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# GREGOR: SMALL MOTORISATION COMMUNICATION TOOL

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## Signatures & Approval

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## 1 Scope

The **SMALL MOTORIZATION COMMUNICATION TOOL** interface, a debugging communication tool, is needed for a fast intervention in case of issues, to determine quickly any failure in the GREGOR Small Motorization System.

## 2 Reference and applicable documents

GCS	-	GREGOR Control System
ICS	-	Instrument Control System
DCP	-	Device Communication Protocol
CoSM	-	Communication of Short Messages system
VI	-	Virtual Instrument

- CoSM\_CS-protocol-V1.07\_commands.pdf – Frank Heidecke – E Labor – KIS (Freiburg)

## 3 Overview

The purpose of this interface is mainly to check and give a quick and easy diagnostic of the communications to all the motorization & sensors devices available in the GREGOR instrument network. The list of devices can be easily implemented to include new developments, such as motorization, force or thermal sensors to be tested. The communication test of a device will follow all the line structure steps from the network to the end device; through the Xport, CoSM client, CoSM server, and in its case the motor driver or controller.

## 4 Structure

The network chain, from the interface to motors, involves elements that are connected through cables and connectors, all of which could be a source of malfunction. The following scheme shows the structure of this linkage:

## 4.1 Framework

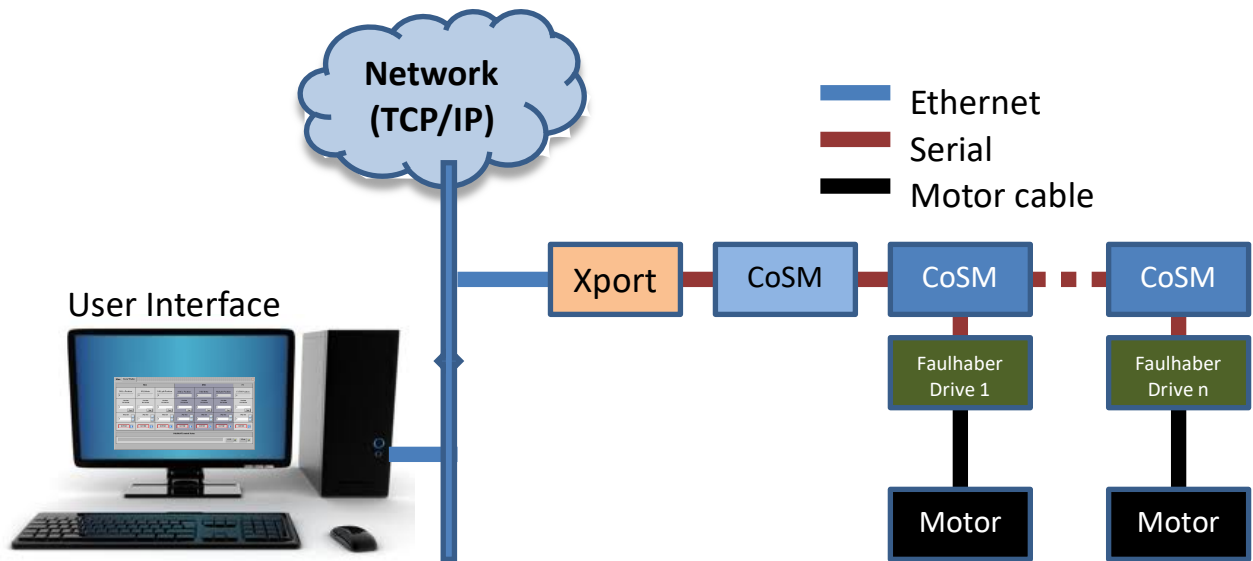


Figure 1 - Small Motorization Network

Only one node is represented in this image, but the GREGOR Small Motorization System counts 8 nodes and up to 40 motor devices, to ensure the telescope functionality.

