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**PROJECT** : **T4S-Monitoring network Software**  
**DOCUMENT TITLE** : **USER Manual**  
**DOCUMENT NUMBER** : **T4S-MAN-0015**  
**ISSUE** : **1**  
**REVISION** : **3**

	NAME	SIGNATURE	DATE
PREPARED BY	X. Vernez		11-JUL-2013
APPROVED BY			

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ISSUE / REVISION	DATE	PAGES	MODIFICATIONS
1/3	11/07/2013	all	

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## Glossary

ACT	Automatic Cavity Tuning
ESA	European Space Agency
FTP	File Transfer Protocol
HTTP	Hypertext Transfer Protocol
HTML	Hypertext Markup Language
UDP	User Datagram Protocol
TCP	Transmission Control Protocol
IP	Internet Protocol
ID	Identification number
IHM	Interface Homme Machine
IDE	Development environment
MASER	Microwave Amplification by Stimulated Emission of Radiation
MMI	Man Machine Interface
PC	Personnel Computer
T4S	Time For Sciences
SW	Software
WINDEV	A complete Development Environment for Windows
SW	Software
EM&C	Embedded Monitoring and Command Software
GPIO,	General Purpose Input Output
FP	Front Panel
SPI	Serial Peripheral Interface Bus
SD	Secure Digital Memory


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## 1. SCOPE

- This document describes how to use of the network interface to monitor the Maser.

The main functions of the module are:

- Display the Monitoring of the Maser via an HTML page
- Record the monitoring on a local SD card memory accessible via FTP
- Allow the adjustment of the synthesis frequency in order to control the absolute Maser frequency

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### 1.1.1 Command definition

There is a set of command in order to control the Network module.

#### Command list (REF\_1)


n°	Command name	Syntax	Effect and restriction	Parameter	Answer
1	HTML	<b>HTML=</b> [parameter];<CRLF> example HTML=1;<CRLF>	Enable or disable the monitoring update of the HTML file accessible with an internet browser	HTML=1; The Monitoring is refreshed every 2 second on the HTML web page HTML=0; the HTML web page is not updated	<b>\$HTML=</b> [parameter];<CRLF>
2	RDFS	RDFS;<CRLF>	Read freq synthesizers in Measurement board EEPROM	No	<b>\$RDFS</b> ;=[value]; <CRLF>
3	RS232MONIT	RS232MONIT =[parameter];<CRLF> example RS232MONIT =0;<CRLF>	Disable or enable the RS232 of the Monitoring port	0 = COM port enable 1 = COM port disable	<b>\$RS232MONIT=</b> [parameter];<CRLF>
4	SETDATE	SETDATE= [Date]; <CRLF>	Set Date of the IP Stack card	Date in format yyyy/mm/dd	<b>\$SETDATE=</b> [parameter];<CRLF>
5	SETTIME	SETTIME=[time];<CRLF>	Set Time of the IP Stack card	Time in format hh:mm:ss	<b>\$SETTIME=</b> [parameter];<CRLF>
6	SETFSREL	SETFSREL= [+/-] [parameter]; <CRLF> example SETFSREL=+21E-8;<CRLF>	Set the frequency delta to increase or decrease the MASER frequency.	SETFSREL in relative value [s/s] Range +/- -29E-9 <SETFS<+29E-9 Resolution 6.4E-15	<b>\$SETFREL=+/-</b> [parameter];<CRLF> <b>\$</b> =[New synthesis value];<CRLF>>
7	MASERID	MASERID=<Text>; <CRLF>	Set the title of the monitoring HTML page	Text to be displayed	<b>\$MASERID=</b> [Text]; <CRLF>
8	GETID	GETID; <CRLF>	Return the software version implemented	No	<b>\$GETID</b> ;=[value]; <CRLF>
9	REBOOT	REBOOT; <CRLF>	Reboot the M&C software	No	<b>No</b>
10	EXIT	EXIT; <CRLF>	EXIT the M&C software	No	<b>\$EXIT</b> ;<CRLF>
12	RDREG	RDREG= [parameter];<CRLF> Example RDREG= UVAR;<CRLF>	Read in IO CARD register	Register list UVAR ADJ1PPS SETH RS232MONIT	<b>\$RDREG=</b> [parameter];=[value]; <CRLF> Example \$RDREG= ADJ1PPS:=000000000; \$RDREG= RS232MONIT;=0;
13	UVAR	UVAR= [parameter];<CRLF> example UVAR= 43.56;<CRLF>	Set U varactor value in % of the IO CARD register	UVAR in % of the Range 0<UVAR<100 Resolution 0.001	<b>\$UVAR=</b> [parameter];<CRLF>
14	SETH	SETH= [parameter]; <CRLF> example SETH= 53.56;<CRLF>	Set Hydrogen flux value in % of the IO CARD register	SETH in % of the Range fixed in config file Resolution 0.01	<b>\$SETH=</b> [parameter];<CRLF>
15	ADJ1PPS	<b>ADJ1PPS=</b> [parameter];<CRLF> example ADJ1PPS= 000000150;<CRLF>	Set delay on 1PPS pulse	ADJ1PPS in ns 000 000 000 < ADJ1PPS < 999 999 950 Resolution 50ns	<b>\$ADJ1PPS=</b> [parameter];<CRLF>



