



INSTRUMENT SERVICES MANUAL



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Setting The Clinical Standard

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Title: GSI Instrument Services Manual

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Introduction

It is possible to extract the data from the GSI AudioStar Pro, GSI Pello and GSI TympStar Pro for direct integration of audiologic results into third party software programs (Electronic Medical Records (EMR) and Electronic Healthcare Records (EHR)). It is also possible to import a list of patients into the AudioStar Pro, Pello and TympStar Pro. GSI provides data integration with a computer using the GSI Instrument Service software.

This software component resides on a connected computer and facilitates the electronic transmission of test parameter information from the instrument to a PC application. In the event that the user has either AudioStar Pro or Pello audiometers, as well as GSI 61 audiometers, backwards compatibility functionality is available. The backwards compatibility also extends to the TympStar.

Two programming interfaces for PC applications are provided to communicate with the GSI instruments. The Data Port interface provides two (virtual) serial communications ports that are backwards compatible with the GSI 61 data stream and the TympStar data stream. This allows existing PC programs that can read data from the GSI 61 or TympStar to also read similar data from the AudioStar Pro, Pello and TympStar Pro. The Instrument Services Public Interface is a programmatic interface using XML to communicate all of the available data that the instrument collects to be read out to a PC application.

Intended Use

GSI Instrument Services provides access to the data created by the GSI AudioStar Pro and Pello audiometer and the TympStar Pro tympanometer for the transfer of audiometric data electronically. Independent software programming engineers may implement the Instrument Services software provided by GSI into their proprietary software in order to manage patient data directly. The direct transfer of data gives the physician immediate access to the audiometric data in the electronic record. This manual describes the functionality and data that is available from the GSI Instrument Services.

Installation

Minimum System Requirements

- CPU: 1.6 GHz
- RAM: 1 GB
- Hard Disk: 3 GB
- USB Port: 1 for each connected GSI instrument
- CD-ROM Drive

Supported Operating systems

- Microsoft Windows™ 7 Professional
- Microsoft Windows™ 10

Software requirements

- Microsoft .NET Framework version 4.5

Installation instructions

1. Insert the CD or USB drive into the computer.
2. Browse the contents of the CD /USB to the “GSI Instrument Services” folder.
3. Double-click on the setup.exe.
4. Follow the on-screen instructions to properly install the selected software.

When installation is complete, the GSI Instrument Services will be an icon in the system tray.



NOTE: You will need administrative rights to install the GSI Instrument Services software. If you install GSI Suite V2.3 or above, it will also install the GSI Instrument Services.

Compatibility and Restrictions

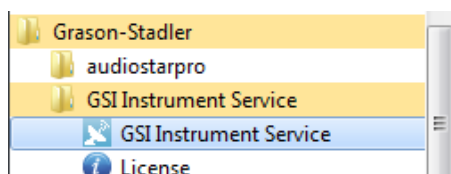
The GSI Instrument Service may be used at the same time as the GSI Suite and AudioStar Pro, Pello and TympStar Pro Config Apps. The GSI Suite will utilize the Instrument Service for communications to the instrument. If the Instrument Service is not running, the GSI Suite will start it.

The GSI Instrument Service must be closed when using the AudioStar Pro, Pello or TympStar Pro calibration application. It can be restarted from the Windows Start menu.

The GSI Instrument Services V2.5 is not compatible with an AudioStar Pro running V1.0 or V1.1, or GSI Suite V2.3 or earlier. Versions are displayed in the GSI Instrument Services About dialog.

Windows Start menu

The Instrument Service Software may be initiated from the Windows Start menu.



USB Ports

During idle periods, some operating systems will force USB connections into a “sleep” mode. This causes an interruption in USB connectivity between the GSI instruments and the PC.

In order to ensure consistent communication to the GSI instruments, it is recommended that the USB sleep mode is disabled.

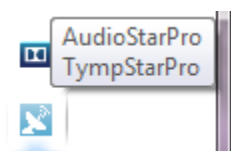
These settings may be changed from the computer's control panel. Typical location is found under advanced settings of the power options.

Remote Computer

When installed on a PC, the GSI Instrument Services icon will appear in the Windows system tray.

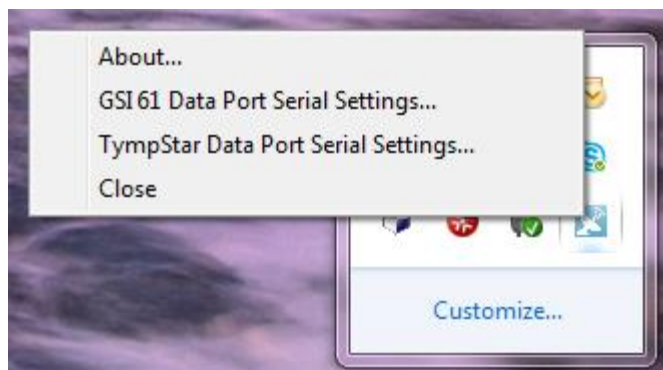


If you place your mouse pointer over the top of the icon, you will get the following tooltip.



Context Menu

The context menu is displayed when you right click on the Instrument Services Icon. There are four options that may be selected from the context menu.



About (dialog)

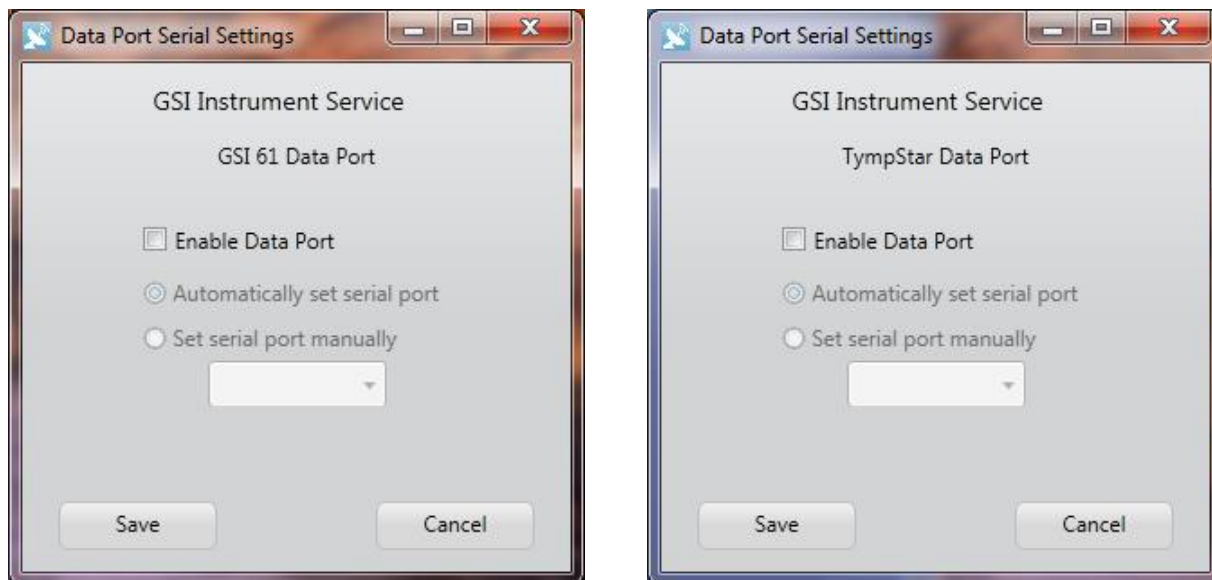
The about dialog shows the current version, copyright and connected instrument information. The selected serial port for the Data Port, if enabled, is displayed. The connection status to an AudioStar Pro and/or TympStar Pro is displayed along with the version of the connected instrument.



Automatically update devices date and time: When this check box is checked, the program will update the date and time of the connected AudioStar Pro, Pello or TympStar Pro instrument to match the date and time of the PC.

Press OK to close.

Data Port Serial Settings (dialog)



1. **Enable Data Port:** The Data Port is used with programs that require backward compatibility with the GSI 61 or TympStar data stream. Check the box to enable this backward compatibility. GSI Suite does not require this backward compatibility and there is no need to enable the Data Port when using GSI Suite.
2. **Automatic:** GSI Instrument Service will automatically search for a serial communication port that is not already being utilized by another application. The user must configure the PC application to the same serial port as the data port for seamless communication with the GSI Instrument Service/AudioStar Pro/Pello/TympStar Pro.

NOTE: When the GSI Instrument Service starts, it will first try to use the serial port that is previously used. If this is not available, it will automatically search for the next open serial port. It will assign itself to the next unassigned serial port. The user must ensure the serial ports are the same.

