# DLMon-RMon Radiation Monitoring System

## **Operators Manual**



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## 1. General Information

#### 1.1 <u>Purpose</u>

The Radiation Monitoring System (DLMon / RMon) detects the local dose rate of radiation with connected detectors.

The software DLMon additional realize the handling of patients for I-131 therapy.

#### 1.2 General functioning

All detectors and displays are connected with PC via a serial interface of type RS-485. Each detector / display has a unique system address. The PC communicates with each module over this serial bus system.

This communication is realized by the software named '*Modul- Monitor*' (SVMO.exe). The '*Modul-Monitor*' runs in the background of PC, normally without his own program- window.

Tasks / Functions of the software 'Modul- Monitor':

- Initialization of detectors and displays
- Start of data acquisition of the detectors
- Reactivation of inactive modules (eg after failure of power supply)
- Storing measured values on the local hard disk
- Storing measured values on SQL database on PC
- Calibration / programming of parameters of modules

The software '*DLMon*' (DLMon.exe) is used for patient handling and visualization and analysis of patient data. The software 'DLM*on*' does not communicate directly with modules, the communication happens always through the '*Modul- Monitor*'.

Tasks / Function of the software 'DLMon' :

- Handling of patient (Admission in bed, transfer to other bed and discharge) in window with special ground plan
- Display patient data of I-131- therapy
- Cyclic scan of detector measured values from 'Modul- Monitor'
- Display patient measurements in diagram dose rate vs. time
- Calculate fit with measurements from the night (because patient is in bed)
- Send measurement value to assigned display
- Enter data of application (activity, date, time,..)
- Calculate date / time of discharge
- Calculate dose
- Calculate additional applications
- Print of patient data, diagram and other lists
- Tool for planning of patients

The software '*RMon*' (Rmon.exe) is used for visualization and analysis of measurement values. The software '*Rmon*' does not communicate directly with modules, the communication happens always through the '*Modul-Monitor*'.

Tasks / Function of the software '*Rmon*' :

- Cyclic scan of detector measured values from 'Modul- Monitor'
- Presentation of measurement values in the plan
- Display of measurement values in chart
- Send display value to assigned display
- Loading archive values from SQL database
- Signaling inactive detectors
- Representation of limits
- Print of dose rate charts

#### 1.3 Basic wiring diagram



## 2. Components

## 2.1 PC

The PC is the central component for controlling the modules (Detectors / displays) via the serial bus system RS-485. PC requirement:

- Standard PC with operating system Windows NT, Windows 2000 or Windows XP
- 2 GB RAM
- 17" Monitor

The connection to the RS-485 bus system is realized on:

- a internal PCI card from National Instruments or
- a external Converter USB- RS485.

Standard port: COM 3

Important:

- Deactivation of all standby options for hard drive and monitor!
- Disabling the operating system updates!
- Set administrator rights of PC user!
- Virus Scan software can cause problems.

## 2.2 Connection cable and connection box for serial interface RS 485

You need following components to connect the bus system from PC with the bus system of detectors and displays:

- Internal PCI- Card for interface RS485 or external converter USB RS485
- 9- pin serial connection cable with built-in resistors
- Special 'Connection box'

The 9- pin special cable connects the PC serial port (Standard COM 3) with the 'Connection box'.

In addition, the bus system is supplied with the required operating voltage of 12 V DC over the 'Connection Box'.

Wiring of connection cable:	Drawing: "RS-485 Cable Rmon / DLMon" Appendix 5

Wiring of connection box: Drawing: "Wiring Connection Box' Appendix 6

#### Assignment of the cable:

Name of connection	Color of wires
grey-pink + grey + black + blue	GND (Ground)
red-blue + red + purple + pink	+ 12 V DC
white + white-yellow	Daten 1 +

green + white-green	Daten 1 -
yellow + yellow-brown	Daten 2 -
brown + brown-green	Daten 2 +

## 2.3 Detector SON16, SON 20, SON31

The local dose rate is measured with the detectors SON16, SON20 or SON31. They differ only by the built-in counter tube, they are identical in electrical connection and operating.

