte12										
bit-0	Ppeak High				"Ppeak high"						
bit-1	Relief Valve Opened				"Relief valve opened"						
bit-2	Ppeak Low				"Ppeak low"						
bit-3	Sustained Paw				"Sustained Paw"						
bit-4	Breathing Circuit Occlusion				"Breathing circuit occlusion"						
bit-5	Circuit Leak				"Circuit leak?"						
bit-6	Circuit Leak Off				"Circuit leak alarm off"						
	Byte13										
bit-0	Patient Connection Leak				"Patient connection leak?"						
bit-1	Apnea				"Apnea"						
bit-2	Apnea Alarm Off				"Apnea alarm off"						
bit-3	MVexp Low				"MVexp low"						
bit-4	MVexp High				"MVexp high"						
bit-5	MVexp Low Alarm Off				"MVexp low alarm off"						
bit-6	No Patient Effort				"No patient effort"						
	Byte14										
bit-0	RR Low				"RR low"						
bit-1	RR High				"RR high"						
bit-2	FiO2 Low				"FiO2 low"						
bit-3	FiO2 High				"FiO2 high"						
bit-4	TVexp Low				"TVexp low"						
bit-5	TVexp High				"TVexp high"						
bit-6	TV Not Achieved				"TV not achieved"						
	Byte15										
bit-0	EtO2 Low				"EtO2 low"						
bit-1	EtO2 High				"EtO2 high"						
bit-2	EtCO2 Low				"EtCO2 low"						
bit-3	EtCO2 High				"EtCO2 high"						
bit-4	Patient Disconnected				"Patient disconnected"						
bit-5	reserved										
bit-6	reserved										
	Byte16										
bit-0	PEEPe High				"PEEPe high"						
bit-1	PEEPe Low				"PEEPee low"						
bit-2	PEEPi High				"PEEPi high"						
bit-3	Paux High				"Paux high"						
bit-4	Plimit Reached				"Plimit reached"						
bit-5	Unable to Deliver TV				"Unable to Deliver TV"						
bit-6	reserved										

Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

	COM 1.5				Engström, COM1.5	Engström Display on iCentral	DIS	AM internal	AM MGAS	CCM internal	CCM MGAS
	Byte17										
bit-0	VO2 Out of Range				"Out of range"						
bit-1	VCO2 Out of Range				"Out of range"						
bit-2	CO2 Over Range				"Over range"						
bit-3	O2 Over Range				"Over range"						
bit-4	NO VO2, FiO2 > 85%				"No VO2, FiO2>85%"						
bit-5	Artifact				"Artifact"						
bit-6	Bias Flow High				"Bias flow high"						
	Byte18										
bit-0	MGAS Warming Up - 2 min				"Module warming up"						
bit-1	MGAS Warming Up - 5 min				"Module warming up"						
bit-2	reserved										
bit-3	reserved										
bit-4	reserved										
bit-5	reserved										
bit-6	reserved										
	Byte19										
bit-0	reserved										
bit-1	reserved										
bit-2	reserved										
bit-3	reserved										
bit-4	reserved										
bit-5	Alarms Silenced										
bit-6	New Breath/10 second data										
Waveform data response	:VTw	4	0								
	1st waveform block	30	4		1st waveform block		X				pressure
	2nd waveform block	30	34		2nd waveform block		X				flow
	3rd waveform block	30	64		3rd waveform block		X				volume
	4th waveform block	30	94		4th waveform block		X				CO2
	5th waveform block	30	124		5th waveform block		X				O2
	6th waveform block	30	154		6th waveform block		X				
	breath end/start index	1	184		breath end/start index		X				
	checksum	1	185								
	<CR>	1	186								
			187								
Spiro Dynamics data response	:VTh	4	0								
	paux waveform data	30	4		paux waveform data		X				
	volume waveform data	30	34		volume waveform data		X				

Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

	COM 1.5				Engström, COM1.5	Engström Display on iCentral	DIS	AM internal	AM MGAS	CCM internal	CCM MGAS
	end of breath index	1	64		end of breath index		X				
	sequence number	3	65		sequence number		X				
	checksum	1	68								
	<CR>	1	69								
			70								
Dynostatic Curve data response	:VTk	4	0								
	paux curve data	120	4		paux curve data		X				
	volume curve data	120	124		volume curve data		X				
	low compliance	3	244		low compliance		X				
	mid compliance	3	247		mid compliance		X				
	high compliance	3	250		high compliance		X				
	sequence number	3	253		sequence number		X				
	reserved	10	256								
	checksum	1	266								
	<CR>	1	267								
			268								
Checkout data response	:VTr	4	0								
	last checkout date stamp (yyyymmdd)	8	4		last checkout data (yyyymmdd)		X				
	last checkout time stamp (hhmm)	6	12		last checkout time (hhmmss)		X				
	breathing circuit leak	4	18		breathing circuit leak		X				
	breathing circuit compliance	4	22		breathing circuit compliance		X				
	breathing circuit resistance	4	26		breathing circuit resistance		X				
	checkout verdict	1	30		checkout verdict		X				
	reserved	8	31								
	checksum	1	39								
	<CR>	1	40								
			41								
System data response	:VTs	4	0								
	current date (yyyymmdd)	8	4		current date (yyyymmdd)		X				
	current time (hhmmss)	6	12		current time (hhmmss)		X				
	system state	1	18		system state		X				
	reserved	8	19								
	checksum	1	27								
	<CR>	1	28								
			29								

Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

	COM 1.5				Engström, COM1.5	Engström Display on iCentral	DIS	AM internal	AM MGAS	CCM internal	CCM MGAS
Procedures status data response	:VTp	4	0								
	procedure status bytes	3	4		procedure status bytes		X				
	PEEPi	3	7		PEEPi		X				
	PEEPi Volume	3	10		PEEPi Volume		X				
	P0.1	2	13		P0.1		X				
	vital capacity	3	15		vital capacity		X				
	negative inspiratory force	3	18		negative inspiatory force		X				
	FRC	4	21		FRC		X				
	reserved	8	25								
	checksum	1	33								
	<CR>	1	34								
			35								
Procedures Status Bytes Bitmaps	Byte1										
	bit-0 nebulizer on/off										
	bit-1 pre-oxygenate on/off										
	bit-2 suction on/off										
	bit-3 post-oxygenate on/off										
	bit-4 intrinsic PEEP on/off										
	bit-5 inspiratory hold on/off										
	bit-6 expiratory hold on/off										
	Byte2										
	bit-0 SBT on/off										
	bit-1 oxygenation on/off										
	bit-2 P0.1 on/off										
	bit-3 negative inspiratory force on/off										
	bit-4 vital capacity on/off										
	bit-5 FRC on/off										
	bit-6 PEEP Inview on/off										
	Byte3										
	bit-0 Lung Inview on/off										
	bit-1 reserved										
	bit-2 reserved										
	bit-3 reserved										
	bit-4 reserved										
	bit-5 reserved										
	bit-6 new measurement/10 sec data										
Data Transfer Configuration response	:VTz	4	0								

Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

	COM 1.5				Engström, COM1.5	Engström Display on iCentral	DIS	AM internal	AM MGAS	CCM internal	CCM MGAS
	data to transfer	1	4		data to transfer		X				
	time period	1	5		time period		X				
	sample interval	1	6		sample interval		X				
	waveforms on/off	1	7		waveforms on/off		X				
	patients	1	8		patients		X				
	transfer media	1	9		transfer media		X				
	reserved	10	10								
	checksum	1	20								
	<CR>	1	21								
			22								
Data Transfer Configuration response	:VTz	4	0								
	checksum	1	4								
	<CR>	1	5								
			6								

Note

T: value is trended

Bold: available in Monitor sw Q1/2004

Used to identify the device

Note

[illegible]

Note

[illegible]

Note

[illegible]

Note

This image shows a full page of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There is no handwriting or other markings on the paper.

