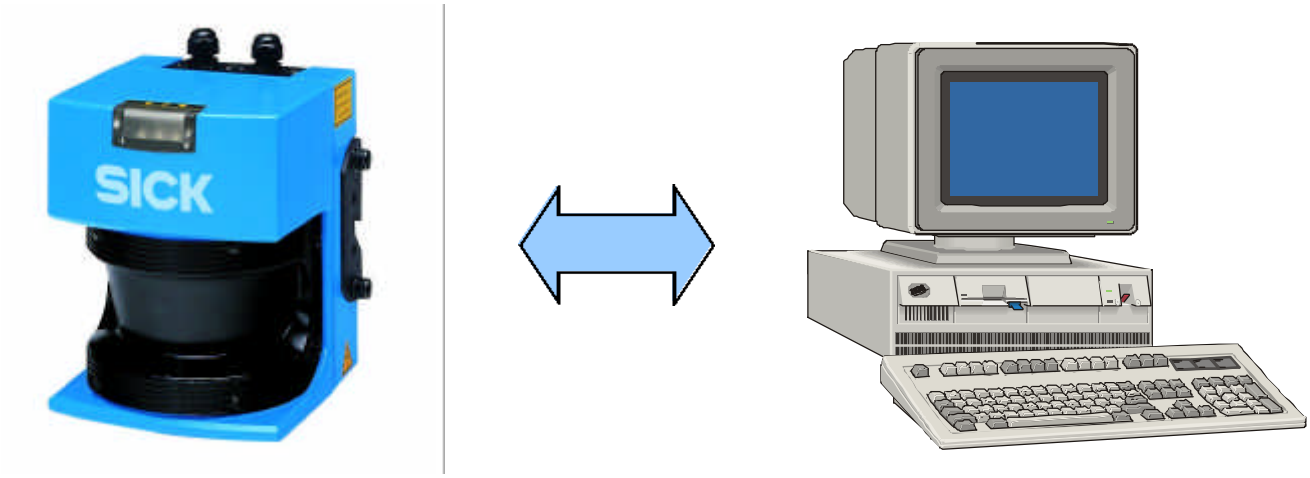
Quick Manual for MST Demo setup



Software setup and configuration

Version 1.0 August 2002 (HW/MV)

Contents

! This is a quick start manual. For extended information please refer to the documents listed in section D.4. !

A. Introduction

1. Basics of the LMS System

The Laser Measurement System LMS 200, LMS 220, LMS 211, LMS 221, LMS 291 is based on a **time-of-flight** measurement principle (Laser Radar). A single Laser pulse is sent out and reflected by an object surface within the range of the sensor. The elapsed time between emission and reception of the Laser pulse serves to calculate the distance between object and LMS.
Via a integrated rotating mirror the Laser pulses sweep a radial range in front of the LMS unit. A 2-dimensional measurement field / detection area is defined.
(For further details please refer to the Technical Description Laser Measurement Systems SICK order no.: 8008970)

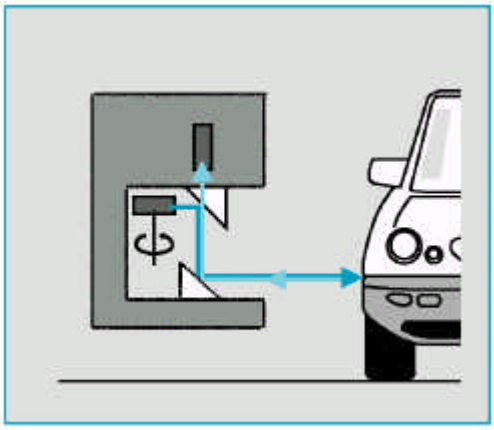


Fig.1: Measurement principle LMS

Main benefits of this measurement principle are:
- Detection of objects independent of object color and surface structure
- Reliable detection of object presence