Each detector has a unique address on the bus (up to 255 modules available). The software 'Modul- Monitor' can initialize each detector with this address and activates the automatic measurement.

The dose rate can be measured only after this software activation. The measurement values are stored on the internal EPROM of the detector (up to 10.000 values).

The software 'Modul- Monitor' loads this values in cyclic intervals.

Each detector is specially programmed over several parameters (type, serial number, interface parameter, ..). The following parameters have an influence to the measurement values:

- Measurement time (1 99 sec) or (1 99 min)
- Sensitivity / Calibration factor
- Background (Standard:  $0.0 \,\mu$ Sv/h)
- Dead time (50 300 µsec, depending on detector)

The parameter are stored on detector and can be changed with software *'Modul- Monitor'.* 

Attention: Incorrect settings can cause malfunctions of the detector!

As standard, the detectors are calibrated for CO-60 or Cs-137 (see Certificate of Calibration). With a calibration factor of 1.0000 the detector delivers the measurement value in the unit 'Counts per Second' (cps).

Construction and wiring of detector:

Wiring of detector: Drawing: "Wiring Modules of System RMon / DLMon" (see Appendix 7)

#### Assignment of the cable:

Name of connection	Color of wires
grey-pink + grey + black + blue	GND (Ground)
red-blue + red + purple + pink	+ 12 V DC
white + white-yellow	Daten 1 +
green + white-green	Daten 1 -
yellow + yellow-brown	Daten 2 -
brown + brown-green	Daten 2 +



Wiring of connection board

Attention: External connection must be orange !



Connection of counter tube on controller board



Functional, opened detector SON31

## 2.4 Display AT-1

The display modules are used to represent the measured values of Rmon system. Each display has a unique address within the bus system (see Appendix: List of Modules)

The initialization of the intelligent display modules is realized by software *'Modul- Monitor'*. In contrast, the software 'Rmon' controls the assignment to the detector and the generation of the displayed value.

The internal display controller also realizes the control of LED's for thresholds. It compares the current displayed value with the 3 programmed thresholds. On this base it activates one of the 3 LED's.

Each display is programmed by various parameters. In addition to information on type, serial number and interface parameter the following parameters can be set individually:

-	Threshold 1	(Activation LED green)
-	Threshold 2	(Activation LED yellow)
-	Threshold 3	(Activation LED red)

Construction and wiring of display:

Wiring of display: Drawing: "Wiring Modules of System RMon /DLMon" (see Appendix 7)

Assignment of the cable:

Name of connection	Color of wires
grey-pink + grey + black + blue	GND (Ground)
red-blue + red + purple + pink	+ 12 V DC
white + white-yellow	Daten 1 +
green + white-green	Daten 1 -
yellow + yellow-brown	Daten 2 -
brown + brown-green	Daten 2 +





Functional, opened display AT1-1

Additional information for opening the new display housing:



## 3. Installation and Start of DLMon / RMon- System

Software is completely furnished on the PC. Required software:

- Operating system
- Driver (FTDI for USB)
- Microsoft SQL Server with special database
- Modul- Monitor (realized the communication with detectors and displays)
- Software for I-131 therapy 'DLMon'
- Software for room monitoring 'RMon'
- 3.1 Quick start
  - 1. Connect the serial interface (Standard: COM 3) of computer via 'Connecting cable' to the 'Connection Box'.
  - 2. Connect the 12 V DC power supply with 'Connection Box'.
  - 3. Start the PC, login the user (Standard <u>without</u> password)
  - 4. The software 'Modul-Monitor' (SVMO.exe) starts automatically, because it is in the folder 'Autostart'.
  - 5. Start the desired software 'DLMon' or 'RMon' via desktop icon:



Active program window after start (shows the special layout with placed detectors):

