Centre de Brest
Département Recherche et Développements Technologiques

Programme 8, projet 8

Observatoires fond de mer pluridisciplinaires

NEPTUNE CANADA : TEMPO-MINI V2 documentation

établi le :	par :	Réf :	n° analytique :	Indice :
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Diffusion :

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DOCUMENT VERSIONS

Version	Date	Description	Reference secretariat
A	19/02/10	Document creation	RDT/EIM/10-015
B	03/12/10	Modification §10.1 :add of a CHLORINATION initialisation phase §10.3 : inversion of the chlorination command	RDT/EIM/10-053
C	12/01/11	Connectors added on the synoptic drawing (§2)	-
D	31/01/11	Chemini data description completed (§9.5)	-

SUMMARY

1 - Introduction

Tempo-mini is a biological module designed and realised by IFREMER in order to study deep-sea hydrothermal ecosystems. It has been deployed on the Canadian VENUS network in October 2008 for testing.

Tempo-mini has been upgraded to be deployed on the NEPTUNE CANADA Endeavour node, in September 2010.

Tempo-mini now integrates a high definition streaming video camera with LED lights, an oxygen sensor, a 10m-long 10-sensor temperature probe and a chemical analyser. It also includes an anti biofooling system for optical sensors parts.

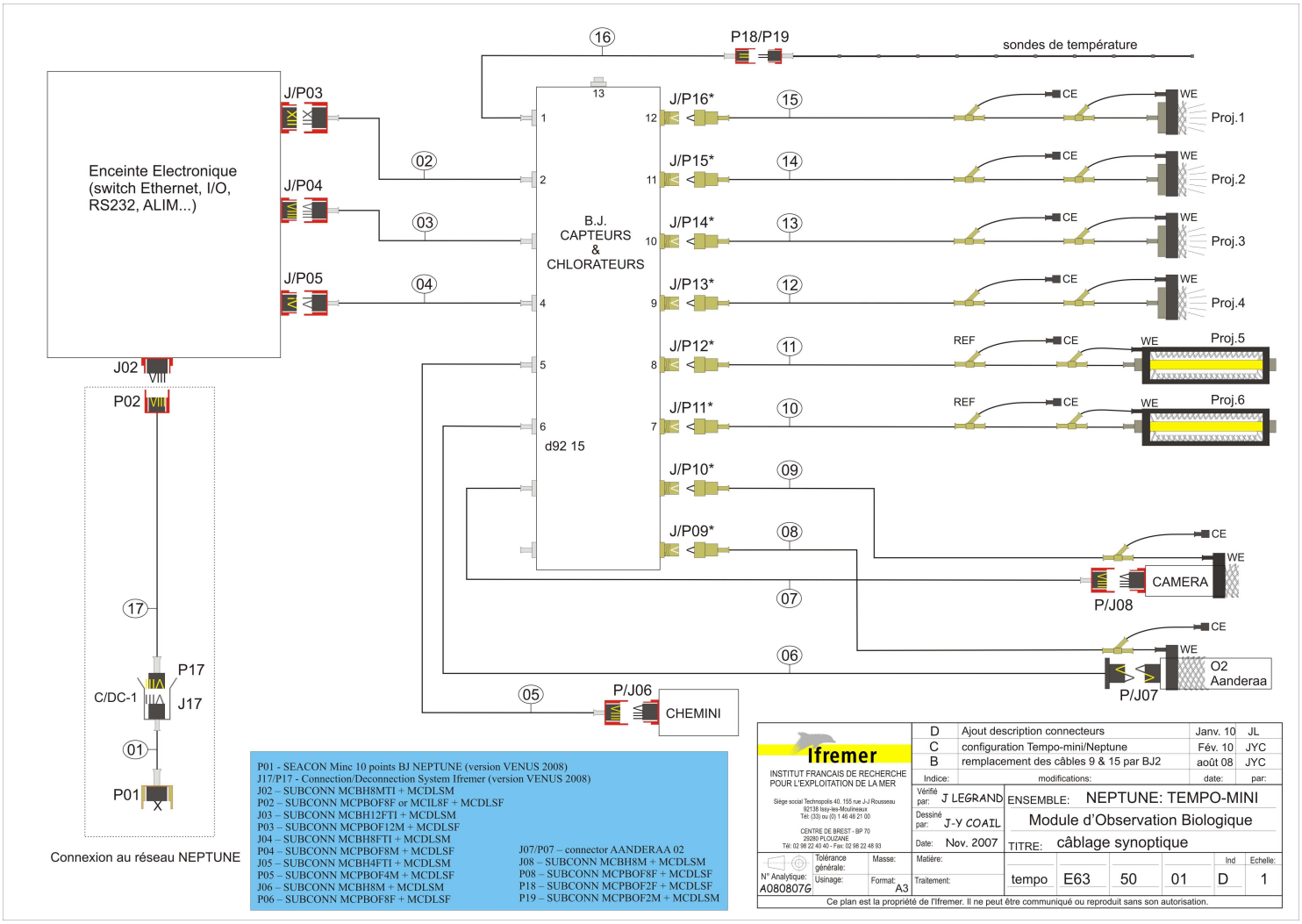
This document describes the different parts of Tempo-mini and details software protocol between its sensors and NEPTUNE CANADA.

Different examples are detailed in this document to show the frame sent to and received from the sensor (or the Barionet). For a better comprehension, 2 different colors are used to detail the frames sent to the sensor (blue) and the frame received from the sensor (green).

2 – Synoptic drawing

Tempo-mini is fitted with the following parts :

- An electronic unit,
- An oil filled junction box,
- A HD camera (AXIS Q1755),
- 6 LED lights (IFREMER),
- An oxygen sensor (Aanderaa optode),
- An iron chemical analyser (IFREMER CHEMINI),
- A 10m T°probe.