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n°	Command name	Syntax	Effect and restriction	Parameter	Answer
16	SYNCPPS	SYNCPPS;<CRLF>	Force the synchronisation of the PPS pulse	No	<b>\$ SYNCPPS;</b> <CRLF>
17	MONIT	MONIT;<CRLF>	Reading of the 40 analog channels an lock status	No	<b>\$ [40 parameters in ASCII];</b> <CRLF>
18	DISSSW	<b>DISSSW=</b> [parameter] <CRLF> example DISSW= 1;<CRLF>	Set state switch Dissociator in IO CARD register	DISSSW Boolean 0= DISSW OFF 1= DISSW ON	<b>\$DISSSW=</b> [parameter] ;<CRLF>
19	BEAMSW	<b>BEAMSW=</b> [parameter]; <CRLF> example BEAMSW= 1;<CRLF>	Set state switch Beam stabilizer in IO CARD register	BEAMSW Boolean 0= BEAMSW OFF 1= BEAMSW ON	<b>\$BEAMSW=</b> [parameter]; <CRLF>

**Table 1 Command set**

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### 1.1.2 Command Format

Command specification for data exchange.

General format:

**<Command name= [parameter; <CR><LF>**

**<Command name>** : Name of the command.  
**=** : separator between command and parameter  
**[parameter]** : Parameter associated to a dedicated command.  
**;** : separator of commands or between parameters of a same command  
**<cr><lf>** : terminator (Note single terminator will also be accepted either <cr> or <lf>).

Query message: <Command name> [parameter]  
 Direction: PC client -> MASER

Answer of the MASER: \$<Command name> [answer] <CR><LF>  
 Direction: MASER -> PC client

Example: PC client - > MASER: **GETID;<CR><LF>**  
 MASER - > PC client: **\$GETID;= Monitoring NDCU Ver. 2.0; <CR><LF>**

Write message: <Command name> [parameter] <CR><LF>  
 Direction: PC client -> MASER


Answer of the MASER: \$<Command name>[parameter] <CR><LF>  
 Direction: MASER -> PC client

Example: PC client - > MASER: **HTML=1 ;<CR><LF>**  
 MASER - > PC client: **\$HTML=1 ; <CR><LF>**

Error message: <Command name> [parameter] <CR><LF>  
 Direction: MASER -> PC client


For each invalid command, an answer with an error code is replied.  
 Answer of the MASER: : **!<sent command>**

Example: PC client - > MASER: **BLIBLOBLU=43.56;<CR><LF>**  
 MASER - > PC client: **!BLIBLOBLU=43.56 ; <CR><LF>**


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### 1.1.3 Command description