Ward Patients Detector	l layout, Zoom: 0, Display ex Planning activity View Wir	trapolated value dow   ?			
Ward layout, Zoom	0, Display extrapolated val	ue			
Nuclear Medicine	Station:	Prince Sultan Medical Military City	· · · ·	7	
Roon #4	I vacant D0 µSv/h Roon #3 2 Bed v 0.000	C C C C C C C C C C C C C C C C C C C		Nurses WS	
Use mouse to select a bed /	detector !			Stop loa	ad MV

## 3.2 Software 'Modul-Monitor' (*SVMO.exe*)

The software '*Modul- Monitor*' communicates in the background via serial port with all modules on bus system (detectors and displays). The tasks / functions of the program are:

- Initialization of all modules with the commands RESET, DATE and TIME
- Start the automatic measurement of the detectors with the START command (only after this commands the detector can measure!)
- From software '*RMon*' received displayed values are sent to the display modules
- Programming of new parameters on detectors and displays
- Calibration of detectors
- Storing the measurement values on the local hard disk at C:\Programme\SVMO\data\. In this folder exists for each detector a measurement file with name 'sonde.caa' (with c ... Number of COM- port, und aa ... Address of detector )
- Storing the measurement values in SQL- database STEP\_MODUL\_SQL in table '*tMw*'
- Storing all of the bus data transfer in special text file at C:\Programme\SVMO\protocol\



Structure of folder C:\Programme\SVMO

The software '*Modul- Monitor*' can be started by itself <u>without</u> software 'DLMOn' or 'Rmon' (therefore the software 'DLMon' or 'Rmon' must be closed!):

- 1. By a click on 'SVMO.exe' in the explorer
- 2. By the icon on desktop.



After start the program window is shown with 'List of all available STEP-Moduls':

	STEP- Module- Monitor V4.02 - L	ist of all available STEP- Moduls (detectors + displays):					
	Program Interfase Module Service View ?						
ſ	List of all available STEP- Modu	ls (detectors + displays):					
	Moduls on interface COM3:						
	Detector:	SON16 -> ID: 1					
I	Measuring value:	3.2700E+01 cps					
	Time measuring value:	11.07.2011 14:36:19					
	Module state:	active					
	Detector:	SON16 -> ID: 2					
	Measuring value:	- cps					
	Time measuring value:	·					
	Module state:	active					
	Detector:	AT1-1 -> ID: 3					
	Module state:	inactive					
	Detector:	AT1-1 -> ID: 4					
	Module state:						

More information can be found in help file of software 'DLMon' or 'RMon'.

#### Attention:

Only an active software 'Modul- Monitor' can load measurement values from detector.

When a detector was started by software <u>and then</u> the program '*Modul-Monitor*' or 'DLMOn' / '*RMon*' <u>stopped</u>, continuously the measurement values are stored in EPROM of the detector, but not transferred to PC! Of course, by the next start of software the last-stored measurement values are loaded, but the process takes some time and so the system is not up to date!

Tipp: The software should never be inactive for some time <u>or</u> you deactivate the power supply for modules directly after end of software!

#### Password:

Some features / menu of the software are protect by a password:

Please enter password:	×
Password:	
OK Cancel	

The password is variable and depends on the current system date. Construction of the password: '*d.m*'

	with	d.	Number	of curren	nt day + 1	(2	3	2)
e.g.:	password for password for	20. Ju 31. De	ly 2011: ecember 2	010:	21.8' '32.13'	1 (2	Ix	3)

## 3.3 Software 'DLMon' (DLMon.exe)

The software '*DLMon*' is the first central program, which has following tasks / functions:

- Complete Handling of patients for i-131 therapy
- Planning of patients in special planning tool
- Takeover the detector values by the software 'Modul- Monitor'
- Calculate dose rate dose of patient
- Display the measurements into different charts
- Use SQL- database RJT2000SQL and RJT2000SQL\_ARCHIV1 for saving patient therapy data
- Send the display value to the program '*Modul- Monitor*', indicating the module address

Start the software 'DLMon' :

1. By using the icon on desktop



2. By using the explorer C:DLMon\DLMon.exe



Read for further information on using the software the additional manual for DLMon!