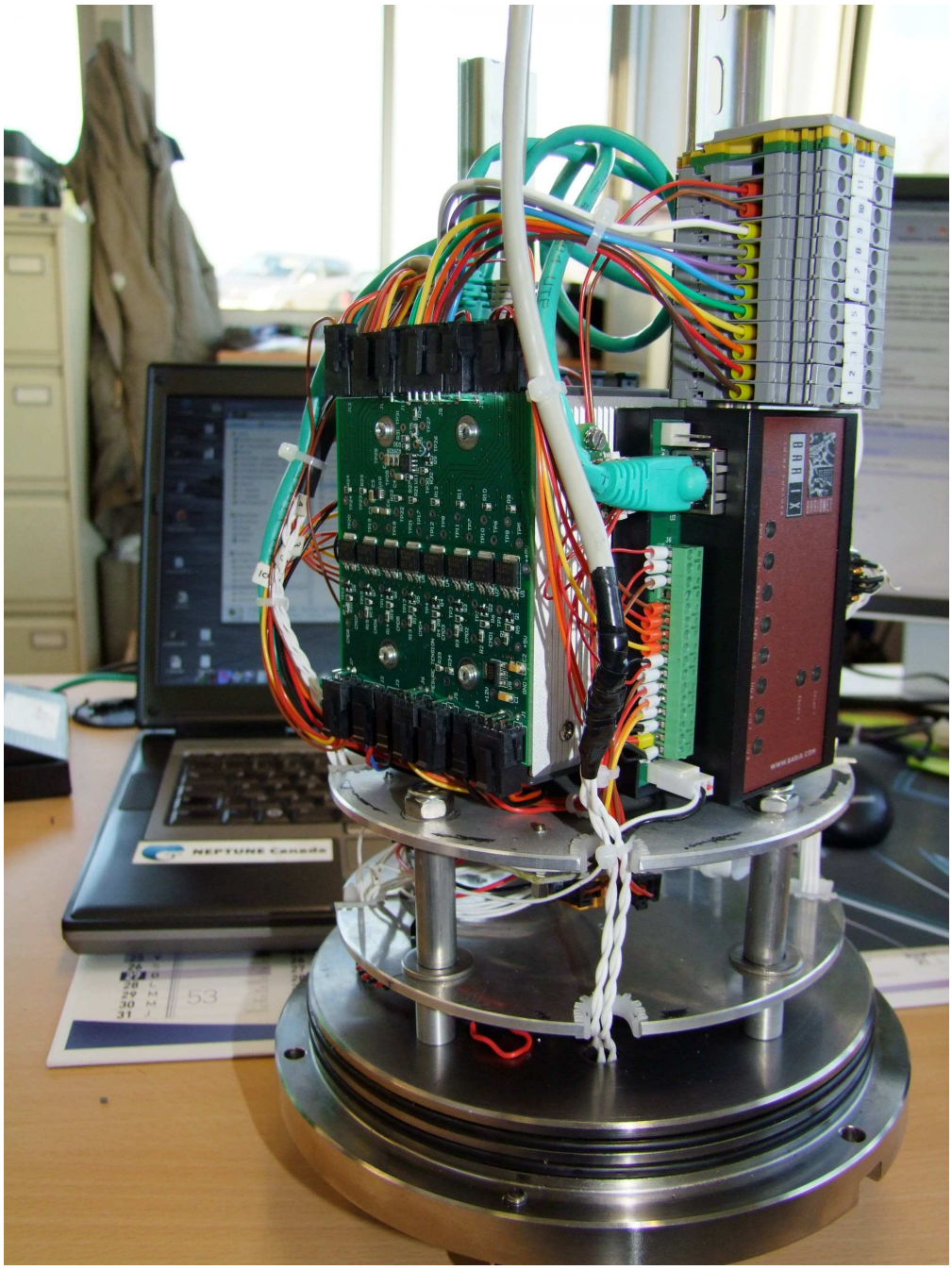


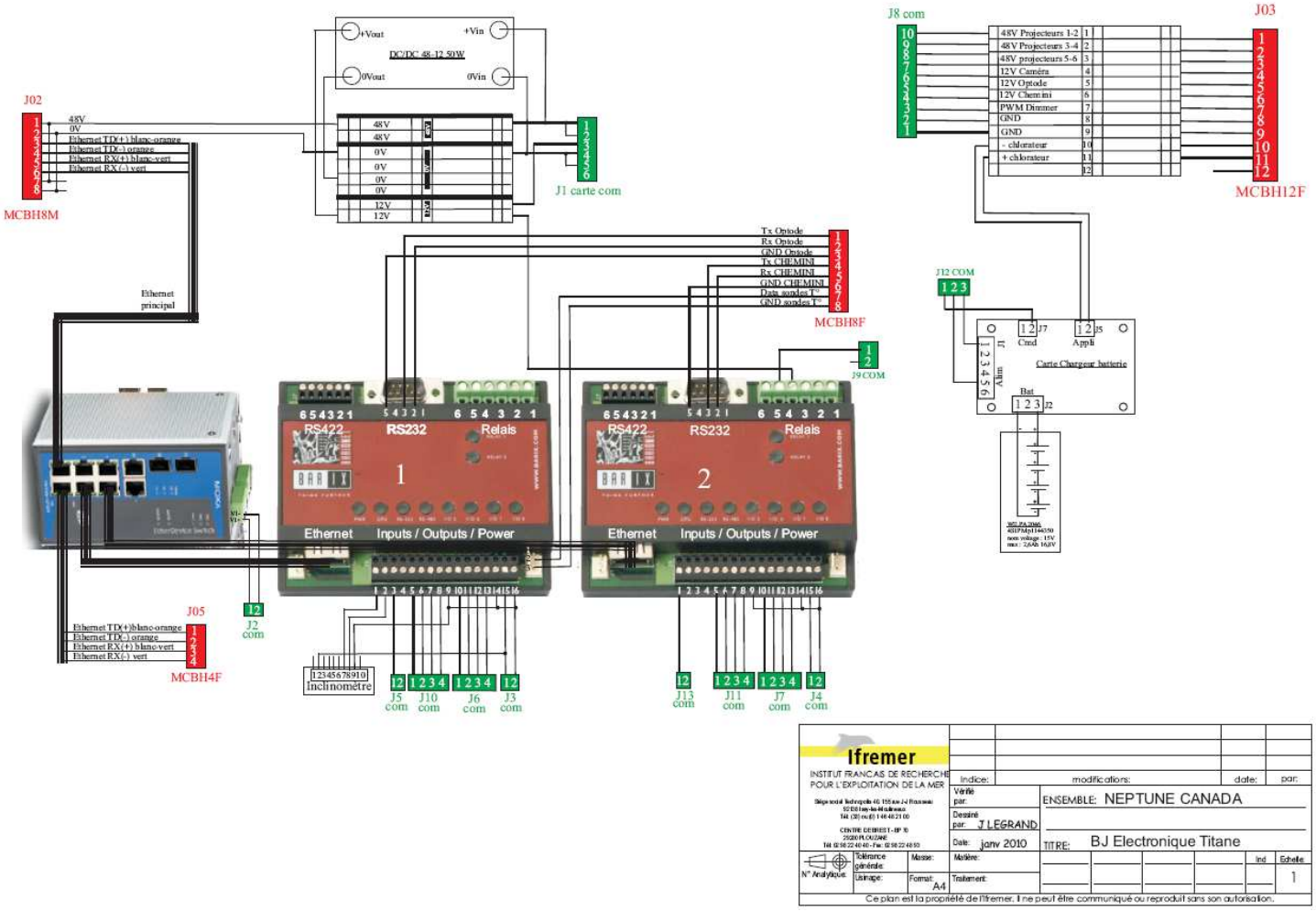
3 – The electronic unit

The electronic unit is the interface between camera, lights and sensors and the NEPTUNE junction box. It is composed with following parts :

- A Moxa Ethernet switch (see §3.1),
- 2 Barix Barionet programmable network controller (see §3.2 and 3.3),
- A 48V to 12V DC-DC converter,
- An electronic board for power switching and lights dimming,
- A tiltmeter board,
- An energy management board for chlorination,
- A lithium-ion battery for chlorination.

