g **tec**

**GUGER
TECHNOLOGIES**

g **MOBIlab** $^+$

MOBILE LABORATORY

Instructions for use

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CONTENT

Instructions for use

Disclaimer

g.MOBIlab+ is not a medical device. The product is not intended to be used as a medical device. Additional examinations are needed for diagnosis and no diagnosis must be done based on using this device.

Intended function

The intended function of the equipment is to measure EEG, EMG, EOG and ECG signals in humans for research purposes from the intact surface of the body.

Attention

- Conductible parts of all electrodes must **not** have contact to earth or other conductible parts.
- The device is **not** protected against the effect of cardiac defibrillator discharge.
- The device must **not** be used in humans with pace-makers or electrical stimulators.
- It is **not** allowed to use other power supply units than AA batteries.
- The device **must not** be used directly on the heart
- The device **must not** be used for patient monitoring
- The device **must not** be used for the determination of brain death
- the digital input and output lines are part of the applied part of the device and are **not** galvanically isolated from the analog lines. You **must** check patient isolation and leakage currents when using these lines.

Warning and safety notice

If g.MOBIlab+ is connected to other devices like a PC the following leakage currents have to be checked.

- Ground leakage current
- Enclosure leakage current
- Patient leakage current

Accessory equipment connected to the analog and digital interfaces must be certified according to the respective IEC standards (e.g. IEC 60950 for data processing equipment and IEC 60601-1 for medical equipment). Furthermore all configurations shall comply with the system standard IEC 60601-1-1. Everybody who connects additional equipment to the signal input part or signal output part configures a medical system, and is therefore responsible that the system complies with the requirements of the system standard IEC 60601-1-1. If in doubt, consult the technical service department or the local representative.

Inspection

The manufacturer is responsible for safety, performance and reliability of the device under the condition as supplied to the customer at the time of delivery and

a) if changes are performed by the manufacturer only and service and repair is performed by corresponding qualified personnel only.

b) the device is used according to the instructions for use.

According to (EN 62353:2008) the device and its accessories have to be checked in intervals of two years.

The intended environment of use

The device must not be used in dangerous conditions such as wet rooms or explosive environments. The relative humidity must be between 25 % and 95 %. The device must not be used in combination with any other medical high-frequency device. The usage of a high frequency device together with g.MOBIlab+ can result in burnings under the electrodes and could damage the biosignal amplifier.

Recommended electrodes for use

The manufacturer recommends EEG, EOG, ECG and EMG electrodes from g.tec medical engineering GmbH, Austria.

Introduction to g.MOBIlab+

g$^{®}$.MOBIlab+ - g.tec's portable biosignal acquisition system - is the perfect tool for recording biosignal data on a standard PC or notebook. The system allows investigating brain-, heart-, muscle-activity, eye movement, respiration, galvanic skin response and other body signals. Additionally, digital input and digital output channels are available. Also a reaction switch can be connected to the device.

Raw data can be logged directly onto the device using a micro SD card. Additionally the data can be transferred in real-time via a serial or Bluetooth connection to the host for visualization and further online data processing.

Highlights

- Acquire EEG, ECG, EOG, EMG simultaneously
- On-line visualization and storage of up to 8 analog channels and 8 digital channels
- Real-time biosignal analysis with Highspeed On-line Processing for Simulink
- Location-independent data acquisition due to implemented micro SD card
- Signal acquisition and real-time analysis on the PC (or notebook)
- Can be combined with g.BSanalyze for off-line biosignal analysis under MATLAB

g.MOBIlab+ can be ordered in two different versions:

1) Multi-Purpose version
- Six bipolar and two unipolar analog inputs.
- Four digital inputs, four digital ports configurable as inputs or outputs.

The device settings are optimized to measure four EEG/EOG and two ECG/EMG type channels. Two additional analog inputs are configured such that they can be utilized for other sensors.

