Inductive Modem Option for Aquadopp Current Meter

YOU MIGHT LIKE TO KNOW THAT ...

- The Aquadopp with Inductive Modem Option can be operated with or without the IMM.
- The minimum configuration is an Aquadopp with IM option and an inductive modem connected to a controller in the surface buoy at the top end of the mooring line.
- If the IMM on an IMM-enabled Aquadopp is not operational, the power consumption in sleep mode is increased by ~35 µA, or approximately twice the normal power consumption when running RS232.

ABBREVIATIONS:

IMM: Inductive Modem Module

SIM: Surface Inductive Modem

- The Aquadopp Inductive Modem Option enables communication over a jacketed (isolated) mooring line.
- The Aquadopp can be set to store data in either ASCII or binary format on the Inductive Modem Module (IMM).
- The Aquadopp can be configured and deployed through the Aquadopp software.

The Aquadopp can communicate inductively through the new Inductive Modem Module (IMM) which is located next to the Aquadopp electronics inside the pressure housing. The IMM is connected to an inductive coupler which in turn is clamped onto a jacketed mooring line to form a loop, using sea water as the return path.

Before you can use the inductive modem option, the IMM must be enabled and the device ID and the IMM's transmit power level must be set. This must be done *before* the deployment as part of the deployment planning process. Use the Aquadopp software to configure the instrument and prepare for deployment. As with standard deployment, the instrument must be in deployment mode in order to work with the inductive modem.

Online measurements with the Aquadopp can be conducted only when the IMM option is disabled.

Data collected during the deployment will be stored in the Aquadopp recorder and also sent to the IMM electronics module. The data are then transferred from the IMM module to the SIM (Surface Inductive Modem) as part of the inductive communication between the IMM and the SIM.

Note: If diagnostic data collection is enabled in the deployment planning menu, the diagnostic data will not be transferred to the IMM and the data will only be collected after the regular data has been transferred to the IMM. Consequently, the collection of diagnostic data can be delayed if the Aquadopp is waiting for access to the IMM. This will be the case if the IMM is busy communicating with the SIM.

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- The Aquadopp can be configured and deployed through the Aquadopp software since both the regular communication plug and the IMM coupler are in the end bell.
- The IMM is powered directly by the batteries in the Aquadopp. This ensures that IMM communication can be established when the Aquadopp is in sleep mode.
- When the IMM option is used, the communication baud rate for the Aquadopp must be set to 9600 baud. The baud rate for firmware upgrade and recorder data download can be higher.
- The SIM should always check for the **<BUSY/>** tag when communicating with the Aquadopp IMM.

Data Transfer

Prior to deployment, the software estimates the (nominal) extra power that is required to power the IM and transfer the data over the inductive link. The calculation assumes that the surface modem (SIM) only communicates with a single Aquadopp. Some overhead has been added to the power consumption estimate to take into account situations where the SIM is not using the most power efficient way to read the data in the IMM.

When operating, the Aquadopp data are transferred to a 40-sample ring buffer in the IMM. The SIM can select how often data are read out (i.e. transferred over the inductive link), for example reading six 10-minute mean current samples one time every hour. The SIM is responsible for reading the data from the buffer and for erasing data before the ring buffer runs full.

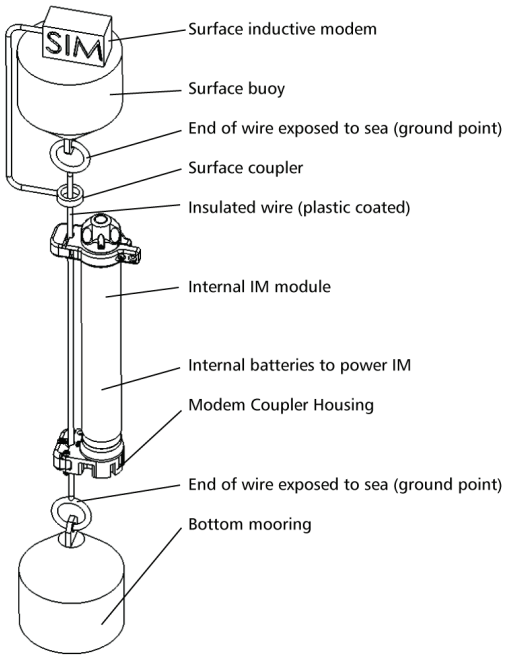
If the ring buffer is full, the IMM automatically deletes the oldest sample before adding the new one.