3. **Manual:** The GSI Instrument Service will use the configured serial communication port even if it is already being utilized by another application. In this case, it would be the user's responsibility to troubleshoot serial port conflicts.

Data Port Interface

The Data Port interface allows the AudioStar Pro, Pello and TympStar Pro data transfer function to be backwards compatible with the GSI 61 and TympStar data stream. This interface is for GSI 61 or TympStar users who are currently transferring data to a 3rd Party PC application such as an EMR system and wish to maintain that transfer function with the AudioStar Pro, Pello and TympStar Pro. The GSI Instrument Service will alter the GSI AudioStar Pro, Pello and TympStar Pro data stream, to mimic that of the GSI 61 and TympStar respectively.

The default settings are 9600 baud rate, no parity, 8 data bits, 1 stop bit, and hardware flow control.

When the GSI Instrument Service is initiated, the Data Port Interface will always try to use the serial ports it used before. If it cannot reuse the serial port it used before, it will choose another available serial port if it is configured to automatic serial port selection.

NOTE: In Windows Device Manager, the Data Port will be displayed as the “GSI data port (COM X), where “X” is the currently assigned serial port.

GSI AudioStar Pro, Pello Data Transfer Record and Field Formatting

Communication with the remote audiometer is performed by sending a request and receiving information in *records*. Each type of information has its own record format. Each record is divided into *fields* which contain specific information. All records are formatted with a predefined, fixed length format.

The record prefix consists of a “:” character and denotes the start of a record. Input records do not contain a checksum. The record terminator consists of a “CR,” “LF” sequence. Each record consists of fixed length data fields with any unused or Zero data fields filled with a “0.” All records consist of a sequence of printable ASCII characters from the set of “0” to “9,” “A” to “G,” “-,” “:,” “,” “_,” “CR” and “LF.” All multiple character ASCII fields will be right justified with unused character positions filled with “_” characters. Positive numeric values will not contain a “+” sign; this will be implied. Negative values contain a “-” sign in any character position to the left of the most significant digit of the number. Unless specified, the decimal point for non-integer numbers will not be included in the character sequence.

Checksums

Checksums will be calculated to maintain compatibility with the GSI 61 as the mod 256 sum of all preceding characters on the record, including the “:” prefix, and stored as two HEX ASCII characters.

Input Operation

Validation

When a complete input record is received, the record is validated and processed. If the record is invalid, an error record is transmitted back to the remote device. All input records are validated in the following manner:

- Must begin with a “:,” and end with a carriage return, line feed sequence.
- Must contain all valid ASCII characters.
- Must contain a valid record type.
- Must contain a valid function code.
- Must contain a valid function subcode when required.

Acknowledgment

The GSI AudioStar Pro will acknowledge the correct reception and processing of all input records by transmitting back the requested information.

Input Record Type

These records are sent by the remote device to control its functions.

Input Record Type 5 - Pushbutton Code Record

This record type provides the ability to remotely simulate the operation of selected user controls. The record specifies the control operation using a function code which defines the group of controls and a sub-function code which defines the specific parameter to select the function to perform. Control operations are processed in the same manner as if they had been manually entered. All parameter or functional defaults and restrictions will still apply.

Function Codes

The following are function codes that describe the commands sent and the response you can expect to see when transferring data from the AudioStar Pro to a computer using the Data Port Software.

Function Code	Function Group	Function Subgroup	Sub Code	Pushbutton Function
43	Transmit Unit ID Record	“0”		
47	Data Transfer	“3”		Test Battery Data Record

Output Record Type 4 - Error Record

This type of error record contains information on each type of error that has occurred. The types of errors which would result in an Error Record are:

- System errors.
- Input record which has an incorrect format or is invalid for the current operating mode.
- Push button operation commands which are invalid.

Character Offset	Number of Characters	Field Name	Field Description
0	1	Record Prefix	“.”
1	1	Record Type	“4”
2	2	Error Code	See next table: Error Codes
4	2	Checksum	See prior section concerning checksums.
6	2	Record Terminator	“CR” & “LF”

Error Record Codes

Error Code	Error Description
10	Generic NACK in response to an invalid input (negative acknowledgement)

Output Record Type - Test Battery Data Record

Record Prefix

Character Offset	Number of Characters	Data Type	Field Name	Field Description
0	1	ASCII	Record Prefix	“.”
1	1	ASCII	Record Type	“6”

Left Ear Test Data - Pure Tone

2	4	slnt	Pure Tone Test - 125 Hz Air Conduction Threshold - Test Ear	-20 to 120 dB x 2 NR = 260 to 540 NT = 32768 (0 x 8000)
6	4	slnt	Pure Tone Test - 125 Hz Air Conduction Threshold - Masking Ear	-20 to 120 dB x 2 NR = 260 to 540 NT = 32768 (0 x 8000)
10	4	slnt	Pure Tone Test - 125 Hz Bone Conduction Threshold - Test Ear	-20 to 120 dB x 2 NR = 260 to 540 NT = 32768 (0 x 8000)
14	4	slnt	Pure Tone Test - 125 Hz Bone Conduction Threshold - Masking Ear	-20 to 120 dB x 2 NR = 260 to 540 NT = 32768 (0 x 8000)
18	4	slnt	Pure Tone Test - 125 Hz Sound Field	-20 to 120 dB x 2 NR = 260 to 540 NT = 32768 (0 x 8000)
22	20		Pure Tone Test - 250 Hz	See Pure Tone Test - 125 Hz fields
42	20		Pure Tone Test - 500 Hz	See Pure Tone Test - 125 Hz fields
62	20		Pure Tone Test - 750 Hz	See Pure Tone Test - 125 Hz fields
82	20		Pure Tone Test - 1 kHz	See Pure Tone Test - 125 Hz fields
102	20		Pure Tone Test - 1.5 kHz	See Pure Tone Test - 125 Hz fields
122	20		Pure Tone Test - 2 kHz	See Pure Tone Test - 125 Hz fields
142	20		Pure Tone Test - 3 kHz	See Pure Tone Test - 125 Hz fields
162	20		Pure Tone Test - 4 kHz	See Pure Tone Test - 125 Hz fields

182	20		Pure Tone Test - 6 kHz	See Pure Tone Test - 125 Hz fields
202	20		Pure Tone Test - 8 kHz Low Freq.	See Pure Tone Test - 125 Hz fields
222	20		Pure Tone Test - 12 kHz	See Pure Tone Test - 125 Hz fields
242	20		Pure Tone Test - 8 kHz High Freq.	See Pure Tone Test - 125 Hz fields
262	20		Pure Tone Test - 9 kHz	See Pure Tone Test - 125 Hz fields
282	20		Pure Tone Test - 10 kHz	See Pure Tone Test - 125 Hz fields
302	20		Pure Tone Test - 11.2 kHz	See Pure Tone Test - 125 Hz fields
322	20		Pure Tone Test - 12.5 kHz	See Pure Tone Test - 125 Hz fields
342	20		Pure Tone Test - 14 kHz	See Pure Tone Test - 125 Hz fields
362	20		Pure Tone Test - 16 kHz	See Pure Tone Test - 125 Hz fields
382	20		Pure Tone Test - 18 kHz	See Pure Tone Test - 125 Hz fields
402	20		Pure Tone Test - 20 kHz	See Pure Tone Test - 125 Hz fields
422	2	uChar	Bone Vibrator Calibration	“_0” = Forehead “_1” = Mastoid

Speech Test

Character Offset	Number of Characters	Data Type	Field Name	Field Description
424	4	slnt	Speech Test - Test Ear Threshold	-20 to 120 dB x 2 NR = 260 to 540 NT = 32768 (0 x 8000)
428	4	slnt	Speech Test - Masking Threshold	-20 to 120 dB x 2 NR = 260 to 540 NT = 32768 (0 x 8000)
432	2	uChar	Speech Test - Masking Type	“_0” = None “_1” = White Noise “_2” = Speech Noise “_3” = Ext. A “_4” = Ext. B
434	2	uChar	Speech Test - Number Presented	_0 to 100 Decimal
436	2	uChar	Speech Test - Number Correct	_0 to 10 Decimal0

