

BRISTOL BABCOCK DPC 33XX
CUSTOM INTERFACE MODULE

- * -

QSONIC PROTOCOL
USER MANUAL

User Manual: Version 02.00.00 - September 26, 2002.

for Firmware Versions:

- | | |
|--|------------------------------------|
| A) Controller Family: | * Protected Mode, Ethernet-capable |
| System Firmware Type: | PES or PEX |
| Replaces Standard Protocols Firmware Type: | PCE |
| Custom Protocol Firmware Version: | QS PCE 02.00.## |
| Custom Protocol Firmware File: | QSPCE20#.BIN |
| B) Controller Family: | Protected Mode, pre-Ethernet |
| System Firmware Type: | PLS or PLX |
| Replaces Standard Protocols Firmware Type: | PCP |
| Custom Protocol Firmware Version: | QS PCP 02.00.## |
| Custom Protocol Firmware File: | QSPCP20#.BIN |
| C) Controller Family: | Real Mode |
| System Firmware Type: | RMS |
| Replaces Standard Protocols Firmware Type: | STP |
| Custom Protocol Firmware Version: | XQS.20# |
| Custom Protocol Firmware File: | QSU3B20#.HEX |

* = an Ethernet-capable controller may or may not be populated with Ethernet

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TARGET TEST Version QS 00.01.00 (October 16, 1997) A - i

FIELD TEST Version QS 01.01.00 (June 25, 2001) A - ii

Version QS 02.00.00 (September 26, 2002) A - ii

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INTRODUCTION

A Bristol Babcock Network 3000 series controller can be configured, via its Custom Ports, to be a communications Master to a Q.Sonic SPU.

The controller functions as a master on a half-duplex communications link, receiving regular data messages from the Q.Sonic (there is NO provision for command/response messaging).

Each port acts as an independent Master, and any number of ports may be used concurrently for communication with Q.Sonics.

In this manual, the 'driver' refers to the entire suite of firmware which handles the Q.Sonic Master communication.

The user's ACCOL program must supply the driver with sufficient information for this task.

In return, the driver performs communication and supplies information, from and about the attached Q.Sonic, to the ACCOL program.

In addition, the driver provides information about its own execution (the stage it is at, its success or lack thereof, the cause of any error it experiences, etc.)

The Master's driver status is indicated in the first signal in the Master Configuration List: the Status signal.

For the driver to communicate as a Q.Sonic Master, a port must be configured in Custom Q.Sonic Master mode and the ACCOL program must supply appropriate signal lists/arrays for communication.

The the Q.Sonic driver can support ANY of the following configuration combinations:

Note

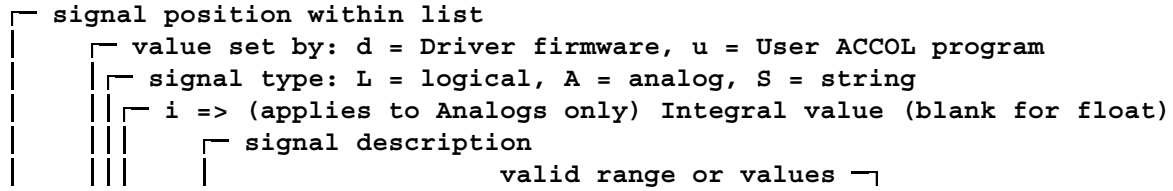
- or Stand-alone SPU (RS-485)
- or SPU+ Remote Unit (RS-232C)
- and
- * or Standard Protocol (checksum modulo 256)
- * or Extended Protocol (checksum XOR inverse)
- and
- + or Standard Data Message (code 35 = Q_DATA)
- + or Extended Data Message (code 36 = Q_XDATA)
- + or Universal Data Message (code 37 = U_DATA)
- and
- + or CheckSonic, FlareSonic, P.Sonic-1 Data (quantity of acoustic paths: N = 1)
- + or CheckSonic, FlareSonic, P.Sonic-2, Q.Sonic-2 Data (quantity of acoustic paths: N = 2)
- + or Q.Sonic-3 Data (quantity of acoustic paths: N = 3)
- + or Q.Sonic-5 Data (quantity of acoustic paths: N = 5)

Notes:

- =This is an electrical configuration which does not affect the driver in any way.
 - * = This is selected via the user ACCOL program configuration of the driver.
 - + =These are auto-detected by the driver. The contents of the Master Configuration List required from the user ACCOL program by the driver are sufficient for the most demanding combination of codes 35/36/37 and N = 1/2/3/5 (i.e. all of the signals must always be present, but some of these may be ignored depending upon the actual combination in use).
- Valid combinations are: 35:1,3,5 36:3,5 37:1,2,3,5

GENERAL NOTES ABOUT LISTS

LEGEND FOR LISTS



XXX XXX XXXXXXXXXXXXXXXXXXXXXXXXXXXX..... XXXXX....

VALID RANGE OR VALUES

For signals that appear in lists, the list descriptions show the valid range or value for each signal for the given purpose.

Analog signals:

{x..y}The acceptable range: minimum x, maximum y.

#TIME.000.ACCOL time format (see: Encode Module in ACCOL manual.)

Logical signals:

ON=textIndicates the meaning when the signal is ON/TRUE.

String signals:

{x..y} charsThe acceptable range of a String's length.

size [x]The required (fixed) size of a String signal (current length may vary).

STATUS SIGNALS

The Master Configuration List contains, as its first signal, a Status. The value of this signal is a status code indicating the status of the driver. It may be an interim value, or indicate a fatal or non-fatal error.

Notes on Status Codes

A final status greater than zero is non-fatal: processing continued to the end and the first non-fatal error that was encountered is reported.

A final status less than zero is fatal: processing was not completed.

Signals will be updated up to the point at which a fatal error is encountered, so that partially-updated lists can result when a fatal error occurs.

Wildcards in Status Values

+/- XXXX =the signal/element number, within the ACCOL list, of the signal that caused the error.

LIST OF STATUS CODES

- 8XXXX = unable to store value to signal
- 100 = overheard a command/response - message ignored
- 0 = successful completion, awaiting next data message
- 1 = mode not supported by Custom Firmware (see ACCOL User Manual)
- 31 = I/O request general failure
- 32 = received character overrun error
- 33 = received character parity error
- 34 = received character framing error
- 36 = received message format error
- 38 = receive timeout
- 41 = received message checksum error
- 42 = received message syntax error
- 1XXXX = signal/element is absent or of incorrect type
- 2XXXX = invalid signal/element value
- 6YYYY = validation error

ERROR ANALYSIS

? = apparent hang with no apparent status code setting

This occurs if some error is made in configuration such that there is no way to indicate the error.

For example, if the Custom Port parameter P1 is set to a value which does not correspond to an existing list, the driver cannot indicate the problem because it cannot place a status code value in a signal (the Status signal is in the list which has been misidentified).

Possible errors of this sort are:

the Custom Port parameter P1 (Master Configuration List Number) contains a number for which there is no list,

the Master Configuration List does not contain an Analog signal as its first entry,

the Status signal in the Master Configuration List is Control Inhibited (in this case, driver execution DOES continue, but no statuses can ever be reported).

Once these points have been passed, errors can be reported.

8XXXX = driver could not store value to signal

- indicates a problem with a signal in the current list:
- the driver is unable to update a signal (usually because it is control-inhibited, or due to truncation of a string value)
- to correct the problem, either use a different signal or modify the troublesome signal's attributes
- note that this is not a fatal error; processing continues, and the first such error is reported

100 = overheard a command/response - message ignored

- indicates that a command or response message was overheard
- the message is reported in the Last Received Message signal
- the message contents are ignored

0 = successful completion, awaiting next data message

- no error occurred during the most recent reception
- the driver is waiting to receive another data message

-1 = mode not supported by custom EPROM

- this value is placed in the Custom module STATUS terminal when the user attempts to configure a port for Custom Q.Sonic Master mode without first installing a Custom EPROM which supports the mode; refer to the ACCOL User Manual

-31 = I/O request general failure
-32 = received character overrun error
-33 = received character parity error
-34 = received character framing error
-36 = received message format error
-38 = receive timeout

- these codes are placed in the Status signal when the driver detects the respective problem during reception of an otherwise valid data message (i.e. ignored during noise bursts)
- they should be self-explanatory, and cannot be corrected by re-configuration or by ACCOL programming
- they indicate errors that are externally-, environmentally-, or hardware-generated
- (a "format" error refers to an invalid Length or Trailer)

-41 = received message checksum error
-42 = received message syntax error

- these codes indicate errors in a received data message
- usually the fault is due to message corruption
- it is possible that such an error is due to faulty communication hardware in this or the other device
- (a "syntax" error refers to an invalid length for the combination of data message type (Code) and quantity of acoustic paths (N) received)

-1XXXX = signal is absent or of incorrect type

- the list is too short/small (absent signal)
- or the signal is not of the required ACCOL type

-2XXXX = invalid signal/element value

- the value is less than the low limit (if any)
- or the value is greater than the high limit (if any)
- or the value is not integral (if required)
- or the item specified by the value cannot be used for the intended purpose (e.g. the value is supposed to specify a list number but the list does not exist).
- refer to the description of the signal, in the description of the respective list, for the constraints on a particular value

-6YYYY = validation error

- these codes indicate errors internal to the controller
- such errors cannot be corrected by re-configuration or by ACCOL programming
- (the YYYY portion is a number which is not externally meaningful but can be used by Bristol Babcock to diagnose the error)
- any such error should be reported to Bristol Babcock

CUSTOM PORT CONFIGURATION

The following are the parameter fields for a Custom port and their values when configured for Q.Sonic Master mode:

MODESet this field to 161 to indicate Custom Q.Sonic Master Mode.

BAUDSet this field to the desired communication rate.
This can also be changed online via the PORTSTATUS module.

CHARACTER LENGTHThe number of data bits per character is fixed internally (8).

STOP BITS . . .The number of stop bits per character is fixed internally (1).

PARITYSet this field to the desired character parity.
This can also be changed online via the PORTSTATUS module.