Those different parts are integrated in a 6000m titanium housing.





3.1 Ethernet switch

Reference : Moxa EDS-510A-3SFP
Serial number : 00039
MAC Adress : 00:90:E8:10:99:99
IP address : To Be Defined (TBD)
Voltage : 12V

3.2 Barionet n°1

Reference : Barix Barionet
MAC address : 00:20:4A:A9:5C:63
IP address : TBD
Voltage: 12V

The following table describes the Barionet I/O addressing for the different elements connected :

Barionet Channel	Port Number	I/O Address	Function	Use instructions
Relay 1	1223	1	-	
Relay 2	1223	2	-	
Digital Output 1	1223	101	Camera Lights 1&2 Power	0=OFF, 1=ON
Digital Output 2	1223	102	Camera Lights 3&4 Power	0=OFF, 1=ON
Digital Output 3	1223	103	Camera Lights 5&6 Power	0=OFF, 1=ON
Digital Output 4	1223	104	Camera Power	0=OFF, 1=ON
Analog Input 1	1223	501	Inclinometer X	0V = -30°, 2,5V = 0°, +5V = +30°
Analog Input 2	1223	502	Inclinometer Y	0V = -30°, 2,5V = 0°, +5V = +30°
Analog Input 3	1223	503	12V Tension	0V- > 0V, 4,75V ->12V
Analog Input 4	1223	504	-	
Digital Input 1	1223	205	Feedback Camera Lights 1&2 Power	0=OK, 1=Default
Digital Input 2	1223	206	Feedback Camera Lights 3&4 Power	0=OK, 1=Default
Digital Input 3	1223	207	Feedback Camera Lights 5&6 Power	0=OK, 1=Default
Digital Input 4	1223	208	Feedback Camera Power	0=OK, 1=Default
Temperature 1	1223	601	Temperature probe 1	x 0,0625 →℃
Temperature 2	1223	602	Temperature probe 2	x 0,0625 →℃
Temperature 3	1223	603	Temperature probe 3	x 0,0625 →℃
Temperature 4	1223	604	Temperature probe 4	x 0,0625 →℃
Temperature 5	1223	605	Temperature probe 5	x 0,0625 →℃
Temperature 6	1223	606	Temperature probe 6	x 0,0625 →℃
Temperature 7	1223	607	Temperature probe 7	x 0,0625 →℃
Temperature 8	1223	608	Temperature probe 8	x 0,0625 →℃
Temperature 9	1223	609	Temperature probe 9	x 0,0625 →℃
Temperature 10	1223	610	Temperature probe 10	x 0,0625 →℃
RS232 Serial link	10001	-	Oxygen Optode	See §7

The different devices connected to the Barionet are accessible with a TCP socket on the port defined in the table.

2 commands are available to read and write the state on different I/O :

getio,I/O :

This command is used to enquire the state of a specific input, output or I/O address of the Barionet. In response to this enquiry, the Barionet sends a “state” message indicating the actual state (or value for analog inputs) of the addressed function.

Example to read the inclinometer X value :

telnet IP_Adress(Barionet 1) 1223 <CR> *Telnet initialisation on Barionet 1, port 1223*
getio,501<CR> *Read inclinometer X value*
state,501,14<CR> *Read=14*

setio,I/O,val :

This command is used to set an output of the Barionet to either active, inactive, toggle it or pulse it (reverse it) for a certain time. The “**I/O**” address is given as defined in Appendix C. The value “**val**” can either be “**1**” for “on”, “**0**” for “off”, “**999**” to toggle the current state or

a number between “**2**” and “**500**” for the pulse option. The length of the pulse is given in units of 100 ms (1/10th of a second). Here some examples:

- **setio,1,1** activate relay 1,
- **setio,101,999** toggle digital output 1,
- **setio,2,50** pulse relay 2 for 5 seconds.

The **setio** command can not only address existing outputs but all I/O addresses which allows for addressing virtual I/Os such as mapped I/Os from Barix extensions.

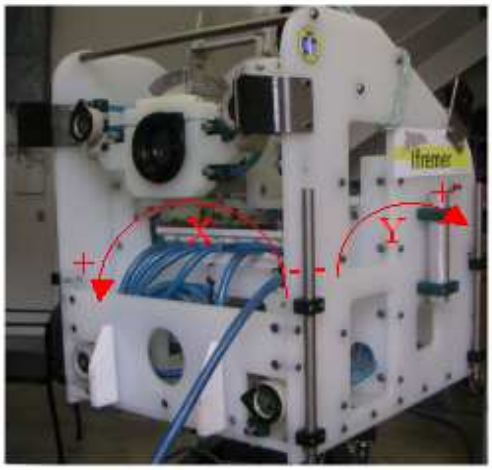
The **setio,IO,val** will invoke a response with a **state,IO,val<CR>** to confirm command reception.

Example to switch the camera on :

telnet IP_Adress (Barionet 1) 1223 <CR>	*Telnet initialisation on Barionet 1, port 1223*
setio,104,1<CR>	*Switch the camera ON*
statechange,104,1<CR>	*Barionet acknowledge*

Analog input 1&2 : inclinometer orientation

The following picture shows the axis orientation for the inclinometer X and Y measurement.



Digital input 1,2,3&4 : Feedbacks

The digital inputs 1,2,3 and 4 are used to detect a default (short-circuit) from the MOSFET switching respectively the lights 1&2, 3&4, 5&6 and the camera.