- **SETDATE=YYYY/MM/DD;<CR><LF>**  
Set the date of the Module.  
The date is displayed in the HTML page and tags each monitoring record.  
Each time the supply of the module is interrupted, by switching off the receiver or unplugging the supply connector, the date shall be reset.
- **SETTIME=HH :MM :SS;<CR><LF>**  
Set the Time of the Module.  
The time is displayed in the HTML page and tags each monitoring record.  
Each time the supply of the module is interrupted, by switching off the receiver or unplugging the supply connector, the time shall be reset.
- **HTML=1 ;<CR><LF> :**  
Start to display of the monitoring of the Maser on the HTML page  
The monitoring can be observed on any computer connected to the network.  
In order to display the current monitoring, type in a web browser IP address of the network module (ie. 168.192.1.23)  
Each time the supply of the module is interrupted, by switching off the receiver or unplugging the supply connector, the HTML command shall be send.  
HTML=1; enable the display of the monitoring  
HTML=0; disable the display of the monitoring
- **RECMONIT=60 ;<CR><LF>**  
Record the monitoring in a file stored on the local SD memory card.  
The record time interval is given in second.  
RECMONIT=0 ;<CR><LF> disable the record of the monitoring, the status of the monitoring ON or OFF is visible on the HTML page.  
Each time the supply of the module is interrupted, by switching off the receiver or unplugging the supply connector, the record of the monitoring shall be reinitiated.  
The recorded file can be accessed by FTP under the directory ./Montoring  
Each time the file size reach 2MB, the file is copied with a tag of the date and time, and the current file is reset.
- **MASERID=<Text> ;<CR><LF>**  
Define the title displayed on the HTML page.  
Each time the supply of the module is interrupted, by switching off the receiver or unplugging the supply connector, the title of the monitoring shall be reinitiate.  
The default title displayed the name of the Network module and/or the Maser number.
- **GETID;<CR><LF>**  
Return the software version implemented on the network module
- **SETFSREL=+2E-13;<CR><LF>**  
Set the synthesis frequency according the phase drift in [s/s].  
The scientific number format shall be used and the sign +/- is mandatory

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- RS232MONIT=1 ;<CR><LF>  
Stop the serial communication between the network module and the Maser.  
This command shall be used prior each time the serial cable is disconnected from the Maser.  
In order to restart the serial communication the command RS232MONIT=0 ;<CR><LF> shall be send
- REBOOT ;<CR><LF>  
Reset the pocket PC  
After a reboot the time and date are kept, but the display of the HTML page and the record of the monitoring are disabled.  
In order to enable them send the command  
HTML=1 ;<CR><LF>  
RECMONIT=60 ;<CR><LF>
- RDFS ;<CR><LF>  
Read the current synthesis frequency
- EXIT ;<CR><LF>  
Quit the software.  
This command is used for a software update.
- UVAR  
Set the varactor voltage, the command is given in % of the full range with a resolution of 0.001%  
The range is define between 0% and 100%  
See the command RDREG to retrieve the UVAR value
- SETH  
Set the Hydrogen voltage, the command is given in % of the full range with a resolution of 0.01%  
The range is define between 43% and 56%  
When increasing the SETH value it will decrease the amount of hydrogen going to the Dissociator. The limits ensure that there will always have enough hydrogen for a proper operation of the MASER  
The limit values are stored in the Config.cfg file  
See the command RDREG to retrieve the SETH value
- ADJ1PPS  
Set the delay to apply to the 1HZ OUT pulse.  
After the synchronization The ADJ1PPS is reset to 000000000.  
The minimum shift between the reference pulse and the MASER pulse is 1us. Bellow this delay no synchronization happens.  
If an offset is set while synchronization the offset remains after synchronization.  
See the command RDREG to retrieve the ADJ1PPS value
- SYNCPPS  
Force the synchronisation of the 1PPS pluse with a reference pulse.  
In a normal way the reference pulse hase to be plugged during 60sec in order to initiate the synchronisation of the 1PPS of the MASER.  
In case the synchronisation is not done after 60sec the command SYNCPPS can be


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sent in order to force the synchronisation.

- MONIT  
Return the 40 analog parameter of the MASER
- RDREG  
Retrieve the value from the specified parameter

RDREG=UVAR;	return the last programmed UVAR value
RDREG=SETH;	return the last programmed SETH value
RDREG=ADJ1PPS;	return the last programmed ADJ1PPS value
RDREG=RS232MON;	return the last programmed RS232 value
RDREG=DISSSW;	Return two parameters, RDREG=DISSSW;=1;1; The first parameter is the programmed value sent to the M&C software, the second parameter is the physical power of the Dissociator.
RDREG=BEAMSW;	Return two parameters, RDREG=BEAMSW;=1;1; The first parameter is the programmed value sent to the M&C software, the second parameter is the physical power of the Beam Stabilizer.