P1Set this field to the Master Configuration List number
{1..255}.
This can NOT be changed online via the PORTSTATUS module.

P2Set this field to the Test Diagnostics List number {1..255} or
{0} for no extra diagnostics.
This can NOT be changed online via the PORTSTATUS module.

PORTSTATUS MODULE

The PORTSTATUS Module in an ACCOL program can be used to manipulate a Q.Sonic Custom port in a limited manner:

- Modes 0,4,5,6,7 are NOT supported
- Mode 1 can be used to read the entire port configuration
- Mode 2 can be used to write ONLY the BAUD_RATE and PARITY (if other characteristics are specified, they are ignored)
- Mode 3 can be used to reset the port characteristics to the original configuration (actually changes only the BAUD_RATE and PARITY)

MASTER CONFIGURATION LIST

The Master Configuration List number is specified in the Custom port configuration parameter P1. The list supplies general operating parameters to the driver for communication with a Q.Sonic.

Master Configuration List contents:

1	dAi	Status	see section on Status Codes
2	uAi	Protocol Type	{0=Standard,1=Extended}
3	uL	DCD Required During Receive	{ON=required,OFF=not-required}
4	dAi	Reception Count	{0..65535} wrap-around
5	dAi	Data Message Type Code	{35=Q_DATA,36=Q_XDATA,37=UDATA}
V-Status bits:			
6	dL	00: reserved	insignificant
7	dL	01: Current Output Load Error	{ON=fault,OFF=ok}
8	dL	02: Current Output DAC Underflow	{ON=fault,OFF=ok}
9	dL	03: Current Output DAC Overflow	{ON=fault,OFF=ok}
10	dL	04: Frequency Generator Underflow	{ON=fault,OFF=ok}
11	dL	05: Frequency Generator Overflow	{ON=fault,OFF=ok}
12	dL	06: Reduced Accuracy	{ON=reduced,OFF=normal}
13	dL	07: Security	{ON=disabled,OFF=enabled}
14	dL	08: Communication Error	{ON=fault,OFF=ok}
15	dL	09: Timeout Error	{ON=fault,OFF=ok}
16	dL	10: reserved	insignificant
17	dL	11: reserved	insignificant
18	dL	12: reserved	insignificant
19	dL	13: reserved	insignificant
20	dL	14: reserved	insignificant
21	dL	15: Remote Unit Error	{ON=Remote,OFF=SPU}
C/R-Status bits:			
22	dL	00: reserved	insignificant
23	dL	01: Current Output Load Error	{ON=fault,OFF=ok}
24	dL	02: Current Output DAC Underflow	{ON=fault,OFF=ok}
25	dL	03: Current Output DAC Overflow	{ON=fault,OFF=ok}
26	dL	04: Frequency Generator Underflow	{ON=fault,OFF=ok}
27	dL	05: Frequency Generator Overflow	{ON=fault,OFF=ok}
28	dL	06: Reduced Accuracy	{ON=reduced,OFF=normal}
29	dL	07: Security	{ON=disabled,OFF=enabled}
30	dL	08: Communication Error	{ON=fault,OFF=ok}
31	dL	09: Timeout Error	{ON=fault,OFF=ok}
32	dL	10: reserved	insignificant
33	dL	11: reserved	insignificant
34	dL	12: reserved	insignificant
35	dL	13: reserved	insignificant
36	dL	14: reserved	insignificant
37	dL	15: Remote Unit Error	{ON=Remote,OFF=SPU}
	:		

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38 dAi Quantity of Acoustic Paths (N) {1,2,3,5}
39 dAi Quantity of Samples Taken {0..65535}
40 dAi Path 1: Quantity of Valid Samples {0..65535}
41 dAi Path 2: Quantity of Valid Samples {0..65535}
42 dAi Path 3: Quantity of Valid Samples {0..65535}
43 dAi Path 4: Quantity of Valid Samples {0..65535}
44 dAi Path 5: Quantity of Valid Samples {0..65535}
45 dAi Path 1, Transducer A: AGC Level {0..65535}
46 dAi Path 1, Transducer B: AGC Level {0..65535}
47 dAi Path 2, Transducer A: AGC Level {0..65535}
48 dAi Path 2, Transducer B: AGC Level {0..65535}
49 dAi Path 3, Transducer A: AGC Level {0..65535}
50 dAi Path 3, Transducer B: AGC Level {0..65535}
51 dAi Path 4, Transducer A: AGC Level {0..65535}
52 dAi Path 4, Transducer B: AGC Level {0..65535}
53 dAi Path 5, Transducer A: AGC Level {0..65535}
54 dAi Path 5, Transducer B: AGC Level {0..65535}
55 dAi Path 1, Transducer A: AGC Limit {0..65535}
56 dAi Path 1, Transducer B: AGC Limit {0..65535}
57 dAi Path 2, Transducer A: AGC Limit {0..65535}
58 dAi Path 2, Transducer B: AGC Limit {0..65535}
59 dAi Path 3, Transducer A: AGC Limit {0..65535}
60 dAi Path 3, Transducer B: AGC Limit {0..65535}
61 dAi Path 4, Transducer A: AGC Limit {0..65535}
62 dAi Path 4, Transducer B: AGC Limit {0..65535}
63 dAi Path 5, Transducer A: AGC Limit {0..65535}
64 dAi Path 5, Transducer B: AGC Limit {0..65535}
65 dA (Corrected) Speed of Sound {±3.4e±38} m/s
66 dA (Corrected) Gas Velocity {±3.4e±38} m/s
67 dA Pressure {±3.4e±38} kPa
68 dA Temperature {±3.4e±38} K
69 dA Flow Rate - Line (Operating) {±3.4e±38} m3/h
70 dA Flow Rate - Base (Reference) {±3.4e±38} m3/h
71 dAi Stability {-32768..32767}

72 dA Path 1: Cpp (uncor. speed of sound) {±3.4e±38} m/s
73 dA Path 2: Cpp (uncor. speed of sound) {±3.4e±38} m/s
74 dA Path 3: Cpp (uncor. speed of sound) {±3.4e±38} m/s
75 dA Path 4: Cpp (uncor. speed of sound) {±3.4e±38} m/s
76 dA Path 5: Cpp (uncor. speed of sound) {±3.4e±38} m/s
77 dA Path 1: Vpp (uncor. gas velocity) {±3.4e±38} m/s
78 dA Path 2: Vpp (uncor. gas velocity) {±3.4e±38} m/s
79 dA Path 3: Vpp (uncor. gas velocity) {±3.4e±38} m/s
80 dA Path 4: Vpp (uncor. gas velocity) {±3.4e±38} m/s
81 dA Path 5: Vpp (uncor. gas velocity) {±3.4e±38} m/s

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82  dA  Meter Type                {0..65535}
83  dA  Sequence Number          {0..4294967295} *
84  dA  Forward [Error] Volume   {±3.4e±38} m3
85  dA  Reverse [Error] Volume   {±3.4e±38} m3
86  dA  Tspare (for future TwinSonic) {±3.4e±38}
87  dL  00: Path 1 Diagnostic Bit 00 reserved
88  dL  01: Path 1 Diagnostic Bit 01 reserved
89  dL  02: Path 1 Diagnostic Bit 02 reserved
90  dL  03: Path 1 Trans A AGC Level Status {ON=clipped,OFF=normal}
91  dL  04: Path 1 Diagnostic Bit 04 reserved
92  dL  05: Path 1 Diagnostic Bit 05 reserved
93  dL  06: Path 1 Diagnostic Bit 06 reserved
94  dL  07: Path 1 Trans B AGC Level Status {ON=clipped,OFF=normal}
95  dL  08: Path 1 Speed of Sound Status {ON=out-of-range,OFF= normal}
96  dL  09: Path 1 Gas Velocity Status {ON=out-of-range,OFF= normal}
97  dL  10: Path 1 Diagnostic Bit 10 reserved
98  dL  11: Path 1 Performance Status {ON=low,OFF=normal}
99  dL  12: Path 1 Diagnostic Bit 12 reserved
100 dL  13: Path 1 Diagnostic Bit 13 reserved
101 dL  14: Path 1 Diagnostic Bit 14 reserved
102 dL  15: Path 1 Diagnostic Bit 15 reserved
103 dL  00: Path 2 Diagnostic Bit 00 reserved
104 dL  01: Path 2 Diagnostic Bit 01 reserved
105 dL  02: Path 2 Diagnostic Bit 02 reserved
106 dL  03: Path 2 Trans A AGC Level Status {ON=clipped,OFF=normal}
107 dL  04: Path 2 Diagnostic Bit 04 reserved
108 dL  05: Path 2 Diagnostic Bit 05 reserved
109 dL  06: Path 2 Diagnostic Bit 06 reserved
110 dL  07: Path 2 Trans B AGC Level Status {ON=clipped,OFF=normal}
111 dL  08: Path 2 Speed of Sound Status {ON=out-of-range,OFF= normal}
112 dL  09: Path 2 Gas Velocity Status {ON=out-of-range,OFF= normal}
113 dL  10: Path 2 Diagnostic Bit 10 reserved
114 dL  11: Path 2 Performance Status {ON=low,OFF=normal}
115 dL  12: Path 2 Diagnostic Bit 12 reserved
116 dL  13: Path 2 Diagnostic Bit 13 reserved
117 dL  14: Path 2 Diagnostic Bit 14 reserved
118 dL  15: Path 2 Diagnostic Bit 15 reserved
119 dL  00: Path 3 Diagnostic Bit 00 reserved
120 dL  01: Path 3 Diagnostic Bit 01 reserved
121 dL  02: Path 3 Diagnostic Bit 02 reserved
122 dL  03: Path 3 Trans A AGC Level Status {ON=clipped,OFF=normal}
123 dL  04: Path 3 Diagnostic Bit 04 reserved
124 dL  05: Path 3 Diagnostic Bit 05 reserved
125 dL  06: Path 3 Diagnostic Bit 06 reserved
126 dL  07: Path 3 Trans B AGC Level Status {ON=clipped,OFF=normal}
127 dL  08: Path 3 Speed of Sound Status {ON=out-of-range,OFF= normal}
128 dL  09: Path 3 Gas Velocity Status {ON=out-of-range,OFF= normal}
129 dL  10: Path 3 Diagnostic Bit 10 reserved
130 dL  11: Path 3 Performance Status {ON=low,OFF=normal}
:

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:
131 dL 12: Path 3 Diagnostic Bit 12 reserved
132 dL 13: Path 3 Diagnostic Bit 13 reserved
133 dL 14: Path 3 Diagnostic Bit 14 reserved
134 dL 15: Path 3 Diagnostic Bit 15 reserved
135 dL 00: Path 4 Diagnostic Bit 00 reserved
136 dL 01: Path 4 Diagnostic Bit 01 reserved
137 dL 02: Path 4 Diagnostic Bit 02 reserved
138 dL 03: Path 4 Trans A AGC Level Status {ON=clipped,OFF=normal}
139 dL 04: Path 4 Diagnostic Bit 04 reserved
140 dL 05: Path 4 Diagnostic Bit 05 reserved
141 dL 06: Path 4 Diagnostic Bit 06 reserved
142 dL 07: Path 4 Trans B AGC Level Status {ON=clipped,OFF=normal}
143 dL 08: Path 4 Speed of Sound Status {ON=out-of-range,OFF=normal}
144 dL 09: Path 4 Gas Velocity Status {ON=out-of-range,OFF=normal}
145 dL 10: Path 4 Diagnostic Bit 10 reserved
146 dL 11: Path 4 Performance Status {ON=low,OFF=normal}
147 dL 12: Path 4 Diagnostic Bit 12 reserved
148 dL 13: Path 4 Diagnostic Bit 13 reserved
149 dL 14: Path 4 Diagnostic Bit 14 reserved
150 dL 15: Path 4 Diagnostic Bit 15 reserved
151 dL 00: Path 5 Diagnostic Bit 00 reserved
152 dL 01: Path 5 Diagnostic Bit 01 reserved
153 dL 02: Path 5 Diagnostic Bit 02 reserved
154 dL 03: Path 5 Trans A AGC Level Status {ON=clipped,OFF=normal}
155 dL 04: Path 5 Diagnostic Bit 04 reserved
156 dL 05: Path 5 Diagnostic Bit 05 reserved
157 dL 06: Path 5 Diagnostic Bit 06 reserved
158 dL 07: Path 5 Trans B AGC Level Status {ON=clipped,OFF=normal}
159 dL 08: Path 5 Speed of Sound Status {ON=out-of-range,OFF= normal}
160 dL 09: Path 5 Gas Velocity Status {ON=out-of-range,OFF= normal}
161 dL 10: Path 5 Diagnostic Bit 10 reserved
162 dL 11: Path 5 Performance Status {ON=low,OFF=normal}
163 dL 12: Path 5 Diagnostic Bit 12 reserved
164 dL 13: Path 5 Diagnostic Bit 13 reserved
165 dL 14: Path 5 Diagnostic Bit 14 reserved
166 dL 15: Path 5 Diagnostic Bit 15 reserved

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1. Status Analog, integral, written by driver
 -status code indicating the overall condition of the Master driver
 -the possible status codes are listed in the section describing Status Signals
2. Protocol Type Analog, integral, supplied by user
 -selects the protocol type
 -value must be one of the following:
 0 = Standard Protocol (checksum modulo 256),
 1 = Extended Protocol (checksum XOR inverse).
 -note that this signal sets only the checksum type; baud rate and parity are user-configurable via the port configuration
3. DCD Required During Receive Logical, supplied by user
 -if OFF, received bytes are accepted even if Data Carrier Detect is not asserted
 -if ON, received bytes are only accepted if Data Carrier Detect is asserted
4. Reception Count Analog, integral, written by driver
 -count of the quantity of error-free Data messages received (i.e. excludes data messages containing errors, commands, responses, and bursts of noise)
 -initialized to zero by the driver on startup
 -value wraps-around back to zero when it exceeds 65535
 -can be used by the ACCOL program to monitor the health of the Q.Sonic and/or the communication link (e.g. alarm if the value does not change within a time period)
5. Data Message Type Code Analog, integral, written by driver
 -indicates the message data type
 -value will be one of the following:
 35 = Q_DATA = Standard Data Message
 (the data signals 6-71 may be written-to by the driver, depending upon the Number of Acoustics Paths, N)
 36 = Q_XDATA = Extended Data Message
 (the data signals 6-81 may be written-to by the driver, depending upon the Number of Acoustics Paths, N)
 37 = U_DATA = Universal Data Message
 (the data signals 6-81 and 83-167 may be written-to by the driver, depending upon the Number of Acoustics Paths, N)
- NOTE: -a message with any other Code value is ignored by the driver (is a command or a response)
 -when it overhears such a message (as indicated by status 100), the driver does NOT write to this signal or any that follow

66. (Corrected) Gas Velocity Analog, written by driver
 -corrected, all paths' weighted average, gas velocity
 -range: {±3.4e±38}, unit: metres per second

67. Pressure Analog, written by driver
 -pressure
 -range: {±3.4e±38}, unit: kilopascals

68. Temperature Analog, written by driver
 -absolute temperature
 -range: {±3.4e±38}, unit: kelvin

69. Flow Rate - Line (Operating) Analog, written by driver
 -volume flow rate at line (=operating) conditions
 -range: {±3.4e±38}, unit: cubic metres per hour

70. Flow Rate - Base (Reference) Analog, written by driver
 -volume flow rate at base (=reference) conditions
 -range: {±3.4e±38}, unit: cubic metres per hour

71. Stability Analog, integral, written by driver
 -additional status information
 -range: {-32768..32767}

72.-76. Cpp = (Uncorrected) Speed of Sound, Per Path Analogs,
 -all 5 must always be present, written by driver
 but are only written-to when:
 Code = 36 = Q_XDATA = Extended Data Message
 or Code = 37 = U_DATA = Universal Data Message
 (i.e. not written-to by driver when Code = 35 = Q_DATA = Standard Data
 Message)
 -extra data items (e.g. for paths 4,5 when only 1,2,3 are reported by the
 Q.Sonic) must be present but will not be written-to by the driver
 -range for each: {±3.4e±38 m/s}

77.-81. Vpp = (Uncorrected) Gas Velocity, Per Path Analogs,
 -all 5 must always be present, written by driver
 but are only written-to when:
 Code = 36 = Q_XDATA = Extended Data Message
 or Code = 37 = U_DATA = Universal Data Message
 (i.e. not written-to by driver when Code = 35 = Q_DATA = Standard Data
 Message)
 -extra data items (e.g. for paths 4,5 when only 1,2,3 are reported by the
 Q.Sonic) must be present but will not be written-to by the driver
 -range for each: {±3.4e±38 m/s}

82. Meter Type Analog, written by driver
 -flow meter's type ID, it can range from 0 through 65535
 -refer to Q.Sonic documentation for a list of predefined types
83. Sequence Number Analog, written by driver
 -measurement interval sequence number
 -nominal range is {0..4294967295}, but as it is held in a floating point number within the BBI DPC, it's integer range is {0..8388607}; higher values are possible, but resolution can be lost
84. Forward [Error] Volume Analog, written by driver
 -if the Sequence Number (signal 84, above) is even, Forward Volume is the accumulated volume for the flow meter's 'forward' flow direction
 -if the Sequence Number (signal 84, above) is odd, Forward Volume is the accumulated 'error' volume for the flow meter's 'forward' flow direction; the flow totalizer runs only in the 'Reduced Accuracy' state (V-Status bit 06, signal 12; and C/R-Status bit 06, signal 28)
 -range: {±3.4e±38} m³
85. Reverse [Error] Volume Analog, written by driver
 -if the Sequence Number (signal 84, above) is even, Forward Volume is the accumulated volume for the flow meter's 'reverse' flow direction
 -if the Sequence Number (signal 84, above) is odd, Forward Volume is the accumulated 'error' volume for the flow meter's 'reverse' flow direction; the flow totalizer runs only in the 'Reduced Accuracy' state (V-Status bit 06, signal 12; and C/R-Status bit 06, signal 28)
 -range: {±3.4e±38} m³
86. Tspare Analog, written by driver
 -reserved for future TwinSonic applications
 -range: {±3.4e±38}
- 87.-166. Sixteen Diagnostic Bits for Each of Five Paths Logicals,
written by driver
 -indicate individual statuses
 -'reserved' bits contain meaningless values
 (i.e. are unused at present)
 -a single signal can be used for all 'reserved' bits
 -layout of each of the 5 sets, one for each possible path, is identical
 -each of 16 bits per path is ON to indicate a fault or abnormal condition, OFF to indicate normal
 -no detailed explanations follow-- the names for the individual bits should be self-explanatory and/or explained in Q.Sonic documentation

TEST DIAGNOSTICS LIST

The Test Diagnostics List number is specified in the Custom port configuration parameter P2. The list supplies diagnostic information for test purposes.