Example to read the feedbacks inputs :

telnet IP_Adress(Barionet 1) 1223 <CR>	*Telnet initialisation on Barionet 1, port 1223*
getio,205<CR>	*Read lights 1&2 power feedback input*
state,205,1<CR>	*Read=1, default detected*

In this case, a default is detected and the matching MOSFET (here, Lights 1&2 MOSFET) should be switched OFF :

telnet IP_Adress(Barionet 1) 1223 <CR>	*Telnet initialisation on Barionet 1, port 1223*
setio,101,0<CR>	*Switch chlorination OFF*

statechange,101,0<CR> *Barionet acknowledge*

3.3 Barionet n°2

Reference : Barix Barionet
MAC address : 00:20:4A:93:34:A2
IP address : TBD
Voltage : 12V

The following table describes the Barionet I/O addressing for the different elements connected :

Barionet Channel	Port Number	I/O Address	Function	Use instructions
Relay 1	1223	1	CHEMINI Power	0=OFF, 1=ON
Relay 2	1223	2	-	
Digital Output 1	1223	101	Oxygen Optode Power	0=OFF, 1=ON
Digital Output 2	1223	102	Dimming INC	0,2sec pulse = 1 increment
Digital Output 3	1223	103	Dimming Up/Down	0=UP, 1=DOWN
Digital Output 4	1223	104	Chlorination Power	0=OFF, 1=ON
Analog Input 1	1223	501	Dimming position (light attenuation)	0V-> Light full power, 5V -> Light low power
Analog Input 2	1223	502	-	
Analog Input 3	1223	503	-	
Analog Input 4	1223	504	-	
Digital Input 1	1223	205	Feedback Oxygen Optode Power	0=OK, 1=Default
Digital Input 2	1223	206	Feedback Dimming INC	0=OK, 1=Default
Digital Input 3	1223	207	Feedback Dimming Up/Down	0=OK, 1=Default
Digital Input 4	1223	208	Feedback Chlorination Power	0=OK, 1=Default
RS232 Serial link	10001	-	CHEMINI (IFREMER Fe analyser)	See §7

The different devices connected to the Barionet are accessible with a TCP socket on the port defined in the table.

2 commands are available to read and write the state on different I/O :

getio,I/O :
This command is used to enquire the state of a specific input, output or I/O address of the Barionet. In response to this enquiry, the Barionet sends a “state” message indicating the actual state (or value for analog inputs) of the addressed function.

setio,I/O,val :
This command is used to set an output of the Barionet to either active, inactive, toggle it or pulse it (reverse it) for a certain time. The “**I/O**” address is given as defined in Appendix C. The value “**val**” can either be “**1**” for “on”, “**0**” for “off”, “**999**” to toggle the current state or a number between “**2**” and “**500**” for the pulse option. The length of the pulse is given in units of 100 ms ($1/10_{th}$ of a second). Here some examples:

- **setio,1,1** activate relay 1
- **setio,101,999** toggle digital output 1

• **setio,2,50** pulse relay 2 for 5 seconds

The **setio** command can not only address existing outputs but all I/O addresses which allows for addressing virtual I/Os such as mapped I/Os from Barix extensions.

The **setio,IO,val** will invoke a response with a **state,IO,val<CR>** to confirm command reception.

Example to switch the chlorination ON :

telnet IP_Adress(Barionet 2) 1223 <CR>	*Telnet initialisation on Barionet 1, port 1223*
setio,104,1<CR>	*Switch chlorination ON*
statechange,104,1<CR>	*Barionet acknowledge*

Digital input 2,3&4 : Feedbacks

The digital inputs 2,3 and 4 are used to detect a default (short-circuit) from the MOSFET switching respectively the dimming INC, the dimming Up/Down and the chlorination power.

Example to read the feedbacks inputs :

telnet IP_Adress 1223(Barionet 2) <CR>	*Telnet initialisation on Barionet 1, port 1223*
getio,208<CR>	*Read chlorination power feedback input*
state,208,1<CR>	*Read=1, default detected*

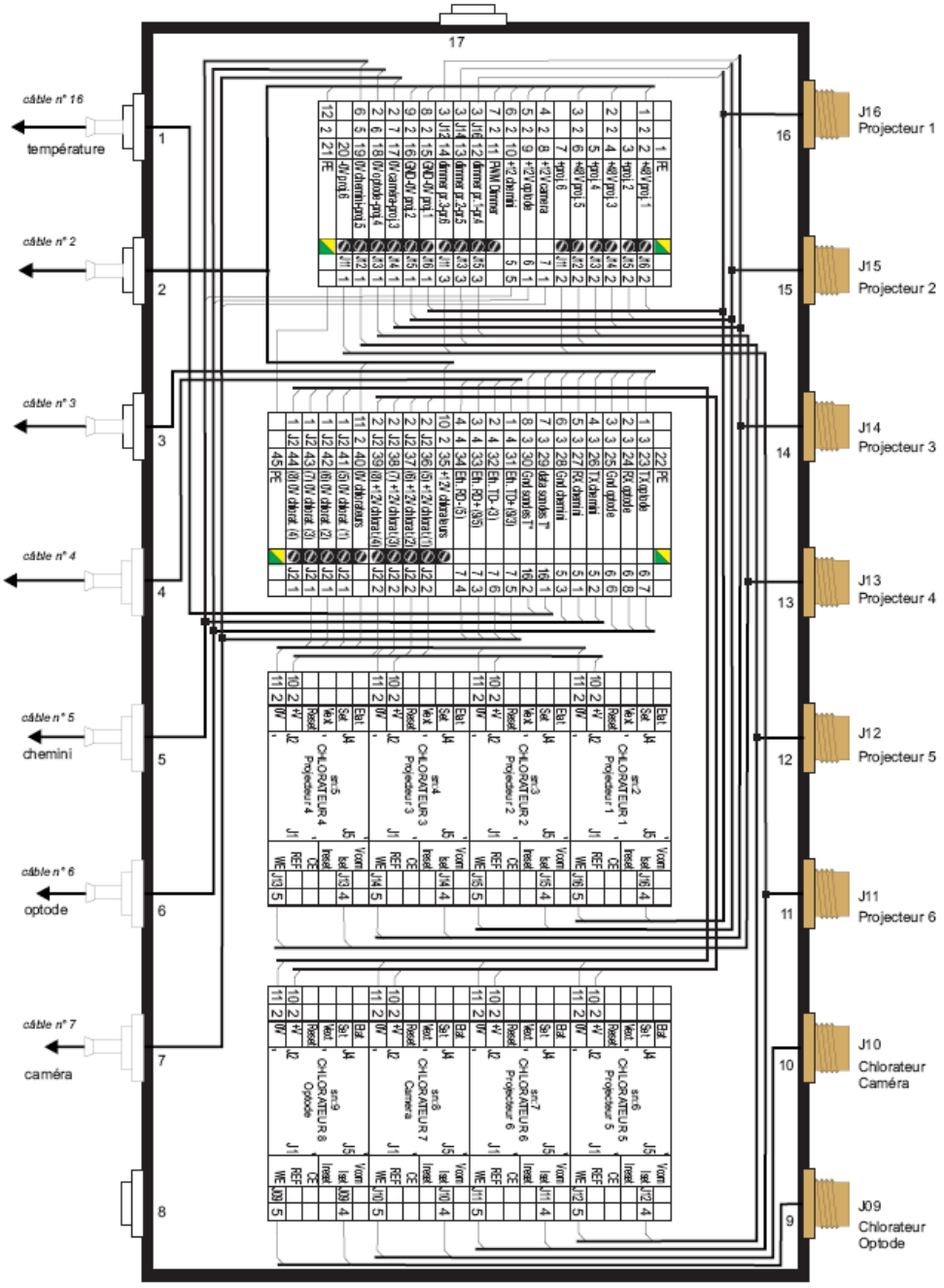
In this case, a default is detected and the matching MOSFET (here, Chlorination power MOSFET) should be switched OFF :

telnet IP_Adress 1223(Barionet 2) <CR>	*Telnet initialisation on Barionet 1, port 1223*
setio,208,0<CR>	*Switch chlorination OFF*
statechange,208,0<CR>	*Barionet acknowledge*

4 – Oil filled junction box

The oil filled junction box distributes wiring from the electronic unit to the camera, the lights and the sensors. It also contains the chlorination modules for the biofooling protection.