Note

17 of 22

Note

[illegible]

Note

for internal use

Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

[illegible]

Note

[illegible]

Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

Note

Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

	COM 1.0			COM 1.2				COM 1.3			7900 v4.x, COM1.0	Centiva/5, COM1.3	Aespire View, COM 1.0	Aespire View, COM 1.2	Avance, COM1.2	Aisys, COM1.2	Engström, COM1.3	iVent101, COM1.3
		# bytes	Pos		# bytes	Pos			# bytes	Pos								
Select Datex-Ohmeda communications protocol command				<ESC>VTO	4	0		<ESC>VTO	4	0								
				protocol number	2	4		protocol number	2	4		protocol number	protocol version	protocol version	protocol number	protocol number	protocol number	protocol number
				checksum	1	6		checksum	1	6			checksum	checksum				
				<CR>	1	7		<CR>	1	7								
						8				8								
Send waveform data command	<ESC>VTW	4	0	<ESC>VTw	4	0		<ESC>VTw	4	0								
	waveform 1	1	4	waveform 1	1	4		waveform 1	1	4	waveform 1		waveform 1	waveform 1	waveform 1	waveform 1	waveform 1	waveform 1
	waveform 2	1	5	waveform 2	1	5		waveform 2	1	5	waveform 2		waveform 2	waveform 2	waveform 2	waveform 2	waveform 2	waveform 2
	checksum	1	6	waveform 3	1	6		waveform 3	1	6			waveform 3	waveform 3	waveform 3	waveform 3	waveform 3	waveform 3
	<CR>	1	7	waveform 4	1	7		waveform 4	1	7				waveform 4	waveform 4	waveform 4	waveform 4	waveform 4
			8	waveform 5	1	8		waveform 5	1	8				waveform 5	waveform 5	waveform 5	waveform 5	waveform 5
				waveform 6	1	9		waveform 6	1	9				waveform 6	waveform 6	waveform 6	waveform 6	waveform 6
				checksum	1	10		checksum	1	10								
				<CR>	1	11		<CR>	1	11								
						12				12								
Gas composition input command	<ESC>VT%	4	0															
	inspired O2%	3	4								inspired O2%							
	expired O2%	3	7								expired O2%							
	inspired CO2%	3	10								inspired CO2%							
	expired CO2%	3	13								expired CO2%							
	N2O%	3	16								N2O%							
	anesth agent type	1	19								anesth agent type							
	inspired AA%	3	20								inspired AA%							
	expired AA%	3	23								expired AA%							
	baro pressure	3	26								baro pressure							
	checksum	1	29															
	<CR>	1	30															
			31															
Synchronize real time clock				<ESC>VTCC	5	0		<ESC>VTCC	5	0								
				year,month,day	8	5		year,month,day	8	5					year,month,day	year,month,day	year,month,day	year,month,day
				time	4	13		time	4	13					time	time	time	time
				checksum	1	17		checksum	1	17								
				<CR>	1	18		<CR>	1	18								
						19				19								
Synchronize demographic data command				<ESC>VTCD	5	0		<ESC>VTCD	5	0								
				set patient type	1	5		set patient type	1	5								
				set IBW	3	6		set IBW	3	6								
				set BSA	3	9		set BSA	3	9								
				set patient weight	3	12		set patient weight	3	12								
				set patient height	3	15		set patient height	3	15								
				set patient ID	10	18		set patient ID	10	18								
				set bed loc	5	28		set bed loc	5	28								
				set patient age	8	33		set patient age	8	33								
				checksum	1	41		checksum	1	41								
				<CR>	1	42		<CR>	1	42								
						43				43								

Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

	COM 1.5			Engström, COM1.5
		# bytes	Pos	
Select Datex-Ohmeda communications protocol command	<ESC>VTO	4	0	
	protocol number	2	4	protocol number
	checksum	1	6	
	<CR>	1	7	
			8	
Send waveform data command	<ESC>VTw	4	0	
	waveform 1	1	4	waveform 1
	waveform 2	1	5	waveform 2
	waveform 3	1	6	waveform 3
	waveform 4	1	7	waveform 4
	waveform 5	1	8	waveform 5
	waveform 6	1	9	waveform 6
	checksum	1	10	
	<CR>	1	11	
			12	
Enable Spiro Dynamics Data Mode	<ESC>VTs	4	0	
	enable/disable	1	4	enable/disable
	checksum	1	5	
	<CR>	1	6	
			7	
Enable snapshot notification	<ESC>VTB	4	0	
	enable disable	1	4	
	checksum	1	5	
	<CR>	1	6	
			7	

Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

Baud Rate	Start Bits	Data Bits	Parity Bit	Stop Bits	Char Rate
19200	1	7	1	1	1920 chars/second
bits/second					

Com 1.0, 7900/7100

:VTM	:VTD	:VTQ	:VTW	totals
18	33	59	96	206 chars
0.009375	0.017188	0.030729	0.05	0.107292 seconds
	3.44	6.15	20.83	30.42 % duty cycle

Com 1.2, Katana

:VTm	:VTd	:VTq	:VTw	:VTt	
33	216	222	187	212	870 chars
0.017188	0.1125	0.115625	0.097396	0.110417	0.453125 seconds
	22.50	23.13	24.35	0.18	70.16 % duty cycle

Com 1.2, Avance

:VTm	:VTd	:VTq	:VTw	:VTt	
33	216	222	187	212	870 chars
0.017188	0.1125	0.115625	0.097396	0.110417	0.453125 seconds
	22.50	23.13	24.35	0.18	70.16 % duty cycle

Com 1.3, Centiva

:VTm	:VTu	:VTv	:VTw	:VTt	
33	218	224	187	212	874 chars
0.017188	0.113542	0.116667	0.097396	0.110417	0.455208 seconds
	22.71	23.33	24.35	0.18	70.57 % duty cycle

Com 1.3, iVent101

:VTm	:VTu	:VTv	:VTw	:VTt	
33	218	224	187	212	874 chars
0.017188	0.113542	0.116667	0.097396	0.110417	0.455208 seconds
	22.71	23.33	24.35	0.18	70.57 %duty cycle

:VTW Waveform Data Response Period

0.240 seconds

:VTw Waveform Data Response Period

0.400 seconds

Maximum Number of Chars per 0.240 Seconds

460.8

Maximum Number of Chars per 0.400 Seconds

768

Datex-Ohmeda COM 1.0/1.2/1.3 Protocol Definition (version H)

Baud Rate	Start Bits	Data Bits	Parity Bit	Stop Bits	Char Rate
19200	1	7	1	1	1920 chars/second
bits/second					

Worst Case Scenario

Com 1.5	:VTf	:VTg	:Vta	:VTx	:VTw	:VTh	:VTk	:VTr	:VTs	:VTp	:VTz	:VTb	totals
	206	219	25	35	187	70	268	41	29	35	22	6	1143 chars
	0.107292	0.114063	0.013021	0.018229	0.097396	0.036458	0.139583	0.021354	0.015104	0.018229	0.011458	0.003125	0.595313 seconds
	21.46	11.41	1.30		24.35	9.11	13.96		0.03	1.82			83.44 % duty cycle

High Volume Steady State Scenario

Com 1.5	:VTf	:VTg	:Vta	:VTx	:VTw	:VTh	:VTk	:VTr	:VTs	:VTp	:VTz	:VTb	totals
	206	219	25	35	187	70	268	41	29	35	22	6	1143 chars
	0.107292	0.114063	0.013021	0.018229	0.097396	0.036458	0.139583	0.021354	0.015104	0.018229	0.011458	0.003125	0.595313 seconds
	21.46	1.14	1.30		24.35	9.11	13.96		0.03	1.82			73.17 % duty cycle

:VTk Dynostatic Curve Response Period
1.000 seconds

:VTw Waveform Data Response Period
0.400 seconds

Maximum Number of Chars per 1.000 Seconds
1920

Maximum Number of Chars per 0.400 Seconds
768