MODEL 870 ORIENTATION PACKAGE

SERIAL INTERFACE SPECIFICATION (v1.03)

OVERVIEW

The Model 870 Orientation package communicates over a 2-wire differential RS-485 serial data transmission line or optionally a half-duplex RS-232 data line. To interrogate the Orientation package and receive data, a Switch Data Command string is sent via a serial command program at a baud rate of **115200 bps, No Parity, 8 Data Bits and 1 Stop Bit**. When the Switch Data command is accepted, the Orientation package sends its return data back to the command program.

SWITCH DATA COMMAND

The Orientation package accepts up to 27 bytes of switch data from the serial interface and must see the switch data header (2 bytes: **0xFE** and **0x44** HEX) in order to process the switches. The Orientation package will stop accepting switch data when it sees the termination byte (**0xFD** HEX). The termination byte must be present for the head to process the switches.

> **Note: the Termination Byte is the only switch value allowed to have a value of 0xFD. All other switches should be set higher or lower than 0xFD (253 Decimal) so they are not interpreted as a termination byte!**

Byte #	Description							
0 – 7	**0xFE**	**0x44**	Head ID	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Reserved 0
8 – 15	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Reserved 0
16 – 23	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Operation	Cal. Memory Page	Reserved 0	Reserved 0
24 – 26	Switch Delay	Reserved 0	Term. **0xFD**					

Table 1 Model 870 Switch Data Command for reading data

SWITCH DATA COMMAND (con't)

BYTE DESCRIPTIONS

Note: All Byte values are shown in decimal unless noted with a '0x' (hexadecimal) prefix.

Byte 0 **Switch Data Header (1st Byte)**
Always **0xFE** (254 decimal)

Byte 1 **Switch Data Header (2nd Byte)**
Always **0x44** (68 decimal)

Byte 2 **Head ID**
0x18 to 0x1F (0x18 standard)

Byte 3 **Reserved**
Always 0

Byte 4 **Reserved**
Always 0

Byte 5 **Reserved**
Always 0

Byte 6 **Reserved**
Always 0

Byte 7 **Reserved**
Always 0

Byte 8 **Reserved**
Always 0

Byte 9 **Reserved**
Always 0

Byte 10 **Reserved**
Always 0

Byte 11 **Reserved**
Always 0

Byte 12 **Reserved**
Always 0

SWITCH DATA COMMAND (con't)

Byte 13 **Reserved**
Always 0

Byte 14 **Reserved**
Always 0

Byte 15 **Reserved**
Always 0

Byte 16 **Reserved**
Always 0

Byte 17 **Reserved**
Always 0

Byte 18 **Reserved**
Always 0

Byte 19 **Reserved**
Always 0

Byte 20 **Operation**
0x00 = normal data returned
0x01 = calibration data returned
0x02 = calibration memory returned
0x03 = calibration memory written
0x21 = reset gyro to zero

Byte 21 **Calibration memory page**
Used for the reading and writing of calibration memory
Set to 0 for normal operation

Byte 22 **Reserved**
Always 0

Byte 23 **Reserved**
Always 0

SWITCH DATA COMMAND (con't)

Byte 24 **Switch Delay**
The Orientation package can be commanded to pause (from 0 to 510 sec) before sending its return data to allow the commanding program enough time to setup for serial reception of the return data.
0 to 255 in 2 msec increments
Byte 24 = delay_in_milliseconds/2
Do not use a value of 253!

Byte 25 **Reserved**
Always 0

Byte 26 **Termination Byte**
The orientation package will stop looking for Switch Data when it sees this byte.
Always **0xFD** (253 decimal)

RETURN DATA FOR NORMAL OPERATION

This mode returns data from the Orientation module, which have been compensated with calibration values. The normal data is returned when byte 20 of the switch data command is set to 0.