#### Password:

Some features / menu of the software are protect by a password:

Please enter	password:	×
Password:	****	
ОК	Cancel	

The password is variable and depends on the current system date. Construction of the password: '*d.m*'

	with	d	Nur	nber c	of current of	day + 1	(2		32)
		m	Nur	nber c	of current r	nonth <b>+ 1</b>	(2	1	13)
e.g.:	password for	or 20.	July 201	11:	'21	.8'			-
passwo	ord for 31. D	ecembe	er 2010:	'32.13	,				

## 3.4 Software 'RMon' (*Rmon.exe*)

The software '*RMon*' is the second central program, which has following tasks / functions:

- Takeover the detector values by the software 'Modul- Monitor'
- Display the measurements into different charts
- Load archive values from SQL- database
- Send the display value to the program '*Modul- Monitor*', indicating the module address

3 possibilities to start the software 'RMon' :

- 3. Restart the computer ('*RMon*' will start automatically)
- 4. By the explorer C:\Programm\Rmon\Rmon.exe
- 5. By the icon on desktop



Further information on operating the software, see the help file: C:\Programme\Rmon\RMON.HLP.

RMon ¥ 3.6 - RMon Institute of Radiation Medicine Zo	om: 0
System View ?	
Detector-Info: All detectors active!	Additional info:
RMon Institute of Radiation Medicine Zoom: 0	

#### Password:

Some features / menu of the software are protect by a password:

Please enter	password:	×
Password:	****	
OK	Cancel	

The password is variable and depends on the current system date. Construction of the password: '*d.m*'

	with	d	Number	of curre	nt day <b>+ 1</b>	(2	 32)
		m	Number	of curre	nt month + 1	(2	 13)
e.g.:	password for password for	20. Ji 31. D	uly 2011: ecember 2	010:	'21.8' '32.13'	·	·

## 3.5 SQL- Server

The software 'DLMon', 'RMon' and 'Modul-Monitor' store data in a SQL database. Therefore on the pc is installed the SQL Server. You see the active symbol on the right side in tast bar:



The SQL- sever with all necessary databases are preinstalled and ready to use. Following databases are using:

- DLMon ... RJT2000SQL and RJT2000SQL\_ARCHIV1
  - RMon ... STEP\_MODUL\_SQL
- Modul- Monitor ... STEP\_MODUL\_MONITOR

The software DLMon store all patient data for therapy in the database.

Optional:

All detector measurement values are stored in an SQL database: Name of database: STEP\_MODUL\_SQL Location of storing: C:\MSSQL7\STEP\_MODUL\_SQL Name of table with values:tMw

The software '*Modul-Monitor*' loads the measurement values from detector and stores in database.

The software '*RMon*' loads the stored values from database and displays it in the charts.

An ODBC driver realizes the access to the database. Each PC user account needs its own ODBC driver. (see section 4.3)

For maintenance on the database, the tool 'Enterprise Manager' can be used. (see section 4.4)

To use the database, the Microsoft SQL Server must be active, which is realized automatically by booting the system. The symbol on the bottom right

of status bar is shows the active state of SQL Server.

Backup:

Every day 2:00 clock AM the database will be automatically backed up in special directory (e.g. for DLMon >> C:\DLMon\Database\Backup). Backups older than 4 weeks will be deleted.

#### 4. Maintenance

The DLMon/RMon system is designed for permanent operation, 24 hours / 7 days per week.

However, please note the following information's:

Recommendation: Please restart the complete software 1 time per week!