Here is its wiring drawing :



Ifremer	B	Câblage pour campagne 2010	1/3/10 JYC
INSTITUT FRANCAIS DE RECHERCHE POUR L'EXPLOITATION DE LA MER	Indice:	modifications:	date: par:
	Vérifié par: J LEGRAND	ENSEMBLE: NEPTUNE	
	Dessiné par: J-Y COAIL	TEMPO MINI_2	
	Date: Juin 2008	TITRE: câblage BJ Capteurs	
N° Analytique: E020903E	Tolérance générale: / Usinage: / Masse: / Matière: / Format: A3 / Traitement:		Ind B / Echelle: 1

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5 - Camera

5.1 – Information

Reference : AXIS Q1755
Serial Number : 00408C8F17CF
MAC address = 00:40:8C:8F:17:CF
IP address : TBD
Voltage : 12V

5.2 - Technical specifications

Function/group	Item	Specification
Camera	**Models**	• AXIS Q1755 50Hz • AXIS Q1755 60Hz
	Image sensor	1/3" Progressive Scan CMOS 2 Megapixel
	Lens	• F1.8 - 2.1, f = 5.1 - 51mm • Auto day/night IR filter, Autofocus • Near focus limit: 10mm (wide) or 800mm (tele) • Angle of view, horizontal: 5.4° - 50° • M37x0.75 mounting thread for optional lens adaptor
	Minimum illumination	Color: 2 lux at 30IRE, F1.8 B/W: 0.2 lux at 30IRE, F1.8
	Shutter time	1/10000s to 1/2s
	Zoom	10x optical and 12x digital, total 120x
Video	**Video compression**	• H.264 Baseline profile • Motion JPEG
	Resolutions	• HDTV 1080i 1920x1080 • HDTV 720p 1280x720
	Frame rate H.264	30/25 fps in all resolutions
	Frame rate Motion JPEG	30/25 fps in all resolutions
	Video streaming	• Multi-stream H.264 and Motion JPEG: simultaneous, individually configured streams in max. resolution at 30/25 fps • Controllable frame rate and bandwidth • VBR/CBR H.264 • Max 10 simultaneous clients
	Image settings	• Compression, brightness, sharpness, white balance, exposure control, backlight compensation, rotation • Mirroring of images • Text and image overlay • Privacy mask
Audio	**Audio streaming**	Two-way, half duplex
	Audio compression	• AAC LC 8/16 kHz • G.711 PCM 8 kHz • G.726 ADPCM 8 kHz • Configurable bit rate
	Audio Input/Output	Built-in microphone, external microphone or line input, line output
Network	**Security**	Password protection, IP address filtering, HTTPS encryption, IEEE 802.1X network access control, digest authentication, user access log
	Supported protocols	IPv4/v6, HTTP, HTTPS, SSL/TLS*, QoS Layer 3 DiffServ, FTP, SMTP, Bonjour, UPnP, SNMPv1/v2c/v3(MIB-II), DNS, DynDNS, NTP, RTSP, RTP, TCP, UDP, IGMP, RTCP, ICMP, DHCP, ARP, SOCKS, etc. *This product includes software developed by the Open SSL Project for use in the Open SSL Tool kit (www.openssl.org)

System Integration	**Application Programming Interface**	• Open API for software integration, including VAPIX® from Axis Communications*, AXIS Media Control SDK*, event trigger data in video stream • Quality of Service (QoS) layer 3, DiffServ Model • Embedded Linux operating system *Available at www.axis.com
	Intelligent Video	Video motion detection, active tampering alarm, audio detection, Gatekeeper
	Alarm triggers	Intelligent video, temperature and external input
	Alarm events	• File upload via FTP, HTTP and email • Notification via email, HTTP and TCP • External output activation
	Video buffer	96 MB pre- and post alarm
	Video access from web browser	• Camera live view • Video recording to file (ASF) • Customizable HTML pages • Windows Vista, XP, 2000, 2003 server • DirectX 9c or higher • For other operating systems and browers see www.axis.com/techsup
General	**Local Storage**	SD/SDHC memory card slot (memory card not included)
	Processors, memory	• ARTPEC-3, 256 MB RAM, 128 MB Flash • Battery backed-up real-time clock
	Power	• 8 – 20 V DC max 11,2 W • 20 - 24 V AC max 17,4 VA • Power over Ethernet IEEE 802.3af Class 3
	Connectors	• RJ-45 10BASE-T/100BASE-TX PoE, terminal block for power, I/O terminal block for two configurable inputs/outputs • 3.5 mm mic/line in, 3.5 mm line out • RS485/RS422 • Video out: 3x RCA Y/Pb/Pr (HD), 1x RCA Composite (SD)
	Operating conditions	0 - 45 ºC (32-113 ºF) Humidity 20-80% RH (non-condensing)
	Approvals	• EN 55022 Class B • EN 61000-3-2 • EN 61000-3-3 • EN 55024 • EN 61000-6-1 • EN 61000-6-2 • EN 60950-1 • FCC Part 15, Subpart B, Class B • VCCI, Class B ITE • C-tick AS/NZS CISPR 22 • ICES-003, Class B
	Dimensions (HxWxD)	58 x 79 x 186 mm (2.3" x 3.1" x 7.3")
	Weight	985 g (2.17 lb) excl. power supply
	Included accessories	Connector kits, Installation Guide, CD with installation tools, recording software and User's Manual, Windows decoder 1-user license

6 – Lights

6.1 – Information

Tempo-mini is fitted with 6 LEDs lights with dimming capability, manufactured by IFREMER.