During the write operation to the ringbuffer in the IMM, the Aquadopp hardware will poll the IMM at 1 second intervals until it gets access and can store the data in the buffer. The SIM must be prepared to retry any commands it sends to the IMM to handle situations where the IMM is busy handling a request from the Aquadopp.

We encourage staggering the inductive modem communication in the SIM if there are several Aquadopp along the communication cable.

When the IMM is enabled, the measurement interval must be at least 60 seconds longer than the average interval plus the number of diagnostic samples. The extra time is required since the Aquadopp may poll for IMM access for 45 seconds before giving up.

In the design of the software that controls the Surface Inductive Modem (SIM), it is important that access is granted to the Aquadopp hardware so that data can be transferred to the IMM at regular intervals.



The Aquadopp IM Principle

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- During the deployment process, the software tests both the internal connection to the IMM coupler and the impedance of the coupler. The impedance value is stored in the deployment log file.

- The formats of the data stored in the IMM are described in the *Nortek System Integrator Manual*, which can be downloaded from **www.nortek-as.com**.

- The ASCII format is also described in the hdr-file that is output when Aquadopp files are converted since the ASCII format is the same as the format of the dat-file.

Inductive Modem Integration

The following options are available for deployment planning in the Aquadopp software:

- enabling the IMM
- setting the device ID in the IMM
- setting the transmit power level
- selecting ASCII or binary format

The parameters are not set in the modem until the deployment is started.

During the deployment process the IMM configuration is stored in the deployment log file by the Aquadopp software, and the complete configuration of the Aquadopp is stored in the Host File in the IMM. This enables the surface inductive modem (SIM/IMM) to retrieve the Aquadopp configuration through the command HostFileGetData.

These data are only stored in binary format, so if this command is used the SIM must be configured for binary data. This is also the case if Aquadopp binary format is selected for storage in the IMM.

The following commands are the most relevant for use in the SIM for retrieving data from the Aquadopp:

- !iiSampleGetList
- !iiSampleGetData:
- !iiSampleGetLast
- !iiSampleEraseAll
- !iiHostFileGetData

The file example.log on the following page is an example SIM session for binary data transfer.

A corresponding example for ASCII data is shown in the file data01.log. The corresponding converted Aquadopp file data01.dat shows the converted data from the internal recorder in the Aquadopp.