Byte #	Description					
0 to 5	ASCII 'I'	ASCII 'O'	ASCII 'X'	Head ID 0x18	Serial Status	Reserved 0
6 to 11	Reserved 0	Version	Reserved 0	Reserved 0	Data Bytes (LO)	Data Bytes (HI)
12 to (N-2)	Data 16 Data Bytes					
N-1	Term 0xFC					

Table 2 Model 870 Return Data

BYTE DESCRIPTIONS

Note: All Byte values are shown in decimal unless noted with a '0x' prefix.
N = total number of return bytes

Byte 0 - 2 **Imagenex Return Data Header**
ASCII '**IOX**'

Byte 3 **Head ID**
0x18 to 0x1F

Byte 4 **Serial Status**
Bit 0 - 0 = Normal, 1 = Gyro Error
Bit 1 - 0
Bit 2 - 0
Bit 3 - 0
Bit 4 - 0
Bit 5 - 0
Bit 6 - 1 = Switches Accepted
Bit 7 - 1 = Character Overrun

RETURN DATA FOR NORMAL OPERATION (con't)

Byte 5 **Reserved**
Always 0

Byte 6 **Reserved**
Always 0

Byte 7 **Version**
0 - original
1 - add Microstrain 3DM-GX1 for pitch, roll and heading
2 - add KVH DSP-3000 Fiber Optic Gyro
3 - uses Imagenex sensor for pitch, roll and heading
4 - add water contact for air sonar
5 - uses new Imagenex sensor with gyro status
6 - air sonar with water contact and new Imagenex sensor with gyro status

Byte 8 9 **Reserved**
Always 0

Byte 10 -11 **Data bytes**

Byte 10								**Byte 11**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0	**Data bytes (LO)**							**0**	**Data bytes (HI)**						**L**

Data Bytes High Byte = (Byte 9 & 0x7E)>>1
Data Bytes Low Byte = [((Byte 9 & 0x01)<<7) | (Byte 8 & 0x7F)]
Data Bytes = (Data Bytes High Byte<<8) | Data Bytes Low Byte

Byte 12-13 **Temperature external**

Byte 12								**Byte 13**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0	**Temperature ext (LO)**							**0**	**Temperature ext (HI)**						**L**

Temperature ext High Byte = (Byte 13 & 0x7E)>>1
Temperature ext Low Byte = [((Byte 13 & 0x01)<<7) | (Byte 12 & 0x7F)]
Temperature ext = (Temperature ext High Byte<<8)
| Temperature ext Low Byte

0 = -55 °C
880 = 0 °C
2880 = 125 °C

RETURN DATA FOR NORMAL OPERATION (con't)

Byte 14-15 **Temperature internal**

Byte 14								Byte 15							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0	**Temperature int (LO)**							**0**	**Temperature int (HI)**						**L**

Temperature int High Byte = (Byte 15 & 0x7E)>>1
Temperature int Low Byte = [((Byte 15 & 0x01)<<7) | (Byte 14 & 0x7F)]
Temperature int = (Temperature int High Byte<<8)
| Temperature int Low Byte

0 = -55 °C
880 = 0 °C
2880 = 125 °C

Byte 16-17 **Depth**

Byte 16								Byte 17							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0	**Depth (LO)**							**0**	**Depth (HI)**						**L**

Depth High Byte = (Byte 17 & 0x7E)>>1
Depth Low Byte = [((Byte 17 & 0x01)<<7) | (Byte 16 & 0x7F)]
Depth = (Depth High Byte<<8) | Depth Low Byte

0 = 0 M
2000 = 200M

Byte 18-19 **Pitch**

Byte 18								Byte 19							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0	**Pitch (LO)**							**0**	**Pitch (HI)**						**L**

Pitch High Byte = (Byte 19 & 0x7E)>>1
Pitch Low Byte = [((Byte 19 & 0x01)<<7) | (Byte 18 & 0x7F)]
Pitch = (Pitch High Byte<<8) | Pitch Low Byte

0 = -90 °
900 = 0 °
1800 = +90 °

RETURN DATA FOR NORMAL OPERATION (con't)

Byte 20-21 **Roll**

Byte 20								Byte 21							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0	**Roll (LO)**							**0**	**Roll (HI)**						**L**

Roll High Byte = (Byte 21 & 0x7E)>>1
Roll Low Byte = [((Byte 21 & 0x01)<<7) | (Byte 20 & 0x7F)]
Roll = (Roll High Byte<<8) | Roll Low Byte

0 = -90 °
900 = 0 °
1800 = +90 °

Byte 22-23 **Heading**

Byte 22								Byte 23							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0	**Heading (LO)**							**0**	**Heading (HI)**						**L**

Heading High Byte = (Byte 23 & 0x7E)>>1
Heading Low Byte = [((Byte 23 & 0x01)<<7) | (Byte 22 & 0x7F)]
Heading = (Heading High Byte<<8) | Heading Low Byte