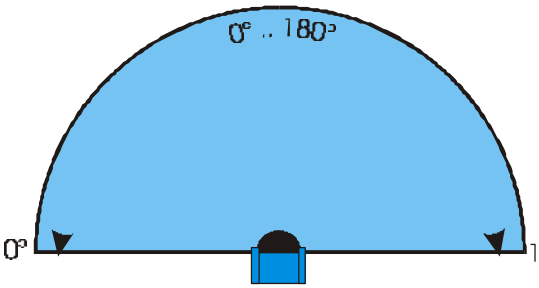
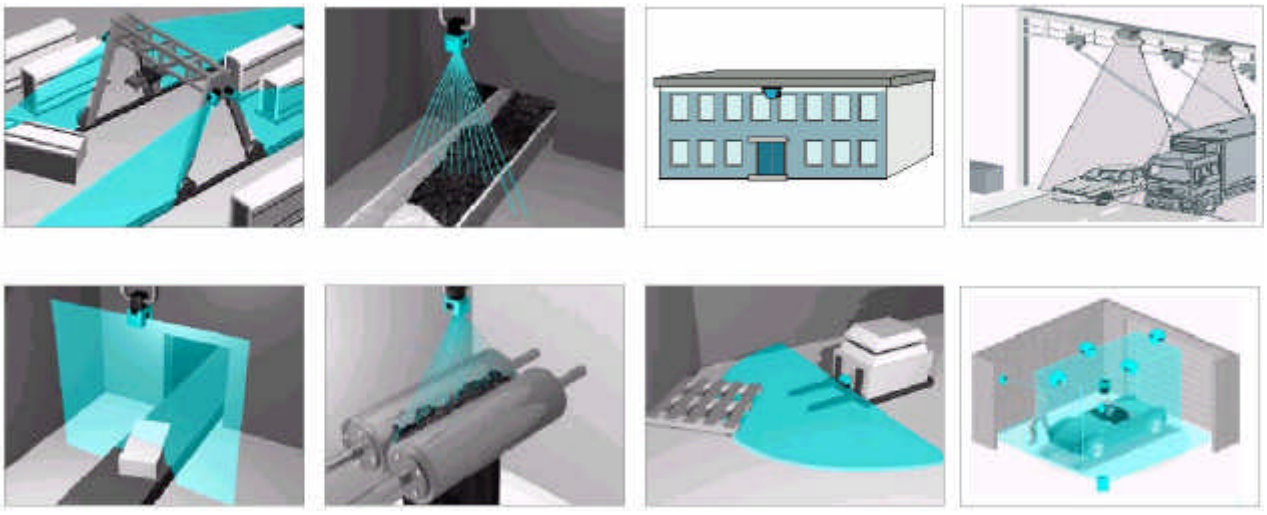


Fig.2: Angular range LMS

The Laser Measurement System LMS offers a solution for a **large range of applications:**
- Determining the volumes of objects (measuring packages, pallets, containers)
- Determining the position of objects (pallets, containers, transport vessels)
- Collision prevention for vehicles or cranes
- Controlling docking processes (positioning)
- Classification of objects (vehicle detection, camera trigger)
- Process automation (e.g. calander rollers)
- Checking overhang/area monitoring in automated multi-storey car parks
- Determining the volumes or contours of bulk materials
- Monitoring open spaces for building security (facades, grounds, shafts)
- ... and many more



B. Hardware setup

1. Before you start ... : Required components

As a minimum requirement to set up an LMS sensor with a data connection to a PC, the following components are required:

For LMS200/LMS291:

Item/Specification	Description	SICK order number
1 x LMS unit with cable connectors	LMS200-30106	1015850
	LMS291-S05	1018028
1 x power supply 24 V DC +- 15%, min. 2.5 A	Power supply DC 24V / 2.5 A	6010361
1 x cable for power supply and output signals (open cable ends 1 x cable for data interface	Cable set 1: 5 m length	2018964
	Cable set 2: 10 m length	2018965

For LMS211/LMS220/LMS221:

Item/Specification	Description	SICK order number
1 x LMS unit with cable connectors	LMS211-30206	1018023
	LMS220-30106	1015945
	LMS221-30206	1018022
1 x power supply 24 V DC +- 15%, min. 2.5 A for LMS electronics	Power supply DC 24V / 2.5 A	6010361
1 x power supply 24 V DC +- 15%, min. 5 A for LMS heating	Power supply DC 24V / 10 A	6011156
1 x cable for power supply and output signals (open cable ends 1 x cable for data interface	Cable set: 5 m length	2019561

Note: In case of longer cables, please source your own cable. Please make sure to use correct cable diameters to avoid voltage drops along large cable lengths.

- Suitable brackets, mounting.

A **laptop or desktop computer** serves as user interface with the LMS unit. The computer is connected via a serial interface:

- RS232 interface (up to 10 m cable length) (standard COM1 or COM2 in most computers)
- RS422 interface (up to 1200 m cable length) (special interface card required)

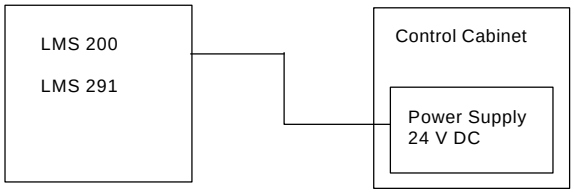
In case a high-speed data transmission is required, SICK offers special interface boards for 500 kBaud transmission rate. For details and information please refer to section D.2.

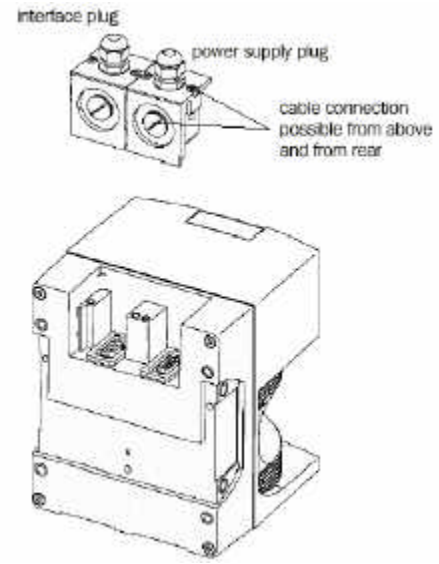
2. Power supply

The LMS unit is supplied with 24 V DC +/- 15%. Depending on the length of the power supply cable, the power supply needs to provide sufficient current.