NORTEK AS
Vangkroken 2
NO-1351 Rud
Norway

example.log

```
IMM>captureline
<Executing/>
!15HostFileGetData
<RemoteReply><Executing/>
<HostData Len='784' CRC='0x43FFA2E2'>
Binary data returned:
          a5 05 18 20 41  51 44 20 35 35 30 35 20
 20 20 20 20 20 0c 20 7a  22 20 20 03 20 90 20 2c
 20 20 20 41 fa 20 20 7a  22 41 fa 20 20 39 69 33
 33 40 ce a5 04 70 20 0f  20 d0 07 20 20 41 51 44
 20 30 36 39 38 20 20 20  20 20 20 20 20 20 20 20
 20 50 0b 50 0b 20 20 b0  f4 50 0b 20 20 b0 f4 b0
 f4 a0 16 01 80 a8 20 c0  34 b3 fe 01 80 77 06 39
 34 f7 fe 20 20 20 20 20  20 ff ff 20 20 01 20 20
 20 01 20 20 20 20 20 20  20 20 20 ff ff 20 20 ff
 ff 20 20 ff ff 20 20 20  20 20 20 ff ff 01 20 20
 20 20 20 ff ff ff ff 20  20 20 20 01 20 20 10 20
 20 c9 05 03 01 d8 1b 6d  2a 01 80 13 01 68 2e 38
 20 01 80 c9 02 69 2e 78  ff ff 7f d9 01 53 01 d9
 01 af 7e e0 f7 7a fc c9  fb ae 73 67 20 e0 ff 88
 ff 20 20 20 20 20 20 20  20 20 20 20 20 20 20 20
 20 55 15 10 0e 10 0e 10  27 64 20 20 20 20 20 20
 20 20 20 20 20 20 20 20  20 20 20 20 20 20 20 03
 20 7e a4 a5 20 20 01 7d  20 31 20 20 20 b5 01 20
 02 01 20 3c 20 03 20 40  20 20 20 20 20 20 20 20
 20 02 20 20 20 01 20 20  20 2c 01 69 6d 6d 74 73
 74 20 20 30 20 07 12 09  04 10 0e 20 20 02 20 11
 41 14 20 01 20 14 20 04  06 21 20 2e 33 5e 01 02
 3d 1e 3d 39 3d 53 3d 6e  3d 88 3d a2 3d bb 3d d4
 3d ed 3d 06 3e 1e 3e 36  3e 4e 3e 65 3e 7d 3e 93
 3e aa 3e c0 3e d6 3e ec  3e 02 3f 17 3f 2c 3f 41
 3f 55 3f 69 3f 7d 3f 91  3f a4 3f b8 3f ca 3f dd
 3f f0 3f 02 40 14 40 26  40 37 40 49 40 5a 40 6b
 40 7c 40 8c 40 9c 40 ac  40 bc 40 cc 40 db 40 ea
 40 f9 40 08 41 17 41 25  41 33 41 42 41 4f 41 5d
 41 6a 41 78 41 85 41 92  41 9e 41 ab 41 b7 41 c3
 41 cf 41 db 41 e7 41 f2  41 fd 41 08 42 13 42 1e
 42 28 42 33 42 3d 42 47  42 51 42 5b 42 64 42 6e
 42 77 42 80 42 89 42 91  42 9a 42 a2 42 aa 42 b2
 42 ba 42 20 20 20 20 20  20 20 20 20 20 20 20 20
 20 20 20 20 20 20 20 20  20 20 20 20 20 20 20 20
 20 20 20 20 20 20 20 20  20 20 20 20 20 20 20 20
 20 20 20 20 20 20 20 20  20 20 20 20 20 20 20 20
 20 20 20 20 20 20 20 20  20 20 20 20 20 20 20 20
 20 20 20 20 20 20 20 20  20 20 20 20 20 20 20 20
 20 20 20 20 20 20 20 20  20 20 20 20 20 20 20 20
 20 20 20 20 20 20 20 20  20 20 20 20 20 20 20 2a
 20 0f 20 20 20 20 20 20  20 20 20 20 20 20 20 20
 20 20 20 20 20 20 20 20  20 20 20 20 20 20 20 20
 20 20 20 20 20 20 20 20  20 20 20 20 20 20 20 20
 20 20 20 20 20 20 20 20  20 20 20 20 20 20 20 20
 20 20 20 20 20 20 20 20  20 20 20 20 20 20 20 20
 20 06 20 03 20 20 20 20  20 20 20 20 20 20 20 20
 20 20 20 20 20 20 20 20  20 20 20 20 20 20 20 20
 20 0a ff cd ff 8b 20 e5  20 ee 20 0b 20 84 ff 3d
 ff 4b 5a
</HostData>
<Executed/>
</RemoteReply>
```