0 = 0 °
3599 = 359.9 °

Byte 24-25 **Gyro Heading**

Byte 24								Byte 25							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0	**Gyro Heading (LO)**							**0**	**Gyro Heading (HI)**						**L**

Gyro Heading High Byte = (Byte 25 & 0x7E)>>1
Gyro Heading Low Byte = [((Byte 25 & 0x01)<<7) | (Byte 24 & 0x7F)]
Gyro Heading = (Gyro Heading High Byte<<8) | Gyro Heading Low Byte

0 = 0 °
3599 = 359.9 °

RETURN DATA FOR NORMAL OPERATION (con't)

Byte 26 **Reserved**
Always 0

Byte 27 **Reserved**
Always 0

Byte 28 **Termination Byte**
0xFC

RETURN DATA FOR CALIBRATION

This mode returns data to be used in the calibration of the device. The calibration data is returned when byte 20 of the switch data command is set to 1.

Byte #	Description					
0 to 5	ASCII 'I'	ASCII 'O'	ASCII 'X'	Head ID 0x18	Serial Status	Reserved 0
6 to 11	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Data Bytes (LO)	Data Bytes (HI)
12 to (N-2)	Data 16 Data Bytes					
N-1	Term 0xFC					

Table 3 Model 870 Return Data

BYTE DESCRIPTIONS

Note: All Byte values are shown in decimal unless noted with a '0x' prefix.
N = total number of return bytes

Byte 0 - 2 **Imagenex Return Data Header**
ASCII '**IOX**'

Byte 3 **Head ID**
0x18 to 0x1F

Byte 4 **Serial Status**
Bit 0 - 0
Bit 1 - 0
Bit 2 - 0
Bit 3 - 0
Bit 4 - 0
Bit 5 - 0
Bit 6 - 1 = Switches Accepted
Bit 7 - 1 = Character Overrun

RETURN DATA FOR CALIBRATION (con't)

Byte 5 **Reserved**
Always 0

Byte 6 **Reserved**
Always 0

Byte 7 **Reserved**
Always 0

Byte 8 **Reserved**
Always 0

Byte 9 **Reserved**
Always 0

Byte 10 -11 **Data bytes**

Byte 10								**Byte 11**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0	**Data bytes (LO)**							**0**	**Data bytes (HI)**						**L**

Data Bytes High Byte = (Byte 9 & 0x7E)>>1
Data Bytes Low Byte = [((Byte 9 & 0x01)<<7) | (Byte 8 & 0x7F)]
Data Bytes = (Data Bytes High Byte<<8) | Data Bytes Low Byte

Byte 12-13 **Temperature external calibration value**

Byte 12								**Byte 13**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0	**Temperature ext (LO)**							**0**	**Temperature ext (HI)**						**L**

Temperature ext High Byte = (Byte 13 & 0x7E)>>1
Temperature ext Low Byte = [((Byte 13 & 0x01)<<7) | (Byte 12 & 0x7F)]
Temperature ext = (Temperature ext High Byte<<8)
| Temperature ext Low Byte

0 = -55 °C
880 = 0 °C
2880 = 125 °C

RETURN DATA FOR CALIBRATION (con't)

Byte 14-15 **Temperature internal calibration value**

Byte 14								Byte 15							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0	**Temperature int (LO)**							**0**	**Temperature int (HI)**						**L**

Temperature int High Byte = (Byte 15 & 0x7E)>>1
Temperature int Low Byte = [((Byte 15 & 0x01)<<7) | (Byte 14 & 0x7F)]
Temperature int = (Temperature int High Byte<<8)
| Temperature int Low Byte

0 = -55 °C
880 = 0 °C
2880 = 125 °C

Byte 16-17 **Depth calibration value**

Byte 16								Byte 17							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0	**Depth (LO)**							**0**	**Depth (HI)**						**L**

Depth High Byte = (Byte 17 & 0x7E)>>1
Depth Low Byte = [((Byte 17 & 0x01)<<7) | (Byte 16 & 0x7F)]
Depth = (Depth High Byte<<8) | Depth Low Byte

Byte 18-19 **Pitch duty cycle**

Byte 18								Byte 19							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0	**Pitch (LO)**							**0**	**Pitch (HI)**						**L**

