

I24 Science & I24 Module

INSTRUCTIONS FOR USE



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TABLE OF CONTENTS

Safety Instructions 5

Before the start.....	5
Symbols and signs	5
Warnings	6
Cautions	7

Device Description 8

Intended Use.....	8
Description of function.....	8
I24 Science vs. I24 Module	9
Applied parts.....	9
Contraindications.....	9
Delivered items.....	10

Operation Instructions 11

Preconditions.....	11
Device Components.....	11

Device control lamp.....	12
Set-up	12
After use.....	14

ScienceMode 15

Serial communication through the comport.....	15
Packet Structure.....	15
Commands and Responses.....	17
General commands	17
Dyscom commands	19
Result and errors.....	29

Troubleshooting 30

Maintenance 30

Cleaning and Disinfection (only I24 Science)	30
Maintaining the technical safety	31

Technical Specification	32
--------------------------------	-----------

EMC Informations	33
-------------------------	-----------

Warnings	33
----------------	----

Cautions	33
----------------	----

Electromagnetism.....	33
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SAFETY INSTRUCTIONS

Before the start

Before starting the device, read the instructions for use completely and pay particular attention to the safety and precautionary measures.

If support is required for start-up, operation or maintenance, please contact HASOMED GmbH support. Please also report unexpected operating performance or incidents to HASOMED GmbH.






The device must be inspected by HASOMED service personnel. You are not allowed to open the device. The repair must be carried out by the manufacturer.

This user manual describes the safe and correct use of I24 Science and I24 Module. The safety measures contained herein must be strictly observed. Accident prevention regulations that









apply in the country where the device is being used, as well as general safety and hygiene regulations, must also be complied with.


Symbols and signs

The following symbols and labels are used on the I24 Science and I24 Module. The nameplate with the exact model name, the CE marking, the date of manufacture and the information on the power supply can be found on the underside of the device.

	General warning and caution sign
	Notice sign
	Applied part of type BF
	Class II equipment
	Reference to the user manual



Safety Instructions | Warnings





	Do not dispose of as normal household waste. Contact HASOMED for further information.
	CE marking
IP2X	IP Code
	Direct current
	Keep dry
	Manufacturer identification and manufacture date
	Maximum and minimum temperature limits at which the device shall be stored, transported or used
	Acceptable upper and lower limits of relative humidity
	Acceptable upper and lower limits of atmospheric pressure


	<p>The listed warnings and cautions of this manual refer exclusively to the functionality of the device but not to the safety of an overall system or system building.</p> <p>Users are encouraged to identify risks through their own design and to reduce or eliminate them.</p>
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Warnings

A **WARNING** indicates a hazardous situation which, if not avoided, could result in death or serious injury.





	Disregarding the proper use will result in serious injury. Follow the Instructions specified in this manual.
	Improper use of the cables belonging to the I24 Science/I24 Module can lead to unwanted strangulation. Do not wrap the cables around the neck or other parts of the body.



	The device must not be held in the hand or carried on the body during operation.
	Prevent the equipment from immersion in water or other liquids. The I24 Science/I24 Module is not waterproof. If water or foreign substances enter the interior, immediately turn OFF the device. Continued use of the device may result in fire or electrical shock. Please contact the manufacturer.
	Connection of a proband to a high frequency (HF) surgical equipment and to an electromyograph simultaneously may result in burns at the site of the electrodes and possible damage to the device.
	Do not use the device in close proximity to a shortwave or microwave therapy equipment. This may produce instability in the applied parts.

	Avoid accidental contact between connected but unapplied active leads and other conductive parts including those connected to protective earth.
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Cautions

The term "caution" is used to explain a hazard statement that warns the reader of a potentially hazardous situations which, if not avoided, could result in minor or moderate injury of the user, or damage of the equipment or other property.

	Do not open the device
	Do not servicing and maintenance while the device is in use
	Before cleaning or disinfection, the device, disconnect the unit from the PC.
	Modification of the device is not permitted.

	The device and its surfaces can get warm during a session. Areas with longer direct contact to the device should be covered with clothing to prevent skin irritations.
	The device should be used only with the leads and Electrodes recommended for use by the manufacturer.

DEVICE DESCRIPTION

Intended Use

The I24 Science/I24 Module is a device that can be controlled by a computer system via a specified interface to measure potential and impedance changes. The I24 Science/I24 Module is intended for research applications only and is not intended to be used for medical purposes on human beings according to Regulation (EU) 2017/745.