Due to the LMS models, connection diagrams are different for LMS200/LMS291 and LMS220/211/221.

a. For LMS 200 / LMS 291



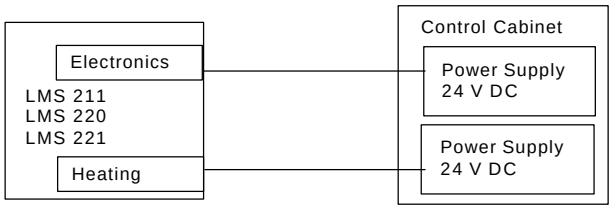


Pin assignment:

Pin No.	Signal designation	Input/ Output	Wire color
1	**GND_EXT (ground)**	**Supply**	**brown**
2	Restart	Input	blue
3	**VCC_EXT (24V DC +- 15%)**	**Supply**	**red**
4	Not connected	-	-
5	OUT C (for field detection)/ weak signal	Output	grey
6	Not connected	-	-
7	Not connected	-	-
8	OUT B (for field detection)	Output	turquoise
9	OUT A (for field detection)	Output	orange

Note: Minimum connections marked in bold
PIN 5 / 8 / 9 cannot be used for data processing purposes with the LMS sensor

b. For LMS 211 / LMS 220 / LMS 221



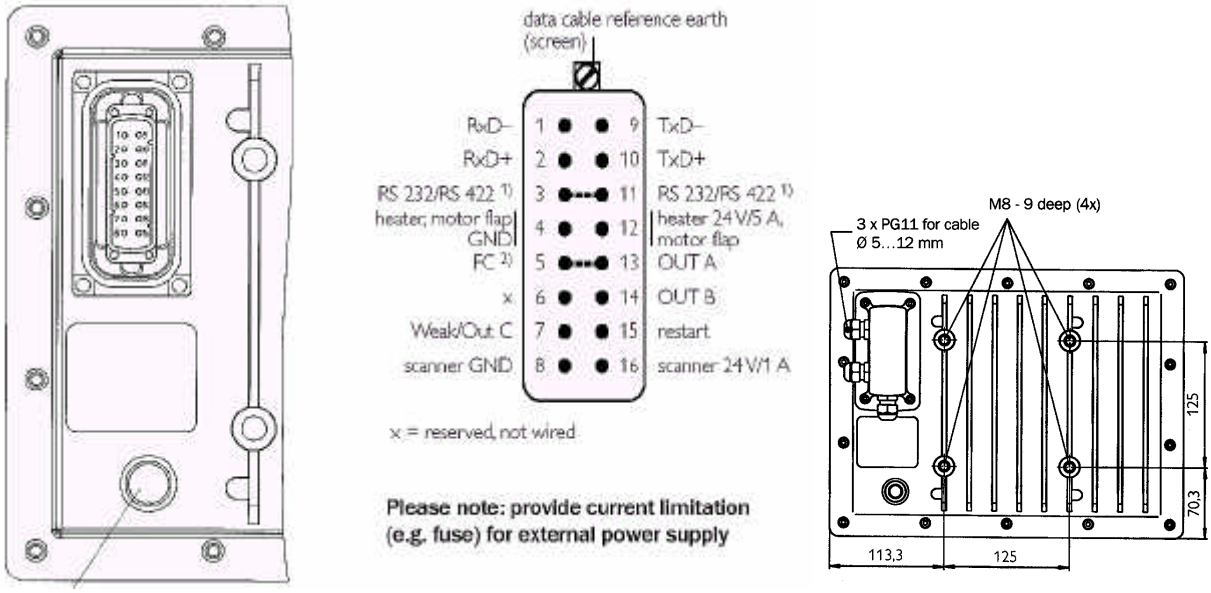


Fig.2: Connections on backplane of LMS211/LMS220/LMS221

Pin assignment:

Pin No.	Signal designation	Input/ Output	Remark
1	RxD-	Interface	
2	RxD+	Interface	
3	RS232/RS422 Jumper 1		With jumper → RS422 Without jumper → RS232 (default)
4	GND_EXT for heating	Supply	
5	Flap control	Input	For flap control details please refer to technical description
6	Not connected	-	
7	OUT C (for field detection)/ weak signal	Output	
8	**GND_EXT for electronics**	**Supply**	
9	TxD-	Interface	
10	TxD+	Interface	
11	RS232/RS422 Jumper 2		
12	VCC_EXT for heating	Supply	
13	OUT A (for field detection)	Output	
14	OUT A (for field detection)	Output	
15	Restart		
16	**VCC_EXT for electronics**	**Supply**	

Note: Minimum connections marked in bold
Use separate cables for connecting the scanner electronics and the heating.

3. Serial interface for data exchange

For data exchange in measuring tasks, the LMS is equipped with a serial RS 232 / RS 422 interface.
By setting a jumper, RS422 or RS232 can be enabled. Default setting is RS232.

a. Connection of the RS 232 interface.