## 4.2 Device list

Used for the small motorization communication:

Element	Quantity
Xports	8
CoSM Clients	8
CoSM Servers	39
Faulhaber Motorization Drivers + Hexapod Controller	39
Cables	47+
Connectors	274+

Line	Cables	Connectors
1	$\text{nbCoSMS} + 1$	$5 + (6 \times \text{nbCoSMS}) + 1$ (for termination)

## 5 Interface

The Small Motorization Communication Tool (VI) has been developed in the LabVIEW15/64bits environment, on the CentOS7 Linux operating system.

It is composed of two panels, “Communication tester” and “Configuration tables”.

On the ICS interface (Gregor Instrument Control), just click on the SMS Communication Tool item in the explorer menu at the left side, after verifying that the SMS Communication Tool interface is not running on the system:

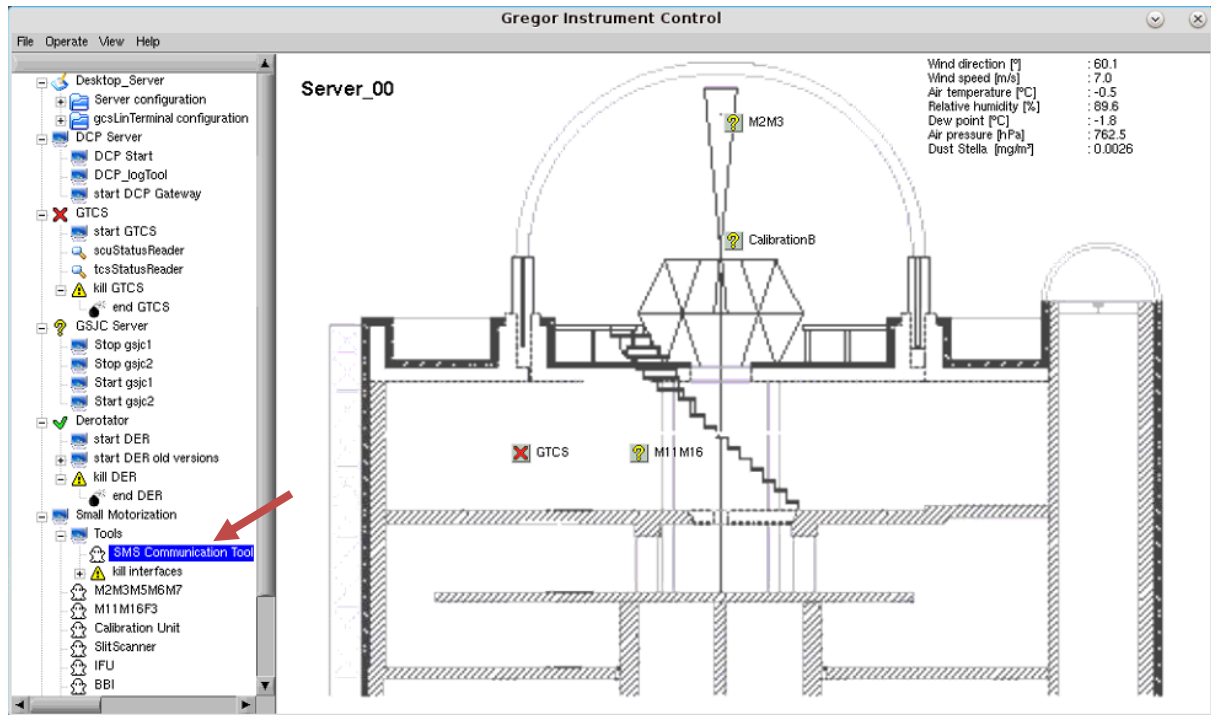


Figure 2 - ICS interface – Starting the SMS-ComTool interface

Only one instance of the interface is allowed; any attempt to start more than one instance will generate an error message, as the communication ports for remote panel, the DCP client name at the GCS DCP server and the motorization Xport are already used by the first one.

After the startup, the window appears...

## 6 Installation

The LabVIEW15/64bits IDE is used to compile the source as an executable application.

It should be installed on the GCS computer, at the “/opt/G\_Control/SMS-ComTool/” directory, with a subfolder: “config” containing the configuration file for the communication & motorization setting.