SISI Test

Character Offset	Number of Characters	Data Type	Field Name	Field Description
438	4	slnt	SISI Test - 125 Hz Test Ear Threshold	_-20 to 120 dB HL x 2 NR = 260 to 540 NT = 32768 (0 x 8000)
442	2	uChar	SISI Test - 125 Hz Pulse Height	“_0” = 5 dB “_1” = 2 dB “_2” = 1 dB
444	2	uChar	SISI Test - 125 Hz Number Presented	_0 to 100
446	2	uChar	SISI Test - 125 Hz Number Correct	_0 to 100
448	10		SISI Test - 250 Hz	See SISI Test - 125 Hz Fields
458	10		SISI Test - 500 Hz	See SISI Test - 125 Hz Fields
468	10		SISI Test - 750 Hz	See SISI Test - 125 Hz Fields
478	10		SISI Test - 1 kHz	See SISI Test - 125 Hz Fields
488	10		SISI Test - 1.5 kHz	See SISI Test - 125 Hz Fields
498	10		SISI Test - 2 kHz	See SISI Test - 125 Hz Fields
508	10		SISI Test - 3 kHz	See SISI Test - 125 Hz Fields
518	10		SISI Test - 4 kHz	See SISI Test - 125 Hz Fields
528	10		SISI Test - 6 kHz	See SISI Test - 125 Hz Fields
538	10		SISI Test - 8 kHz Low Frequency	See SISI Test - 125 Hz Fields
548	10		SISI Test - 12 kHz	See SISI Test - 125 Hz Fields
558	10		SISI Test - 8 kHz High Frequency	See SISI Test - 125 Hz Fields
568	10		SISI Test - 9 kHz	See SISI Test - 125 Hz Fields
578	10		SISI Test - 10 kHz	See SISI Test - 125 Hz Fields
588	10		SISI Test - 11.2 kHz	See SISI Test - 125 Hz Fields

598	10		SISI Test - 12.5 kHz	See SISI Test - 125 Hz Fields
608	10		SISI Test - 14 kHz	See SISI Test - 125 Hz Fields
618	10		SISI Test - 16 kHz	See SISI Test - 125 Hz Fields
628	10		SISI Test - 18 kHz	See SISI Test - 125 Hz Fields
638	10		SISI Test - 20 kHz	See SISI Test - 125 Hz Fields

Alternate (ABLB)

Character Offset	Number of Characters	Data Type	Field Name	Field Description
648	4	slnt	Alternate Test - 125 Hz Test Ear Threshold	_-20 to 120 dB HL x 2 NR = 260 to 540 NT = 32768 (0 x 8000)
658	4	slnt	Alternate Test - 125 Hz Masking Ear Threshold	_-20 to 120 dB HL x 2 NR = 260 to 540 NT = 32768 (0 x 8000)
656	8		Alternate Test - 250 Hz	See Alternate Test - 125 Hz Fields
664	8		Alternate Test - 500 Hz	See Alternate Test - 125 Hz Fields
672	8		Alternate Test - 750 Hz	See Alternate Test - 125 Hz Fields
680	8		Alternate Test - 1 kHz	See Alternate Test - 125 Hz Fields
688	8		Alternate Test - 1.5 kHz	See Alternate Test - 125 Hz Fields
696	8		Alternate Test - 2 kHz	See Alternate Test - 125 Hz Fields
704	8		Alternate Test - 3 kHz	See Alternate Test - 125 Hz Fields
712	8		Alternate Test - 4 kHz	See Alternate Test - 125 Hz Fields
720	8		Alternate Test - 6 kHz	See Alternate Test - 125 Hz Fields
728	8		Alternate Test - 8 kHz Low Freq.	See Alternate Test - 125 Hz Fields
736	8		Alternate Test - 12 kHz	See Alternate Test - 125 Hz Fields
744	8		Alternate Test - 8 kHz High Freq.	See Alternate Test - 125 Hz Fields
752	8		Alternate Test - 9 kHz	See Alternate Test - 125 Hz Fields

760	8		Alternate Test - 10 kHz	See Alternate Test - 125 Hz Fields
768	8		Alternate Test - 11.2 kHz	See Alternate Test - 125 Hz Fields
776	8		Alternate Test - 12.5 kHz	See Alternate Test - 125 Hz Fields
784	8		Alternate Test - 14 kHz	See Alternate Test - 125 Hz Fields
792	8		Alternate Test - 16 kHz	See Alternate Test - 125 Hz Fields
800	8		Alternate Test - 18 kHz	See Alternate Test - 125 Hz Fields
808	8		Alternate Test - 20 kHz	See Alternate Test - 125 Hz Fields

Right Ear Test Data

Character Offset	Number of Characters	Data Type	Field Name	Field Description
816	814			See Left Ear Fields

Record Terminator

Character Offset	Number of Characters	Data Type	Field Name	Field Description
1630	2	uChar	Checksum	See prior section concerning checksums.
1632	2	ASCII	Record Terminator	“CR” & “LF”

NOTE: HL threshold values are transmitted as hexadecimal values scaled by 2.

NR values are calculated by subtracting 300 from the returned value (260 to 540) and dividing by 2

Speech Test Number Presented and Speech Test Number Correct are transmitted as Decimal values not hexadecimal values

Output Record Type 7 – Instrument Type

This type of error record contains the instrument type and software version information.

Character Offset	Number of Characters	Field Name	Field Description
0	1	Record Prefix	“.”
1	1	Record Type	“7”
2	2	Instrument Type	“04”
4	5	Software Revision	“xx.xx”
9	2	Checksum	See prior section concerning checksums.
11	2	Record Terminator	“CR” & “LF”

GSI TympStar Pro

Data Port - Data Transfer

Output Record Formats

NOTE: X = ASCII character representing the particular value being defined.

All compliance values are transmitted as (Compliance x 1000). For example a transmitted value of 1234 equals 1.234 ml or mmho.

All Gradient values are transmitted as (Gradient x 100).

Summary Data Records

Tymp Diagnostic

Character Offset	Number of Characters	Field Name	Field Description
0	1	Start of record	"I"
1	1	Record Type	1 = Summary data record 8 = Summary data record with attached XY data records
2	2	Record Sequence Number	xx 00 to 99
4	45	Patient Name	xxxxxxxxxx 0 to 45 characters "-" for unused characters
49	45	Patient ID	xxxxxxxxxx 0 to 45 characters "-" for unused characters
94	45	Tester Name	xxxxxxxxxx 0 to 45 characters "-" for unused characters
139	45	Facility Name	xxxxxxxxxx 0 to 45 characters "-" for unused characters
184	9	Probe S/N	xxxxxxx 9 characters "-" for unused characters
193	20	Date/Time	xx/xx/xxxx xx:xx xm "—" for xm if 24 Hour time format
213	2	Test type	0 = Tymp Diagnostic
215	1	Test number	1 to 9 and A to Q
216	1	Ear Under Test	"L" = Left Ear "R" = Right Ear
217	1	Auto Sequence	0 = Off 1 = On
218	2	ProbeTone	0 = 226Hz 1 = 678 Hz 2 = 1000 Hz 3 —> 38 = Not used
220	4	Start Pressure	+/-xxx -600 to +400 daPa
224	1	Baseline Status	0 = Off 1 = On

225	1	Gradient Status of last Tymp run	0 = Off 1 = Tymp Width daPa 2 = Ratio ml
226	6	ECV/CI data	+/-xxxxx -30800 to +30800
232	1	Number of lines	0, 1, 2 or 3
233	1	Y axis scale	0 = -0.5 to +1.5 1 = -0.5 to +3.0 2 = -0.5 to +5.0 3 = -1.0 to +7.0 4 = -1.0 to +9.0 5 = -2.5 to +15.0 6 = -5.0 to +25.0 7 = -5.0 to +35.0
234	5	Cursor X value	“——” “ Cursor not supported
239	2	Line 1 data header	“L1”
241	6	Line 1 cursor Y value	“——” “ Cursor not supported
247	1	Admittance status	0 = Y 1 = B 2 = G 3 = B/G
248	1	Pressure Range status	0 = Normal 1 = Wide
249	1	Pressure Rate status	0 = 12.5 daPa/sec 1 = 50 daPa/sec 2 = 200 daPa/sec 3 = 600/200 daPa/sec
250	6	Peak Compliance data	+/-xxxxx -30800 to +30800 “——” if no Peak found
256	4	Peak Pressure data	+/-xxx -600 to +400 daPa “——” if no Peak found
260	1	Sweep Direction status	0 = positive to negative 1 = negative to positive
261	3	Gradient data	If Gradient = “RATIO”: xxx 1 to 999 daPa If Gradient = “TYMP WIDTH”: xxxx +00 to +990 “0” if Gradient could not be calculated. “—” if Gradient Status = OFF
264	2	Line 2 data header	“L2”
266	6	Line 2 cursor Y value	“——” “ Cursor not supported
272	1	Admittance status	0 = Y 1 = B 2 = G 3 = B/G
273	1	Pressure Range status	0 = Normal 1 = Wide
274	1	Pressure Rate status	0 = 12.5 daPa/sec 1 = 50 daPa/sec