Voltage :	48V
Power :	30W
LEDs per light :	11
LED reference :	Avago Moonstone ASMT-MW22 (3W, 145Lumens)
IP Address :	TBD
Port Number :	1223
I/O Addresses:	
❑ Lights 1&2 :	101
❑ Lights 3&4 :	102
❑ Lights 5&6 :	103

6.2 – Example

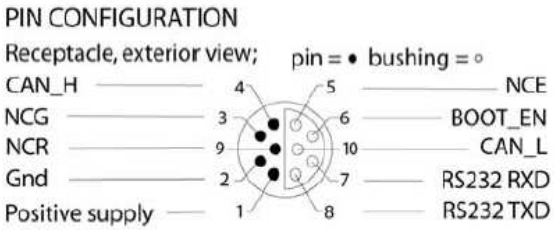
Command examples :

telnet IP_address(Barionet1) 1223<CR>	*Telnet initialisation on Barionet 1, port 1223*
setio,101,1<CR>	*Switching the lights 1&2 ON*
statechange,101,1<CR>	
getio,205<CR>	*Read the lights 1&2 MOSFET feedback*
state,205,0<CR>	*Read=0 : no default detected*

7 – Oxygen Sensor

7.1 – Information

Reference : AANDERAA Oxygen optode 4330
Serial Number : 184
IP Adress : IP(Barionet 1)
Port number : 10001
Voltage : 12V
RS232 configuration : 9600 baud, 8 data bits, 1 stop bit, no parity, XON/XOFF Flow Control



7.2 – Data frame

When powered up, the optode sends the following frame :
<CR><LF>
MODE<0x09>Rs232<CR><LF>
<0x13> *Power-up message*
This initialisation frame is followed by the data frame :
<0x11>Model_number<0x09>Serial_number<0x09><0x09>02_Concentration<0x09><0x09>Air_Saturation<0x09><0x09>Temperature<0x09><CR><LF><0x13> *Data string*

The data frame is also received after the following request:
do_sample<CR>
This data frame can also be received periodically without sending any command (period to be defined).

Parameter	Unit
Model_number	4330
Serial_number	184
02_Concentration	µM
Air_Saturation	%
Temperature	℃

7.3 – Example

telnet IP_address(Barionet2) 1223<CR>	*Telnet initialisation on Barionet 2, port 1223*
setio,101,1<CR>	*Switching the Optode ON*
statechange,101,1<CR>	*Barionet Acknowledge*
telnet IP_address(Barionet1) 10001<CR>	*Telnet initialisation on Barionet 1, port* 10001
do_sample<CR>	*Measurement request*
#<CR><LF> <0x11>4330<0x09>184<0x09><0x09>251.370<0x09><0x09>96.207<0x09><0x09>24.251<0x09><CR><LF>	*Data string*
telnet IP_address(Barionet2) 1223<CR>	*Telnet initialisation on Barionet 2, port 1223*
setio,101,0<CR>	*Switching the Optode OFF*
statechange,101,0<CR>	*Barionet Acknowledge*

8 – T° probe

8.1 – Information

A 10m-long 10-sensors temperature probe is connected to the Barionet 1, with a 1-wire interface.

Reference :	DS18B20
IP Address :	IP(Barionet 1)
Port Number :	1223
I/O Address :	601 to 610
Voltage :	5V

8.2 – Example

Example :

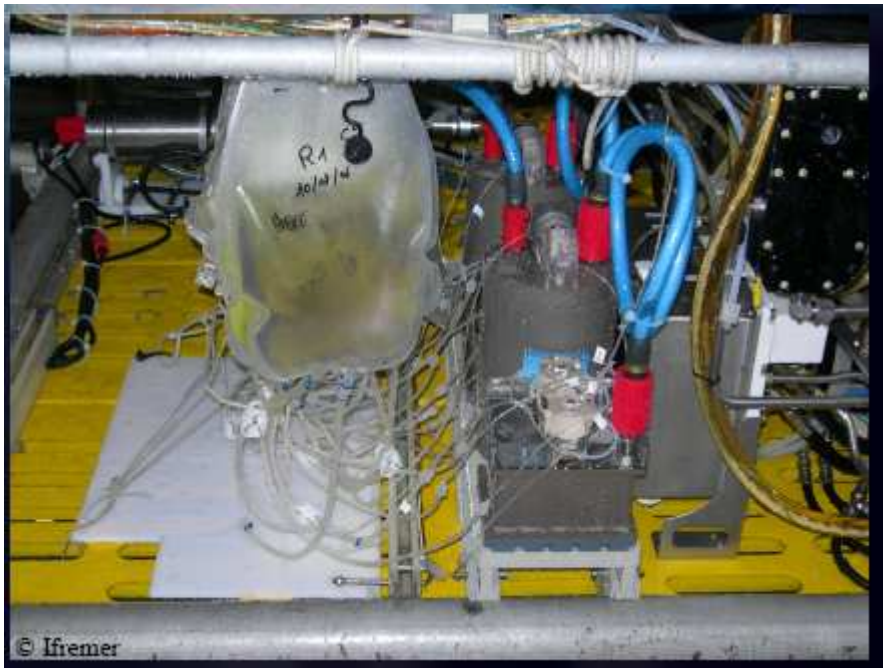
telnet IP_address(Barionet1) 1223<CR>	*Telnet initialisation on Barionet 1, port 1223*
getio,601<CR>	*Read T°value from sensor n°1*
State,601,value1<CR>	*Barionet response*
getio,602<CR>	*Read T°value from sensor n°2*
State,601,value2<CR>	*Barionet response*
……	
getio,610<CR>	*Read T°value from sensor n°10*
State,601,value10<CR>	*Barionet response*

Where value1, value2,…value10 are the raw 12bits values from respectively T°sensor n° 1,2,…10.
These values must be multiplied by 0,0625 to get the value in °C.

9 – CHEMINI Chemical analyser

9.1 – Information

Reference : IFREMER CHEMINI Iron
Serial Number : 2
IP Address : IP(Barionet 2)
Port number : 10001
Voltage : 12V
RS232 configuration : 9600 baud, 8 data bits, 1 stop bit, no parity, no Flow Control, ASCII protocol.



9.2 - CHEMINI main specifications

	Iron
FIA colorimetric detection	*Ferrozine*
Linearity	0 – 100 µmol.l^{-1}
Detection limit	0,3 µmol.l^{-1}
Accuracy	5% (6 µmol.l^{-1})
Measuring frequency	2 min

9.3 – CHEMINI measurement schedule

4 different cycles (Measurement programs) are stored in CHEMINI memory.
Cycle 1 will be executed every day at 6am.
Cycle 1 will be executed every day at 6.05am.

Cycle 1 will be executed every day at 6.10am.
Cycle 5 will be executed every day at 6.15am.
Cycle 3 will be executed every day at 18pm.
Cycle 3 will be executed every day at 18.05pm.
Cycle 3 will be executed every day at 18.10pm.
Cycle 6 will be executed every day at 18.15pm.

9.4 - Command frames

Start	Adress	Command size	Command	Checksum	End
$	01	XX(2bytes)	XX bytes	1 byte	<CR><LF>

Checksum calculation :

XOR between the bytes from the Address, Command size and Command fields,
XOR between the 2 resulting quartets,
The checksum is the resulting quartet, coded in ASCII.