Test Diagnostics List contents:

1	dAi	Status	{0,-1XXXX} see Status Codes
2	dS	Last Received Message	size 64 -> {0..21} msg chars
3	dAi	Buffer Length	{0..255}
4	dAi	Length in Message	{0..253}
5	dS	1st Part of Received Message	size 64
6	dS	2nd Part of Received Message	size 64
7	dS	3rd Part of Received Message	size 64
8	dS	4th Part of Received Message	size 64
9	dS	5th Part of Received Message	size 64
10	dS	6th Part of Received Message	size 64
11	dS	7th Part of Received Message	size 64
12	dS	8th Part of Received Message	size 64
13	dS	9th Part of Received Message	size 64
14	dS	10th Part of Received Message	size 64
15	dS	11th Part of Received Message	size 64
16	dS	12th Part of Received Message	size 64
17	dS	13th Part of Received Message	size 64
18	dS	14th Part of Received Message	size 64
19	dS	15th Part of Received Message	size 64
20	dS	16th Part of Received Message	size 64
21	dS	17th Part of Received Message	size 64
22	dS	18th Part of Received Message	size 64
23	dS	19th Part of Received Message	size 64
24	dS	20th Part of Received Message	size 64
25	dS	Checksum Result	size 64
26	dS	Syntax Check Result	size 64
27	dS	Syntax Error Result	size 64

1. Status

Analog, integral, written by driver

- status code indicating the overall condition of the Test Diagnostics List
- the possible status codes are confined to {0 and -1XXXX} as listed in the section describing Status Signals
- if any of the expected signals are absent or of the incorrect type, the first such signal is indicated (all earlier signals are still updated with diagnostics); if all the signals are present and of the correct type, this Status is set to 0 by the driver

2 Last Received Message

String [64], written by driver

- driver writes the most recently received message into the signal
- message excludes preamble (xFF's), header (x80,x81,x82,x83), trailer (x84,x85,x86,x87) and postamble (xFF's)
- communication activity not framed by these excluded bytes is completely ignored (i.e. treated as noise)
- commands/responses that are overheard ARE displayed but are not acted upon by the driver
- each byte is shown in hexadecimal, separated by spaces
- if the string is empty (current length is zero), it means that no message was received (e.g. on startup)

3. Buffer Length

Analog, integral, written by driver

- indicates the quantity of bytes received by the driver after a complete, valid Header but excluding the Trailer and optional Postamble
- the value is reported even if the message is incomplete or corrupted (will be zero if only the start of a Header was received)
- note that it includes the Length and Checksum fields of the message (i.e. in a "good" message, is 2 greater than the Length in Message)

4. Length in Message

Analog, integral, written by driver

- contains the value of the Length field in the message (i.e. in a "good" message will be 2 less than the Buffer Length)
- if the driver received the start of a message that was not long enough to contain a Length, the value is zero

5.-24. Nth Part of Received Message String [64], written by driver

- filled with received bytes from the message, between the Length and Trailer
- each byte is shown in hexadecimal, separated by spaces
- format varies depending upon the Code and Qty of Paths
- only the first 17 parts are used to display valid received message bytes; the remaining three are used in displaying an invalid message's bytes: if the Code is not 35, 36, or 37, the driver assumes that the received message is an overheard comand or response of unknown layout. The received bytes are displayed 13 in each of the (at most) 20 Parts, in order of reception (there is sufficient capacity to show an entire maximum-length message).

Appendix C contains a map of the contents of these Nth Part signals for each valid COMMAND-CODE/QTY-OF-PATHS combination.

Appendix D contains tables of message bytes vs. data signals used and unused for each valid COMMAND-CODE/QTY-OF-PATHS combination.

25. Checksum Result String [64], written by driver

- if the received message is not long enough to warrant a checksum verification, this signal is blank
 - if the message is long enough, the string contains the explanation:
"RCV_CS = xx , CAL_CS = yy (zzz)"
- where:
- xx is the received checksum (hex)
 - yy is the calculated checksum (hex)
 - zzz is the conclusion "ok" or "MISMATCH!", as appropriate

26. Syntax Check Result String [64], written by driver

27. Syntax Error Result String [64], written by driver

-these two signals operate as a pair, providing information about the acceptability of the received message

-if the receive failed at a low driver level (e.g. Configuration Status is -3#), the Check Result string will be blank and the Error Result string will be one of the following:

"Driver: General Failure"

"Driver: Overrun Error"

"Driver: Parity Error"

"Driver: Framing Error"

"Driver: Format Error"

"Driver: Receive Timeout"

-if the reception was unsuccessful at a higher level (e.g. invalid length, invalid Qty of Paths, etc), the Check Result string will show as much of the Code, Qty of Paths, and Received Message Length as could be deciphered (i.e. not all may be shown), in the form:

"Syntax Code=xx(XXX),QP=yyyy,Len=zz"

where

xx = the Message Type Code in hex (usually x23/24/25 -> 35/36/37)

XXX = Message Type text (usually Std/Ext/Uni -> 35/36/37)

yyyy = the Quantity of Paths (N) in hex

zz = Length in Message, in hex

and the Error Result string will contain an explanation of why the message was rejected, such as:

"Error: Code is unknown, msg ignored"

"Error: QP should be YYY"

"Error: Len should be ZZ"

-if the received message passes all syntax checks, the Check Result string is:

"Ok: Code=xx(XXX),QP=yyyy,Len=zz"

and the Error Result string is blank.

APPENDIX A: REVISION HISTORY

PRELIMINARY Version QS 00.00.00 (September 4, 1997)

User manual only, for review (no associated firmware).

PRELIMINARY Version QS 00.00.01 (September 16, 1997)

User manual plus firmware for bench tests.

- 1.Changed title page, Table of Contents, and Revision History to reflect this version.
- 2.Protocol Type now determines only the checksum used; baud rate and parity now set by port configuration (pp.2,7,10,Bi).
- 3.Added status code 100 = overheard a command/response - message ignored (pp.4,5,Bi).
- 4.Changed status code value -42 to -36 = received message format error (pp.4,6,Bi).
- 5.Deleted status codes -35, -39, -43, -44, -45 (pp.4,6,Bi).
- 6.Added status code -42 = received message syntax error (pp.4,6,Bi).
- 7.Added status codes 6YYYY = validation errors (pp.4,6,Bi).
- 8.Eliminated signal: Last Transmitted Message, renumbered all subsequent signals (pp.8-12,Bii-Biii).

TARGET TEST Version QS 00.01.00 (October 16, 1997)

User manual plus firmware for target tests.

- 9.Changed title page, Table of Contents, and Revision History to reflect this version.
- 10.Changed user-configurability of port, added support for PORTSTATUS Module (pp.7,Bi).
- 11.Clarified description of driver actions when a command or response message is overheard (p.11).
- 12.Clarified descriptions of occasions when driver writes to extra and spare data items (pp.11,12).
- 13.Added description of Test Diagnostics List (pp.13-15,Biv).

FIELD TEST Version QS 01.01.00 (June 25, 2001)

User manual plus firmware for field tests.

- 14.Changed title page, Table of Contents, and Revision History to reflect this version.
- 15.Added OPTIONAL signal to Master Configuration List: 82. DCD Required During Receive (pp.9,13,Biii).

Version QS 02.00.00 (September 26, 2002)

- 16.Changed title page, Table of Contents, and Revision History to reflect this version.
- 17.Removed the Last Received Message signal from the Master Configuration List (signal 3), inserted it into the Test Diagnostics List (signal 2) (pp.8,12,16).
- 18.Moved the DCD Required During Receive signal withinn the Master Configuration List, from signal 82 to signal 3 (pp.8,12,15). THIS SIGNAL IS NOW MANDATORY.
- 17.Added support for Universal Data Message (code 37 = U_DATA) (pp.2,5,13).
- 18.Added support for CheckSonic, FlareSonic, P.Sonic-1 Data (quantity of acoustic paths: N = 1) and CheckSonic, FlareSonic, P.Sonic-2, Q.Sonic-2 Data (quantity of acoustic paths: N = 2) (pp.2,9,13).
- 19.Renamed the "reserved" V-Status and C/R-Status bits 06 and 07 in the Master Configuration List (signals 12,13,28,29) to "Reduced Accuracy" and "Security", respectively (pg.8).
- 20.Renamed the signals 65 and 66 of the Master Configuration List for consistency: "Velocity of Sound" -> "(Corrected) Speed of Sound" and "Gas Velocity" -> "(Corrected) Gas Velocity" (pp.9,15).
- 21.Renamed the signals 72-81 of the Master Configuration List: "Spare 1" and "Spare 2" become (per path) "Cpp = (Uncorrected) Speed of Sound" and "Vpp = (Uncorrected) Gas Velocity" (pp.9,15).
- 22.Added signals 82 through 166 to the Master Configuration List for support of Universal Data Message (code 37 = U_DATA) (pp.10,11,15,16).
- 23.Inserted new Nth Part of Received Message signals and a second Syntax Error Result signal to the Test Diagnostics List, in part to cover the longer Universal Data Message (code 37 = U_DATA) (pp.16,17).
- 24.Added Appendix C : Received Message Diagnostics and Appendix D : Received Message vs. Data Signals.

APPENDIX B: QUICK REFERENCE

LIST OF STATUS CODES

8XXXX = unable to store value to signal

100 = overheard a command/response - message ignored

0 = successful completion, awaiting next data message

-1 = mode not supported by custom EPROM (see ACCOL User Manual)

-31 = I/O request general failure

-32 = received character overrun error

-33 = received character parity error

-34 = received character framing error

-36 = received message format error

-38 = receive timeout

-41 = received message checksum error

-42 = received message syntax error

-1XXXX = signal/element is absent or of incorrect type

-2XXXX = invalid signal/element value

-6YYYY = validation error

CUSTOM PORT CONFIGURATION

MODE161 = Custom Q.Sonic Master Mode

BAUDcommunication rate: user- and online-configurable

CHARACTER LENGTHnumber of data bits per character: fixed (8)

STOP BITSnumber of stop bits per character: fixed (1)

PARITYcharacter parity: user- and online-configurable

P1Master Configuration List Number {1..255}: user-config only

P2Test Diagnostics List Number {1..255} or {0} for no diags:
user-configurable only

MASTER CONFIGURATION LIST

1	dAi	Status	see section on Status Codes
2	uAi	Protocol Type	{0=Standard,1=Extended}
3	uL	DCD Required During Receive	{ON=required,OFF=not-required}
4	dAi	Reception Count	{0..65535} wrap-around
5	dAi	Data Message Type Code	{35=Q_DATA,36=Q_XDATA,37=UDATA}

V-Status bits:

6	dL	00: reserved	insignificant
7	dL	01: Current Output Load Error	{ON=fault,OFF=ok}
8	dL	02: Current Output DAC Underflow	{ON=fault,OFF=ok}
9	dL	03: Current Output DAC Overflow	{ON=fault,OFF=ok}
10	dL	04: Frequency Generator Underflow	{ON=fault,OFF=ok}
11	dL	05: Frequency Generator Overflow	{ON=fault,OFF=ok}
12	dL	06: Reduced Accuracy	{ON=reduced,OFF=normal}
13	dL	07: Security	{ON=disabled,OFF=enabled}
14	dL	08: Communication Error	{ON=fault,OFF=ok}
15	dL	09: Timeout Error	{ON=fault,OFF=ok}
16	dL	10: reserved	insignificant
17	dL	11: reserved	insignificant
18	dL	12: reserved	insignificant
19	dL	13: reserved	insignificant
20	dL	14: reserved	insignificant
21	dL	15: Remote Unit Error	{ON=Remote,OFF=SPU}

C/R-Status bits:

22	dL	00: reserved	insignificant
23	dL	01: Current Output Load Error	{ON=fault,OFF=ok}
24	dL	02: Current Output DAC Underflow	{ON=fault,OFF=ok}
25	dL	03: Current Output DAC Overflow	{ON=fault,OFF=ok}
26	dL	04: Frequency Generator Underflow	{ON=fault,OFF=ok}
27	dL	05: Frequency Generator Overflow	{ON=fault,OFF=ok}
28	dL	06: Reduced Accuracy	{ON=reduced,OFF=normal}
29	dL	07: Security	{ON=disabled,OFF=enabled}
30	dL	08: Communication Error	{ON=fault,OFF=ok}
31	dL	09: Timeout Error	{ON=fault,OFF=ok}
32	dL	10: reserved	insignificant
33	dL	11: reserved	insignificant
34	dL	12: reserved	insignificant
35	dL	13: reserved	insignificant
36	dL	14: reserved	insignificant
37	dL	15: Remote Unit Error	{ON=Remote,OFF=SPU}

:

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:
38 dAi Quantity of Acoustic Paths (N) {1,2,3,5}
39 dAi Quantity of Samples Taken {0..65535}
40 dAi Path 1: Quantity of Valid Samples {0..65535}
41 dAi Path 2: Quantity of Valid Samples {0..65535}
42 dAi Path 3: Quantity of Valid Samples {0..65535}
43 dAi Path 4: Quantity of Valid Samples {0..65535}
44 dAi Path 5: Quantity of Valid Samples {0..65535}
45 dAi Path 1, Transducer A: AGC Level {0..65535}
46 dAi Path 1, Transducer B: AGC Level {0..65535}
47 dAi Path 2, Transducer A: AGC Level {0..65535}
48 dAi Path 2, Transducer B: AGC Level {0..65535}
49 dAi Path 3, Transducer A: AGC Level {0..65535}
50 dAi Path 3, Transducer B: AGC Level {0..65535}
51 dAi Path 4, Transducer A: AGC Level {0..65535}
52 dAi Path 4, Transducer B: AGC Level {0..65535}
53 dAi Path 5, Transducer A: AGC Level {0..65535}
54 dAi Path 5, Transducer B: AGC Level {0..65535}
55 dAi Path 1, Transducer A: AGC Limit {0..65535}
56 dAi Path 1, Transducer B: AGC Limit {0..65535}
57 dAi Path 2, Transducer A: AGC Limit {0..65535}
58 dAi Path 2, Transducer B: AGC Limit {0..65535}
59 dAi Path 3, Transducer A: AGC Limit {0..65535}
60 dAi Path 3, Transducer B: AGC Limit {0..65535}
61 dAi Path 4, Transducer A: AGC Limit {0..65535}
62 dAi Path 4, Transducer B: AGC Limit {0..65535}
63 dAi Path 5, Transducer A: AGC Limit {0..65535}
64 dAi Path 5, Transducer B: AGC Limit {0..65535}
65 dA (Corrected) Speed of Sound {±3.4e±38} m/s
66 dA (Corrected) Gas Velocity {±3.4e±38} m/s
67 dA Pressure {±3.4e±38} kPa
68 dA Temperature {±3.4e±38} K
69 dA Flow Rate - Line (Operating) {±3.4e±38} m3/h
70 dA Flow Rate - Base (Reference) {±3.4e±38} m3/h
71 dAi Stability {-32768..32767}

72 dA Path 1: Cpp (uncor. speed of sound) {±3.4e±38} m/s
73 dA Path 2: Cpp (uncor. speed of sound) {±3.4e±38} m/s
74 dA Path 3: Cpp (uncor. speed of sound) {±3.4e±38} m/s
75 dA Path 4: Cpp (uncor. speed of sound) {±3.4e±38} m/s
76 dA Path 5: Cpp (uncor. speed of sound) {±3.4e±38} m/s
77 dA Path 1: Vpp (uncor. gas velocity) {±3.4e±38} m/s
78 dA Path 2: Vpp (uncor. gas velocity) {±3.4e±38} m/s
79 dA Path 3: Vpp (uncor. gas velocity) {±3.4e±38} m/s
80 dA Path 4: Vpp (uncor. gas velocity) {±3.4e±38} m/s
81 dA Path 5: Vpp (uncor. gas velocity) {±3.4e±38} m/s

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:
```

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:
82  dA  Meter Type                {0..65535}
83  dA  Sequence Number          {0..4294967295} *
84  dA  Forward [Error] Volume   {±3.4e±38} m3
85  dA  Reverse [Error] Volume   {±3.4e±38} m3
86  dA  Tspare (for future TwinSonic) {±3.4e±38}
87  dL  00: Path 1 Diagnostic Bit 00 reserved
88  dL  01: Path 1 Diagnostic Bit 01 reserved
89  dL  02: Path 1 Diagnostic Bit 02 reserved
90  dL  03: Path 1 Trans A AGC Level Status {ON=clipped,OFF=normal}
91  dL  04: Path 1 Diagnostic Bit 04 reserved
92  dL  05: Path 1 Diagnostic Bit 05 reserved
93  dL  06: Path 1 Diagnostic Bit 06 reserved
94  dL  07: Path 1 Trans B AGC Level Status {ON=clipped,OFF=normal}
95  dL  08: Path 1 Speed of Sound Status {ON=out-of-range,OFF= normal}
96  dL  09: Path 1 Gas Velocity Status {ON=out-of-range,OFF= normal}
97  dL  10: Path 1 Diagnostic Bit 10 reserved
98  dL  11: Path 1 Performance Status {ON=low,OFF=normal}
99  dL  12: Path 1 Diagnostic Bit 12 reserved
100 dL  13: Path 1 Diagnostic Bit 13 reserved
101 dL  14: Path 1 Diagnostic Bit 14 reserved
102 dL  15: Path 1 Diagnostic Bit 15 reserved
103 dL  00: Path 2 Diagnostic Bit 00 reserved
104 dL  01: Path 2 Diagnostic Bit 01 reserved
105 dL  02: Path 2 Diagnostic Bit 02 reserved
106 dL  03: Path 2 Trans A AGC Level Status {ON=clipped,OFF=normal}
107 dL  04: Path 2 Diagnostic Bit 04 reserved
108 dL  05: Path 2 Diagnostic Bit 05 reserved
109 dL  06: Path 2 Diagnostic Bit 06 reserved
110 dL  07: Path 2 Trans B AGC Level Status {ON=clipped,OFF=normal}
111 dL  08: Path 2 Speed of Sound Status {ON=out-of-range,OFF= normal}
112 dL  09: Path 2 Gas Velocity Status {ON=out-of-range,OFF= normal}
113 dL  10: Path 2 Diagnostic Bit 10 reserved
114 dL  11: Path 2 Performance Status {ON=low,OFF=normal}
115 dL  12: Path 2 Diagnostic Bit 12 reserved
116 dL  13: Path 2 Diagnostic Bit 13 reserved
117 dL  14: Path 2 Diagnostic Bit 14 reserved
118 dL  15: Path 2 Diagnostic Bit 15 reserved
119 dL  00: Path 3 Diagnostic Bit 00 reserved
120 dL  01: Path 3 Diagnostic Bit 01 reserved
121 dL  02: Path 3 Diagnostic Bit 02 reserved
122 dL  03: Path 3 Trans A AGC Level Status {ON=clipped,OFF=normal}
123 dL  04: Path 3 Diagnostic Bit 04 reserved
124 dL  05: Path 3 Diagnostic Bit 05 reserved
125 dL  06: Path 3 Diagnostic Bit 06 reserved
126 dL  07: Path 3 Trans B AGC Level Status {ON=clipped,OFF=normal}
127 dL  08: Path 3 Speed of Sound Status {ON=out-of-range,OFF= normal}
128 dL  09: Path 3 Gas Velocity Status {ON=out-of-range,OFF= normal}
129 dL  10: Path 3 Diagnostic Bit 10 reserved
130 dL  11: Path 3 Performance Status {ON=low,OFF=normal}
:

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:
131 dL 12: Path 3 Diagnostic Bit 12 reserved
132 dL 13: Path 3 Diagnostic Bit 13 reserved
133 dL 14: Path 3 Diagnostic Bit 14 reserved
134 dL 15: Path 3 Diagnostic Bit 15 reserved
135 dL 00: Path 4 Diagnostic Bit 00 reserved
136 dL 01: Path 4 Diagnostic Bit 01 reserved
137 dL 02: Path 4 Diagnostic Bit 02 reserved
138 dL 03: Path 4 Trans A AGC Level Status {ON=clipped,OFF=normal}
139 dL 04: Path 4 Diagnostic Bit 04 reserved
140 dL 05: Path 4 Diagnostic Bit 05 reserved
141 dL 06: Path 4 Diagnostic Bit 06 reserved
142 dL 07: Path 4 Trans B AGC Level Status {ON=clipped,OFF=normal}
143 dL 08: Path 4 Speed of Sound Status {ON=out-of-range,OFF=normal}
144 dL 09: Path 4 Gas Velocity Status {ON=out-of-range,OFF=normal}
145 dL 10: Path 4 Diagnostic Bit 10 reserved
146 dL 11: Path 4 Performance Status {ON=low,OFF=normal}
147 dL 12: Path 4 Diagnostic Bit 12 reserved
148 dL 13: Path 4 Diagnostic Bit 13 reserved
149 dL 14: Path 4 Diagnostic Bit 14 reserved
150 dL 15: Path 4 Diagnostic Bit 15 reserved
151 dL 00: Path 5 Diagnostic Bit 00 reserved
152 dL 01: Path 5 Diagnostic Bit 01 reserved
153 dL 02: Path 5 Diagnostic Bit 02 reserved
154 dL 03: Path 5 Trans A AGC Level Status {ON=clipped,OFF=normal}
155 dL 04: Path 5 Diagnostic Bit 04 reserved
156 dL 05: Path 5 Diagnostic Bit 05 reserved
157 dL 06: Path 5 Diagnostic Bit 06 reserved
158 dL 07: Path 5 Trans B AGC Level Status {ON=clipped,OFF=normal}
159 dL 08: Path 5 Speed of Sound Status {ON=out-of-range,OFF= normal}
160 dL 09: Path 5 Gas Velocity Status {ON=out-of-range,OFF= normal}
161 dL 10: Path 5 Diagnostic Bit 10 reserved
162 dL 11: Path 5 Performance Status {ON=low,OFF=normal}
163 dL 12: Path 5 Diagnostic Bit 12 reserved
164 dL 13: Path 5 Diagnostic Bit 13 reserved
165 dL 14: Path 5 Diagnostic Bit 14 reserved
166 dL 15: Path 5 Diagnostic Bit 15 reserved