The last source version is updated after modifications and available at the KIS-GitLab site (<https://gitlab.leibniz-kis.de/ot/labview/>).



### 6.1 Configuration tables

The screenshot shows the 'MotorizationCommunicationTool.vi' interface. It has two tabs: 'Communication tester' and 'Configuration tables'. The 'Configuration tables' tab is active, displaying two tables: 'Motorization Table' and 'Node Table'. The 'Motorization Table' contains a list of motor components with columns for Name, Ref, Type, Node, CoSM, Command, and EndChar. The 'Node Table' lists nodes with columns for Node, IP XPort, and Port. A warning box at the bottom right of the interface reads: 'Please, don't modify any parameter, if you are not sure of the consequences.'

Name	Ref	Type	Node	CoSM	Command	EndChar
M2 (Hexapod)	M02-1	PI	1	#50	*IDN?	\n
M3 axis 1	M03-1	FA	1	#61	VER	\r
M4 axis 1	M04-1	FA	7	#32	VER	\r
M4 axis 2	M04-2	FA	7	#33	VER	\r
M5 axis 1	M05-1	FA	1	#11	VER	\r
M5 axis 2	M05-2	FA	1	#12	VER	\r
M6 axis 1	M06-1	FA	1	#13	VER	\r
M6 axis 2	M06-2	FA	1	#14	VER	\r
M7 axis 1	M07-1	FA	1	#15	VER	\r
M7 axis 2	M07-2	FA	1	#16	VER	\r
M11 axis Lin	M11-1	FA	2	#52	VER	\r
M11 axis Azi	M11-2	FA	2	#76	VER	\r
M11 axis Ele	M11-3	FA	2	#77	VER	\r
M15 axis Lin	M15-1	FA	2	#55	VER	\r
M15 axis Azi	M15-2	FA	2	#45	VER	\r
M15 axis Ele	M15-3	FA	2	#46	VER	\r
M16 axis Lin	M16-1	FA	2	#72	VER	\r
M16 axis Azi	M16-2	FA	2	#73	VER	\r
M16 axis Ele	M16-3	FA	2	#60	VER	\r
F3 Wheel	W03-1	FA	2	#75	VER	\r
Beam Rotation	BR1-1	FA	2	#58	VER	\r
A0 axis 1	AO1-1	FA	2	#56	VER	\r
A0 axis 2	AO2-1	FA	2	#57	VER	\r
Visitor1 Lin	AO1-1	FA	2	#53	VER	\r
Visitor2 Rot	AO2-1	FA	2	#54	VER	\r
Calib.Wheel 1	W01-1	FA	3	#62	VER	\r
Calib.Rotat. 1	R01-1	FA	3	#64	VER	\r
Calib.Wheel 2	W02-1	FA	3	#63	VER	\r
Calib.Rotat. 2	R02-1	FA	3	#65	VER	\r
SlitScan.X	SM1-1	FA	4	#25	VER	\r
SlitScan.Focus	SM1-3	FA	4	#26	VER	\r
BBI Focus 1	BM1-1	FA	5	#31	VER	\r
BBI Wheel 1	BW1-1	FA	5	#10	VER	\r
AO-BBI-Wheel 1	AW1-1	FA	6	#10	par	\r
AO-BBI-Wheel 2	AW1-2	FA	6	#36	par	\r
IFU Vert. x	FM1-1	FA	4	#23	VER	\r

Node	IP XPort	Port
1	192.168.90.81	10001
2	192.168.90.77	10001
3	192.168.90.80	10001
4	192.168.90.103	10001
5	192.168.90.104	10001
6	192.168.90.89	10001
7	192.168.90.120	10001
8	192.168.90.121	10001

Figure 3 - Configuration tables

### 6.1.1 Motorization table

This lists all motorization devices connected in the system that can be tested.