2) 8 channel monopolar EEG version
- Eight monopolar EEG type channels.
- Four digital inputs, four digital ports configurable as inputs and outputs.

The device settings are optimized to measure 8 monopolar EEG type channels.

Example g.MOBIlab+ configuration:

Multi-Purpose g.MOBIlab+ with electrode connectors and trigger button.

The standard Multi-Purpose version includes

- Portable biosignal amplifier g.MOBIlab+ equipped with four EEG/EOG type, two ECG type and two analog input channels including a Bluetooth module for wireless connection
- EEG/EOG connector box for four bipolar channels (four active, one common ground)
- ECG/EMG direct connection cable for two bipolar channels (two active, one common ground)
- Micro SD card
- Four AA batteries
- Documentation

The standard 8 channel monopolar EEG version includes

- Portable biosignal amplifier g.MOBIlab+ equipped with eight EEG type analog channels including a Bluetooth module for wireless connection
- EEG connector box for eight monopolar EEG channels (eight active, one common reference, one common ground)
- Micro SD card
- Four AA batteries
- Documentation

Option: wireless Bluetooth connection for PC (notebook) use

- Bluetooth dongle

Option: wired serial interface connection for the PC (or notebook)

- Serial cable to connect g.MOBIlab+ via RS232 to PC (or notebook)

Optional connector boxes (note: not all options are available for both versions)

- ECG/EMG connector box for two bipolar channels (two active, one ground)
- Green/red light box for reaction time paradigm
- Analog and digital input/output (AI DIO) connector box
- Connectors for all sockets including 2 m cable (open end)

Other accessories

- PC or notebook
- EEG electrode cap with 64 electrode positions (small, medium or large)
- Screwable EEG electrodes for the electrode cap (Au, sintered Ag/AgCl)
- Switch box for external triggering
- EEG disk electrodes
- Disposable electrodes Ag/AgCl
- ECG electrode cables
- Respiration sensor

- Photoelectric pulse sensor
- Galvanic skin response sensor (GSR)
- Water-proof heavy duty case

For other sensors and available accessories, please contact g.tec via email office@gtec.at or via www.gtec.at.

Related Products

g.tec provides several biosignal analysis elements that are especially relevant to the kinds of tasks you perform with g.MOBIlab+. Please visit our homepage www.gtec.at for further information.

Hardware and Software Requirements

g.MOBIlab+ can be connected to a PC or notebook via a serial cable connection or a wireless Bluetooth connection.

PC or notebook

g.MOBIlab+ requires a PC compatible desktop or notebook computer running a Microsoft Windows operating system (Windows 7 Professional English). The table below lists optimal settings:

Hardware	Properties
CPU	Pentium working at 2 GHz
Hard disk	20-30 GB
RAM	512 - 1024 MB
USB slot	Two free connectors for software hard lock and Bluetooth dongle

Help

The PDF help requires Adobe Reader (version 11.0.04).