Regarding possible prospective developments, the I24 Science/I24 Module were developed

and tested taking into account additional requirements not resulting from the intended use. The I24 Science/I24 Module thus fulfil, among other things, requirements for electrical safety and electromagnetic compatibility for medical devices without having an intended medical purpose and being a medical device.

An intended medical purpose may result of the integration of the I24 Science/I24 Module as non-medical device into a medical device or medical system under the responsibility of the customer or user. In this case, the customer or user is responsible for the conformity of the medical device or medical system.

Description of function

The I24 Science/I24 Module is a device for potential and impedance measurement. Based on external control, the device can use up to 4 channels simultaneously, whereby 3 channels can be used for potential measurement and 1

channel for impedance measurement. The device needs to be controlled and powered externally. A USB-C interface with a well-defined protocol is available for this purpose. The device has one lithium button cell for the backup circuit, which is used to preserve the time and backup registers. The internal battery (CR1220) may only be changed by service personnel.



The I24 Science/I24 Module is electrical equipment and complies with the essential requirements of the Low Voltage Directive (LVD) 2014/35/EU and the Restriction of Hazardous Substances Directive (RoHS) 2002/95/EC. The I24 Science/I24 Module is no medical device according to the Regulation (EU) 2017/745 on medical devices.

The individual adjustment to the needs of the respective user is possible using different parameter settings.

Device Description | I24 Science vs. I24 Module

I24 Science vs. I24 Module

The I24 Science has a housing, while the I24 Module does not. That is the only difference. The device variants are identical in all other respects. The I24 Module is intended for integration into another device in compliance with regulatory requirements.

Applied parts

The whole device is considered as type BF applied part.

Contraindications

The contraindications are to be determined by the user, considering possible hazards that may arise from usage. These contraindications absolutely exclude users from applying I24 Science/I24 Module:

- skin lesions or open wounds at the electrode application sites

Device Description | Delivered items

- allergic reaction to the gel used in the electrodes
- Persons with cardiac arrhythmias or heart transplanted persons as a precaution or only after consultation with the treating physician
- pregnant women should not be measured to avoid risk, the calculated results are distorted in pregnant women

Individuals with implanted electronically controlled devices such as pacemakers, implanted defibrillators, implanted substance delivery systems, DDD pacemakers, active prostheses, cranial pacemakers, etc. must be measured.

Persons who are connected to a life-supporting electronic device, such as an artificial heart or artificial lungs, must be measured




In the case of a pacemaker or other implanted equipment, please consult authorized professionals before first usage.

Delivered items

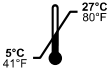
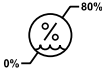
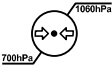
QTY	Description	Part. No.
1	I24 Science (EMG/BI Device)	INGEo240
1	I24 Module (EMG/BI Module)	INGEo241
1	Grey Measurement cable color coded endings green: EMG & BI measurement Red: output for BI measurement White: common-mode rejection	INGEo242
1	White Measurement cable color coded endings black: EMG measurement yellow: EMG measurement white: common-mode rejection	INGEo243
1	USB Cable Type C to C	FESo2401
1	USB Flash drive	FESo1212
1	EMG electrodes (50 pieces)	INGE2201
1	ScienceMode Transport Box	FESo2402

OPERATION INSTRUCTIONS

	The control of the device and the setting of the measurement parameters as well as the placement of the electrodes should only be performed by qualified users. Incorrect measurement setup can lead to incorrect measured values. The responsibility and evaluation for this lies with the user.
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Preconditions

Use the device only under these environmental conditions:

		
Temperature limitation	Humidity limitation	Atmospheric pressure

Operation Instructions | Preconditions

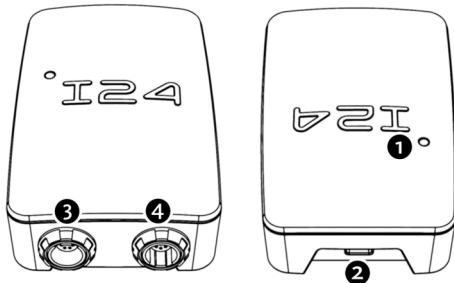
The device is operated in combination with a computer system, which provides power and control of the device via USB. Please notice:

	The computer to be used with I24 Science/I24 Module must fulfil the requirements according to IEC/EN 60950-1 or IEC/EN 60601-1 or IEC/EN 62368-1 standard.
	The I24 Science/I24 Module has integrated two means of protection (2MOPP) for 250VAC working voltage according to the requirements of IEC 60601-1.