			2 = 200 daPa/sec 3 = 600/200 daPa/sec
275	6	Peak Compliance data	+/-xxxxx -30800 to +30800 “_____” if no Peak found
281	4	Peak Pressure data	+/-xxx -600 to +400 daPa “_____” if no Peak found
285	1	Sweep Direction status	0 = positive to negative 1 = negative to positive
286	3	Gradient data	If Gradient = “RATIO”: xxx 1 to 999 daPa If Gradient = “TYMP WIDTH”: xxxx +00 to +990 “ 0” if Gradient could not be calculated. “—” if Gradient Status = OFF
289	2	Line 3 data header	“L3”
291	6	Line 3 cursor Y value	“_____” Cursor not supported
297	1	Admittance status	0 = Y 1 = B 2 = G 3 = B/G
298	1	Pressure Range status	0 = Normal 1 = Wide
299	1	Pressure Rate status	0 = 12.5 daPa/sec 1 = 50 daPa/sec 2 = 200 daPa/sec 3 = 600/200 daPa/sec
300	6	Peak Compliance data	+/-xxxxx -30800 to +30800 “_____” if no Peak found
306	4	Peak Pressure data	+/-xxx -600 to +400 daPa “_____” if no Peak found
310	1	Sweep Direction status	0 = positive to negative 1 = negative to positive
311	3	Gradient data	If Gradient = “RATIO”: xxx 1 to 999 daPa If Gradient = “TYMP WIDTH”: xxxx +00 to +990 “ 0” if Gradient could not be calculated. “—” if Gradient Status = OFF
314	2	Checksum	xx
316	1	Carriage return	“CR”
317	1	Line Feed	“LF”

Tymp Screening

Character Offset	Number of Characters	Field Name	Field Description
0	1	Start of record	“ ”
1	1	Record Type	1 = Summary data record 8 = Summary data record with attached XY data records
2	2	Record Sequence Number	xx 00 to 99
4	45	Patient Name	xxxxxxxxxxxx 0 to 45 characters “-” for unused characters
49	45	Patient ID	xxxxxxxxxxxx 0 to 45 characters “-” for unused characters
94	45	Tester Name	xxxxxxxxxxxx 0 to 45 characters “-” for unused characters
139	45	Facility Name	xxxxxxxxxxxx 0 to 45 characters “-” for unused characters
184	9	Probe S/N	xxxxxxxx 9 characters “-” for unused characters
193	20	Date/Time	xx/xx/xxxx xx:xx xm “—” for xm if 24 Hour time format
213	2	Test type	1 = Tymp Screening
215	1	Test number	1 to 9 and A to Q
216	1	Ear Under Test	“L” = Left Ear “R” = Right Ear
217	2	ProbeTone	0 = 226Hz
219	4	Start Pressure	+/-xxx -600 to +400 daPa
223	1	Baseline Status	0 = Off 1 = On
224	1	Gradient Status	0 = Off 1 = Tymp Width daPa 2 = Ratio ml
225	6	ECV/CI data	+/-xxxxx -30800 to +30800
231	1	Number of lines	0 or 1
232	1	Y axis scale	0 = -0.5 to +1.5 1 = -0.5 to +3.0 2 = -0.5 to +5.0 3 = -1.0 to +7.0 4 = -1.0 to +9.0 5 = -2.5 to +15.0 6 = -5.0 to +25.0 7 = -5.0 to +35.0
233	5	Cursor X value	“—” “Cursor not supported
238	2	Line 1 data header	“L1”
240	6	Line 1 cursor Y value	“—” “Cursor not supported
246	1	Admittance status	0 = Y
247	1	Pressure Range status	0 = Normal 1 = Wide

248	1	Pressure Rate status	0 = Not used 1 = Not used 2 = 200 daPa/sec 3 = 600/200 daPa/sec
249	6	Peak Compliance data	+/-xxxxx -30800 to +30800 “——” if no Peak
255	4	Peak Pressure data	+/-xxx -600 to +400 daPa “——” if no Peak
259	1	Sweep Direction status	0 = positive to negative 1 = negative to positive
260	3	Gradient data	If Gradient = “RATIO”: xxx 1 to 999 daPa If Gradient = “TYMP WIDTH”: xxxx +00 to +990 “0” if Gradient could not be calculated. “—” if Gradient Status = OFF
263	1	Reflex Type status	0 = Off 1 = Ipsi 2 = Contra 3 = Ipsi. and Contra
264	1	Reflex Frequency #1	0 = 500 Hz 1 = 1000 Hz 2 = 2000 Hz 3 = 4000 Hz “—” = If Reflex Type = Off or Ipsi and Contra
265	1	Reflex Frequency #2	0 = 500 Hz 1 = 1000 Hz 2 = 2000 Hz 3 = 4000 Hz “—” = If Reflex Type = Off or Ipsi and Contra
266	1	Auto Start status	0 = Off 1 = On
267	1	Reflex #1 data	0 = NA 1 = NT 2 = NR 3 = YES 4 = NT <> 5 = NR <> 6 = NT CAL “—” if Reflex Type = Off or if 2nd frequency not selected
268	1	Reflex #2 data	0 = NA 1 = NT 2 = NR 3 = YES 4 = NT <> 5 = NR <>

			6 = NT CAL “—” if Reflex Type = Off or if 2nd frequency not selected
269	2	Checksum	xx
271	1	Carriage return	“CR”
272	1	Line Feed	“LF”

Reflex Threshold

Character Offset	Number of Characters	Field Name	Field Description
0	1	Start of record	“ ”
1	1	Record Type	1 = Summary data record 8 = Summary data record with attached XY data records
2	2	Record Sequence Number	xx 00 to 99
4	45	Patient Name	xxxxxxxxxx 0 to 45 characters “-” for unused characters
49	45	Patient ID	xxxxxxxxxx 0 to 45 characters “-” for unused characters
94	45	Tester Name	xxxxxxxxxx 0 to 45 characters “-” for unused characters
139	45	Facility Name	xxxxxxxxxx 0 to 45 characters “-” for unused characters
184	9	Probe S/N	xxxxxxxx 9 characters “-” for unused characters
193	20	Date/Time	xx/xx/xxxx xx:xx xm “—” for xm if 24 Hour time format
213	2	Test type	2 = Reflex Threshold
215	1	Test number	1 to 9 and A to Q
216	1	Ear Under Test	“L” = Left Ear “R” = Right Ear
217	1	Auto Sequence	0 = Off 1 = On
218	2	ProbeTone	0 = 226Hz 1 = 678 Hz 2 = 1000 Hz
220	5	Timebase	xxxxx 15000 to 60000 msec
225	1	Number of lines	0, 1 or 2
226	1	Y axis scale	0 = +.04 to -.16 1 = +.08 to -.32 2 = +.12 to -.48 3 = +.16 to -.64 4 = +.20 to -.80 5 = -.04 to +.16 6 = -.08 to +.32 7 = -.12 to +.48 8 = -.16 to +.64 9 = -.20 to +.80
227	5	Cursor X value	“—” “Cursor not supported
232	2	Line 1 data header	“L1”
234	6	Line 1 cursor Y value	“—” “Cursor not supported
240	1	Admittance status	0 = Y 1 = B 2 = G

241	1	Stimulus Ear status	0 = IPSI 1 = Steady CONTRA 2 = Pulsed CONTRA
242	1	Timing - Manual/Auto	0 = Manual 1 = Automatic
243	5	On Time	xxxxx 1000 to 54000 msec “____” if Manual Timing
248	5	Off Time	xxxxx 0 to 52000 msec “____” if Manual Timing
253	2	Zero field	“__”
255	1	Threshold Seek	0 = Off 1 = On
256	3	Min. Change	x.xx .02 to 0.8
259	3	Start dBHL	xxx 35 to 120 dB
262	3	Stop dBHL	xxx 35 to 110 dB
265	2	Zero field	“__”
267	2	Activator Stimulus	0 = 250 Hz 1 = 500 Hz 2 = 1000 Hz 3 = 2000 Hz 4 = 4000 Hz 5 = Low Band Noise 6 = High Band Noise 7 = Broad band Noise 8 = Click 9 = External 10 = Non Acoustic 11 = Not used
269	3	Click Rate	xxx 50 to 300
272	2	Zero field	“__”
274	4	Pressure	+/-xxx -600 to +400 daPa
278	1	Number of traces	0 to 7
279	1	Intensity unit	0 = HL 1 = HL* 2 = SPL
280	3	Trace 1 intensity	xxx 35 to 120 dB
283	6	Trace 1 amplitude	+/-xxxxx -30800 to +30800
289	3	Trace 2 intensity	xxx 35 to 120 dB
292	6	Trace 2 amplitude	+/-xxxxx -30800 to +30800
298	3	Trace 3 intensity	xxx 35 to 120 dB
301	6	Trace 3 amplitude	+/-xxxxx -30800 to +30800
307	3	Trace 4 intensity	xxx 35 to 120 dB
310	6	Trace 4 amplitude	+/-xxxxx -30800 to +30800
316	3	Trace 5 intensity	xxx 35 to 120 dB
319	6	Trace 5 amplitude	+/-xxxxx -30800 to +30800
325	3	Trace 6 intensity	xxx 35 to 120 dB
328	6	Trace 6 amplitude	+/-xxxxx -30800 to +30800
334	3	Trace 7 intensity	xxx 35 to 120 dB
337	6	Trace 7 amplitude	+/-xxxxx -30800 to +30800