```

TEST DIAGNOSTICS LIST

1	dAi	Status	{0,-1XXXX} see Status Codes
2	dS	Last Received Message	size 64 -> {0..21} msg chars
3	dAi	Buffer Length	{0..255}
4	dAi	Length in Message	{0..253}
5	dS	1st Part of Received Message	size 64
6	dS	2nd Part of Received Message	size 64
7	dS	3rd Part of Received Message	size 64
8	dS	4th Part of Received Message	size 64
9	dS	5th Part of Received Message	size 64
10	dS	6th Part of Received Message	size 64
11	dS	7th Part of Received Message	size 64
12	dS	8th Part of Received Message	size 64
13	dS	9th Part of Received Message	size 64
14	dS	10th Part of Received Message	size 64
15	dS	11th Part of Received Message	size 64
16	dS	12th Part of Received Message	size 64
17	dS	13th Part of Received Message	size 64
18	dS	14th Part of Received Message	size 64
19	dS	15th Part of Received Message	size 64
20	dS	16th Part of Received Message	size 64
21	dS	17th Part of Received Message	size 64
22	dS	18th Part of Received Message	size 64
23	dS	19th Part of Received Message	size 64
24	dS	20th Part of Received Message	size 64
25	dS	Checksum Result	size 64
26	dS	Syntax Check Result	size 64
27	dS	Syntax Error Result	size 64

APPENDIX C: RECEIVED MESSAGE DIAGNOSTICS

The following diagrams show the contents of the Test Diagnostic Nth Part of Received Message signals, one diagram per CODE:PATH combination.

CODE 37	0	1	2	3	4
5 PATHS	0123456789012345678901234567890123456789012345678901234567				
1st Part	Cd	Vstat	CRsta	QPath	QSamp
	~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~
2nd Part	ValS1	ValS2	ValS3	ValS4	ValS5
	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~
3rd Part	Lev1A	Lev1B	Lev2A	Lev2B	
	~~ ~~	~~ ~~	~~ ~~	~~ ~~	
4th Part	Lev3A	Lev3B	Lev4A	Lev4B	
	~~ ~~	~~ ~~	~~ ~~	~~ ~~	
5th Part	Lev5A	Lev5B	Lim1A	Lim1B	
	~~ ~~	~~ ~~	~~ ~~	~~ ~~	
6th Part	Lim2A	Lim2B	Lim3A	Lim3B	
	~~ ~~	~~ ~~	~~ ~~	~~ ~~	
7th Part	Lim4A	Lim4B	Lim5A	Lim5B	
	~~ ~~	~~ ~~	~~ ~~	~~ ~~	
8th Part	Speed-Sound		GasVelocity		-Pressure--
	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~
9th Part	Temperature		LineFloRate		BaseFloRate
	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~
10th Part	Stabi				
	~~ ~~				
11th Part	CppForPath1		CppForPath2		CppForPath3
	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~
12th Part	CppForPath4		CppForPath5		
	~~ ~~	~~ ~~	~~ ~~	~~ ~~	
13th Part	VppForPath1		VppForPath2		VppForPath3
	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~
14th Part	VppForPath4		VppForPath5		
	~~ ~~	~~ ~~	~~ ~~	~~ ~~	
15th Part	MType	SequenceNum			
	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~
16th Part	Forward-Vol		Reverse-Vol		TSonicSpare
	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~
17th Part	Diag1	Diag2	Diag3	Diag4	Diag5
	~~ ~~	~~ ~~	~~ ~~	~~ ~~	~~ ~~
	0123456789012345678901234567890123456789012345678901234567				
	0	1	2	3	4

```

CODE 37          0          1          2          3          4
3 PATHS        012345678901234567890123456789012345678901234567

1st Part      Cd          Vstat      CRsta      QPath      QSamp
~~           ~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~

2nd Part      ValS1     ValS2     ValS3     --  --     --  --
~~  ~~      ~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~

3rd Part      Lev1A     Lev1B     Lev2A     Lev2B
~~  ~~      ~~  ~~    ~~  ~~    ~~  ~~

4th Part      Lev3A     Lev3B     --  --     --  --
~~  ~~      ~~  ~~    ~~  ~~    ~~  ~~

5th Part      --  --     --  --     Lim1A     Lim1B
~~  ~~      ~~  ~~    ~~  ~~    ~~  ~~

6th Part      Lim2A     Lim2B     Lim3A     Lim3B
~~  ~~      ~~  ~~    ~~  ~~    ~~  ~~

7th Part      --  --     --  --     --  --     --  --
~~  ~~      ~~  ~~    ~~  ~~    ~~  ~~

8th Part      Speed-Sound  GasVelocity  -Pressure--
~~  ~~  ~~  ~~  ~~  ~~  GasVelocity  -Pressure--

9th Part      Temperature  LineFloRate  BaseFloRate
~~  ~~  ~~  ~~  ~~  ~~  LineFloRate  BaseFloRate

10th Part     Stabi
~~  ~~

11th Part     CppForPath1  CppForPath2  CppForPath3
~~  ~~  ~~  ~~  ~~  ~~  CppForPath2  CppForPath3

12th Part     --  --  --  --  --  --  --  --
~~  ~~  ~~  ~~  ~~  ~~  ~~  ~~

13th Part     VppForPath1  VppForPath2  VppForPath3
~~  ~~  ~~  ~~  ~~  ~~  VppForPath2  VppForPath3

14th Part     --  --  --  --  --  --  --  --
~~  ~~  ~~  ~~  ~~  ~~  ~~  ~~

15th Part     MType      SequenceNum
~~  ~~      ~~  ~~  ~~  ~~

16th Part     Forward-Vol  Reverse-Vol  TSonicSpare
~~  ~~  ~~  ~~  Reverse-Vol  TSonicSpare

17th Part     Diag1      Diag2      Diag3     --  --     --  --
~~  ~~      ~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~

012345678901234567890123456789012345678901234567
0          1          2          3          4

```

CODE 37	0	1	2	3	4
2 PATHS	012345678901234567890123456789012345678901234567				
1st Part	Cd	Vstat	CRsta	QPath	QSamp
	~~	~~	~~	~~	~~
2nd Part	ValS1	ValS2	ValS3	--	--
	~~	~~	~~	~~	~~
3rd Part	Lev1A	Lev1B	Lev2A	Lev2B	
	~~	~~	~~	~~	
4th Part	--	--	--	--	
	~~	~~	~~	~~	
5th Part	--	--	Lim1A	Lim1B	
	~~	~~	~~	~~	
6th Part	Lim2A	Lim2B	--	--	
	~~	~~	~~	~~	
7th Part	--	--	--	--	
	~~	~~	~~	~~	
8th Part	Speed-Sound		GasVelocity	-Pressure--	
	~~	~~	~~	~~	
9th Part	Temperature		LineFloRate	BaseFloRate	
	~~	~~	~~	~~	
10th Part	Stabi				
	~~				
11th Part	CppForPath1		CppForPath2	--	--
	~~	~~	~~	~~	~~
12th Part	--	--	--	--	
	~~	~~	~~	~~	
13th Part	VppForPath1		VppForPath2	--	--
	~~	~~	~~	~~	~~
14th Part	--	--	--	--	
	~~	~~	~~	~~	
15th Part	MType	SequenceNum			
	~~	~~	~~		
16th Part	Forward-Vol	Reverse-Vol		TSonicSpare	
	~~	~~	~~	~~	
17th Part	Diag1	Diag2	--	--	--
	~~	~~	~~	~~	~~
	012345678901234567890123456789012345678901234567				
	0	1	2	3	4


```

CODE 37      0          1          2          3          4
1 PATH      012345678901234567890123456789012345678901234567

1st Part    Cd          Vstat    CRsta    QPath    QSamp
~~         ~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~

2nd Part    ValS1    ValS2    ValS3    --  --    --  --
~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~

3rd Part    Lev1A    Lev1B    --  --    --  --
~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~

4th Part    --  --    --  --    --  --    --  --
~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~

5th Part    --  --    --  --    Lim1A    Lim1B
~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~

6th Part    --  --    --  --    --  --    --  --
~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~

7th Part    --  --    --  --    --  --    --  --
~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~

8th Part    Speed-Sound  GasVelocity  -Pressure--
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

9th Part    Temperature  LineFloRate  BaseFloRate
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

10th Part   Stabi
~~  ~~

11th Part   CppForPath1  --  --  --  --    --  --  --  --
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

12th Part   --  --  --  --    --  --  --  --
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

13th Part   VppForPath1  --  --  --  --    --  --  --  --
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

14th Part   --  --  --  --    --  --  --  --
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

15th Part   MType    SequenceNum
~~  ~~    ~~  ~~  ~~  ~~

16th Part   Forward-Vol  Reverse-Vol  TSonicSpare
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

17th Part   Diag1    --  --    --  --    --  --    --  --
~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~
012345678901234567890123456789012345678901234567
0          1          2          3          4