#### 4.1 PC with software

- The PC must run permanently
- The software 'DLMon' or '*RMon*' must run in continuous operation.
- If the software 'DLMon' or '*RMon*' is longer than 1 hour deactivated (e.g. for maintenance), so should the 12 V power supply for detectors be interrupted.
- Once a month, the software 'RMon' should be restarted.
- Once a year, older log files should be deleted in the following folders:
  - C:\SVMO\protocol\
  - C:\SVMO\LogFile\
  - C:\DLMon\Backup\
  - C:\DLMon\LogFile\
  - C:\RMon\Backup\
  - C:\RMon\LogFile\
- Once per year, the PC should be restarted.

#### 4.2 Detector

Once per year, the calibration of detectors should be checked. This can be done with a calibration source of known activity or by STEP GmbH.

The life time of the counter tube is  $\leq 1$  million pulses! After this time or after 10 years the counter tubes should be replaced.

Attention:

A short interruption of 12 V power supply can result in a malfunction of detector!.

Tip:

We recommend an uninterruptible power supply for the 12 V power supply unit!

## 4.3 ODBC driver

An ODBC driver realizes the access to the SQLdatabase. Each PC user account needs its own ODBC driver.

Access to the ADBC driver by:

'Control Panel'  $\rightarrow$  'Administrative Tools':

1. Open Administrative Tools:



2. Open ODBC driver



3. The installation of a new ODBC driver is described in document "STEP-RMON-ODBC, Adjust ODBC driver"

## 4.4 Enterprise Manager

The 'Enterprise Manager' is a tool for direct access to database STEP\_MODUL\_SQL.



Start the Enterprise Manager:

With the Enterprice Manager you have access to all available databases:



#### **Attention:**

The use of the Enterprice Manager requires special skill that should only be operated by trained personnel.

#### 4.5 Remote access via *TeamViewer*

On the PC is installed the software tool 'TeamViewer'. This tool allows the service technician from STEP access to the system in case of any questions or problems.

A prerequisite for the use of the software is the connection to the Internet.

Recommendation:

Call us with any questions or problem, and our service technicians can help you via remote access.

## 4.6 Serial interface RS 485 (optional)

If the PC includes a special interface card from National Instruments. The type is: PCI – RS485, 2 Ports, 2000 V isolated

You can check the functionality of the 2 interface ports by following tool :

1. C	1. Open tool 'Troubleshooting Wizard':							
	Set Program Access and Defaults Windows Catalog Windows Update				Ŭ			
1	Programs •		Accessories		MI-Serial 🕨	×	Add Serial ENET	
3	Documents •	6	Total Commander	, 1 F	×		NI Serial Hardware Specifications	
Te 🛃	Settings +	6	Microsoft SQL Server	ľ		<b>1</b>	NI Serial Legacy Hardware Specifications NI-Serial Help	
SSI 🔊	Search 🕨	T				6	NI-Serial Readme	
Š 🕐	Help and Support						Serial Reference Guide Troubleshooting Wizard	
<mark>\$</mark> 🗇	Run							
si 🎾	Log Off RMon							
ž 💽	Turn Off Computer							
🕕 Start								

#### Result:

2	NI-	Serial	Troubleshootin	g Wizar	d			_ 🗆 X
	* * *	NI-Se Hardo COM	erial software prese ware presence ve ports sequentially	ence verif ified verified	ied			
	COM COM COM	M Port 13 14	Port Description NI PCI-8433/2 (I NI PCI-8433/2 (I	RS-485) S RS-485) S	6N:15D51CE 6N:15D51CE	3, Port 1 3, Port 2	Status Passed Passed	
		Interfac	e Not Listed	H	Help	Ret	est [	Exit

## 4.7 Setting up new PC- User

When a new PC user account must be installed, the following points to consider:

- 1. A new ODBC driver must be set up (see section 4.3)
- 2. The new PC user account needs administrator rights.

We can help you via TeamViewer (4.5) !

5. Final notes

We strive to continuously improve our hardware and software. We ask for your suggestions and information when errors occur.

Contact:

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## Appendix:

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Appendix 3:	Mounting details of Detector SON31 / SON31K
Appendix 4:	Mounting details display AT-1
Appendix 5:	Wiring of PC- Connection Cable for RS-485
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