Labeling

Switches, connectors and LEDs

Multi-Purpose version:
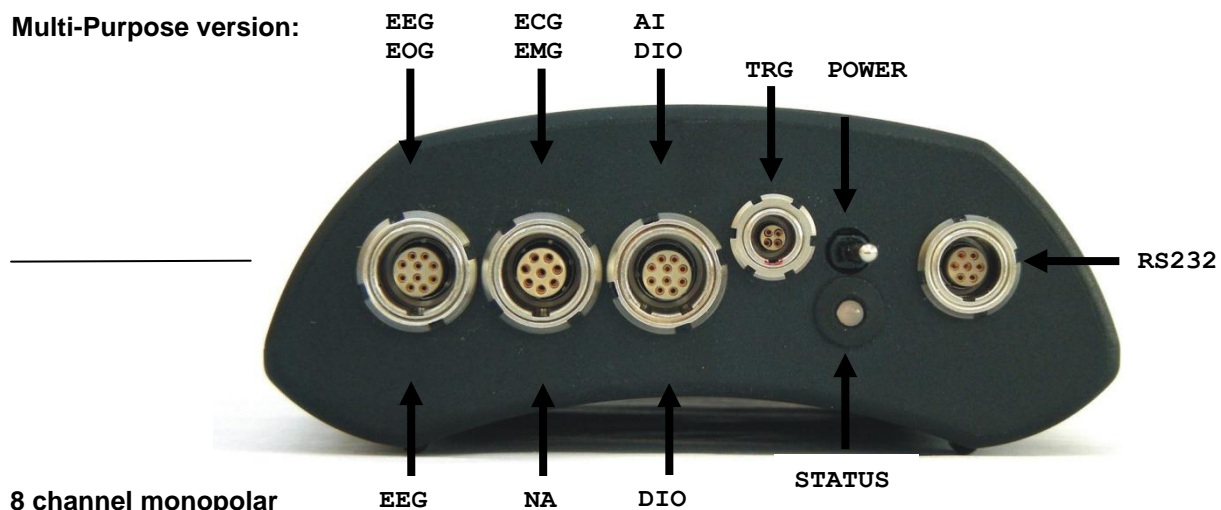
**8 channel monopolar
EEG version:**

On the upper side the g.MOBIlab+ has the following sockets, switches and connectors (from right to left in the picture above):
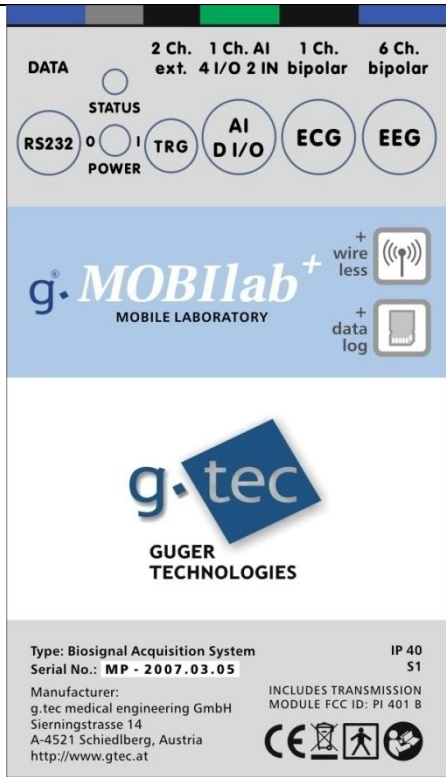
Multi-Purpose version (see picture above, upper side)

RS232	Socket for serial cable if Bluetooth is not used.
STATUS	A green blinking LED indicates correct operation. A green glowing LED indicates ongoing data acquisition. If battery power decreases during recording the LED turns orange and the g.MOBIlab+ stops recording data after five minutes with the LED blinking red. A red blinking LED indicates that the batteries have to be exchanged. In case the LED does not operate at all exchange the batteries as well.
POWER	Switch for turning on/off the device.
TRG	Socket for connecting the switch box.
AI DI/O	Combined socket for the connection of external sensors and digital inputs and outputs
ECG EMG	Socket for the connection of the two bipolar channel ECG/EMG patient cable or two bipolar channel ECG/EMG electrode connector box.
EEG EOG	Socket for the connection of the four bipolar channel EEG/EOG electrode connector box.

8 channel monopolar EEG version (see picture above, lower side)

|	
RS232	Socket for serial cable if Bluetooth is not used.
STATUS	A green blinking LED indicates correct operation. A green glowing LED indicates ongoing data acquisition. If battery power decreases during recording the LED turns orange and the g.MOBIlab+ stops recording data after five minutes with the LED blinking red. A red blinking LED indicates that the batteries have to be exchanged. In case the LED does not operate at all exchange the batteries as well.
POWER	Switch for turning on/off the device.
TRG	Socket for connecting the switch box.
DI/O	Socket for the connection of digital inputs and outputs.
NA	The ECG EMG socket is not available in the 8 channel monopolar EEG version.
EEG	Socket for the connection of the 8 monopolar channel EEG electrode connector box

Labeling on the outside

The socket arrangement can be seen on the top side label of g.MOBIlab+

Multi purpose version	8 channel monopolar EEG version

.