**Name:** Common used name for the motor.

**Ref:** Reference for further use.

**Type:** The motor driver type used for this device.

**Node:** Branch number of a motorization group. (Xport-CoSM-Drivers-Motors)

**CoSM:** Referenced number command to select the CoSM Server of the device.

**Command:** A command that does not affect the state of the motorization, which allows to get an answer from the driver and test the whole communication. The command can be manually modified in the table, but only for technical or maintenance test purposes !!

**End Char:** This is the character(s) that end(s) a command. It may differ from drivers. It is represented with the ‘\’ code display of LabView to show the control characters as [LineFeed] as “\n” or [Return] as “\r”, “0A” and “0D” in hexadecimal.

### 6.1.2 Node table

This table lists all nodes.

**Node:** Branch number.

**IP Xport:** IP number assign to the Xport.

**Port:** Used port number for the TCP connection.

### 6.1.3 Configuration files

Please refer to the above paragraphs to setup or modify the “SMS-motors.ini” and “SMS-nodes.ini” files, for the respective parameter explanations. As example:

“SMS-motors.ini”:

```
M2 (Hexapod)M02-1 PI    1    #50  *IDN? \n
M3 axis 1    M03-1 FA    1    #61  VER  \r
M4 axis 1    M04-1 FA    7    #32  VER  \r
```

...

“SMS-nodes.ini”:

```
1    192.168.90.81 10001
2    192.168.90.77 10001
3    192.168.90.80 10001
```

...