Pitch High Byte = (Byte 19 & 0x7E)>>1
Pitch Low Byte = [((Byte 19 & 0x01)<<7) | (Byte 18 & 0x7F)]
Pitch = (Pitch High Byte<<8) | Pitch Low Byte

RETURN DATA FOR CALIBRATION (con't)

Byte 20-21 **Roll duty cycle**

Byte 20								Byte 21							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0	**Roll (LO)**							**0**	**Roll (HI)**						**L**

Roll High Byte = (Byte 21 & 0x7E)>>1
Roll Low Byte = [((Byte 21 & 0x01)<<7) | (Byte 20 & 0x7F)]
Roll = (Roll High Byte<<8) | Roll Low Byte

Byte 22-23 **Heading X axis**

Byte 22								Byte 23							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0	**Heading X axis(LO)**							**0**	**Heading X axis(HI)**						**L**

Heading X axis High Byte = (Byte 23 & 0x7E)>>1
Heading X axis Low Byte = [((Byte 23 & 0x01)<<7) | (Byte 22 & 0x7F)]
Heading X axis = (Heading High Byte<<8) | Heading Low Byte
Heading X axis = Heading X axis - 8192

Byte 24-25 **Heading Y axis**

Byte 22								Byte 23							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0	**Heading Y axis(LO)**							**0**	**Heading Y axis(HI)**						**L**

Heading Y axis High Byte = (Byte 23 & 0x7E)>>1
Heading Y axis Low Byte = [((Byte 23 & 0x01)<<7) | (Byte 22 & 0x7F)]
Heading Y axis = (Heading High Byte<<8) | Heading Low Byte
Heading Y axis = Heading Y axis - 8192

Byte 26 **Reserved**
Always 0

Byte 27 **Reserved**
Always 0

RETURN DATA FOR CALIBRATION (con't)

Byte 28	**Termination Byte** **0xFC**

SWITCH DATA COMMAND FOR READING / WRITING CALIBRATION MEMORY

The Orientation package accepts 123 bytes of switch data from the serial interface and must see the switch data header (2 bytes: **0xFE** and **0x44** HEX) in order to process the switches. The Orientation package will stop accepting switch data when it sees the termination byte (**0xFD** HEX). The termination byte must be present for the head to process the switches.

This mode is used to write data into the Orientation module. Data is written in 64 byte blocks, pointed to by byte 21 of the switch data command. A block of data should read from the Orientation module, modified, and then written back.

Note: the Termination Byte is the only switch value allowed to have a value of 0xFD. All other switches should be set higher or lower than 0xFD (253 Decimal) so they are not interpreted as a termination byte!

Byte #	Description							
0 – 7	**0xFE**	**0x44**	Head ID	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Reserved 0
8 – 15	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Reserved 0
16 – 23	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Operation	Cal. Memory Page	Reserved 0	Reserved 0
24 – 26	Switch Delay	Reserved 0						
27 – 121	Data 96 bytes							
Term. **0xFD**								

Table 3 Model 870 Switch Data Command for writing calibration data

BYTE DESCRIPTIONS

Note: All Byte values are shown in decimal unless noted with a '0x' (hexadecimal) prefix.

Byte 0 **Switch Data Header (1st Byte)**
Always **0xFE** (254 decimal)

Byte 1 **Switch Data Header (2nd Byte)**
Always **0x44** (68 decimal)

Byte 2 **Head ID**
0x18 to 0x1F (0x18 standard)

SWITCH DATA COMMAND FOR READING / WRITING CALIBRATION MEMORY (con't)

Byte 3 **Reserved**
Always 0

Byte 4 **Reserved**
Always 0

Byte 5 **Reserved**
Always 0

Byte 6 **Reserved**
Always 0

Byte 7 **Reserved**
Always 0

Byte 8 **Reserved**
Always 0

Byte 9 **Reserved**
Always 0

Byte 10 **Reserved**
Always 0

Byte 11 **Reserved**
Always 0

Byte 12 **Reserved**
Always 0

Byte 13 **Reserved**
Always 0

Byte 14 **Reserved**
Always 0

Byte 15 **Reserved**
Always 0

Byte 16 **Reserved**
Always 0

SWITCH DATA COMMAND FOR READING / WRITING CALIBRATION MEMORY (con't)

Byte 17 **Reserved**
Always 0

Byte 18 **Reserved**
Always 0

Byte 19 **Reserved**
Always 0

Byte 20 **Operation**
0 = normal data returned
1 = calibration data returned
2 = calibration memory returned
3 = calibration memory written