Device Components

The input and output interfaces of the I24 Science are shown in the following figure. Their description can be found in the table. The I24 Module has the same connectors, but without housing.

Operation Instructions | Device control lamp



No.	Description
1	Device control lamp (LED)
2	USB-C receptacle
3	Output socket white
4	Output socket grey

Device control lamp

The control lamp indicates the current operating status of the I24 Science/I24 Module. The following states are distinguished.

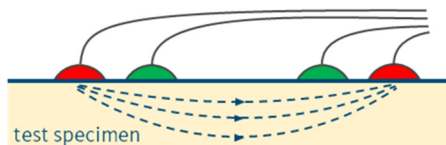
Color	Meaning
Violet	Device is in start-up routine
Green	Device application is running
Green blinking	Measurement is active in live data or sd storage mode
Yellow blinking	Measurement is active but loading calibration file has failed. Using default calibration
Red	An error has occurred

Set-up

I24 Science/I24 Module uses for the grey and the white measurement cable the following color-coded electrode plugs, illustrated in this chapter:

- green plugs representing EMG/BI measurement electrodes, responsible for data collection of impedance and potential signals

- red plugs representing current electrodes, responsible to drive electricity into the test specimen.
- white plugs are reference electrodes, responsible for common-mode rejection.



Electrodes for each used channel needs to be placed using the following procedure:

- 1) Find the correct placement for the electrodes
- 2) Prepare the skin so that the area is clean and dry. Trim extensive body hair.

- 3) The lifespan of the electrodes can be prolonged by applying one or two drops of water on the gel surface. The electrode itself must not get wet.
- 4) Place the electrodes

The user must replace the electrodes:

- After each use
- If a problem occurs during the product specific use,
- If irritations occur or
- The electrodes exceeded the use-by date indicated on the package.

After placing the electrodes, the electrode cables can be connected to the electrodes. Each channel is color coded to avoid wrong application. The electrode cable must be connected to the socket of the I24 Science/I24 Module with the same color. Connect the cable only into the

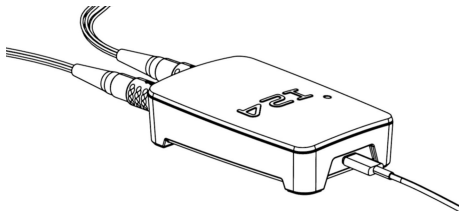
Operation Instructions | After use

I24 Science/I24 Module when the device control lamp is not yellow and or red.



Plugs and connectors of I24 Science/I24 Module electrode cables are color coded and coded by pin and groove. Inverting the connections can damage the device and cause unwanted reactions.

The I24 Science/I24 Module needs to be connected to the computer using the USB-C cable. Insert the USB-C plug into the corresponding receptacle. Connect the other side of the USB cable to the USB-A port of the computer.



Position the I24 Science/I24 Module so that it can be easily disconnected from the power supply, but so that the USB cable cannot be accidentally pulled off by a person or object (no tripping hazards). Make sure the USB cable is safely plugged in. Keep it away from hot surfaces and sharp edges.

After use

Always remove the electrodes by lifting one of the edges and do not pull on the cable!



Do not pull on cables to unplug electrodes.

Pulling the cable can damage the plug connection. Also using other electrode types can cause a too strong connection between electrode and electrode cable and can damage or breakaway the cable. HASOMED gives no warranty for obvious misuse.

SCIENCEMODE

ScienceMode is a communication protocol between an external device (e. g. a PC) and the device I24 Science/I24 Module, which is produced by HASOMED. Using the ScienceMode commands, the external device can control the I24 Science/I24 Module to execute complex measurements for a wide range of research applications.

Serial communication through the comport

To initiate the measurement, the virtual comport, which is opened on the computer after connecting the I24 Science/I24 Module device, needs to be opened and commands need to be sent to the device.

The serial settings for the I24 Science/I24 Module protocol are listed in Table 1.