## 6.2 Communication tester

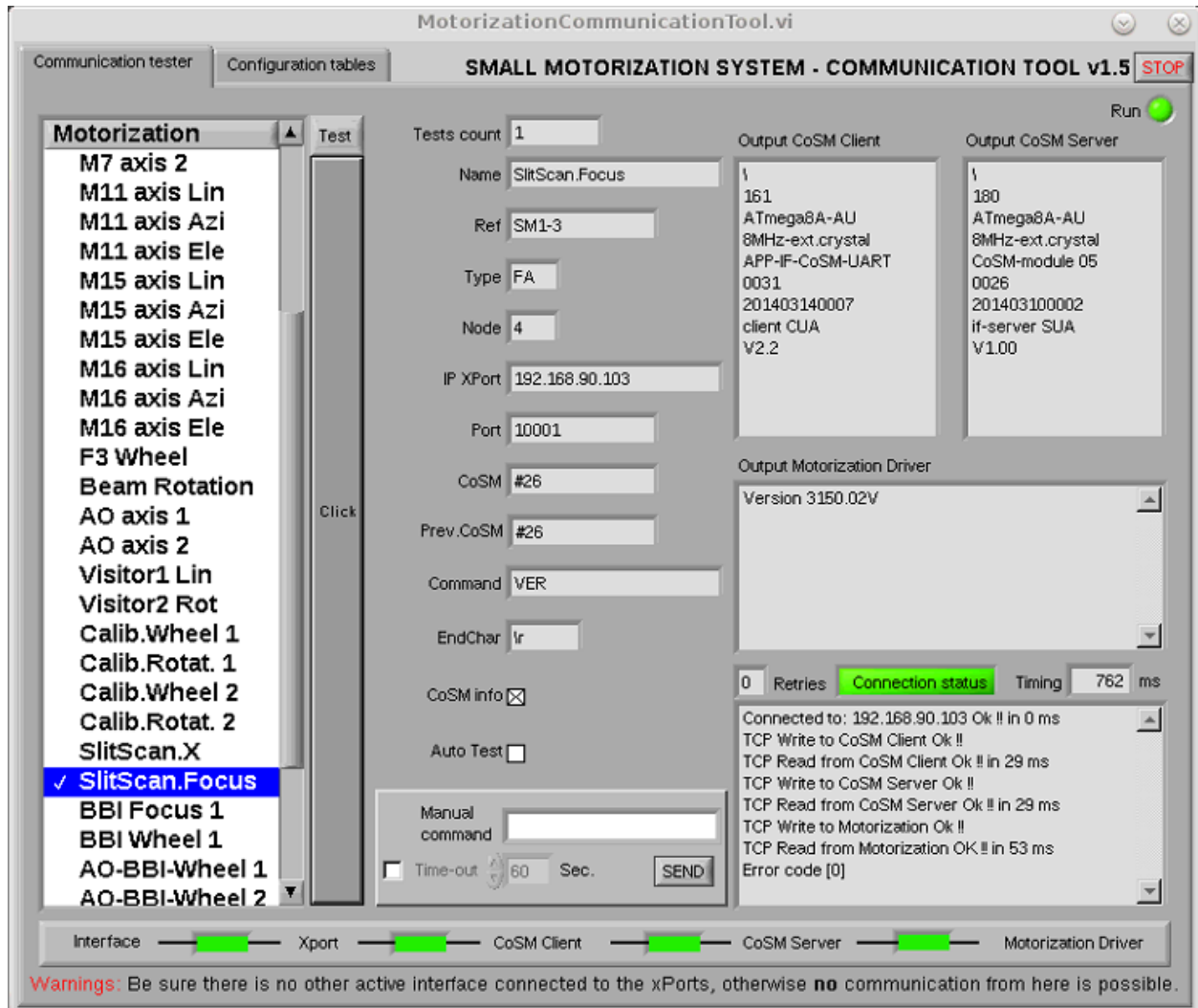


Figure 4 - Communication tester

### 6.2.1 Motorization

This list is used to select the corresponding device to test. The current device is chosen by clicking; the selection appears as inverted color. If the test is OK, a ✓ (checkmark) is shown at its left side, if not, an 'x' appears to warn that an error occurred in the tested chain.

### 6.2.2 Test

This button is vertical, next to the Motorization list, for a quick access to it. Clicking on it will begin the test and it will appear in orange color with “ON” text inside until the test terminates.

### 6.2.3 Stop

Exit the Test program.

### 6.2.4 Run

This LED is “on” when the tester is active.

### 6.2.5 Parameter

**Test count:** Indicates the number of tests since start.

**Name, Ref, Type, Node, IP Xport, Port, CoSM, Command, EndChar:** are the parameters defined in the Configuration tables. For definitions, refer above.

**Prev. CoSM:** Indicates the previous CoSM server tested, so if the user selects another, the last device tested is remembered. It has another function that will be explained below.

**CoSM Info:** Is a checkbox that enables the tester to get the CoSM client and server informations. This information will be displayed in the respective “Output CoSM” indicators.

**Auto Test:** By checking this box, the user will check all the devices of the motorization list with a single Test click. In this case, the previous devices marks are cleared and then displayed for each tested device, beginning from top to bottom of the list. The box unchecks itself after the test.

**Output CoSM Client:** This indicator shows the CoSM Client internal information. The “CoSM info” checkbox must be enabled to have the answer message.

**Output CoSM Server:** Same as CoSM Client.

**Output Motorization Driver:** This indicator shows the answer of the motorization driver tested at the sent command.

**Intents:** This indicator indicates the number of retries of the interface for opening the connection with the current Xport.

**Connection status:** Shows the result of the test: It is green ( good) if all the devices of the chain work correctly. Otherwise it is red.

**Timing:** This display the whole time (in milliseconds) the interface takes to establish, transmit, receive and close the communication for the test. It includes the CoSM infos for both client and server, and intermediate operations of the interface.

**Info:** This text indicator will display the real time of each tested devices and the status. Time is in milliseconds. An error code is display at the end.

**Visual bar:** This control indicator show graphically the result of a communication test over all the involved devices between the Interface and the Motorization Driver. Green color indicates a good device communication. A red color shows the detected problem. A grey color stands for “not possible”.

### 6.2.6 Manual command

A command can be entered in the control box and sent to the selected motorization device, in accordance to the specific device command functions. A time-out (in seconds) , can be selected and specified. Click the "SEND" button, and get the answer in the "Output Motorization Driver" window.

### 6.2.7 Sent strings for testing communications

The interface will send in order to verify the whole chain, every link to get his state, at the beginning, reaching the Xport as opening a TCP connection to it. At this time the interface will send command strings through TCP over the RS232 network after the Xport.