Byte 21 **Calibration memory page**
Sets the page of calibration memory to read from or write to

0	=	-5°C calibration page
5	=	0°C calibration page
55	=	50°C calibration page
0xE0	=	Pitch Linearization (L0)
0xE1	=	Pitch Linearization (HI)
0xE8	=	Roll Linearization (LO)
0xE9	=	Roll Linearization (HI)
0xF0	=	Configuration page
0xF1	=	EEPROM

Byte 22 **Reserved**
Always 0

Byte 23 **Reserved**
Always 0

Byte 24 **Switch Delay**
The Orientation package can be commanded to pause (from 0 to 510 sec) before sending its return data to allow the commanding program enough time to setup for serial reception of the return data.
0 to 255 in 2 msec increments
Byte 24 = delay_in_milliseconds/2
Do not use a value of 253!

SWITCH DATA COMMAND FOR READING / WRITING CALIBRATION MEMORY (con't)

Byte 25 **Reserved**
Always 0

SWITCH DATA COMMAND FOR READING / WRITING CALIBRATION MEMORY (con't)

Byte 26-28 **Data word 0**

Byte 26								**Byte 27**								**Byte 28**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0	**Calibration byte (LO)**							**0**	**Calibration byte (HI)**						**L**	**0**	**0**	**0**	**0**	**0**	**0**	**L**	**L**

Calibration High Byte = [(Byte 14 & 0x03) <<6) | (Byte 13 & 0x3F)]
Calibration Low Byte = [((Byte 13 & 0x01)<<7) | (Byte 12 & 0x7F)]
Calibration Word = (Calibration High Byte<<8) | Calibration Low Byte

Byte 29-31 **Data word 1**
Byte 32-34 **Data word 2**
Byte 35-37 **Data word 3**
Byte 38-40 **Data word 4**
Byte 41-43 **Data word 5**
Byte 44-46 **Data word 6**
Byte 47-49 **Data word 7**
Byte 50-52 **Data word 8**
Byte 53-55 **Data word 9**
Byte 56-58 **Data word 10**
Byte 59-61 **Data word 11**
Byte 62-64 **Data word 12**
Byte 65-67 **Data word 13**
Byte 68-70 **Data word 14**
Byte 71-73 **Data word 15**
Byte 74-76 **Data word 16**
Byte 77-79 **Data word 17**
Byte 80-82 **Data word 18**
Byte 83-85 **Data word 19**
Byte 86-88 **Data word 20**
Byte 89-91 **Data word 21**
Byte 92-94 **Data word 22**
Byte 95-97 **Data word 23**
Byte 98-100 **Data word 24**
Byte 101-103 **Data word 25**
Byte 104-106 **Data word 26**
Byte 107-109 **Data word 27**
Byte 110-112 **Data word 28**
Byte 113-115 **Data word 29**
Byte 116-118 **Data word 30**
Byte 119-121 **Data word 31**

SWITCH DATA COMMAND FOR READING / WRITING CALIBRATION MEMORY (con't)

Byte 122 **Termination Byte**
The orientation package will stop looking for Switch Data when it sees this byte.
Always **0xFD** (253 decimal)

RETURN DATA FOR READ / WRITE OF CALIBRATION MEMORY

Byte #	Description					
0 to 5	ASCII 'I'	ASCII 'O'	ASCII 'X'	Head ID 0x18	Serial Status	Reserved 0
6 to 11	Reserved 0	Reserved 0	Reserved 0	Reserved 0	Data Bytes (LO)	Data Bytes (HI)
12 to (N-2)	Data 96 Data Bytes					
N-1	Term 0xFC					

Table 4 Model 870 Return Data for reading \ writing calibration memory

BYTE DESCRIPTIONS

Note: All Byte values are shown in decimal unless noted with a '0x' prefix.
N = total number of return bytes

Byte 0 - 2 **Imagenex Return Data Header**
ASCII '**IOX**'

Byte 3 **Head ID**
0x18 to 0x1F

Byte 4 **Serial Status**
Bit 0 - 0
Bit 1 - 0
Bit 2 - 0
Bit 3 - 0
Bit 4 - 0
Bit 5 - 0
Bit 6 - 1 = Switches Accepted
Bit 7 - 1 = Character Overrun