1. For LMS 200 / LMS 291:

Pin assignment:

LMS			**PC**	
Signal designation	**PIN No.**		**PIN No.**	**Signal designation**
Not connected	1		1	NC
RxD	2		2	RxD
TXD	3		3	TXD
Not connected	4		4	Not connected
GND	5		5	GND
Not connected	6		6	Not connected
Not connected	7		7	Not connected
Not connected	8		8	Not connected
Not connected	9		9	Not connected

Note: PINs 2 and 3 are crossed in the cable.
The connector at the PC side is a 9 pin DSub

2. For LMS 211 / LMS 220 / LMS 221

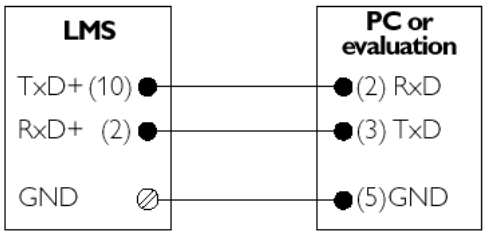


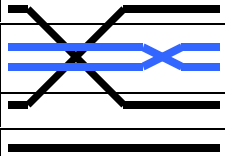
Fig.3: Wiring of the RS232 for LMS211/LMS220/LMS221

Note: The connector at the PC side is a 9 pin DSub

b. Connection of the RS 422 interface

1. For LMS 200 / LMS 291

Pin assignment:

LMS			PC	
Signal designation	**PIN No.**		**PIN No.**	**Signal designation**
RxD-	1		1	RxD-
RxD+	2		2	RxD+
TxD-	3		3	TxD-
TxD+	4		4	TxD+
GND	5		5	GND
Not connected	6		6	Not connected
Jumper 1	7		7	Not connected
Jumper 2	8		8	Not connected
Not connected	9		9	Not connected

Note: As there is no standard for RS422 connector pinning, please check the signal assignments of your RS422 interface card to the respective PINs. Refer to the documentation of your RS422 interface board manufacturer.
In case of deviations, change the cable assignments accordingly.

For selection of the RS422, there needs to be a jumper connection between between PINs 7 and 8 on the LMS side inside the cable connector.
PINs 2 and 3 are crossed in the cable, PINs 1 and 4 are crossed in the cable. It is recommended to use twisted pair cables for RS422 connections.

2. For LMS 211 / LMS 220 / LMS 221

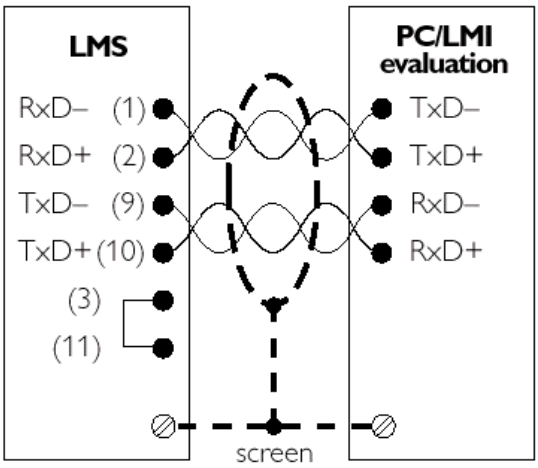


Fig.3: Wiring of the RS232 for LMS211/LMS220/LMS221

Note: For selection of the RS422, there needs to be a jumper connection between between PINs 3 and 11 on the LMS side in the cable connector.
PINs 2 and 3 are crossed in the cable, PINs 1 and 4 are crossed in the cable. It is recommended to use twisted pair cables for RS422 connections.