+ wire less (((•)))	Bluetooth enabled
+ data log	Micro SD card implemented
(applied part of type BF symbol)	Applied part of type BF
(attention to instructions symbol)	Attention to instructions
(crossed-out wheeled bin symbol)	Do not dispose the device with domestic waste. Dispose it via the separate collection system for electrical and electronic equipment.
g.tec - medical engineering GmbH Sierningstrasse 14 A - 4521 Schiedlberg Austria / Europe office@gtec.at www.gtec.at	manufacturer address
Type: Biosignal Acquisition System	Device type
CE	CE marking
IP 40 S1	IP 40: Protected against mechanical wires with a diameter of 1 mm. No protection against liquids. S1: Permanent operation.
Serial No. MP-YYYY.MM.NN	Serial number in the format Year.Month.Number

Labeling on the inside
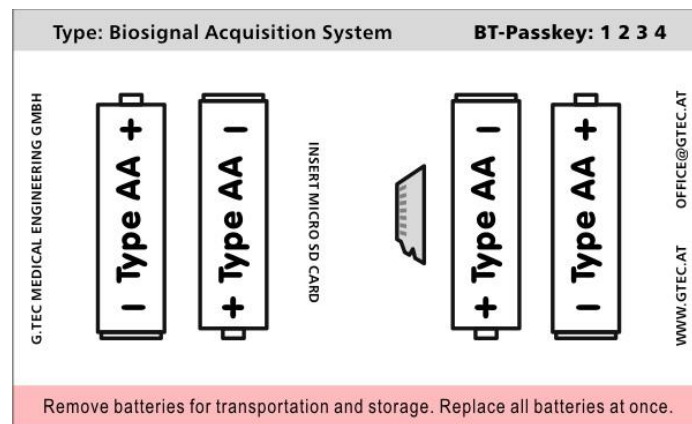
| Type	Biosignal Acquisition System
Battery Type: AA/Mignon	Four AA/Mignon batteries are required for the operation of the device
Insert card	Slot for the micro SD card

Safe operation of g.MOBIlab+

Connecting and switching on g.MOBIlab+

To start the Multi-Purpose Version of g.MOBIlab+ perform the following steps:
(Starting the device for the 8 channel monopolar EEG version is similar except for the ECG/EMG connection. Please keep in mind the different input signal ranges.)

Step 1: Open the battery box at the rear side of the device and insert four identical AA/Mignon batteries. Please insert the batteries according to the illustration at the bottom of the battery box. The battery voltage can be between 1.2 V and 1.5 V DC. The state of charge must be identical for all batteries.

If a micro SD card is used please insert the provided micro SD card into the card slot in the middle of the battery compartment before switching on g.MOBIlab+. Before changing the micro SD card always switch off g.MOBIlab+. Make sure that the micro SD card is formatted in the FAT16 format. See image below how to insert the micro SD card.
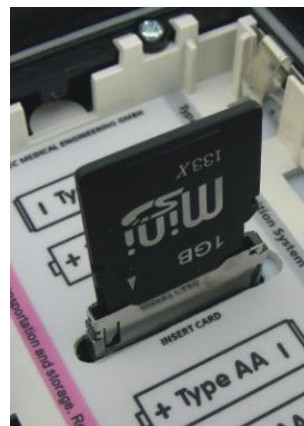
Step 2: Connect the **EEG/EOG electrode box** to the socket **EEG EOG** at the top-end side of g.MOBIlab+.
Step 3: Connect the **ECG Cable** to the socket **ECG EMG**
Step 4: Connect the **Switch Box** to the socket **TRG**
Step 5: If you ordered the g.MOBIlab+ for a PC connection via Bluetooth and your Bluetooth software is already installed then insert the Bluetooth dongle into a free USB slot of the PC. If you experience any problems during Bluetooth installation see Appendix 1: Bluetooth Software and Dongle installation for more information.
If you ordered the g.MOBIlab+ with wired serial RS232 interface connect now the serial cable to the serial port of the g.MOBIlab+ and to the corresponding socket of the PC.