343	2	Trace Mark	0 to 7
345	2	Trace Type	0 = NR 1 = * 2 = NR + TS 3 = * + TS
347	2	Zero field	“__”
349	2	Line 2 data header	“L2”
351	6	Line 2 cursor Y value	“_____” Cursor not supported
357	1	Admittance status	0 = Y 1 = B 2 = G
358	1	Stimulus Ear status	0 = IPSI 1 = Steady CONTRA 2 = Pulsed CONTRA
359	1	Timing - Manual/Auto	0 = Manual 1 = Automatic
360	5	On Time	xxxxx 1000 to 54000 msec “_____” if Manual Timing
365	5	Off Time	xxxxx0 to 52000 msec “_____” if Manual Timing
370	2	Zero field	“__”
372	2	Activator Stimulus	0 = 250 Hz 1 = 500 Hz 2 = 1000 Hz 3 = 2000 Hz 4 = 4000 Hz 5 = Low Band Noise 6 = High Band Noise 7 = Broad band Noise 8 = Click 9 = External 10 = Non Acoustic 11 = Not used
374	3	Click Rate	xxx 50 to 300
377	2	Zero field	“__”
379	4	Pressure	+/-xxx -600 to +400 daPa
383	1	Number of traces	0 to 7
384	1	Intensity unit	0 = HL 1 = HL* 2 = SPL
385	3	Trace 1 intensity	xxx 35 to 120 dB
388	6	Trace 1 amplitude	+/-xxxxx -30800 to +30800
394	3	Trace 2 intensity	xxx 35 to 120 dB
397	6	Trace 2 amplitude	+/-xxxxx -30800 to +30800
403	3	Trace 3 intensity	xxx 35 to 120 dB
406	6	Trace 3 amplitude	+/-xxxxx -30800 to +30800
412	3	Trace 4 intensity	xxx 35 to 120 dB
415	6	Trace 4 amplitude	+/-xxxxx -30800 to +30800
421	3	Trace 5 intensity	xxx 35 to 120 dB
424	6	Trace 5 amplitude	+/-xxxxx -30800 to +30800

430	3	Trace 6 intensity	xxx 35 to 120 dB
433	6	Trace 6 amplitude	+/-xxxxx -30800 to +30800
439	3	Trace 7 intensity	xxx 35 to 120 dB
442	6	Trace 7 amplitude	+/-xxxxx -30800 to +30800
448	2	Trace Mark	0 to 7
450	2	Trace Type	0 = NR 1 = *2 = NR + TS 3 = * + TS
452	2	Zero field	“—”
454	2	Checksum	xx
456	1	Carriage return	“CR”
457	1	Line Feed	“LF”

Eustachian Tube Function - Intact

Character Offset	Number of Characters	Field Name	Field Description
0	1	Start of record	“ ”
1	1	Record Type	1 = Summary data record 8 = Summary data record with attached XY data records
2	2	Record Sequence Number	xx 00 to 99
4	45	Patient Name	xxxxxxxxxx 0 to 45 characters “-” for unused characters
49	45	Patient ID	xxxxxxxxxx 0 to 45 characters “-” for unused characters
94	45	Tester Name	xxxxxxxxxx 0 to 45 characters “-” for unused characters
139	45	Facility Name xxxxxxxxxxxx 0 to 45 characters“-” for unused characters	
184	9	Probe S/N	xxxxxxxx 9 characters “-” for unused characters
293	20	Date/Time	xx/xx/xxxx xx:xx xm “—” for xm if 24 Hour time format
213	2	Test type	4 = ETF - Intact TM
215	1	Test number	1 to 9 and A to Q
216	1	Ear Under Test	“L” = Left Ear “R” = Right Ear
217	2	Probe Tone	0 = 226Hz 1 = 678 Hz 2 = 1000 Hz 3 —> 38 = Not used
219	4	Start Pressure	+/-xxx -600 to +400 daPa
223	1	Baseline Status	0 = Off 1 = On
224	1	Gradient Status	0 = Off
225	6	ECV/CI data	+/-xxxxx -30800 to +30800
231	1	Number of lines	0, 1, 2 or 3
232	1	Y axis scale	0 = -0.5 to +1.5 1 = -0.5 to +3.0 2 = -0.5 to +5.0 3 = -1.0 to +7.0 4 = -1.0 to +9.0 5 = -2.5 to +15.0 6 = -5.0 to +25.0 7 = -5.0 to +35.0
233	5	Cursor X value	“—” “ Cursor not supported
238	2	Line 1 data header	“L1”
240	6	Line 1 cursor Y value	“—” “ Cursor not supported

246	1	Admittance status	0 = Y 1 = B 2 = G
247	1	Pressure Range status	0 = Normal 1 = Wide
248	1	Pressure Rate status	0 = 12.5 daPa/sec 1 = 50 daPa/sec 2 = 200 daPa/sec 3 = 600/200 daPa/sec
249	6	Peak Compliance data	+/-xxxxx -30800 to +30800 “_____” if no Peak
255	4	Peak Pressure data	+/-xxx -600 to +400 daPa “_____” if no Peak
259	1	Sweep Direction status	0 = positive to negative 1 = negative to positive
260	3	Zero field	“_”
263	2	Line 2 data header	“L2”
265	6	Line 2 cursor Y value	“_____” “Cursor not supported
271	1	Zero field	“_”
276	1	Zero field	“_”
277	1	Zero field	“_”
278	6	Peak Compliance data	+/-xxxxx-30800 to +30800 “_____” if no Peak
284	4	Peak Pressure data	+/-xxx -600 to +400 daPa “_____” if no Peak
288	1	Zero field	“_”
289	3	Zero field	“_”
292	2	Line 3 data header	“L3”
294	6	Line 3 cursor	“_____” “Cursor not supported
300	1	Zero field	“_”
301	1	Zero field	“_”
302	1	Zero field	“_”
303	6	Peak Compliance data	+/-xxxxx -30800 to +30800 “_____” if no Peak
309	4	Peak Pressure data	+/-xxx -600 to +400 daPa “_____” if no Peak
313	1	Zero field	“_”
314	3	Zero field	“_”
317	2	Checksum	xx
319	1	Carriage return	“CR”
320	1	Line Feed	“LF”

Eustachian Tube Function - Perforated

Character Offset	Number of Characters	Field Name	Field Description
0	1	Start of record	“ ”
1	1	Record Type	1 = Summary data record 8 = Summary data record with attached XY data records
2	2	Record Sequence Number	xx 00 to 99
4	45	Patient Name	xxxxxxxxxxxx 0 to 45 characters “-” for unused characters
49	45	Patient ID	xxxxxxxxxxxx 0 to 45 characters “-” for unused characters
94	45	Tester Name	xxxxxxxxxxxx 0 to 45 characters “-” for unused characters
139	45	Facility Name	xxxxxxxxxxxx 0 to 45 characters “-” for unused characters
184	9	Probe S/N	xxxxxxxx 9 characters “-” for unused characters
193	20	Date/Time	xx/xx/xxxx xx:xx xm “—” for xm if 24 Hour time format
213	2	Test type	5 = ETF - Perforated TM
215	1	Test number	1 to 9 and A to Q
216	1	Ear Under Test	“L” = Left Ear “R” = Right Ear
217	5	Timebase	xxxxx 30000 to 60000 msec
222	4	Maximum Pressure	+/-xxx -600 to +400 daPa
226	4	Open Pressure #1	+/-xxx -600 to +400 daPa “—” if value unavailable or test not started
230	4	Close Pressure #1	+/-xxx -600 to +400 daPa “—” if value unavailable or test not started
234	4	Open Pressure #2	+/-xxx -600 to +400 daPa “—” if value unavailable or test not started
238	4	Close Pressure #2	+/-xxx -600 to +400 daPa “—” if value unavailable or test not started
242	4	Open Pressure #3	+/-xxx -600 to +400 daPa “—” if value unavailable or test not started
246	4	Close Pressure #3	+/-xxx -600 to +400 daPa “—” if value unavailable or test not started
250	1	Y axis scale	0 = -600 to -50 daPa 1 = +400 to +50 daPa “-” if test not started