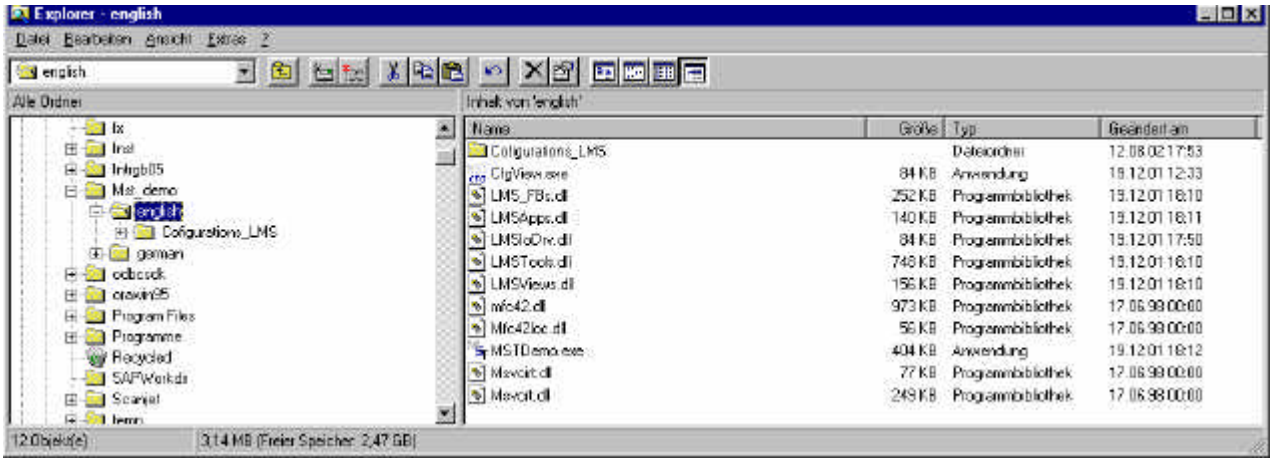
C. Communication via MST Demo

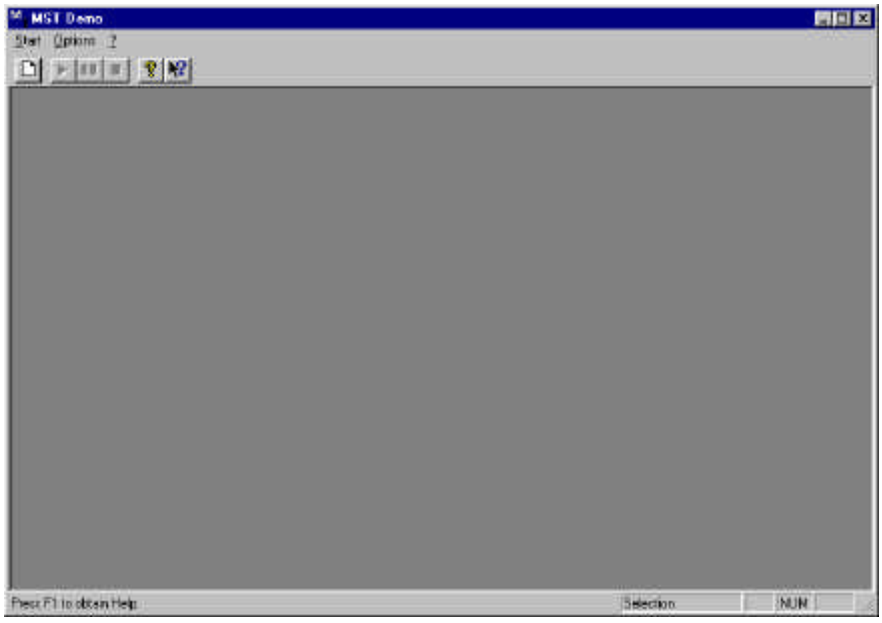
1. Principle of MST-Demo

The MST Demo Tool is made for two main purposes. Primarily it demonstrates what can be done with the software package MST 200 and what functions are available for custom software development. On the other hand it is a tool for **quick and easy recording of scans** for a preliminary data evaluation. The feasibility of the LMS sensor as a data source for a specific application can be evaluated with this tool.

2. Installation of MST

MST is delivered as a ZIP file. Please create a dedicated MST home directory on your harddrive. After unpacking the ZIP file into the home directory, you get the following file structure.





By starting MSTDemo.exe you will get the MST start screen with an active menu (Start | Options).

2. Communication LMS to PC with MST

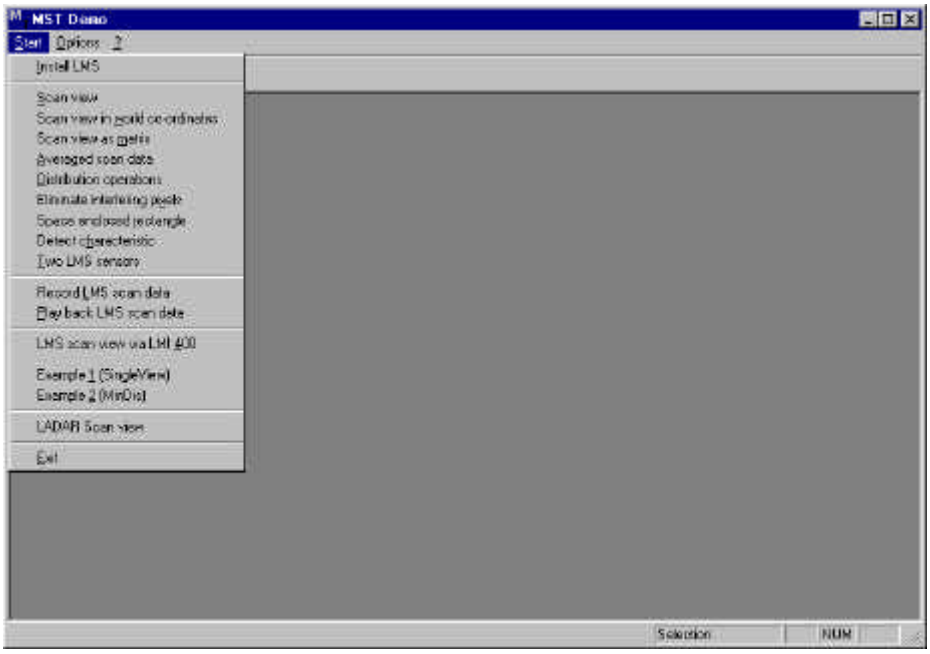
MST Provides a simple data connection. The Hardware connection between PC and LMS is shown in section B3.