NOTE: g.MOBIlab+ is connected with a **null-modem** cable to the PC. If another type of cable is used the connection will NOT work.

Step 6: Switch on g.MOBIlab+ with the switch on the top-end side (switch position I).
For Bluetooth connection: If g.MOBIlab+ is started for the first time the connection via the Bluetooth interface has to be established correctly. Please refer to the corresponding manual for PC or notebook "gMOBIlabBluetoothInstallation.pdf".

The correct operation of g.MOBIlab+ is indicated by a green blinking LED at the top-end side. If the LED is not blinking please check the batteries. If the LED is blinking red, please replace the batteries. See chapter Switches, connectors and LEDs for more information.

Measuring EEG and ECG Signals

In measurement mode, all analog input channels are amplified and every channel is sampled with a 16 bit analog to digital converter. The sampling rate is fixed to 256 Hz. The signals are transmitted via a serial or wireless connection to the PC and/or stored to the micro SD card.

Using external sensor signals

Use the AI D I/O socket of the Multi-Purpose version to connect external sensors to g.MOBIlab+. Note that the analog inputs of the socket AI D I/O can be in the range of $\pm$ 250 mV. Signals with amplitudes of $\pm$ 5 mV can be connected to the ECG EMG amplifier socket, sensors with outputs of $\pm$ 2 mV can be connected to the DC channels 3 and 4 of socket EEG EOG and sensors with outputs of $\pm$ 500 μV to the channels 1 and 2 of socket EEG EOG. Please note that the input ranges for the 8 channel monopolar version of g.MOBIlab+ are different. Please refer to the section Technical Specification within this manual.

Switching off and Storage of g.MOBIlab+

To switch off g.MOBIlab+ and to store the device correctly, please perform the following steps:

Step 1: Turn off the device using the switch on the upper side (switch position 0) – the green LED stops blinking.
Step 2: Disconnect the serial cable – if applicable – from the PC or notebook.
Step 3: Disconnect all other cables and electrode boxes from g.MOBIlab+.
Step 4: If the device is stored for a longer time period, please remove the batteries.

Batteries and Fuse

Batteries

g.MOBIlab+ is powered by 4 AA/Mignon batteries. The voltage of each cell must be between 1.2 and 1.5 V.

General notes on batteries

Handle the batteries with care to avoid fire or burnings. Don't open the batteries; protect the batteries against short-circuits, water and fire.

Storage of the batteries

Rated storage temperature: 0 ° C to 40 °C
Rated air humidity: 25 % to 95 % relative humidity

Waste disposal details

Batteries are small chemical waste. Throw away broken or used up batteries in a special container, hand them in to a recycling center or send them back to the manufacturer.

Internal Fuse

g.MOBIlab+ has an internal 100 mA fast-acting fuse.

General Notes

Classification

Safety class	internal current supply
Degree of protection	BF
Protection against mechanical distortion and liquids	IP40
Operation mode	S1 (permanent operation)

Transportation and Storage conditions

The device can be stored at temperatures between –20 to +60 degrees Celsius. The relative humidity must be between 25 % and 95 %. Wait before usage of the device till condensed water disappeared (wait at least 1h in a heated room).

Location details

Do not use the device near a heating system or directly in the sun. The maximal temperature of the environment is 40 degrees Celsius.

Waste disposal details

Bring the device to a recycling center or send it back to the manufacturer.

Cleaning

You can clean the device carefully with medical rubbing alcohol. Liquid must not enter the g.MOBIlab+.