Table 1: *Serial settings*

Parameter	Value
Baud rate	3 000 000
Data bits	8
Stop bits	2
Parity	None
Flow control RTS/CTS	Yes

In the following the packet structure is described which is need for communication.

Packet Structure

The protocol packet structure is shown in Table 2. Every packet starts with the start byte and ends with the stop byte (see constants in Table 3).

The protocol uses byte stuffing. Every constant from Table 3, except the stuffing key, is escaped with the stuffing byte. The value is then XORed with the stuffing key, e.g. if the command data has a byte which is identical to the start byte

ScienceMode | Packet Structure

value, this start byte (0xF0) is stuffed to 0x81, 0xA5.

The packet length (2 Byte) is the full length of the packet including the start and the stop byte. It is always stuffed and therefore uses 4 Bytes. The maximum packet length including stuffing is 1200 Bytes.

The check sum is the CRC-CCITT 2 Byte (16 Bit) and is generated from the stuffed packet data (see Table 2). It is always stuffed and therefore uses 4 Bytes.

The packet number (6 Bit) and command number (10 Bit) combined use 2 Bytes (Shown as command prefix in Table 2). The packet number ranges from 0 to 63 and is echoed by the stimulator response. It can be used for debugging purposes.

The command is represented by a number for the different commands, responses and information packets, whereas the command data is reserved for the parameter of the command.

The protocol uses big endian byte order.

Table 2: Packet structure

Start byte	Packet length	Check sum	Command prefix	Command data	Stop byte
1 Byte	4 Byte	4 Byte	2 Byte	n Byte	1 Byte
			<- Packet data ->		
			<- Stuffing ->		
			<- Check sum ->		
			<- Packet length ->		
			<- Packet (Header, Data, Footer) ->		

Table 3: Byte constants

Constants	Hex	Binary
Start byte	0xF0	11110000
Stop byte	0x0F	00001111
Stuffing byte	0x81	10000001
Stuffing key	0x55	01010101

Commands and Responses

The device function can be controlled by sending a request command. Most of these request commands have a corresponding device response (ending with ack), containing the result, the requested data and sometimes additional information. The commands, its responses and their parameters are described in the next sections.

There are two layers: general and dyscom. The general layer contains commands for requesting basic information like device id or general status. The dyscom layer contain the commands for the corresponding measurement.

When the command data size is 0, no command data table is provided for the command and the packet length is 12.

General commands

In the following, the general commands, which can also be used for other ScienceMode products, are listed and the structure of the expected data is described.

Table 4: *General commands list*

Cmd. No.	Command	Type	Length Bytes
052	Get_device_id	Cmd	12
053	Get_device_id_ack	Rsp	23
058	Reset	Cmd	12
059	Reset_ack	Rsp	13
068	Get_extended_version	Cmd	12
069	Get_extended_version_ack	Rsp	25
066	General_error	Rsp	13
067	Unknown_cmd	Rsp	13

ScienceMode | General commands

Table 5: Command data *Get_device_id_ack*

Bit	Bytes	Description
	1	See result and errors
	10	Device-ID coded as chars

Table 6: Command data *Reset_ack*

Bit	Bytes	Description
	1	See result and errors

Table 7: Command data *Get_extended_version_ack*

Bit	Bytes	Description
	1	00 – Successful 01 – Transfer error
	1	Firmware-version major
	1	Firmware-version minor
	1	Firmware-version revision
	1	ScienceMode-Version major
	1	ScienceMode-Version minor
	1	ScienceMode-Version revision

	4	Firmware hash
	1	1 – git hash 2 – elf md5 hash 3 – elf sha256 hash
	1	0 – not valid hash 1 – valid hash

Table 8: Command data *General_error*

Bit	Bytes	Description
	1	See result and errors

Table 9: Command data *Unknown_cmd*

Bit	Bytes	Description
	1	11 – Unknown command

Dyscom commands

The DysCom protocol level is used to communicate with the measurement system for control and acquisition of the measurement data.

The following commands are available for this purpose. They are described in more detail in the following sections.