Please select **Options** in the start window and set your connection parameters.

Note: Always select 9600Bd . MST will automatically use the highest Baud rate possible when started.

The Software is now ready.

Within the **Start** button you will have several applications which can be started.

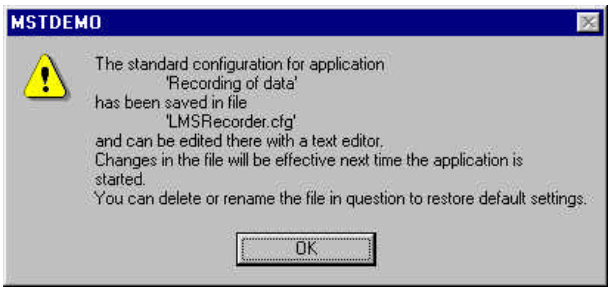


For every application MST_Demo will create a configuration file in the MST home directory. This configuration file is a text file and can be edited with every editor.

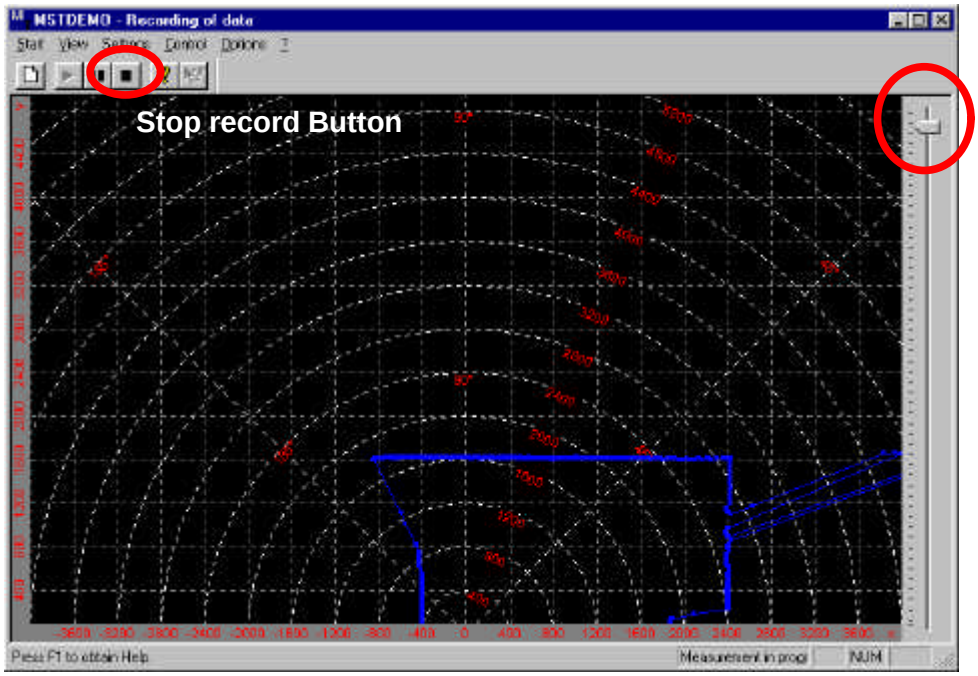
In this quick start manual the application **Record LMS scan data** and **Play back LMS scan data** are discussed. The other applications follow the same idea by principle.

3. Record LMS scan data

The message at the first start of the MST recorder is:



after pressing the **OK** button the scan is displayed and directly stored in the file LMSDATA.dat in the MST home directory (discussed later). The screen should look like this:

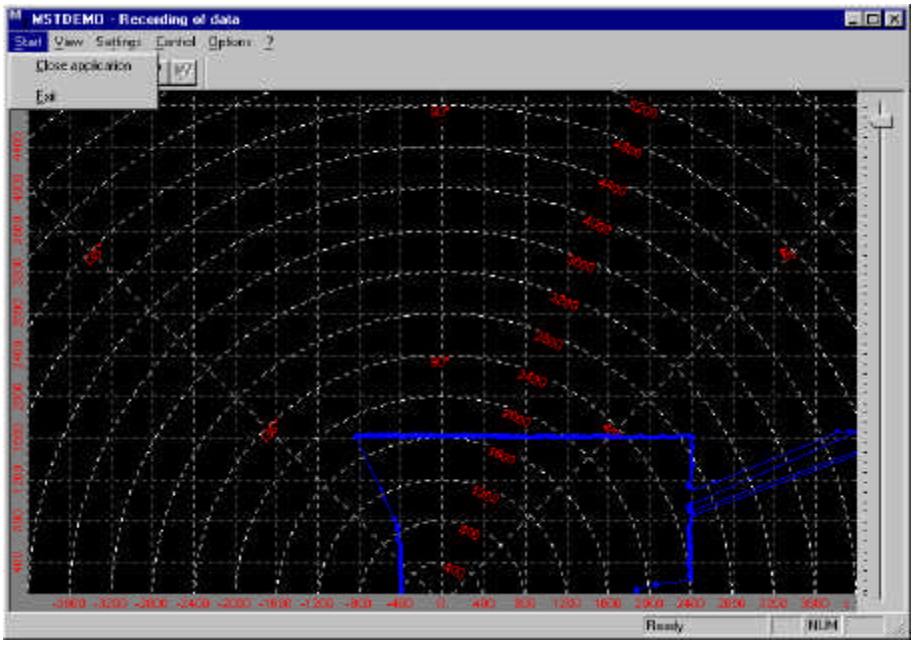


By pressing the stop record button the recording will stop.