Declaration of conformity

Product name

g.MOBIlab+

Manufacturer

g.tec medical engineering GmbH, Sierningstrasse 14, 4521 Schiedlberg, Austria

Classification

Safety class	internally powered
Type of applied part	BF
Protection against mechanical distortion and liquids	IP40
Operation mode	S1 (permanent operation)

CE mark

$C\epsilon$

g.MOBIlab+ is not a certified medical device. The product is NOT intended to be used as a medical device. The manufacturer declares in sole responsibility that g.MOBIlab+ is in conformity with the general requirements for safety (low voltage directive) 73/23/EWG and 89/336/EWG (electromagnetic compatibility).

Dr. Christoph Guger
Chief Executive Officer

Dr. Günter Edlinger
Chief Executive Officer

Schiedlberg, 2014

Technical specifications

Rated power consumption	0.18 VA
Rated DC voltage	3 V DC
Rated current of fuse	500 mA slow acting fuse
Rated voltage of fuse	250V≈
Produced	see year of serial number
Producer	g.tec medical engineering GmbH
	Sierningstrasse 14
	4521 Schiedlberg
	Austria
	http://www.gtec.at

Maximum voltages:

RS232 connector DATA	±15 V DC
at socket TRG	5 V DC
at socket AI D I/O / D I/O	5 V DC

Multi-Purpose version:
Amplifier settings

EEG channels 1 and 2	Sensitivity:	± 500 µV
	Highpass:	0.5 Hz
	Lowpass:	100 Hz
EEG channels 3 and 4	Sensitivity:	± 2 mV
	Highpass:	0.01 Hz
	Lowpass:	100 Hz
ECG channels 5 and 6	Sensitivity	± 5 mV
	Highpass	0.5 Hz
	Lowpass	100 Hz

Analog and digital inputs/outputs at socket
AI D I/O

Analog input	Sensitivity	± 250 mV
	Highpass	DC
	Lowpass	100 Hz
Digital inputs	0 - 5 V (TTL)	
Digital outputs	0 - 5 V (TTL)	

8 channel monopolar EEG version:

Amplifier settings

EEG channels 1 to 8	Sensitivity:	± 500 µV
	Highpass:	0.5 Hz
	Lowpass:	100 Hz

Digital inputs/outputs at socket D I/O

Digital inputs	0 - 5 V (TTL)
Digital outputs	0 - 5 V (TTL)

General:

Digital input at socket TRG

Digital input	0 - 5 V (TTL)

Analog-Digital Converter (ADC):

| ADC resolution	16 bit
Sampling frequency	256 Hz per channel

PIN assignment

Attention: Never connect signals outside the range of 0 to 5 V to Digital Inputs! This will damage the g.MOBIlab+.

PIN assignment Multi-Purpose version

Pin-assignment for the 10 pin socket **EEG EOG**

Pin 1   EEG/EOG Ch 1 -

Pin 2   EEG/EOG Ch 2 +

Pin 3   EEG/EOG Ch 2 -

Pin 4   EEG/EOG Ch 4 +

Pin 5   Analog GND (VCC/2)

Pin 6   EEG/EOG Ch 3 -

Pin 7   EEG/EOG Ch 3 +

Pin 8   EEG/EOG Ch 1 +

Pin 9   EEG/EOG Ch 4 -

Pin 10 Not used

Body   Not connected
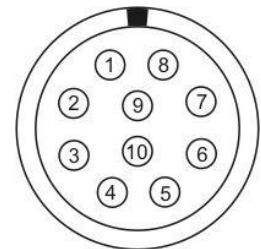
Socket: EEG EOG

Pin-assignment for the 8 pin socket **ECG EMG**

Pin 1   ECG/EMG Ch 5 +

Pin 2   ECG/EMG Ch 5 -

Pin 3   ECG/EMG Ch 6 -

Pin 4   ECG/EMG Ch 6 +

Pin 5   Analog GND (VCC/2)