251	5	Cursor X value	“____” Cursor not supported
256	6	Cursor Y value	“____” Cursor not supported
262	2	Checksum	xx
264	1	Carriage return	“CR”
265	1	Line feed	“LF”

Reflex Decay

Character Offset	Number of Characters	Field Name	Field Description
0	1	Start of record	“ ”
1	1	Record Type	1 = Summary data record 8 = Summary data record with attached XY data records
2	2	Record Sequence Number	xx 00 to 99
4	45	Patient Name	xxxxxxxxxx 0 to 45 characters “-” for unused characters
49	45	Patient ID	xxxxxxxxxx 0 to 45 characters “-” for unused characters
94	45	Tester Name	xxxxxxxxxx 0 to 45 characters “-” for unused characters
139	45	Facility Name	xxxxxxxxxx 0 to 45 characters “-” for unused characters
184	9	Probe S/N	xxxxxxxx 9 characters “-” for unused characters
193	20	Date/Time	xx/xx/xxxx xx:xx xm “—” for xm if 24 Hour time format
213	2	Test type	6 = Reflex Decay
215	1	Test number	1 to 9 and A to Q
216	1	Ear Under Test	“L” = Left Ear “R” = Right Ear
217	1	Auto Sequence	0 = Off 1 = On
218	2	ProbeTone	0 = 226Hz 1 = 678 Hz 2 = Not used 3 —> 38 = Not used
220	5	Timebase	xxxxx 15000 to 60000 msec
225	1	Number of lines	0, 1, or 2
226	1	Y axis scale	0 = +.04 to -.16 1 = +.08 to -.32 2 = +.12 to -.48 3 = +.16 to -.64 4 = +.20 to -.80 5 = -.04 to +.16 6 = -.08 to +.32 7 = -.12 to +.48 8 = -.16 to +.64 9 = -.20 to +.80
227	5	Cursor X value	“_____” Cursor not supported in TympStarPro
232	2	Line 1 data header	“L1”
234	6	Line 1 cursor Y value	+/-xxxxx -30800 to +30800

240	1	Admittance status	0 = Y 1 = B 2 = G
241	1	Stimulus Ear status	0 = IPSI 1 = Steady CONTRA
242	1	Zero field	“_”
243	5	On Time	xxxxx 1000 to 54000 msec
248	5	Zero field	“_____”
253	2	Zero field	“_”
255	2	Activator Stimulus	0 = Not used 1 = 500 Hz 2 = 1000 Hz 3 = 2000 Hz 4 = 4000 Hz 5 = Low Band Noise 6 = High Band Noise 7 = Broad band Noise 8 = Click 9 = External 10 = Not used 11 = Not used
257	3	Click rate xxx 50 to 300/sec	
260	2	Zero field	“_”
262	4	Pressure	+/-xxx -600 to +400 daPa
266	1	Number of traces	0 or 1
267	1	Intensity unit	0 = HL 1 = HL* 2 = SPL
268	3	Trace 1 intensity	xxx 35 to 120 dB
271	6	Trace 1 amplitude	+/-xxxxx -30800 to +30800
277	5	50% Decay time	xxxxx 1000 to 54000 msec “ NA” if value unavailable “ NO” if 50% point not found
282	5	Zero field	“_____”
287	5	Zero field	“_____”
292	5	Zero field	“_____”
297	2	Line 2 data header	“L2”
299	6	Line 1 cursor Y value	“_____” Cursor not supported in TympStarPro
305	1	Admittance status	0 = Y 1 = B 2 = G
306	1	Stimulus Ear status	0 = IPSI 1 = Steady CONTRA
307	1	Zero field	“_”
308	5	On Time	xxxxx 1000 to 54000 msec
313	5	Zero field	“_____”
318	2	Zero field	“_”
320	2	Activator Stimulus	0 = Not used 1 = 500 Hz

			2 = 1000 Hz 3 = 2000 Hz 4 = 4000 Hz 5 = Low Band Noise 6 = High Band Noise 7 = Broad band Noise 8 = Click 9 = External 10 = Not used 11 = Not used
322	3	Click Rate	xxx 50 to 300/sec
325	2	Zero field	“__”
327	4	Pressure	+/-xxx -600 to +400 daPa
331	1	Number of traces	0 or 1
332	1	Intensity unit	0 = HL 1 = HL* 2 = SPL
333	3	Trace 1 intensity	xxx 35 to 120 dB
336	6	Trace 1 amplitude	+/-xxxxx -30800 to +30800
342	5	50% decay time	xxxxx 1000 to 54000 msec “NA” if value unavailable “NO” if 50% point not found
347	5	Zero field	“__”
352	5	Zero field	“__”
357	5	Zero field	“__”
362	2	Checksum	xx
364	1	Carriage return	“CR”
365	1	Line Feed	“LF”

XY Graphic Data Record

Record Format

Character Offset	Number of Characters	Field Name	Field Description
0	1	Start of record	“ ”
1	1	Record Type	2 = XY Graphical data record
2	2	Record Sequence Number	xx 00 to 99
4	1	Test number	1 to 9 and A to Q
5	3	Number of XY data	xxx 0 to 29 pairs for Line 1
8	3	Number of XY data	xxx 0 to 29 pairs for Line 2
11	3	Number of XY data	xxx 0 to 29 pairs for Line 3
14	1	Data pair 1 X digit 4	Hex digit in ASCII format MSB
15	1	Data pair 1 X digit 3	Hex digit in ASCII format
16	1	Data pair 1 X digit 2	Hex digit in ASCII format
17	1	Data pair 1 X digit 1	Hex digit in ASCII format
18	1	Data pair 1 Y digit 4	Hex digit in ASCII format MSB
19	1	Data pair 1 Y digit 3	Hex digit in ASCII format
20	1	Data pair 1 Y digit 2	Hex digit in ASCII format
21	1	Data pair 1 Y digit 1	Hex digit in ASCII format
22	1	Data pair 2 X digit 4	Hex digit in ASCII format MSB
23	1	Data pair 2 X digit 3	Hex digit in ASCII format
24	1	Data pair 2 X digit 2	Hex digit in ASCII format
25	1	Data pair 2 X digit 1	Hex digit in ASCII format
26	1	Data pair 2 Y digit 4	Hex digit in ASCII format MSB
27	1	Data pair 2 Y digit 3	Hex digit in ASCII format
28	1	Data pair 2 Y digit 2	Hex digit in ASCII format
29	1	Data pair 2 Y digit 1	Hex digit in ASCII format
238	1	Data pair 29 X digit 4	Hex digit in ASCII format MSB
239	1	Data pair 29 X digit 3	Hex digit in ASCII format
240	1	Data pair 29 X digit 2	Hex digit in ASCII format
241	1	Data pair 29 X digit 1	Hex digit in ASCII format
242	1	Data pair 29 Y digit 4	Hex digit in ASCII format MSB
243	1	Data pair 29 Y digit 3	Hex digit in ASCII format
244	1	Data pair 29 Y digit 2	Hex digit in ASCII format
245	1	Data pair 29 Y digit 1	Hex digit in ASCII format
246	2	Checksum	xx
248	1	Carriage Return	“CR”
249	1	Line Feed	“LF”

X Value Description

Test	Data Type	Units	Range
Tymp Diagnostic	Pressure	daPa	-600 to +400
Tymp Screening	Pressure	daPa	-600 to +400
Reflex Threshold	Time	msec/2	0 to 30000
ETF - Intact TM	Pressure	daPa	-600 to +400
ETF - Perf TM	Time	msec/2	0 to 30000
Reflex Decay	Time	msec/2	0 to 30000
ARLT Time	msec/2	0 to 1000	
ARST Time	msec/2	0 to 30000	
Mult Hz screen #1	Pressure	daPa	-600 to +400
Mult Hz screen #2	Probe Hz	Hz	250 to 2000
Mult Hz screen #3	Pressure	daPa	-600 to +400

Y Value Description

Test	Data Type	Units	Range
Tymp Diagnostic	Compliance	ml/mmho x 1000	-30800 to +30800
Tymp Screening	Compliance	ml/mmho x 1000	-30800 to +30800
Reflex Threshold	Compliance	ml/mmho x 1000	-30800 to +30800
ETF - Intact TM	Compliance	ml/mmho x 1000	-30800 to +30800
ETF - Perf TM	Pressure	daPa	-600 to +400
Reflex Decay	Compliance	ml/mmho x 1000	-30800 to +30800
ARLT	Compliance	ml/mmho x 1000	-30800 to +30800
ARST	Compliance	ml/mmho x 1000	-30800 to +30800
Mult Hz Screen #1	Compliance	ml x 1000	-30800 to +30800
Mult Hz Screen #2 Line 1	Compliance	ml/mmho x 1000	-30800 to +30800
Mult Hz Screen #2 Line 2	Phase	degrees	+5 to -180
Mult Hz Screen #3	Compliance	ml/mmho x 1000 -	30800 to +30800

NOTE: The Y axis values for Tymp Diagnostic and ETF — Intact TM are transmitted as unbaselined values. If baseline is selected the baselined values may be obtained by subtracting the Y axis values from the Ear canal Volume.