- DISSSW  
Set the state of the DISSSW value  
The DISSSW can only be set to '1' if the BEAMSW power is ON.  
See the command RDREG to retrieve the BEAMSW and DISSSW state
- BEAMSW  
Set the state of the BEAMSW value  
The BEAMSW can be set to '1' independently from the DISSSW state.  
When BEAMSW is set to '0' it will automatically set DISSSW to '0' at the same time.  
See the command RDREG to retrieve the BEAMSW and DISSSW state

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## 2. INITIALISATION

Once the Network module has been powered OFF some command are requested when powering ON in order to display and record the monitoring.

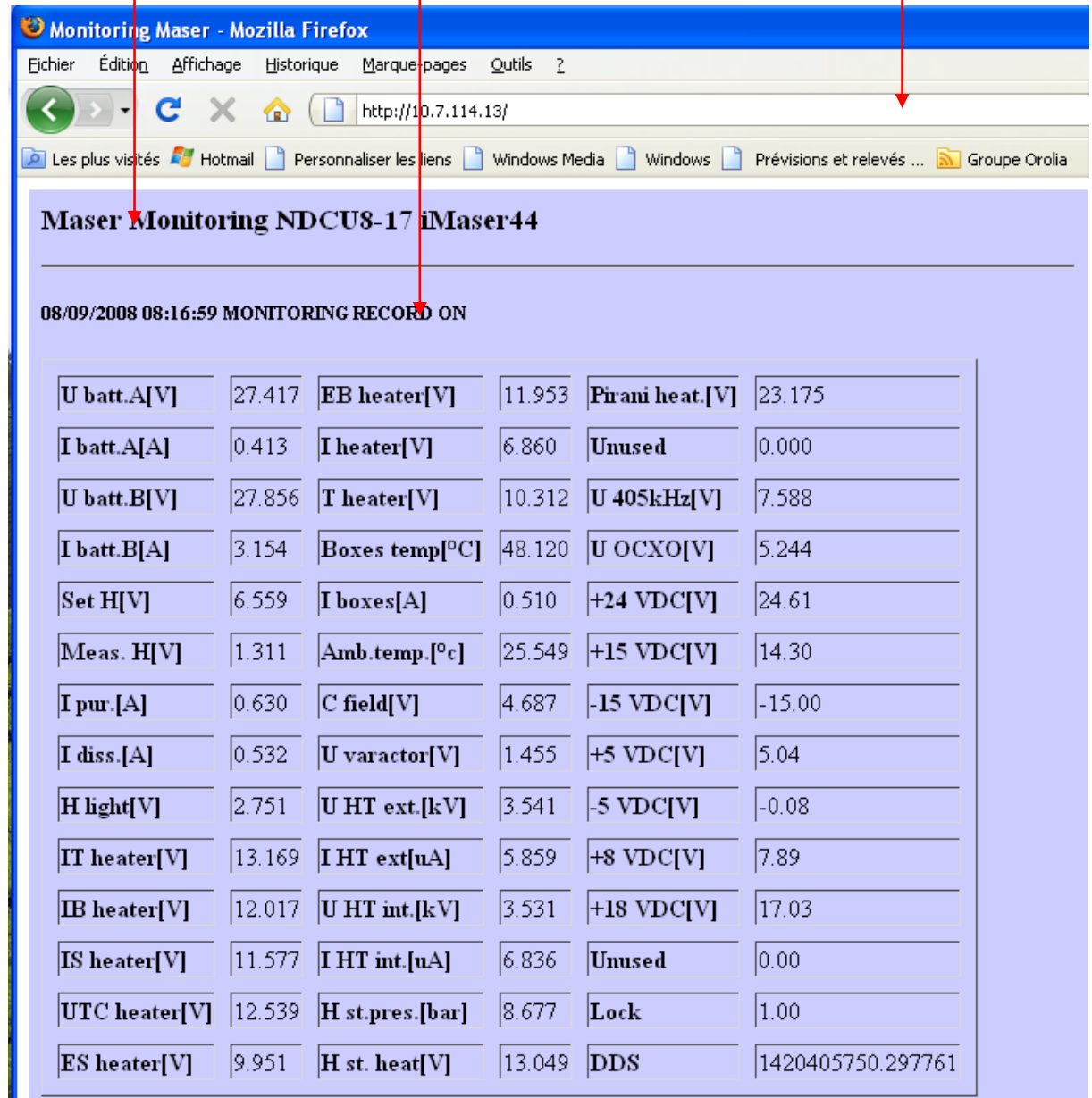
1. SETDATE=YYYY/MM/DD;<CR><LF>  
Actual date
2. SETTIME=HH:MM:SS;<CR><LF>  
Actual time