example.log (cont.)

```
<Executed/>
IMM>releaseline
<Executing/>
<Executed/>
IMM>
```

```
<TIMEOUT msg='HostService 2 min timeout'/>
IMM>

IMM>
<Executed/>
IMM>captureline
<Executing/>
<Executed/>
IMM>!15samplegetsummary
<RemoteReply><Executing/>
<SampleDataSummary NumSamples='8' TotalLen='336' FreeMem='16006'/>
<Executed/>
</RemoteReply>
<Executed/>
IMM>!15samplegetlist
<RemoteReply><Executing/>
<SampleList>
<Sample ID='0x0000024c' Len='42' CRC='0xC7589EDD'/>
<Sample ID='0x0000024b' Len='42' CRC='0x4C593F18'/>
<Sample ID='0x0000024a' Len='42' CRC='0x457FCB04'/>
<Sample ID='0x00000249' Len='42' CRC='0xD6C60EE2'/>
<Sample ID='0x00000248' Len='42' CRC='0x8AFE5C1A'/>
<Sample ID='0x00000247' Len='42' CRC='0x2301B4DB'/>
<Sample ID='0x00000246' Len='42' CRC='0xB3B4B2D4'/>
<Sample ID='0x00000245' Len='42' CRC='0x0BCBBDE2'/>
</SampleList>
<Executed/>
</RemoteReply>
<Executed/>
IMM>!15SAMPLEGETDATA:245
<RemoteReply><Executing/>
<SampleData ID='0x245' LEN='42' CRC='0xbcbbde2'>
Binary data returned:
                a5 01 15  20 35 20 07 12 09 04 20
 20 ff ff 7d 20 20 20 33  0d ed ff e1 ff 20 b1 b3
 37 48 fd cc ff 8e 04 23  03 0e 0e 0e 20 9c d6
<Executed/>
```

example.log (cont.)

```
</RemoteReply>
<Executed/>
IMM>!15SAMPLEGETDATA:246
<RemoteReply><Executing/>
<SampleData ID='0x246' LEN='42' CRC='0xb3b4b2d4'>
Binary data returned:
                                        a5 01
 15 20 40 20 07 12 09 04  20 20 ff ff 7d 20 20 20
 3c 0d ed ff e1 ff 20 b1  92 38 48 fd 16 fd 02 05
 3f 03 0e 0e 0e 20 69 d5
<Executed/>
</RemoteReply>
```

```
<Executed/>
IMM>!15SAMPLEGETDATA:247
<RemoteReply><Executing/>
<SampleData ID='0x247' LEN='42' CRC='0x2301b4db'>
Binary data returned:
                    a5 01  15 20 45 20 07 12 09 04
 20 20 ff ff 7d 20 20 20  33 0d ed ff e1 ff 20 b1
 99 38 48 fd e0 ff 74 06  bb 06 0e 0e 0e 20 24 dd
<Executed/>
</RemoteReply>
<Executed/>
IMM>!15SAMPLEGETDATA:248
<RemoteReply><Executing/>
<SampleData ID='0x248' LEN='42' CRC='0x8afe5c1a'>
Binary data returned:
                                            a5 01
 15 20 50 20 07 12 09 04  20 20 ff ff 7d 20 20 20
 37 0d ed ff e1 ff 20 b1  4b 38 48 fd 3a fd 7b 05
 d8 04 0e 0e 0e 20 63 d7
<Executed/>


<Executed/>
IMM>!15SAMPLEGETDATA:249
<RemoteReply><Executing/>
<SampleData ID='0x249' LEN='42' CRC='0xd6c60ee2'>
Binary data returned:
                    a5 01  15 20 55 20 07 12 09 04
 20 20 ff ff 7d 20 20 20  33 0d ed ff e1 ff 20 b1
 7f 39 48 fd 9c fe 18 05  76 09 0e 0e 0e 20 35 de
 <Executed/>
</RemoteReply>
<Executed/>
IMM>!15SAMPLEGETDATA:24A
```