Table 10: *Dyscom commands list*

Cmd. No.	Command	Type	Length Bytes
100	DI_init	Cmd	13
101	DI_init_ack	Rsp	13
102	DI_Start	Cmd	13
103	DI_Start_ack	Rsp	13
104	DI_stop	Cmd	12
105	DI_stop_ack	Rsp	13
106	DI_Send_Live_Data	Rsp	
107	DI_Send_File	Rsp	
108	DI_Send_MMI	Rsp	

109	DI_Get	Cmd	
110	DI_Get_Ack	Rsp	
111	DI_Power_Module	Cmd	
112	DI_Power_Module_Ack	Rsp	
113	DI_Send_File_Ack	Rsp	
114	DI_Sys	Cmd	
115	DI_Sys_Ack	Rsp	

Initialization

The Init command transfers a register set with configuration data for the measuring chip of the I24 Science/Module, as well as further parameters, which specify the measuring data acquisition and the further measuring data processing.

Table 11: Command data *DL_init*

Parameter	Bytes	Description
RegisterMap ADS129x	26	see data sheet entries for the register map of the ADS1294R, see Table 12 for recommended register values
Start time	11	see Table 13
System time	11	see Table 13
Proband name	128+1	^[\\w,\\s-]{1,128}\\o\$
Investigator name	128+1	^[\\w,\\s-]{1,128}\\o\$
Proband number	36+1	GUID
Number of Channels	2	
Duration	32	duration of planned measurement in seconds
Signal type	8	See Table 15
	1	Unused

Parameter	Bytes	Description
Sync-signal	1	
Filter	1	See Table 16
Flags	1	see Table 14

Table 12: Recommended register values

Register Address	Register Name	Value
01h	Configuration Register 1	83h
03h	Configuration Register 3	FCh
0Dh	RLD Positive Signal Derivation Register	02h
0Eh	RLD Negative Signal Derivation Register	02h
16h	RLD Negative Signal Derivation Register	EAh

Table 13: Time stamp structure

Bytes	Description
1	Seconds
1	Minutes
1	Hours
1	Days
1	Month
2	Years since 1900
1	Weekday (Sunday = 0)
2	Day of the year (January 1 = 0)
1	is day saving time (dst = 1)

Table 14: *dl_init* flags

Bit position (0 - LSB)	Description
0	enable live data mode
1	enable sd storage mode
2	enable timed start
3	set system time with sended system time stamp

4	Mute
5-7	Unused

Table 15: Signal types

Value	Description
0	Unused
1	Unknown
2	BI
3	EMG1
4	OP Voltage
5	Test signal
6	Ground
7	Temperature
8	Internal SC
9	EMG2
10	Time
11	Pushbutton
12	Breathing

Table 16: Channel type

Value	Description
0	Filter off
1	Predefined Filter 1
2	Predefined Filter 2
3	Predefined Filter 3

DL_Init_ack

Response for DL_init; The command is sent after the measurement chip is initialized. It contains information about possible errors.

Table 17: Command data DL_init_ack

Parameter	Bytes	Description
Result	1	See result and errors
Register-Map ADS129x	26	see data sheet entries for the register map of the ADS1294R
Measure-ment file id	60	
Init state	1	See Table 16
Freq out	1	See Table 15

Table 18: *Freq out*

Value	Description
0	Unused
1	32 kSPS
2	16 kSPS
3	8 kSPS
4	4 kSPS
5	2 kSPS
6	1 kSPS
7	500 SPS
8	250 SPS

Table 19: *Init state*

Value	Description
0	Unused
1	Success
2	Error_Storage_Init
3	Error_Storage_write
4	Error_Storage_Full
5	Unused
6	Error_Ads129x_Register

Get

The get command can retrieve various types of information from a measurement device, including file system status, measurement meta-information, operation mode, firmware version, and file information. The exact information that can be obtained depends on the specific Type parameter used with the get command.

Table 20: Command data *DL_get*

Parameter	Bytes	Description
Type	1	See table 15 dl get types

Table 21: Command data *DL_get* appendix when Type == 4

Parameter	Bytes	Description
Filename	128+1	null-terminated C-string
Block offset	4	Starting block for file transfer.
File size	8	[0 .. $2^{64} - 1$] Byte (64 Exa-byte)
Number of blocks	4	[0 .. $2^{32}-1$] blocks

Table 22: Command data *DL_get* appendix when Type = 7

Parameter	Bytes	Description
Filename	128+1	
Block offset	4	
File size	8	

Parameter	Bytes	Description
Number of blocks	4	

Table 23: *DL_get* types

Value	Description
0	Unused
1	FileSystemStatus
2	ListOfMMI (MMI = Measurement Meta Info)
3	OperationMode
4	FileByName
5	DeviceID
6	FirmwareVersion
7	FileInfo

DL_get_ack

Response for *DL_init*; It contains information about possible errors and the information which was requested.