### 3. HTML PAGE DISPLAY


The monitoring is displayed through a HTML page with refresh every 2 [s]  
 In order to visualized the monitoring, you shall start a web browser and type the IP address in the URL field

The additional information are displayed on the page :

- The Title of the page can be changed with the command  
**MASERID=<Titre> ; <CR><LF>**
- The satus ON or OFF of the Monitoring record, defined with the command  
**RECMONT=<Time interval> ; <CR><LF>**



**Figure 1 HTML display**

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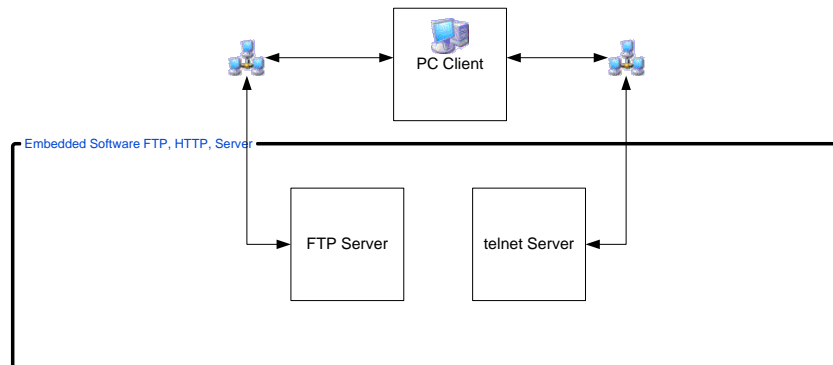
## 4. NETWORK COMMUNICATION

The network communication is UDP based.  
 The UDP port of the module is 14000.  
 The setting of the mask and IP address is customized for each MASER.

It is necessary to use a UDP terminal in order to communicate with the module.

## 5. UPDATE AND MAINTENANCE

### 5.1 FTP AND TELNET CONNECTION



**Figure 2 FTP, Telnet Connection**

It is possible to connect to the MASER via FTP and telnet  
 The Access required the IP address of the MASER and is protected by password.

Username: iMaser  
 Password: ndcu

When connecting by FTP the location will be the Storage Card where all the M&C software files are stored.

The FTP will be used for the following operation

- To update ConfigUser.cfg file
- To get the Monitoring file
- To update the M&C software


### 5.2 CONFIG FILE UPDATE

- Connect to the maser via FTP
- Enter the directory Embedded\_soft on the Storage Card
- Get the ConfigUser.cfg file
- Update it
- Delete the file on the Storage card
- Copy the updated file
- Send the command REBOOT to the M&C software

### 5.3 GET MONITORING FILE

- Connect to the maser via FTP
- Enter the directory Monitoring on the Storage Card
- Get the Monitoring desired file



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## 5.4 M&C SOFTWARE UPDATE

- Send the command EXIT to the M&C software
- Connect to the maser via FTP
- Enter the directory Embedded\_soft on the Storage Card
- Delete the file Embedded\_soft2.exe
- Delete all the files .DLL
- Be careful to conserve the correct config file
- Copy the new M&C software, keep the same name Embedded\_soft2.exe
- Copy the new files .DLL
- Edit the config file line "SW\_ID=T4S-SW-100-a-1;" with the correct SW version
- Enter Telnet with the IP address of the MASER the username and password
- type "**ndcucfg**" in the telnet windows
- Then type "**reboot hardware**" and the Hardware shall reboot launching automatically the software

If there is a troubleshooting in the software update procedure, it may be necessary to kill the task of the Embedded\_soft in order to be able to repeat the procedure.