Example :
$0104!Cs17<CR><LF>
0x30 XOR 0x31 XOR 0x30 XOR 0x34 XOR 0x21 XOR 0x43 XOR 0x73 XOR 0x31 = 0x25
0x02 XOR 0x05 = 0x07
-> Checksum = 0x37 = '7'

Command Description

Command	Function	Argument
!CsX	Cycle selection	X = cycle number (1byte)
!Eo	Start measurement	-
Eo	Start Acknowledge	-
Ef	End of measurement	-
!O	Acknowledge	-
?Fd	Data recovery request	-
Fc,X,Y	Data	X = Measurement number (incrementing at each measurement) Y = Data (separation character = comma)

9.5 - Data description

In the NEPTUNE CANADA configuration, the CHEMINI analyser will transmit only raw data that will have to be post-processed to determine Fe concentration.

Raw data are transmitted as an absorbance spectrum due to the chemical method used to measure the Fe concentration (Flow Injection Analysis with a colorimetric measurement using 2 wavelengths). This spectrum is composed by the different values recovered during the data transfer process. The number of values (n) composing the spectrum is a parameter.

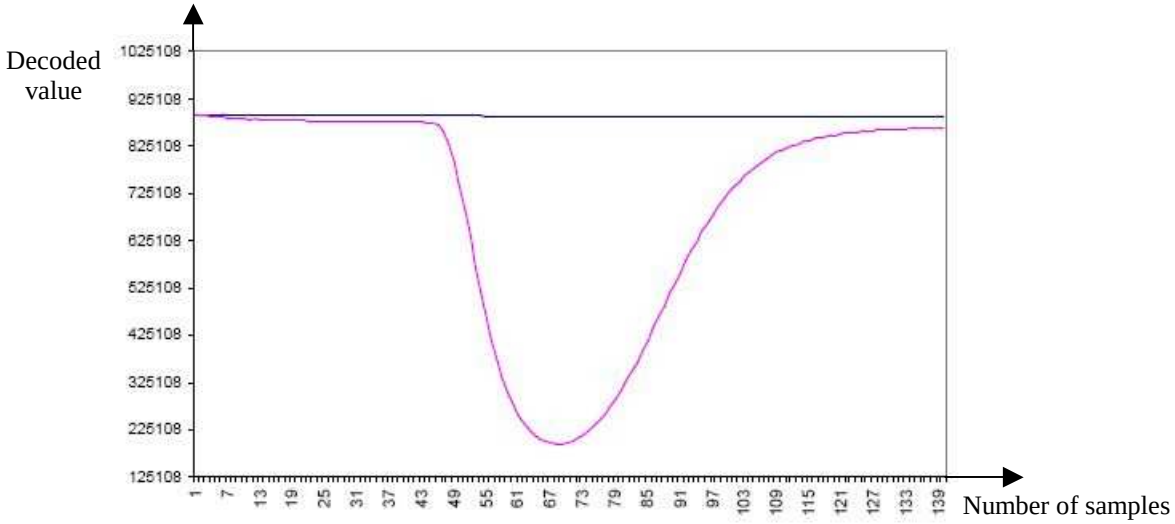
The wavelengths of the LEDs are the following :

LED 1 (Reference)	810 nm
LED 2 (Measure)	560 nm

Each value is coded on 3 bytes with :
2 bits LSB = LED number (1 or 3)
20 bits MSB = data (one spectrum point)
example :
0x3A23CD= 11101000100011111001101
LED number = 1
Data = 0x3A23CD /4 (displacement of 2 bits to the left = division by 4) = 0x0E88F3 = 952563

For a same LED number, the succession of points constitutes the absorbance spectrum of the chemical analyser.

Here is an example of the absorbance spectrum obtained during a measurement :



The blue curve is the reference absorbance spectrum (LED 1).
The pink curve is the measure absorbance spectrum (LED 2).

To calculate the physical Fe concentration, several steps have to be applied on data :

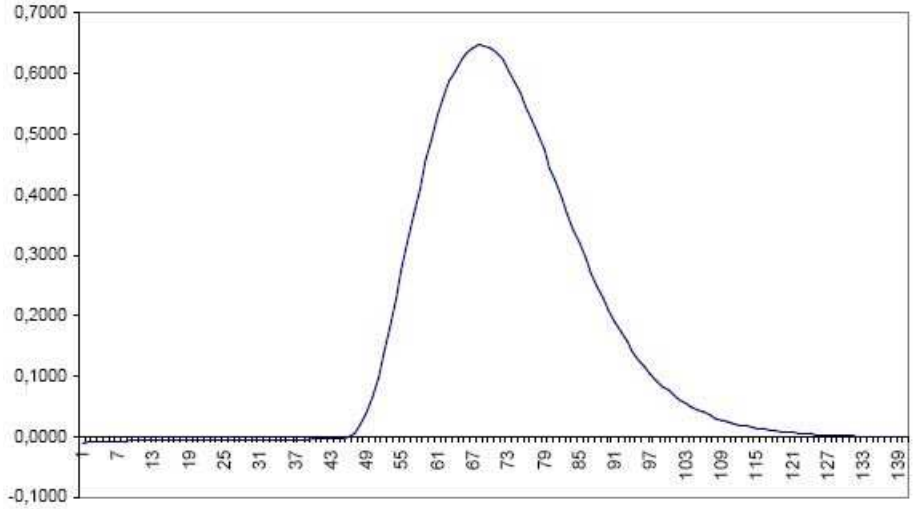
1 – Absorbance spectrum calculation :

The absorbance spectrum is calculated from the 2 previous spectrums (reference and measure) with the following formula :

$A_n = \log [(LbM/LbR)x(MesR_n/MesM_n)]$

with :
LbR = base line of the reference LED (Last 10 samples average value)
LbM = base line of the measure LED (Last 10 samples average value)
$MesR_n$ = Data $_n$ of the reference LED
$MesM_n$ = Data $_n$of the measure LED

After this step, we obtain a new curve, inverted compared to the previous one :



2 – Correction application

A correction has to be applied on the data to obtain a new spectrum :

$B_n = [A_n – (\text{Last 10 } A_n \text{ average value})] \times 10000$

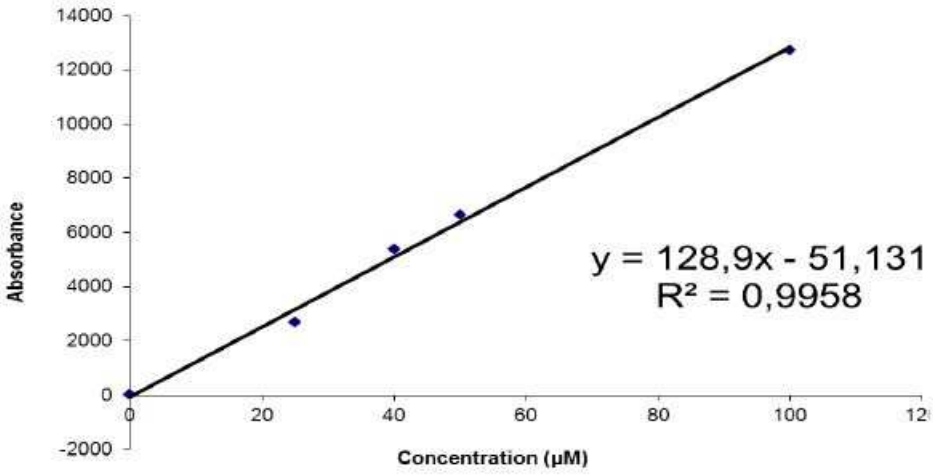
3 – Absorbance maximum determination

The maximal point of the spectrum is the absorbance maximum value.