Table 24: Response data *DI_get_ack*

Parameter	Bytes	Description
Result	1	See results and errors
Type	1	See table 15

Table 25: Additional Response data for *DI_get_ack* when *type == 1* (file system status)

Parameter	Bytes	Description
File system ready	1	1 – true, 0 – false
Used size	8	[0, 2 ⁶⁴ -1] kB = [0, 4095GB]
free size	8	[0, 2 ⁶⁴ -1] kB = [0, 4095GB]

Table 26: Additional Response data for *DI_get_ack* when *type == 2* (ListOfMMI)

Parameter	Bytes	Description
Number of Measurements	2	[0, 2 ¹⁶ -1]

Table 27: Additional Response data for *DI_get_ack* when *type == 3* (operation mode)

Parameter	Bytes	Description
Result	1	0 – Undefined 1 – Idle 2 – Live Measuring Pre 3 – Live Measuring 4 – Record Pre 5 – Record 6 – DataTransfer

Table 28: Additional Response data for *DI_get_ack* when *type == 4* (file by name)

Parameter	Bytes	Description
File name	128 + 1	Null terminated c-string of the complete filename
Block offset	4	[0 .. 2 ³² -1] block offset number
File size	8	[0 .. 2 ⁶⁴ - 1] Byte (64 Exabyte)

ScienceMode | Dyscom commands

Parameter	Bytes	Description
Number of blocks	4	[0 .. 2 ³² -1] blocks

Table 29: Additional Response data for *DL_get_ack* when *type == 5* (device id)

Parameter	Bytes	Description
Device id	128+1	Null terminated c-string

Table 30: Additional Response data for *DL_get_ack* when *type == 6* (firmware version)

Parameter	Bytes	Description
Firmware version	128+1	Null terminated c-string

Table 31: Additional Response data for *DL_get_ack* when *type == 7* (file info)

Parameter	Bytes	Description
Filename	128+1	Null terminated c-string of the complete filename
File size	4	See table 15

Parameter	Bytes	Description
Checksum	2	

Start command

The command is used to start a previously initialized measurement. The command itself has not payload and returns a *dl_start_ack*.

Table 32: Response data *DL_start_ack*

Parameter	Bytes	Description
Result	1	See results and errors

Stop command

The command is used to stop a running measurement. The command itself has not payload and returns a *dl_stop_ack*.

Table 33: Response data *DL_stop_ack*

Parameter	Bytes	Description
Result	1	See results and errors

Power command

The command is used to active the power for the memory card and the measurement chip.

Table 34: Command data *DL_power*

Parameter	Bytes	Description
Module	1	2 – Memory_Card 3 – Measurement
Power	1	0 – switch off 1 – switch on

Table 35: Response data *DL_power_ack*

Parameter	Bytes	Description
Result	1	See results and errors
Module	1	2 – Memory_Card 3 – Measurement
Power	1	0 – power off 1 – power on

Send live data command

The `send_live_data` command sends a set of measurement data to the PC. A set of measurement data consists of a 24-bit sample for each utilized channel, as well as information about the electrode status of the channel.

Table 36: Response data *DL_send_live_data*

Parameter	Bytes	Description
Number of channels	1	
Time offset	4	Time difference in microseconds to the last sample
Value	4	Float measurement data
Signal type	1	See table 14
Status	1	1 - Positive electrode adhesive 2 - Negative electrode adhesive 3 - both electrodes are adhesive

Send file command

The send file command is used to transfer the measurement file from the DysCom hardware to the PC. A send_file command sends a block of up to 512 bytes to the PC

Table 37: *Response data DL_send_file*

Parameter	Bytes	Description
Block number	4	[0,2 ³² -1] Block number
Block size	2	Up to 512
Data	1-512	Size is defined through block size

Send mmi command

The send_MMI command sends measurement meta-information, such as the measurement ID

or the file size, to the PC. The response is triggered by a dl_get command with

Table 38: *Response data DL_send_mmi*

Parameter	Bytes	Description
DL_init payload	361	See dl_init command
Measurement file id	60	8 chars
Measurement file size	8	
Measurement number	2	
Proband number	36+1	
Start time	11	
Length	4	Duration of measurement

sys command

The command is used to

Table 39: *Response data Dl_sys*

Parameter	Bytes	Description
type	1	1 deletefile 2 dev_sleep 3 dev_storage
File name	128+1	Null terminated c-string