example.log (cont.)

```
<RemoteReply><Executing/>
<SampleData ID='0x24a' LEN='42' CRC='0x457fcb04'>
Binary data returned:
 a5 01 15 20 20 20 07 13  09 04 20 20 ff ff 7d 20
 20 20 33 0d ed ff e1 ff  20 b1 ab 38 48 fd 29 01
 22 03 ca 04 0e 0e 0e 20  f7 d9
<Executed/>
</RemoteReply>
<Executed/>
IMM>!15SAMPLEGETDATA:24B
<RemoteReply><Executing/>
<SampleData ID='0x24b' LEN='42' CRC='0x4c593f18'>
Binary data returned:
                         a5 01 15 20 05 20 07 13
 09 04 20 20 ff ff 7d 20  20 20 33 0d ed ff e1 ff
 20 b1 81 38 48 fd 79 ff  33 07 bd 04 0e 0e 0e 20
 26 dc
<Executed/>
</RemoteReply>
```

```
<Executed/>
IMM>!15SAMPLEGETDATA:24C
<RemoteReply><Executing/>
<SampleData ID='0x24c' LEN='42' CRC='0xc7589edd'>
Binary data returned:
 a5 01 15 20 10 20 07 13  09 04 20 20 ff ff 7d 20
 20 20 3c 0d ed ff e1 ff  20 b1 14 38 48 fd 7e fd
 0d 01 b3 05 0e 0e 0e 20  a2 d4
<Executed/>
</RemoteReply>
<Executed/>
IMM>!15SAMPLEERASEALL
<RemoteReply><Executing/>
<Executed/>
</RemoteReply>
<Executed/>
IMM>releaseline
<Executing/>
<Executed/>
IMM>
```

data01.log

```
IMM>
<Executed/>
IMM>CaptureLine
<Executing/>
<Executed/>
IMM>!12SampleGetSummary
<RemoteReply><Executing/>
<SampleDataSummary NumSamples='5' TotalLen='550' FreeMem='15792'/>
<Executed/>
</RemoteReply>
<Executed/>
IMM>!12SampleGetList
<RemoteReply><Executing/>
<SampleList>
<Sample ID='0x00000254' Len='109' CRC='0x45326FC3'/>
<Sample ID='0x00000253' Len='110' CRC='0x74E6ED95'/>
<Sample ID='0x00000252' Len='109' CRC='0x0D7F6C29'/>
<Sample ID='0x00000251' Len='111' CRC='0x9175F508'/>
<Sample ID='0x00000250' Len='111' CRC='0x42E806B9'/>
</SampleList>
<Executed/>
</RemoteReply>
<Executed/>
IMM>!12SAMPLEGETDATA:250
<RemoteReply><Executing/>
<SampleData ID='0x250' LEN='111' CRC='0x42e806b9'> 4 7 2009 13 35 0 0 177 -0.708 0.799
0.154 14 14 14 12.5 0.0 338.3 -1.9 -3.1 14.403 -6.96 65535 0 1.067 318.5
</SampleData>
<Executed/>
</RemoteReply>
<Executed/>
IMM>!12SAMPLEGETDATA:251
<RemoteReply><Executing/>
<SampleData ID='0x251' LEN='111' CRC='0x9175f508'> 4 7 2009 13 45 0 0 177 -0.744 1.434
0.975 14 14 14 12.5 0.0 338.3 -1.9 -3.1 14.412 -6.96 65535 0 1.615 332.6
</SampleData>
<Executed/>
</RemoteReply>
<Executed/>
IMM>!12SAMPLEGETDATA:252
<RemoteReply><Executing/>
<SampleData ID='0x252' LEN='109' CRC='0xd7f6c29'> 4 7 2009 13 55 0 0 177 0.292 0.669
```