Byte 5 **Reserved**
Always 0

RETURN DATA FOR READ / WRITE OF CALIBRATION MEMORY (con't)

Byte 6 **Reserved**
Always 0

Byte 7 **Reserved**
Always 0

Byte 8 **Reserved**
Always 0

Byte 9 **Reserved**
Always 0

Byte 10 -11 **Data bytes**

Byte 10								**Byte 11**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0	**Data bytes (LO)**							**0**	**Data bytes (HI)**						**L**

Data Bytes High Byte = (Byte 9 & 0x7E)>>1
Data Bytes Low Byte = [((Byte 9 & 0x01)<<7) | (Byte 8 & 0x7F)]
Data Bytes = (Data Bytes High Byte<<8) | Data Bytes Low Byte

Byte 12-14 **Data word 0**

Byte 12								**Byte 13**								**Byte 14**							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0	**Calibration byte (LO)**							**0**	**Calibration byte (HI)**						**L**	**0**	**0**	**0**	**0**	**0**	**0**	**L**	**L**

Calibration High Byte = [(Byte 14 & 0x03) <<6) | (Byte 13 & 0x3F)]
Calibration Low Byte = [((Byte 13 & 0x01)<<7) | (Byte 12 & 0x7F)]
Calibration Word = (Calibration High Byte<<8) | Calibration Low Byte

Byte 15-17 **Data word 1**
Byte 18-20 **Data word 2**
Byte 21-23 **Data word 3**
Byte 24-26 **Data word 4**
Byte 27-29 **Data word 5**
Byte 30-33 **Data word 6**
Byte 34-36 **Data word 7**
Byte 37-39 **Data word 8**
Byte 40-42 **Data word 9**

RETURN DATA FOR READ / WRITE OF CALIBRATION MEMORY (con't)

Byte 43-45	**Data word 10**
Byte 46-48	**Data word 11**
Byte 49-51	**Data word 12**
Byte 52-54	**Data word 13**
Byte 55-57	**Data word 14**
Byte 58-60	**Data word 15**
Byte 61-63	**Data word 16**
Byte 64-66	**Data word 17**
Byte 67-69	**Data word 18**
Byte 70-72	**Data word 19**
Byte 73-75	**Data word 20**
Byte 76-78	**Data word 21**
Byte 79-81	**Data word 22**
Byte 82-84	**Data word 23**
Byte 85-87	**Data word 24**
Byte 88-90	**Data word 25**
Byte 91-93	**Data word 26**
Byte 94-96	**Data word 27**
Byte 97-99	**Data word 28**
Byte 100-102	**Data word 29**
Byte 103-105	**Data word 30**
Byte 106-108	**Data word 31**

Byte 109	**Termination Byte 0xFC**

Calibration \ Configuration locations

	Calibration Page (0 – 63)	Configuration Page (0xF0)
Data word 0	Pitch duty cycle at 0°	Reserved
Data word 1	Pitch duty cycle per G	Reserved
Data word 2	Reserved	Reserved
Data word 3	Reserved	Reserved
Data word 4	Roll duty cycle at 0°	Reserved
Data word 5	Roll duty cycle per G	Reserved
Data word 6	Reserved	Reserved
Data word 7	Reserved	Reserved
Data word 8	Depth at 0 PSI	Reserved
Data word 9	Depth at full scale	Reserved
Data word 10	Reserved	Reserved
Data word 11	Reserved	Reserved
Data word 12	Heading X axis offset (low)	Heading X axis offset (low)
Data word 13	Heading X axis offset (high)	Heading X axis offset (high)
Data word 14	Heading Y axis offset (low)	Heading Y axis offset (low)
Data word 15	Heading Y axis offset (high)	Heading Y axis offset (high)
Data word 16	Reserved	Reserved
Data word 17	Reserved	Reserved
Data word 18	Reserved	Reserved
Data word 19	Reserved	Reserved
Data word 20	Reserved	Reserved
Data word 21	Reserved	Reserved
Data word 22	Reserved	Reserved
Data word 23	Reserved	Reserved
Data word 25	Reserved	Reserved
Data word 26	Reserved	Reserved
Data word 27	Reserved	Reserved
Data word 28	Reserved	Reserved
Data word 29	Reserved	Head ID
Data word 30	External temperature offset	Reserved
Data word 31	Internal temperature offset	Reserved