Table 40: *Response data Dl_sys_ack*

Parameter	Bytes	Description
Result	1	See results and errors
Type	1	1 deletefile 2 dev_sleep 3 dev_storage
state	1	0 – undef 1 – sucessfull
Filename	128+1	Null terminated c-string

Result and errors

Table 41: *Result and errors*

Value	Result	Description
00	No error	The command was executed, or the execution started.
01	Transfer error	The check sum and/or length included in the packet do not match with the calculated value.
02	Parameter error	Any of the following conditions is true: <ul style="list-style-type: none"> • At least one parameter has an invalid value. • The packet contains too few parameters.

TROUBLESHOOTING

Device is not responding

Try to restart the device by reconnecting the USB cable. Please check if there is a new virtual com port, when plugging in the device. Try a different USB 3.0 port on the PC which can deliver at least 2.4 A.

Device restarts randomly

Restarting occurs when the used USB port does not provide sufficient current. Connection problems could also trigger a restart.

Com port cannot be opened

Check if the correct com port is tried to be opened. Check if there is a different program running that has opened the com port already.

Error during measurement is indicated through the device LED

A description of possible error cases is given in Result and errors. Try the given solution or follow the protocol description.

MAINTENANCE

Cleaning and Disinfection (only I24 Science)

Clean the I24 Science regularly for hygienic reasons. To clean and disinfect the device, please first disconnect it from the supply source. Remove coarse dirt by gently shaking it or using a hand vacuum cleaner or a small brush. Impurities can be removed with a damp cloth. Use a dry or slightly moist cloth. If there are persistent stains, you can also soak the cloth in alcohol or a universal (BMF) cleaner. Never use strong detergents, soaps or solvents.

Let the I24 Science dry out completely before using it again.

Contact HASOMED if there is any heavy-duty dirt that cannot be removed.

Disinfect the I24 Science before every application session, thus preventing cross contamination between users. Wipe the device's surfaces with disinfectant.

Clean and disinfect parts in direct contact with the user's skin after each training session.

We strongly recommend that you use detergents which feature in the list of disinfectants and disinfectant processes as tested and approved by the Robert Koch Institute.

Maintaining the technical safety

The manufacturer recommends for the device a maintenance interval of 2 years to guarantee the safety standards for further use. Hence, please send your I24 Science/I24 Module on

Maintenance | Maintaining the technical safety
your own account to the manufacturer. HASOMED will examine the adherence to technical parameters and the function of the monitoring elements.

The service life for the device is 5 years.

General information on disposal: Please contact HASOMED GmbH for the respective information on returning.



The internal battery (CR1220) may only be changed by service personnel.

Inappropriate handling can cause damages to the device



TECHNICAL SPECIFICATION

Size and weight		
	I24 Science	I24 Module
Width	68.4 mm	55 mm
Depth	112 mm	107.5 mm
Height	28.3 mm	18.3 mm
Weight	130 g	60 g
USB Port		
USB data specification	USB 2.0 Upstream	
Supply voltage	5 V DC	
Max. current consumption	0,5 A	
USB connector	USB Type-C	
Transfer rate	12 MB/s (Full Speed)	
Isolation voltage	4 kV	
Clearance and creepage distance	>8 mm	


Measurement (* values for configuration according to Table 12)				
	Min	*	Max	Unit
Sampling rate	0.25	4	32	kSPS
Gain	1	6	12	
Input range $V_{ref} = 4V$	± 167	-	± 2000	mV
Input range $V_{ref} = 2.4V$	± 100	± 200	± 1200	mV
Resolution	24			bit
BI frequency	0.5	64	64	kHz
Environmental requirements				
In use	+5 °C to +27 °C; RH 0 % to 80 %, not condensing, AP 700 to 1060 hPa			
Transport / storage	+5 °C to +27 °C; RH 0 % to 80 %, not condensing, AP 700 to 1060 hPa			

EMC INFORMATIONS

Warnings

	The I24 Science/I24 Module should not be used directly next to other devices or stacked with other devices. If such use is nevertheless necessary, the correct operation of the devices should be observed
	Portable RF communication devices and their accessories should not be used closer than 30 cm (12 inches) to any parts and cables of the I24 Science/I24 Module. Otherwise, the performance of this device may be affected.