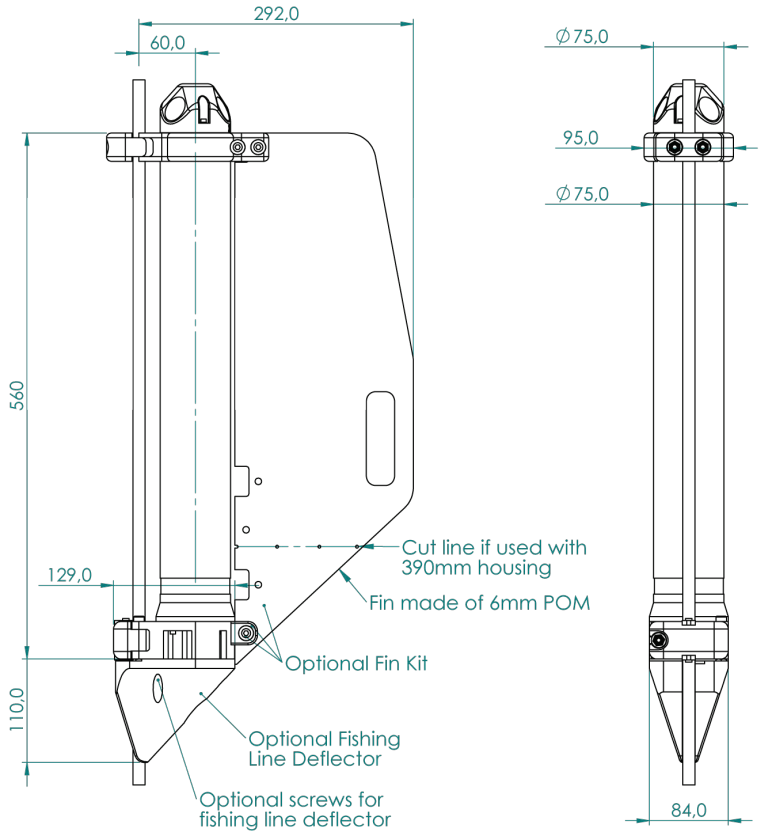
data01.log (cont.)

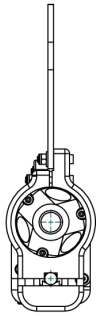
```
0.810 14 14 14 12.5 0.0 338.3 -1.9 -3.1 14.371 -6.96 65535 0 0.730 23.6
</SampleData>
<Executed/>
</RemoteReply>
```

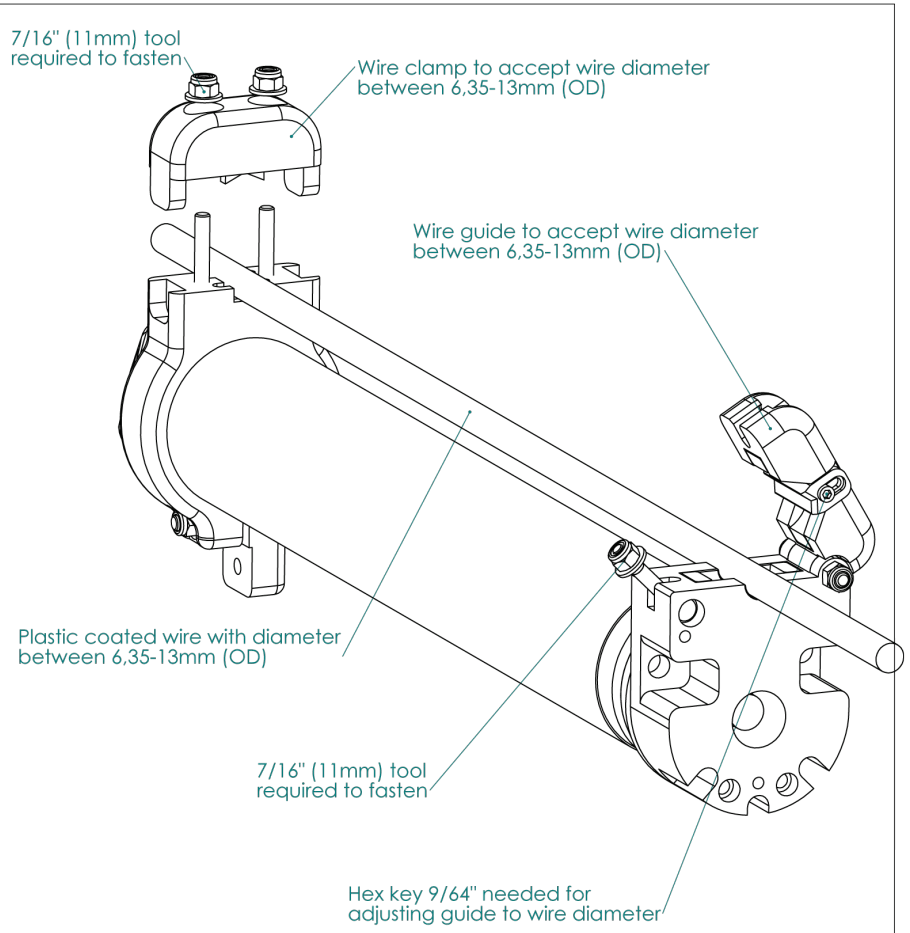
```
<Executed/>
IMM>!12SAMPLEGETDATA:253
<RemoteReply><Executing/>
<SampleData ID='0x253' LEN='110' CRC='0x74e6ed95'> 4 7 2009 14 5 0 0 177 -0.732 0.830
0.805 14 14 14 12.5 0.0 338.3 -1.9 -3.1 14.603 -6.96 65535 0 1.107 318.6
</SampleData>
<Executed/>
</RemoteReply>
<Executed/>
IMM>!12SAMPLEGETDATA:254
<RemoteReply><Executing/>
<SampleData ID='0x254' LEN='109' CRC='0x45326fc3'> 4 7 2009 14 15 0 0 177 0.343 0.964
0.796 14 14 14 12.5 0.0 337.9 -1.9 -3.1 14.493 -6.96 65535 0 1.023 19.6
</SampleData>
<Executed/>
</RemoteReply>
<Executed/>
IMM>!12SampleEraseAll
<RemoteReply><Executing/>
<Executed/>
</RemoteReply>
<Executed/>
IMM>releaseline
<Executing/>
<Executed/>
```