Embedded Control Code

Penup Code

Value = 7FFFH

Purpose = Embedded in the X and Y graphical data to indicate the end of the graph of a stimulus presentation during a Reflex type test. The code indicates to the plotting routines not to plot (draw) between the previous plotted point and the next point to produce the blank space between stimulus graphs on the LCD screen.

End of Summary and XY Data Record

Character Offset	Number of Characters	Field Name	Field Description
0	1	Start of record	“ ”
1	1	Record Type	3 = End of data record
2	2	Record Sequence Number	xx 00 to 99
4	2	Checksum	xx
6	1	Carriage Return	“CR”
7	1	Line Feed	“LF”

Error Record

Character Offset	Number of Characters	Field Name	Field Description
0	1	Start of record	“ ”
1	1	Record Type	4 = Error record
2	2	Record Sequence Number	xx 00 to 99
4	3	Error Code	See TymStar manual Section 9
7	4	Error Sub Code	See TymStar manual Section 9
11	2	Checksum	xx
13	1	Carriage Return	“CR”
14	1	Line Feed	“LF”

Keyboard Entry Record

Patient Name

Character Offset	Number of Characters	Field Name	Field Description
0	1	Start of record	“ ”
1	3	Record type	102
4	1	Request code	0 = Send1 = Query for Patient Name
5	45	Patient Name	Any valid keys including numbers, letters and the special characters of period, comma, hyphen, and apostrophe. There will also be certain foreign characters that are valid depending on the keyboard language that is selected under instrument options.
50	1	Carriage return	“CR”
51	1	Line feed	“LF”

Patient ID

Character Offset	Number of Characters	Field Name	Field Description
0	1	Start of record	“ ”
1	3	Record type	103
4	1	Request code	0 = Send1 = Query for Patient Name
5	45	Patient ID	Any valid keys including numbers, letters and the special characters of period, comma, hyphen, and apostrophe. There will also be certain foreign characters that are valid depending on the keyboard language that is selected under instrument options.
50	1	Carriage return	“CR”
51	1	Line feed	“LF”

Tester Name

Character Offset	Number of Characters	Field Name	Field Description
0	1	Start of record	“ ”
1	3	Record type	104
4	1	Request code	0 = Send1 = Query for Patient Name
5	45	Tester Name	Any valid keys including numbers, letters and the special characters of period, comma, hyphen, and apostrophe. There will also be certain foreign characters that are valid depending on the keyboard language that is selected under instrument options.
50	1	Carriage return	“CR”
51	1	Line feed	“LF”

Facility Name

Character Offset	Number of Characters	Field Name	Field Description
0	1	Start of record	“ ”
1	3	Record type	105
4	1	Request code	0 = Send1 = Query for Patient Name
5	45	Facility Name	Any valid keys including numbers, letters and the special characters of period, comma, hyphen, and apostrophe. There will also be certain foreign characters that are valid depending on the keyboard language that is selected under instrument options.
50	1	Carriage return	“CR”
51	1	Line feed	“LF”

Transmit Test Data Request Command

Character Offset	Number of Characters	Field Name	Field Description
0	1	Start of record	“ ”
1	3	Record type	119
4	1	Request code	0 = Send
5	2	Test number	XX 00 = Transmit all test01 to 26 = Transmit test # selected
7	1	Record format	0 = Summary record1 = Summary & Graphic record
8	1	Carriage return	“CR”
9	1	Line feed	“LF”

ACK/NAK Records

Record Received OK Acknowledgement – ACK

Character Offset	Number of Characters	Field Name	Field Description
0	1	Start of record	“ ”
1	3	Record type	120
4	1	Request code	0 = Send
5	1	Carriage return	“CR”
6	1	Line feed	“LF”

Record Received Incorrectly Acknowledgement – NAK

Character Offset	Number of Characters	Field Name	Field Description
0	1	Start of record	“ ”
1	3	Record type	121
4	1	Request code	0 = Send
5	1	Carriage return	“CR”
6	1	Line feed	“LF”

Instrument Services Public Interface

The Public Interface allows users to electronically transfer data to a Third Party PC application such as an EMR system.

The following information describes the programmatic interface and XML data that is exported. It is intended to be used by experienced computer programmers familiar with Windows Communications Foundation (WCF) to write the interface between the AudioStar Pro, Pello, TympStar Pro and a PC software application.

Changes from previous version; the old interface is supported for backward compatibility only:

- The client URL has been changed from "net.pipe://localhost/GsiInstrumentService/Client_" to @ "net.pipe://localhost/InstrumentInterfaceService/Client_";
- The Server URL has changed from @ "net.pipe://localhost/GsiInstrumentService/Server" to @ "net.pipe://localhost/InstrumentInterfaceService/Server";
- The IPublicInterfaceService has been deprecated; the new Public Interface is IInstrumentPublicInterfaceService
- The IPublicInterfaceCallbacks has been deprecated; the new Callback Interface is IInstrumentPublicInterfaceCallbacks

XML Schema

The XML schema for the audiometric data from the AudioStar Pro and TympStar Pro are provided in separate documents included with this manual. The files are AudioStarPro.xsd and TympStarPro.xsd.

WCF Interface

The Public Interface is implemented using Windows Communication Foundation. There are two interfaces to implement IInstrumentPublicInterfaceService and IInstrumentPublicInterfaceCallbacks. Namespace GrasonStadler.Public Interface. Only the documented interfaces are supported.

Calls to the host

1. **Register:** Registers a GUID the client creates with the host. This will give the host the ID of the client for event messages.
2. **Unregister:** Removes the client from the host.
3. **GetSerialNumber:** Retrieve the serial number of the device.

4. **GetInstrumentType:** Retrieve the instrument type, for example, the AudioStar Pro will return “GSI AudioStar Pro.”
5. **IsConnected:** Returns true if an instrument is connected.

```
namespace GrasonStadler.PublicInterface
{
    public enum GsiInstruments
    {
        AudioStarPro,
        TympStarPro
    };

    [ServiceContract(SessionMode = SessionMode.Allowed)]
    public interface IInstrumentPublicInterfaceService
    {
        /// <summary>
        /// Get the Firmware Version of the instrument
        /// </summary>
        /// <returns>Version</returns>
        [OperationContract]
        Version GetInstrumentVersion(GsiInstruments instrument);

        /// <summary>
        /// Get the Serial Number of the instrument
        /// </summary>
        /// <returns>String containing the serial number</returns>
        [OperationContract]
        string GetSerialNumber(GsiInstruments instrument);

        /// <summary>
        /// Returns a list of the instruments that are connected to the PC
        /// </summary>
        /// <returns></returns>
        [OperationContract]
        List<GsiInstruments> GetConnectedInstruments();

        /// <summary>
        /// Gets the current session data from the instrument
        /// This call is not recommended because building the returned XML
        /// can cause a timeout on the WCF channel
        /// </summary>
        /// <returns>Data in XML formatted string</returns>
        [OperationContract]
        string GetData(GsiInstruments instrument);

        /// <summary>
        /// Returns true if an instrument is connected to the computer
        /// </summary>
        /// <returns></returns>
        [OperationContract]
        bool IsConnected(GsiInstruments instrument);

        /// <summary>
        /// The Client creates a GUID and registers the GUID along with the
        instrument type to connect.
        /// This GUID is the ID the host uses for messages to the client..
        /// </summary>
        /// <param name="clientId"></param>
        /// <param name="instrument"></param>
        /// 0 = no errors
        /// 1 = unable to connect to instrument
    }
}
```

```
    /// 2 = instrument busy
    /// 3 = not supported
    [OperationContract]
    int Register(Guid clientId, GsiInstruments instrument);

    /// <summary>
    /// Removed the client from listening for messages from the instrument
    /// </summary>
    /// <param name="clientId"></param>
    /// <param name="instrument"></param>
    [OperationContract(IsOneWay = true)]
    void UnregisterInstrument(Guid clientId, GsiInstruments instrument);

    /// <summary>
    /// Unregister the client
    /// </summary>
    [OperationContract(IsOneWay = true)]
    void Unregister(Guid clientID);

    /// <summary>
    /// Request the current session from the instrument.
    /// </summary>
    /// <param name="clientId"></param>
    /// <param name="instrument"></param>
    /// 0 = no errors
    /// 1 = unable to connect to instrument
    /// 2 = instrument busy
    /// 3 = not supported
    [OperationContract]
    int RequestData(Guid clientId, GsiInstruments instrument);

    /// <summary>
    /// Request that the current session on the instrument to be discarded.
    /// </summary>
    /// <param name="instrument"></param>
    /// <returns>
    /// 0 = no errors
    /// 1 = unable to connect to instrument
    /// 2 = instrument busy
    /// 3 = not supported
    /// </returns>
    [OperationContract]
    int ClearSession(GsiInstruments instrument);

    /// <summary>
    /// Always returns true. Can be used to verify the Instrument Service is
    running
    /// </summary>
    /// <returns></returns>
    [OperationContract]
    bool ServerReady();
}
```