Cautions

	Use of accessories, transducers, and cables other than those specified or provided by the manufacturer of this equipment could result in increased electromagnetic emissions or decreased electromagnetic im-
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	munity of this equipment and result in improper operation.
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Electromagnetism

The device is suitable for use in all establishments including those directly connected to the public low-voltage power supply network that supplies to buildings power used for domestic purposes.

Emission

Test	Limit	Electromagnetic environment guidance
Conducted emission	CISPR 11, Group 1, Class B	Device uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
Radiated emission	CISPR 11, Group 1, Class B	

Interference immunity

Electrostatic Discharge (IEC 61000-4-2)	
<p><i>Compliance level</i></p> <p>Contact Discharge: ± 8 kV</p> <p>Air Discharge: ± 2 kV, ± 4 kV, ± 8 kV, ± 15 kV</p>	<p><i>Electromagnetic environment - guidance</i></p> <p>Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.</p>

Radiated RF EM field (IEC 61000-4-3)	
<p><i>Compliance level</i></p> <p>80-2700 MHz; 1kHz AM 80 %; 10 V/m</p>	<p><i>Electromagnetic environment - guidance</i></p> <p>Portable and mobile RF communications equipment should be used no closer to any part of the device, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.</p> <p>Recommended separation distance</p> <p>$d = 1.2\sqrt{P}$ for 80 MHz to 800 MHz</p> <p>$d = 2.3\sqrt{P}$ for 800 MHz to 2,7 GHz</p> <p>where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m).</p>

Proximity fields form RF wireless communications equipment (IEC 61000-4-3)*Compliance level*

385 MHz; Pulse Modulation: 18 Hz; 27 V/m
 450 MHz, FM + 5 Hz Deviation: 1 kHz sine; 28 V/m
 710, 745, 780 MHz; Pulse Modulation: 217 Hz; 9 V/m
 810, 870, 930 MHz; Pulse Modulation: 18 Hz; 28 V/m
 1720, 1845, 1970 MHz; Pulse Modulation: 217 Hz; 28 V/m
 2450 MHz; Pulse Modulation: 217 Hz; 28 V/m;
 5240, 5500, 5785 MHz; Pulse Modulation: 217 Hz; 9 V/m

Electromagnetic environment - guidance

Portable and mobile RF communications equipment should be used no closer to any part of the device, including cables, than the recommended separation distance 30 cm.

Electrical fast transients / bursts (IEC 61000-4-4)*Compliance level*

Power lines: 2 kV; 100 kHz repetition frequency
 Signal lines: 1 kV; 100 kHz repetition frequency

Electromagnetic environment - guidance

Mains power quality should be that of a typical environment.

Conducted disturbances induced by RF fields (IEC 61000-4-6)	
<p><i>Compliance level</i></p> <p>0.15-80 MHz; 1kHz AM 80 %; 3 Vrms, 6 Vrms in ISM and amateur radio band</p>	<p><i>Electromagnetic environment - guidance</i></p> <p>Portable and mobile RF communications equipment should be used no closer to any part of the device, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.</p> <p>Recommended separation distance</p> <p>$d = 1.2\sqrt{P}$ for 150 kHz to 80MHz where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m).</p>
Rated power frequency magnetic fields (IEC 61000-4-8)	
<p><i>Compliance level</i></p> <p>30 A/m, 50 Hz</p>	<p><i>Electromagnetic environment - guidance</i></p> <p>Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.</p>

Voltage dips / Voltage interruptions (IEC 61000-4-11)	
<p><i>Compliance level</i></p> <p>0 % UT for 0.5 cycle at 0°, 45°, 90°, 135°, 180°, 225°, 270°, 315°</p> <p>0 % UT for 1 cycle at 0°</p> <p>70 % UT for 25/30 cycles at 0°</p> <p>0 % UT for 250/300 cycles 0°</p>	<p><i>Electromagnetic environment - guidance</i></p> <p>Mains power quality should be that of a typical environment. If the user of the device requires continued operation during power mains interruptions, it is recommended that the device is powered from an uninterruptible power supply or battery.</p>