```

```

CODE 36          0          1          2          3          4
5 PATHS         012345678901234567890123456789012345678901234567

1st Part       Cd          Vstat      CRsta      QPath      QSamp
~~           ~~~ ~~~   ~~~ ~~~   ~~~ ~~~   ~~~ ~~~

2nd Part       ValS1     ValS2     ValS3     ValS4     ValS5
~~ ~~~      ~~~ ~~~   ~~~ ~~~   ~~~ ~~~   ~~~ ~~~

3rd Part       Lev1A     Lev1B     Lev2A     Lev2B
~~ ~~~      ~~~ ~~~   ~~~ ~~~   ~~~ ~~~

4th Part       Lev3A     Lev3B     Lev4A     Lev4B
~~ ~~~      ~~~ ~~~   ~~~ ~~~   ~~~ ~~~

5th Part       Lev5A     Lev5B     Lim1A     Lim1B
~~ ~~~      ~~~ ~~~   ~~~ ~~~   ~~~ ~~~

6th Part       Lim2A     Lim2B     Lim3A     Lim3B
~~ ~~~      ~~~ ~~~   ~~~ ~~~   ~~~ ~~~

7th Part       Lim4A     Lim4B     Lim5A     Lim5B
~~ ~~~      ~~~ ~~~   ~~~ ~~~   ~~~ ~~~

8th Part       Speed-Sound  GasVelocity  -Pressure--
~~ ~~~ ~~~ ~~~ ~~~ ~~~ ~~~ ~~~ ~~~ ~~~ ~~~ ~~~ ~~~

9th Part       Temperature  LineFloRate  BaseFloRate
~~ ~~~ ~~~ ~~~ ~~~ ~~~ ~~~ ~~~ ~~~ ~~~ ~~~ ~~~

10th Part      Stabi
~~ ~~~

11th Part      CppForPath1  CppForPath2  CppForPath3
~~ ~~~ ~~~ ~~~ ~~~ ~~~ ~~~ ~~~ ~~~ ~~~

12th Part      CppForPath4  CppForPath5
~~ ~~~ ~~~ ~~~ ~~~ ~~~ ~~~ ~~~ ~~~ ~~~

13th Part      VppForPath1  VppForPath2  VppForPath3
~~ ~~~ ~~~ ~~~ ~~~ ~~~ ~~~ ~~~ ~~~ ~~~

14th Part      VppForPath4  VppForPath5
~~ ~~~ ~~~ ~~~ ~~~ ~~~ ~~~ ~~~ ~~~ ~~~

15th Part      -- --      -- --      -- --
~~ ~~~      ~~~ ~~~   ~~~ ~~~

16th Part      -- --      -- --      -- --      -- --
~~ ~~~      ~~~ ~~~   ~~~ ~~~   ~~~ ~~~

17th Part      -- --      -- --      -- --      -- --
~~ ~~~      ~~~ ~~~   ~~~ ~~~   ~~~ ~~~

012345678901234567890123456789012345678901234567
0          1          2          3          4

```

```

CODE 36      0          1          2          3          4
3 PATHS     012345678901234567890123456789012345678901234567

1st Part    Cd          Vstat    CRsta    QPath    QSamp
~~         ~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~

2nd Part    ValS1    ValS2    ValS3    --  --    --  --
~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~

3rd Part    Lev1A    Lev1B    Lev2A    Lev2B
~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~

4th Part    Lev3A    Lev3B    --  --    --  --
~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~

5th Part    --  --    --  --    Lim1A    Lim1B
~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~

6th Part    Lim2A    Lim2B    Lim3A    Lim3B
~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~

7th Part    --  --    --  --    --  --    --  --
~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~

8th Part    Speed-Sound  GasVelocity  -Pressure--
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

9th Part    Temperature  LineFloRate  BaseFloRate
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

10th Part   Stabi
~~  ~~

11th Part   CppForPath1  CppForPath2  CppForPath3
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

12th Part   --  --  --  --    --  --  --  --
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

13th Part   VppForPath1  VppForPath2  VppForPath3
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

14th Part   --  --  --  --    --  --  --  --
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

15th Part   --  --    --  --    --  --
~~  ~~    ~~  ~~    ~~  ~~

16th Part   --  --  --  --    --  --  --  --    --  --  --  --
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

17th Part   --  --    --  --    --  --    --  --    --  --
~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~

012345678901234567890123456789012345678901234567
0          1          2          3          4

```

```

CODE 35          0          1          2          3          4
5 PATHS        012345678901234567890123456789012345678901234567

1st Part      Cd          Vstat    CRsta    QPath    QSamp
~~           ~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~

2nd Part      ValS1    ValS2    ValS3    ValS4    ValS5
~~  ~~      ~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~

3rd Part      Lev1A    Lev1B    Lev2A    Lev2B
~~  ~~      ~~  ~~    ~~  ~~    ~~  ~~

4th Part      Lev3A    Lev3B    Lev4A    Lev4B
~~  ~~      ~~  ~~    ~~  ~~    ~~  ~~

5th Part      Lev5A    Lev5B    Lim1A    Lim1B
~~  ~~      ~~  ~~    ~~  ~~    ~~  ~~

6th Part      Lim2A    Lim2B    Lim3A    Lim3B
~~  ~~      ~~  ~~    ~~  ~~    ~~  ~~

7th Part      Lim4A    Lim4B    Lim5A    Lim5B
~~  ~~      ~~  ~~    ~~  ~~    ~~  ~~

8th Part      Speed-Sound  GasVelocity  -Pressure--
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

9th Part      Temperature  LineFloRate  BaseFloRate
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

10th Part     Stabi
~~  ~~

11th Part     --  --  --  --    --  --  --  --    --  --  --  --
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

12th Part     --  --  --  --    --  --  --  --
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

13th Part     --  --  --  --    --  --  --  --    --  --  --  --
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

14th Part     --  --  --  --    --  --  --  --
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

15th Part     --  --    --  --    --  --
~~  ~~    ~~  ~~    ~~  ~~

16th Part     --  --  --  --    --  --  --  --    --  --  --  --
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

17th Part     --  --    --  --    --  --    --  --    --  --
~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~

012345678901234567890123456789012345678901234567
0          1          2          3          4

```

```

CODE 35          0          1          2          3          4
3 PATHS         012345678901234567890123456789012345678901234567

1st Part       Cd          Vstat    CRsta    QPath    QSamp
~~           ~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~

2nd Part       ValS1    ValS2    ValS3    --  --    --  --
~~  ~~      ~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~

3rd Part       Lev1A    Lev1B    Lev2A    Lev2B
~~  ~~      ~~  ~~    ~~  ~~    ~~  ~~

4th Part       Lev3A    Lev3B    --  --    --  --
~~  ~~      ~~  ~~    ~~  ~~    ~~  ~~

5th Part       --  --    --  --    Lim1A    Lim1B
~~  ~~      ~~  ~~    ~~  ~~    ~~  ~~

6th Part       Lim2A    Lim2B    Lim3A    Lim3B
~~  ~~      ~~  ~~    ~~  ~~    ~~  ~~

7th Part       --  --    --  --    --  --    --  --
~~  ~~      ~~  ~~    ~~  ~~    ~~  ~~

8th Part       Speed-Sound  GasVelocity  -Pressure--
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

9th Part       Temperature  LineFloRate  BaseFloRate
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

10th Part      Stabi
~~  ~~

11th Part      --  --  --  --    --  --  --  --    --  --  --  --
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

12th Part      --  --  --  --    --  --  --  --
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

13th Part      --  --  --  --    --  --  --  --    --  --  --  --
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

14th Part      --  --  --  --    --  --  --  --
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

15th Part      --  --    --  --    --  --
~~  ~~    ~~  ~~    ~~  ~~

16th Part      --  --  --  --    --  --  --  --    --  --  --  --
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

17th Part      --  --    --  --    --  --    --  --    --  --
~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~
012345678901234567890123456789012345678901234567
0          1          2          3          4

```

```

CODE 35      0          1          2          3          4
1 PATH      012345678901234567890123456789012345678901234567

1st Part    Cd          Vstat    CRsta    QPath    QSamp
~~         ~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~

2nd Part    ValS1    ValS2    ValS3    --  --    --  --
~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~

3rd Part    Lev1A    Lev1B    --  --    --  --
~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~

4th Part    --  --    --  --    --  --    --  --
~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~

5th Part    --  --    --  --    Lim1A    Lim1B
~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~

6th Part    --  --    --  --    --  --    --  --
~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~

7th Part    --  --    --  --    --  --    --  --
~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~

8th Part    Speed-Sound  GasVelocity  -Pressure--
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

9th Part    Temperature  LineFloRate  BaseFloRate
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

10th Part   Stabi
~~  ~~

11th Part   --  --  --  --    --  --  --  --    --  --  --  --
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

12th Part   --  --  --  --    --  --  --  --
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

13th Part   --  --  --  --    --  --  --  --    --  --  --  --
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

14th Part   --  --  --  --    --  --  --  --
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

15th Part   --  --    --  --    --  --
~~  ~~    ~~  ~~    ~~  ~~

16th Part   --  --  --  --    --  --  --  --    --  --  --  --
~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~    ~~  ~~  ~~  ~~

17th Part   --  --    --  --    --  --    --  --    --  --
~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~    ~~  ~~
012345678901234567890123456789012345678901234567
0          1          2          3          4

```

APPENDIX D: RECEIVED MESSAGE VS. DATA SIGNALS

The following tables show the Received Message Fields, with DATA TYPE and SIZE, vs. Test Diagnostics List Nth PART of Received Message Signals' Contents (with COLumn number therein) for valid combinations of CODES:PATHS, one diagram per QTY of PATHS.