4 – Fe concentration conversion

To convert this absorbance maximum value to a Fe concentration, we use a calibration curve giving the relation between absorbance and Fe concentration.

Here is an example of a calibration curve established during pressure tests at 300 bars, 3,5°C.



We finally obtain the Fe concentration in µM/L

9.6 – Example

You will find below an example for the cycle 1 measurement. The sequence is the same for the other cycle numbers except for the command “!Cs” where the argument changes :

telnet IP_address(Barionet2) 1223<CR>	*Telnet initialisation on Barionet 2, port 1223*
setio,1,1<CR>	*Switching the CHEMINI ON*
statechange,1,1<CR>	*Barionet Acknowledge*
telnet IP_address(Barionet2) 10001<CR>	*Telnet initialisation on Barionet 2, port 10001*
:0129CHEMINI FER 1.1.7 du 02/02/09A<CR><LF>	*Initialisation frame*
$0104!Cs17<CR><LF>	*Cycle 1 selection*
:0103Cs13<CR><LF>	*Response*
$0103!Eo9<CR><LF>	*Start measurement*
:0102EoB<CR><LF>	*start acknowledge*
…After 110 sec, the CHEMINI sends :	
:0102Ef2<CR><LF>	*End of measurement*
$0102!OB<CR><LF>	*End of measurement acknowledge*
$0103?FdE<CR><LF>	*Raw data recovery*
:0114Fc,231,2800985D<CR><LF>	*CHEMINI value (see below for data string)*
$0102!OB<CR><LF>	*Data value acknowledge*
…….	*CHEMINI value*
$0102!OB<CR><LF>	*Acknowledge during data recovery*
…….	
……..	
……..	*CHEMINI last value*
…No more data are available, the CHEMINI sends :	
:0110Fc,233,fin1<CR><LF>	*End of data recovery*
$0102!OB<CR><LF>	*End of data recovery acknowledge*
setio,1,0<CR>	*Switching the CHEMINI OFF*
statechange,1,0<CR>	*Barionet Acknowledge*

9.7 - Time stamping

The data will be time stamped with the NEPTUNE Canada reference time. The reference will be the measurement start.

10 – Chlorination

10.1 – Information

IP Address : IP_address(Barionet 2)
Port number : 1223
I/O Adress : 104

A chlorination system is used to protect sensors optical parts from biofooling. The following parts are protected : camera, lights (1,2,3,4,5,6) and optode.

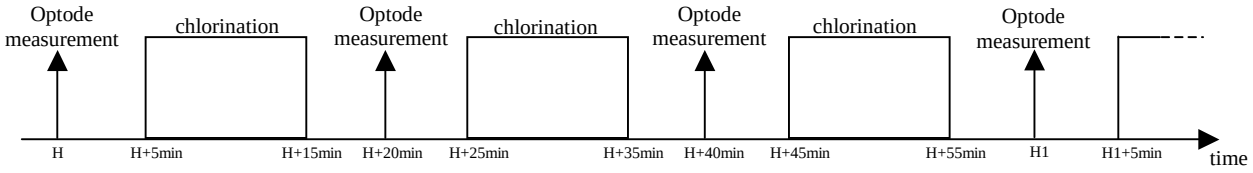
The chlorination is sequenced by NEPTUNE CANADA in order to not disturb the oxygen measurement.

A battery is used to power the chlorination system to avoid current leakage between it and the NEPTUNE CANADA ground. To enable the use of the chlorination system, a command must be sent after powering up TEMPO-Mini. The command is the following :

telnet IP_address(Barionet1) 1223<CR>	*Telnet initialisation on Barionet 1, port 1223*
setio,1,1<CR>	*Enabling the CHLORINATION*
statechange,1,1<CR>	*Barionet Acknowledge*

10.2 - Synchronisation with the Optode

The following scheme shows how to sequence both the optode measurement and the chlorination to not disturb the oxygen measurement :



10.3 - Example

H :	telnet IP_address(Barionet2) 1223<CR>	*Telnet init on Barionet 2, port 1223*
	setio,101,1<CR>	*Switching the Optode ON*
	statechange,101,1<CR>	*Barionet Acknowledge*
	telnet IP_address(Barionet1) 10001<CR>	*Telnet init on Barionet 1, port 10001*
	do_sample<CR>	*Measurement request*
	#<CR><LF>	
	<0x11>4330<0x09>184<0x09><0x09>251.370<0x09><0x09>96.207<0x09><0x09>24.251	
	<0x09><CR><LF>	*Data string*
	telnet IP_address(Barionet2) 1223<CR>	*Telnet init on Barionet 2, port 1223*
	setio,101,0<CR>	*Switching the Optode OFF*
	statechange,101,0<CR>	*Barionet Acknowledge*
H+5min :	telnet IP_address(Barionet2) 1223<CR>	*Telnet init on Barionet 2, port 1223*
	setio,104,0<CR>	*Switching the chlorination ON*
	statechange,104,1<CR>	*Barionet Acknowledge*

H+15min :telnet IP_address(Barionet2) 1223<CR> *Telnet init on Barionet 2, port 1223*
setio,104,1<CR> *Switching the chlorination OFF*
statechange,104,0<CR> *Barionet Acknowledge*
H+20min :telnet IP_address(Barionet2) 1223<CR> *Telnet init on Barionet 2, port 1223*
setio,101,1<CR> *Switching the Optode ON*
statechange,101,1<CR> *Barionet Acknowledge*
telnet IP_address(Barionet1) 10001<CR> *Telnet init on Barionet 1, port 10001*
do_sample<CR> *Measurement request*
#<CR><LF>
<0x11>4330<0x09>184<0x09><0x09>251.370<0x09><0x09>96.207<0x09><0x09>24.251
<0x09><CR><LF> *Data string*
telnet IP_address(Barionet2) 1223<CR> *Telnet init on Barionet 2, port 1223*
setio,101,0<CR> *Switching the Optode OFF*
statechange,101,0<CR> *Barionet Acknowledge*
……