Pin 6   Not connected

Pin 7   Not connected

Pin 8   Not connected

Body   Not connected
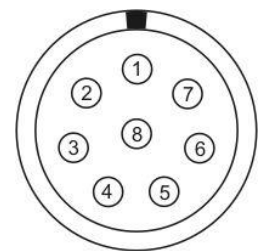
Socket: ECG EMG

Pin-assignment for the 10 pin socket **AI D I/O**

Pin 1   Analog Input Ch 1 +

Pin 2   Analog Input Ch 2 +

Pin 3   Digital In 1

Pin 4   Digital In 2

Pin 5   Digital In/Out 4

Pin 6   Digital In/Out 5

Pin 7   Digital In/Out 6

Pin 8   Digital In/Out 7

Pin 9   Analog GND (VCC/2)
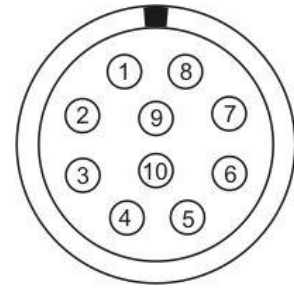
Pin 10   Digital GND

Body   Not connected
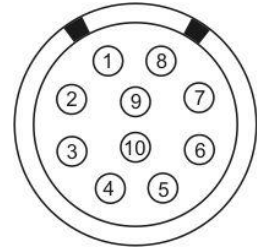
Socket: AI D I/O

PIN assignment 8 channel monopolar EEG version

Pin-assignment for the 10 pin socket **EEG**

Pin 1   EEG Ch 5 +

Pin 2   EEG Ch 2 +

Pin 3   EEG Ch 6 +

Pin 4   EEG Ch 4 +

Pin 5   ANALOG GND (VCC/2)

Pin 6   EEG Ch 7 +

Pin 7   EEG Ch 3 +

Pin 8   EEG Ch 1 +

Pin 9   EEG Ch 8 +

Pin 10   EEG Ch x – (reference)

Body   Not connected

Socket: EEG

Pin-assignment for the 10 pin socket **D I/O**
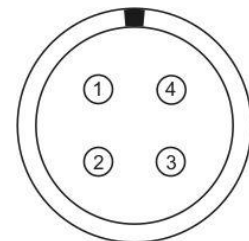
Pin 1   Not connected

Pin 2   Not connected

Pin 3   Digital In 1

Pin 4   Digital In 2

Pin 5   Digital In/Out 4

Pin 6   Digital In/Out 5

Pin 7   Digital In/Out 6

Pin 8   Digital In/Out 7

Pin 9   Analog GND (VCC/2)

Pin 10 Digital GND
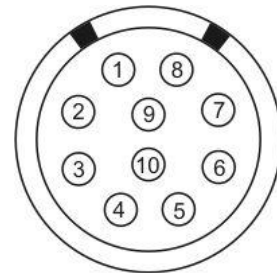
Body   Not connected

Socket: D I/O

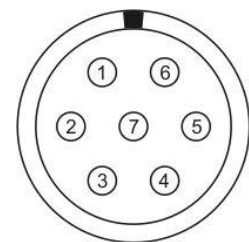Pin-assignment for the 4 pin socket **TRG**

Pin 1   Digital In 3

Pin 2   Digital In 8

Pin 3   Digital GND

Pin 4   +5 V

Body   Not connected

Socket: TRG

Pin-assignment for the 7 pin socket **RS232 DATA**

Pin 1   RX data line

Pin 2   Digital GND

Pin 3   DTR line

Pin 4   RTS line

Pin 5   Digital GND

Pin 6   TX data line

Pin 7   Enable $\overline{RS232}$ / Bluetooth line

Socket: DATA

Appendix 1: BLUETOOTH SOFTWARE AND DONGLE INSTALLATION

see *gMOBIlabBluetoothInstallation.pdf* on your CD

contact information

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