data01.dat

```
04 07 2009 13 35 00 00000000 10110001   -0.708    0.799    0.154    14    14    14  12.5
1414.6 338.3  -1.9  -3.1  14.403  -6.96 65535     0    1.068   318.46

04 07 2009 13 45 00 00000000 10110001   -0.744    1.434    0.975    14    14    14  12.5
1414.6 338.3  -1.9  -3.1  14.412  -6.96 65535     0    1.616   332.58

04 07 2009 13 55 00 00000000 10110001    0.292    0.669    0.810    14    14    14  12.5
1414.6 338.3  -1.9  -3.1  14.371  -6.96 65535     0    0.730    23.58

04 07 2009 14 05 00 00000000 10110001   -0.732    0.830    0.805    14    14    14  12.5
1414.6 338.3  -1.9  -3.1  14.603  -6.96 65535     0    1.107   318.59

04 07 2009 14 15 00 00000000 10110001    0.343    0.964    0.796    14    14    14  12.5
1414.6 337.9  -1.9  -3.1  14.493  -6.96 65535     0    1.023    19.59
```







Optional parts

Nortek Part	Description	Quantity needed
N2011-509	Fin kit AQD IM complete w/screws	1
N2011-494	Fishing line deflector (IM head cone)-without screws	1
	Screws for fishing line deflector (Soc.cap 1/4-20x1,25" titan)	3

REVISION				
REV.	C/O No	DESCRIPTION	DATE	APPROVED

Unless otherwise specified, dimensions are in mm
Tolerances are:
Angles: +/- 0.5 degrees
Decimals: X=+/-0.5mm
0.X=+/-0.2mm
0.0X=+/-0.02mm
Other tolerances:
Nortek Standard N1000-008
ISO 2768-K

NORTEK AS Vangkroken 2
1351 Rud, Norway

Aquadopp IM (STD)

Material	Size	Drawing No.	Rev.
	A-3	N2011-511 Manual	-

Drawn by: BL	Date: 08.06.2009	Sheet 1 of 1
Controlled by:	Date:	Scale: 1:5