Callbacks

1. **OnDeviceConnected - Callback:** Broadcast to all registered clients when an AudioStar Pro connects to the computer.
2. **OnDeviceDisconnected - Callback:** Broadcast to all registered clients when an AudioStar Pro disconnects from the computer.
3. **OnNewData - Callback:** Broadcast to all registered clients when the Transfer button is pressed on the instrument.
4. **OnServerShuttingDown - Callback:** When the server is shut down, which normally should not happen, the server will notify the registered clients of this state change.

```
namespace GrasonStadler.PublicInterface
{
    [ServiceContract(SessionMode = SessionMode.Allowed)]
    public interface IInstrumentPublicInterfaceCallbacks
    {
        /// <summary>
        /// New session data
        /// </summary>
        /// <param name="xmlData"></param>
        /// <param name="instrument"></param>
        [OperationContract]
        void OnNewData(string xmlData, GsiInstruments instrument);

        /// <summary>
        /// Called when a device is connected to the computer
        /// </summary>
        /// <param name="serialNumber"></param>
        /// <param name="instrument"></param>
        [OperationContract]
        void OnDeviceConnected(string serialNumber, GsiInstruments
instrument);

        /// <summary>
        /// Called when a device is disconnected from the computer
        /// </summary>
        [OperationContract]
        void OnDeviceDisconnected(GsiInstruments instrument);

        /// <summary>
        /// If the Instrument Service is closed, this is called on
each of the Registered Clients
        /// </summary>
        [OperationContract]
        void OnServerShuttingDown();
    }
}
```

WCF Bindings

Below are examples of configuring the client and connecting to the host.

Defining WCF bindings with the app.config settings

```
<?xml version="1.0"?>
<configuration>
  <startup>
    <supportedRuntime version="v4.0" sku=".NETFramework,Version=v4.0"/>
  </startup>

  <system.serviceModel>

    <bindings>
      <netNamedPipeBinding>
        <binding name="BindingSettings"
          maxBufferPoolSize="524288000"
          maxReceivedMessageSize="655360000"
          maxBufferSize="655360000" >
          <readerQuotas maxStringContentLength="655360000"
            maxArrayLength="2000001"
            maxBytesPerRead="2000001"
            maxNameTableCharCount="2000001" />
        </binding>
      </netNamedPipeBinding>
    </bindings>

  </system.serviceModel>
</configuration>
```

Creating the connection to the Instrument Service

The client creates a GUID, this is used as part of the endpoint name and passed to the host through the Register command. This GUID is used by the host to send events to the client.

The endpoint name must be 'net.pipe://localhost/GsiInstrumentService/Client_' appended with a GUID, for example:
'net.pipe://localhost/GsiInstrumentService/Client_B088C677-92F9-42B1-B370-89883822C203'

The following is an example for the client to connect and register to Instrument Services

```
clientId = Guid.NewGuid();

clientHost = new ServiceHost(this);
binding = new NetNamedPipeBinding("BindingSettings");

clientHost.AddServiceEndpoint((typeof(IInstrumentPublicInterfaceCallbacks)), binding,
  "net.pipe://localhost/GsiInstrumentService/Client_" + clientId);

clientHost.Open();

factory = new ChannelFactory<IInstrumentPublicInterfaceService>(binding, new
  EndpointAddress("net.pipe://localhost/InstrumentInterfaceService/Server"));

var clientToServerChannel = factory.CreateChannel();
clientToServerChannel.Register(client);
```

Defining WCF bindings programmatically

```
var binding = new NetNamedPipeBinding
{
    MaxBufferSize = 655360000,
    MaxBufferPoolSize = 524288000,
    MaxReceivedMessageSize = 655360000,
    ReaderQuotas =
    {
        MaxStringContentLength = 655360000,
        MaxArrayLength = 2000001,
        MaxBytesPerRead = 2000001,
        MaxNameTableCharCount = 2000001
    }
};

clientId = Guid.NewGuid();

clientHost = new ServiceHost(this);

clientHost.AddServiceEndpoint((typeof(IInstrumentPublicInterfaceCallbacks)), binding,
    "net.pipe://localhost/GsiInstrumentService/Client_" + clientId);

clientHost.Open();

factory = new ChannelFactory< IInstrumentPublicInterfaceService >(binding, new
    EndpointAddress("net.pipe://localhost/InstrumentInterfaceService/Server"));

var clientToServerChannel = factory.CreateChannel();
clientToServerChannel.Register(client);
```

Patient List

The GSI Instrument Service provides a way to download a list of patents and their demographics into the GSI AudioStar Pro, Pello and GSI TympStar Pro. The Patient Lists may be in a XML or CSV file. GSI Suite may be used to create a patient list from the patients defined in GSI Suite. The format of the CSV file is the same as NOAH's patient demographics export; this allows importing of the demographics from the patients defined in NOAH.

The patient list must be placed in C:\ProgramData\Grason-Stadler\GSI Instrument Service\PatientList, the file name must be PatientList.xml or PatientList.csv. The file will be deleted after importing.

Patient List XML Schema

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
  <xs:element name="PatientList">
    <xs:complexType>
      <xs:sequence>
        <xs:element ref="Patient" maxOccurs="unbounded"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>

  <xs:element name="Patient">
    <xs:complexType>
      <xs:sequence>
        <xs:element ref="Guid"/>
        <xs:element ref="FirstName"/>
        <xs:element ref="MiddleName"/>
        <xs:element ref="LastName"/>
        <xs:element ref="Id"/>
        <xs:element ref="Gender"/>
        <xs:element ref="DateOfBirth"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>

  <xs:element name="FirstName">
    <xs:simpleType>
      <xs:restriction base="xs:string"/>
    </xs:simpleType>
  </xs:element>

  <xs:element name="MiddleName">
    <xs:simpleType>
      <xs:restriction base="xs:string"/>
    </xs:simpleType>
  </xs:element>

  <xs:element name="LastName">
    <xs:simpleType>
      <xs:restriction base="xs:string"/>
    </xs:simpleType>
  </xs:element>

  <xs:element name="Id">
```



```
    <xs:simpleType>
      <xs:restriction base="xs:string"/>
    </xs:simpleType>
  </xs:element>
  <xs:element name="Guid">
    <xs:simpleType>
      <xs:restriction base="xs:string"/>
    </xs:simpleType>
  </xs:element>
  <xs:element name="Gender">
    <xs:simpleType>
      <xs:restriction base="xs:string"/>
    </xs:simpleType>
  </xs:element>
  <xs:element name="DateOfBirth">
    <xs:simpleType>
      <xs:restriction base="xs:date"/>
    </xs:simpleType>
  </xs:element>
</xs:schema>
```

Patient List CSV

The CSV format of the Patient List file is based on the patient export from NOAH.

NOAH Field	Suite
PatientGUID	This field can be blank
PatientNo	
FirstName	
LastName	
MiddleName	
Gender	
BirthDate	yyyy-mm-dd
Address1	Not Used
Address2	Not Used
Address3	Not Used
CreateDate	Not Used
UserID	Not Used
Salutation	Not Used
ZipCode	Not Used
City	Not Used
CreatedBy	Not Used
Title	Not Used
Province	Not Used
Country	Not Used
HomeTelephone	Not Used
WorkTelephone	Not Used
SSNumber	Not Used
EMail	Not Used
Insurance1	Not Used
Insurance2	Not Used
Referral	Not Used
Physician	Not Used
MobileTelephone	Not Used
Other1	Not Used
Other2	Not Used

Log Files

The Instrument Services generates log files that contain information for troubleshooting. These logs can be found in the following folder.

C:\ProgramData\Grason-Stadler\GSI Instrument Service\Logs