In reference to the CoSM documentation for commands manual, the first device found after Xport is the CoSM client that switches the communications to the desired CoSM server connected in this network.

For testing the communication to a CoSM client, the command sent is “@\zz” + [Return]. Symbol “@” closes connections between client and server. A problem occurs when there is no connection established and the CoSM client does not respond (as it does not have anything to do): Solution is to send an added barbage “\zz” that will give an error message. In this way, there will always be a response from CoSM client, if it works fine. The expected answer must have at least the [LineFeed] character for acknowledgment. An [ESCAPE] command could have also been used for this purpose.

Once the CoSM client is tested satisfactorily, the next step is to open the connection with the CoSM server. For this, the command is “#XX”+[Return], where XX is the CoSM client number.

The expected answer must have at least the [LineFeed] character for acknowledgment.

If this command works, the route from interface to the Motorization is openend and the next command can be sent in the form “[ASCII text command]”+[End Character]. The “end character” could differ by the manufacturer of the drivers.

The command for testing must not modify or interfere with any configuration parameter of the motorization driver. A “VER”+[Return] command is perfect for the Faulhaber drivers. A “POS”+[Return] command could give the current position. It is the ”\*IDN?”+ [LineFeed] for PI controller that gives the Hexapod version and serial number.

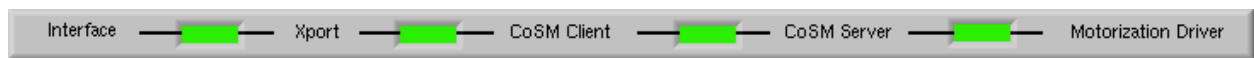
The expected answer must have at least, the [LineFeed] character for acknowledging that is not ending with [Space]+[LineFeed] for PI Hexapod protocol compatibility...

It will be displayed in the Output Motorization Driver indicator.

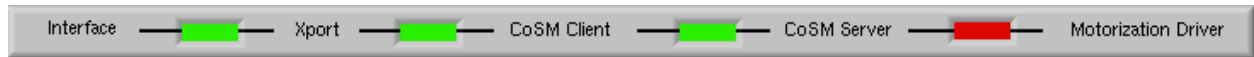
### 6.2.8 Common error codes

- [0] No error.
- [6] CoSM Client not responding.
- [16] CoSM Server not responding.
- [31] No network access to Xport.
- [64] Read end device (Motorization driver) failed.
- [96] Write end device (Motorization driver) failed.
- [112] CoSM Server not responding.

### 6.2.9 Interpretation



No error.



Problem beginning at or after CoSM Server.



Problem beginning at or after CoSM Client.



Problem beginning at or after Xport.



No Network access to Xport. Port is opened by other application, network fault, Xport power fault, Xport fault, bad network cable, ...

## 7 Tips

Check first that no other interface is working with the motorizations. As the interface uses open/close connections, this program interferes with other interfaces (like CalControl, M2M3control or M11M16control). In this case, the user will see a red box between Interface and Xport. It is then necessary to close first the openend User Interface, to be able to establish a possible link between the SMS Communication Tool and the chain to test.

On the “Communication tester” panel, just select the desired motorization and click the “Test” button.

All communication steps are displayed on the indicators. Repeating the test on the same motorization will not send the CoSM channel selection for the server, unless the “Force CoSM” option is checked.

## 8 Debugging

To locate the fault, in case of error, the technician will have to check connector, cables, devices, power supply, termination resistors, etc. at the red box level, on the physical network chain.

In case of various CoSM Server faults into the same network, always check cables and connections from the beginning of the first fault through the end of line.

## 9 What's new...

### Version 1.5

The "Force CoSM" check box has been removed and a "Manual command" panel allows to send commands directly on the current xPort/CoSM module number.

It is possible to set a waiting time-out value (in sec) for the communication test. The motorization and xPort networks parameters are now configurable from the "SMS-motors.ini" and "SMS-nodes.ini" respective files; new motors and xPorts can be easily added to the interface.

(Now, 38 motors and 8 nodes...)