Note:

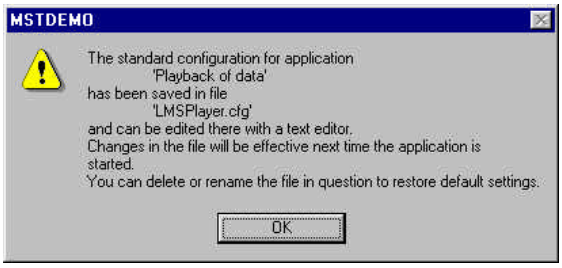
By default the data file is limited to 500 Kbyte.

To re-play the recorded data, close the application in the start button by selecting **Close application**.

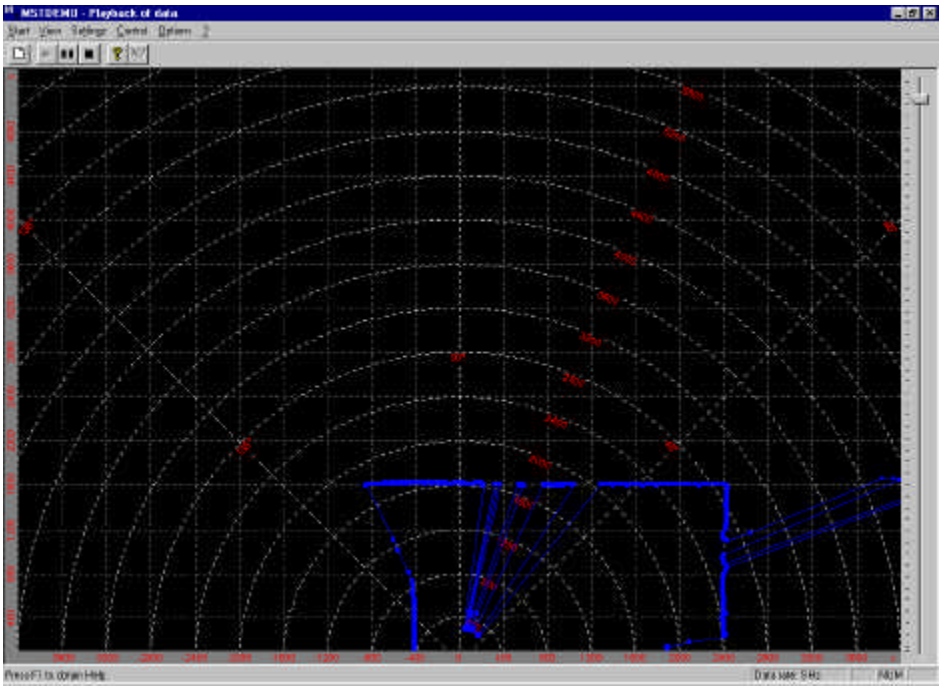


4. Re-play the stored data

By pressing start again and selecting **Play back LMS scan data** the recorded data is displayed. Depending on your computer hardware it is displayed faster than during the actual recording. Remember, if this is the first time you start the player it will create a new configuration file for the player. In this case you will see:



After accepting the next screen looks similar to the following:



The player will show scan after scan in a endless loop. By pressing the quick button **Stop** you stop at the first scan of the recording. In the lower left corner of the display the data rate of the **RECORDING** is indicated.

5. Editing the Configuration file of the recorder

The configuration file can be edited via a standard text editor. To provide an easier configuration change you find possible configurations as pre-sets for the different measurement modes in a separate directory structure under \Configuration_LMS. By copying the required file (LMSRecorder.cfg) into the MST home directory, the new configuration is used by the LMS upon the next start-up of the MST Recorder. The default settings can be restored by deleting the all configuration files (extension .cfg) from the MST home directory.

Default created by the first record task (no LMSRecorder.cfg in the MST home directory):

Default mode		
Angular range	**Angular resolution**	**Measurement range**
0° .. 180°	0,5°	8 m

The \Configuration_LMS directory structure contains the following setup files, which are available to use the LMS in the various measurement modes. Copy the file LMSRecorder.cfg as described.