Then you have to do the following step.

- Enter Telnet with the IP address of the MASER the username and password
- Type "**shell -c**"
- Type "**gi proc**" it will list all the running process
- Look at the number of the process of the Embedded\_soft2.EXE ; it shall be in the form P09.
- Type "**kp 09**" (if the process number is P09).
- Type "**gi proc**" to ensure that the process has been killed
- Type "**exit**" to return to the telnet command
- Repeat the procedure deleting the files and copy the new one as described above

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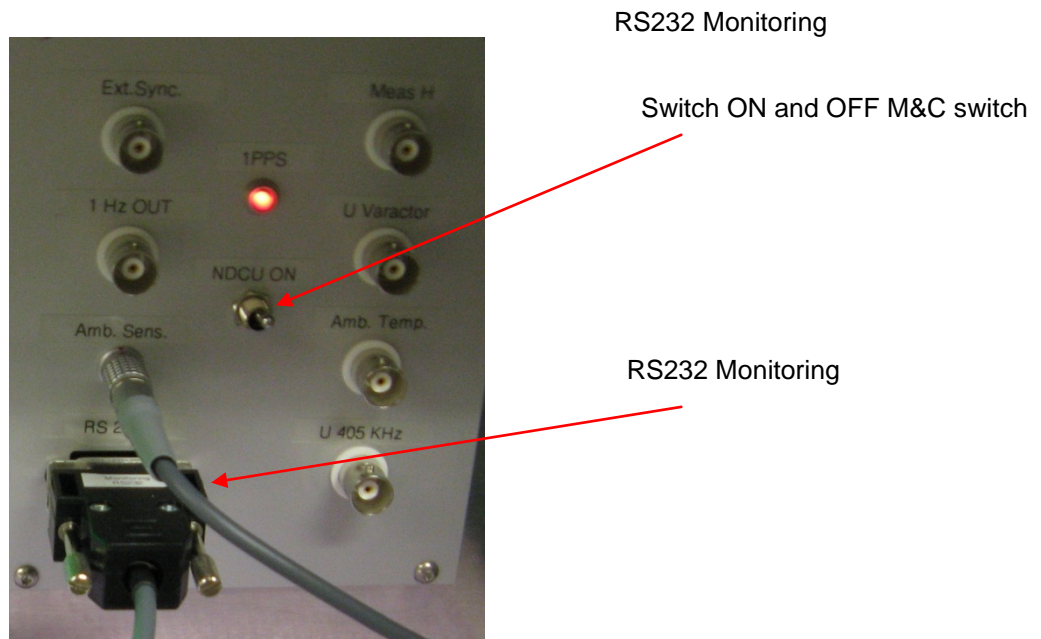
## 5.5 M&C SOFTWARE RESET AND LAN CONNECTION TROUBLESHOOTING

There are two ways to reset the maser one is manual and the second is via telnet.

The Manual reset will reset the whole IO card module and will have the side effect to affect the stability of the Maser and to stop the 1PPS pulse generation for a short time.

Therefore the manual reset will be used only if the Maser can not be accessed by telnet or if there is a problem in the 1PPS pulse generation or the voltage reference of the varactor and hydrogen regulation.

The manual reset is described hereafter



- Put the M&C switch in Off position
- Put the M&C switch in On position
- Wait 30s
- Check the LAN communication

The reset via telnet will performed a reset of the Embedded\_soft, it is the equivalent of the command REBOOT of the Embedded\_soft. Therefore it will be used when the communication with the Embedded\_soft is lost.

It has the advantage to be done remotely and do not required to touch the Maser and it will not affect the stability or the 1PPS generation of the Maser.

In order to perform a reset via telnet you have to:

- Enter Telnet with the IP address of the MASER the username and password
- type **"ndcucfg"** in the telnet windows
- Then type **"reboot hardware"** and the Hardware shall reboot launching automatically the software