For each field, the table lists its Start OFFset within the received message "Information" field, and the corresponding [USED] and <UNUSED> Data Signal numbers.

N = quantity of acoustic paths

chr = character (unsigned 8-bit integer)
 uns = unsigned (16-bit integer)
 int = signed (16-bit integer)
 lng = long (signed 32-bit integer)
 flt = float (IEEE-754 32-bit floating point)

In ACCOL, all numeric values are float.

RECEIVED MESSAGE FIELD	DATA TYPE	DATA SIZE	DIAG_MSG PART.COL	35,37 : 1 OFF	USED	UNUSED
Code	chr	1	1.1	0	[5]	
Vstatus	uns	2	1.2	1	[6-21]	
CRstatus	uns	2	1.3	3	[22-37]	
NumPaths	int	2	1.4	5	[38]	
SampleRate	uns	2	1.5	7	[39]	
ValidSamples [N]	uns	2N	2.1-2.5	9	[40]	<41-44>
AgcLevel [N] [2]	uns	4N	3.1-5.2	11	[45,46]	<47-54>
AgcLimit [N] [2]	uns	4N	5.3-7.4	15	[55,56]	<57-64>
SpeedOfSound	flt	4	8.1	19	[65]	
GasVelocity	flt	4	8.2	23	[66]	
Pressure	flt	4	8.3	27	[67]	
Temperature	flt	4	9.1	31	[68]	
Qline	flt	4	9.2	35	[69]	
Qbase	flt	4	9.3	39	[70]	
Stability	int	2	10.1	43	[71]	
Cpp [N]	flt	4N	11.1-12.2	45	[72]	<73-76>
Vpp [N]	flt	4N	13.1-14.2	49	[77]	<78-81>
MeterType	uns	2	15.1	53	[82]	
SequenceNum	lng	4	15.2	55	[83]	
ForwardVolume	flt	4	16.1	59	[84]	
ReverseVolume	flt	4	16.2	63	[85]	
Tspare	flt	4	16.3	67	[86]	
DiagBits [N]	uns	2N	17.1-17.5	71	[87-102]	<103-166>
TOTAL:				73		

RECEIVED MESSAGE	DATA		DIAG_MSG	37 : 2		
FIELD	TYPE	SIZE	PART.COL	OFF	USED	UNUSED
Code	chr	1	1.1	0	[5]	
Vstatus	uns	2	1.2	1	[6-21]	
CRstatus	uns	2	1.3	3	[22-37]	
NumPaths	int	2	1.4	5	[38]	
SampleRate	uns	2	1.5	7	[39]	
ValidSamples [N]	uns	2N	2.1-2.5	9	[40,41]	<42-44>
AgcLevel [N] [2]	uns	4N	3.1-5.2	13	[45-48]	<49-54>
AgcLimit [N] [2]	uns	4N	5.3-7.4	21	[55-58]	<59-64>
SpeedOfSound	flt	4	8.1	29	[65]	
GasVelocity	flt	4	8.2	33	[66]	
Pressure	flt	4	8.3	37	[67]	
Temperature	flt	4	9.1	41	[68]	
Qline	flt	4	9.2	45	[69]	
Qbase	flt	4	9.3	49	[70]	
Stability	int	2	10.1	53	[71]	
Cpp [N]	flt	4N	11.1-12.2	55	[72,73]	<74-76>
Vpp [N]	flt	4N	13.1-14.2	63	[77,78]	<79-81>
MeterType	uns	2	15.1	71	[82]	
SequenceNum	lng	4	15.2	73	[83]	
ForwardVolume	flt	4	16.1	77	[84]	
ReverseVolume	flt	4	16.2	81	[85]	
Tspare	flt	4	16.3	85	[86]	
DiagBits [N]	uns	2N	17.1-17.5	89	[87-118]	<119-166>
TOTAL:				93		

RECEIVED MESSAGE	DATA	DIAG_MSG	35,36,37 : 3			
FIELD	TYPE	SIZE	PART.COL	OFF	USED	UNUSED
Code	chr	1	1.1	0	[5]	
Vstatus	uns	2	1.2	1	[6-21]	
CRstatus	uns	2	1.3	3	[22-37]	
NumPaths	int	2	1.4	5	[38]	
SampleRate	uns	2	1.5	7	[39]	
ValidSamples [N]	uns	2N	2.1-2.5	9	[40-42]	<43,44>
AgcLevel [N] [2]	uns	4N	3.1-5.2	15	[45-50]	<51-54>
AgcLimit [N] [2]	uns	4N	5.3-7.4	27	[55-60]	<61-64>
SpeedOfSound	flt	4	8.1	39	[65]	
GasVelocity	flt	4	8.2	43	[66]	
Pressure	flt	4	8.3	47	[67]	
Temperature	flt	4	9.1	51	[68]	
Qline	flt	4	9.2	55	[69]	
Qbase	flt	4	9.3	59	[70]	
Stability	int	2	10.1	63	[71]	/ Code 35
Cpp [N]	flt	4N	11.1-12.2	65	[72-74]	<75,76>
Vpp [N]	flt	4N	13.1-14.2	77	[77-89]	<80,81> / Code 36
MeterType	uns	2	15.1	89	[82]	
SequenceNum	lng	4	15.2	91	[83]	
ForwardVolume	flt	4	16.1	95	[84]	
ReverseVolume	flt	4	16.2	99	[85]	
Tspare	flt	4	16.3	103	[86]	
DiagBits [N]	uns	2N	17.1-17.5	107	[87-134]	<135-166> / Code 37
-----				---		
TOTAL:				113		

RECEIVED MESSAGE	DATA	DIAG_MSG	35,36,37 : 5		
FIELD	TYPE	SIZE	PART.COL	OFF	USED
Code	chr	1	1.1	0	[5]
Vstatus	uns	2	1.2	1	[6-21]
CRstatus	uns	2	1.3	3	[22-37]
NumPaths	int	2	1.4	5	[38]
SampleRate	uns	2	1.5	7	[39]
ValidSamples [N]	uns	2N	2.1-2.5	9	[40-44]
AgcLevel [N] [2]	uns	4N	3.1-5.2	19	[45-54]
AgcLimit [N] [2]	uns	4N	5.3-7.4	39	[55-64]
SpeedOfSound	flt	4	8.1	59	[65]
GasVelocity	flt	4	8.2	63	[66]
Pressure	flt	4	8.3	67	[67]
Temperature	flt	4	9.1	71	[68]
Qline	flt	4	9.2	75	[69]
Qbase	flt	4	9.3	79	[70]
Stability	int	2	10.1	83	[71]
Cpp [N]	flt	4N	11.1-12.2	85	[72-76]
Vpp [N]	flt	4N	13.1-14.2	105	[77-81]
MeterType	uns	2	15.1	125	[82]
SequenceNum	lng	4	15.2	127	[83]
ForwardVolume	flt	4	16.1	131	[84]
ReverseVolume	flt	4	16.2	135	[85]
Tspare	flt	4	16.3	139	[86]
DiagBits [N]	uns	2N	17.1-17.5	143	[87-166]
TOTAL:				153	

The following tables show the Test Diagnostics List Nth PART of Received Message Signals' Contents (including QTY of columns) for valid combinations of CODES:PATHS.

For Nth PART signal, the table lists the BYTES within the received message "Information" field displayed, and the corresponding [USED] and <UNUSED> Data Signal numbers.

DIAG_MSG	35,37 : 1			37 : 2			<- CODES:PATHS	
PART QTY	BYTES	USED	UNUSED	BYTES	USED	UNUSED		
1st (5)	0-8	[5-39]		0-8	[5-39]		\	\
2nd (5)	9-10	[40]	<41-44>	9-12	[40,41]	<42-44>		
3rd (4)	11-14	[45,46]	<47,48>	13-20	[45-48]			
4th (4)			<49-52>			<49-52>		
5th (4)	15-18	[55,56]	<53,54>	21-24	[55,56]	<53,54>		
6th (4)			<57-60>	25-28	[57,58]	<59,60>		
7th (4)			<61-64>			<61-64>		
8th (3)	19-30	[65-67]		29-40	[65-67]			
9th (3)	31-42	[68-70]		41-52	[68-70]			
10th (1)	43,44	[71]		53,54	[71]			
11th (3)	45-48	[72]	<73,74>	55-62	[72,73]	<74>		/ Code 35
12th (3)			<75,76>			<75,76>		
13th (3)	49-52	[77]	<78,79>	63-70	[77,78]	<79>		
14th (3)			<80,81>			<80,81>		
15th (2)	53-58	[82,83]		71-76	[82,83]			
16th (3)	59-70	[84-86]		77-88	[84-86]			
17th (5)	71-72	[87-102]	<103-166>	89-92	[87-118]	<119-166>		/ Code 37

DIAG_MSG	35,36,37 : 3			35,36,37 : 5		<- CODES:PATHS	
PART QTY	BYTES	USED	UNUSED	BYTES	USED		
1st (5)	0-8	[5-39]		0-8	[5-39]		\ \ \
2nd (5)	9-14	[40-42]	<43,44>	9-18	[40-44]		
3rd (4)	15-22	[45-48]		19-26	[45-48]		
4th (4)	23-26	[49,50]	<51,52>	27-34	[49-52]		
5th (4)	27-30	[55,56]	<53,54>	35-42	[53-56]		
6th (4)	31-38	[57-60]		43-50	[57-60]		
7th (4)			<61-64>	51-58	[61-64]		
8th (3)	39-50	[65-67]		59-70	[65-67]		
9th (3)	51-62	[68-70]		71-82	[68-70]		
10th (1)	63,64	[71]		83-84	[71]		
11th (3)	65-76	[72-74]		85-96	[72-74]		
12th (3)			<75,76>	97-104	[75,76]		
13th (3)	77-88	[77-79]		105-116	[77-79]		
14th (3)			<80,81>	117-124	[80,81]		
15th (2)	89-94	[82,83]		125-130	[82,83]		
16th (3)	95-106	[84-86]		131-142	[84-86]		
17th (5)	107-112	[87-166]	<135-166>	143-152	[87-166]		

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