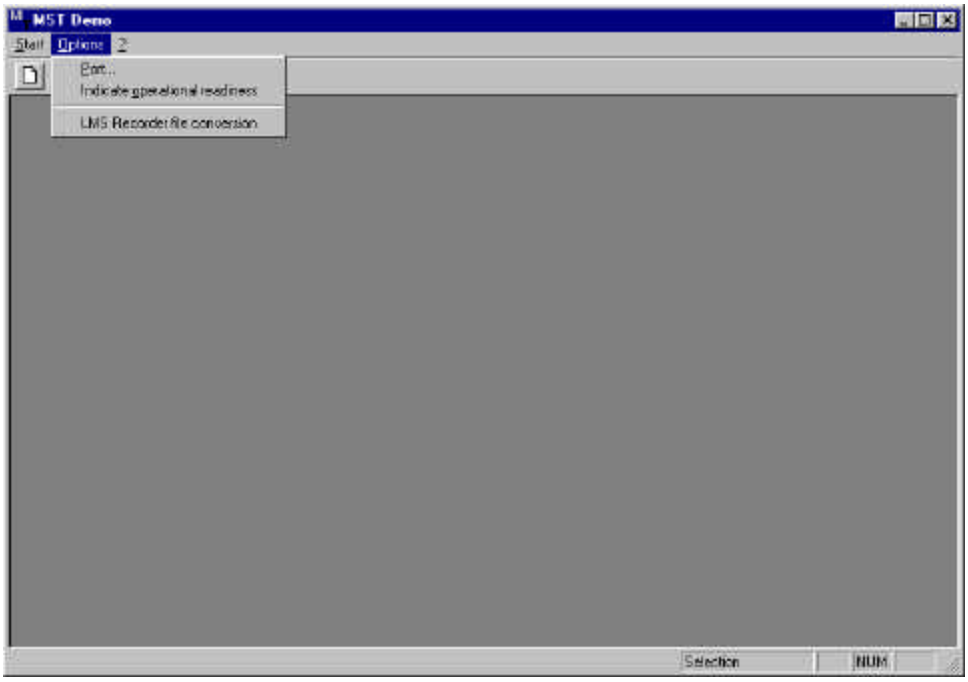
Angular range	**Angular resolution**	**Measurement range**	**Path in directory**
0° .. 180°	1°	8 m	Home directory/LMS_8_M/LMS_100_180
0° .. 180°	0.5°	8 m	Created by default
0° .. 100°	0.25°	8 m	Home directory/LMS_8_M/LMS_025_100
0° .. 180°	0.25°	8 m	Home directory/LMS_8_M/LMS_025_180
0° .. 180°	1°	32 m	Home directory/LMS_32_M/LMS_100_100
0° .. 180°	0.5°	32 m	Home directory/LMS_32_M/LMS_050_100

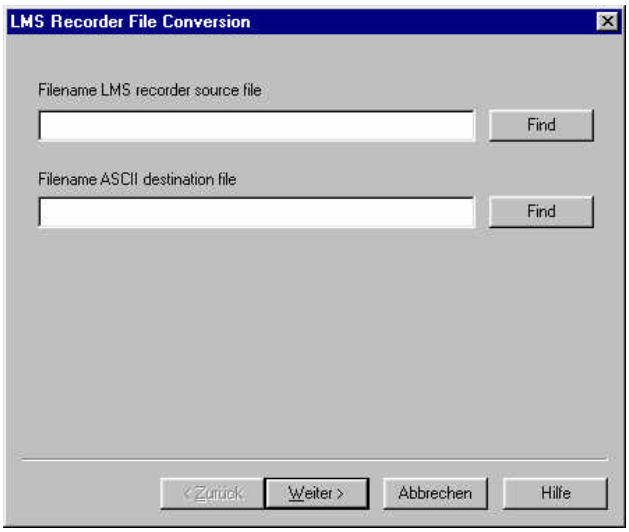
0° .. 100°	0.25°	32 m	Home directory/LMS_32_M/LMS_025_100
0° .. 180°	0.25°	8 m	Home directory/LMS_32_M/LMS_025_180

The configuration 180° with 0,25° leads to a special data output format which will be discussed later.

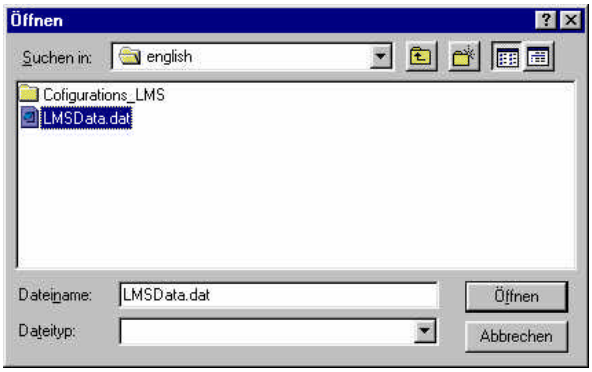
6.Transferring the file LMSData.dat to a LMSData.txt file

By starting the recorder automatically a new file **LMSDATA.dat** is created. This file is only readable by MST Software. To generate a readable text file, MST Demo provides an integrated conversion function. Close all open applications and select the **LMS Recorder file conversion** function in the **Options** menu.

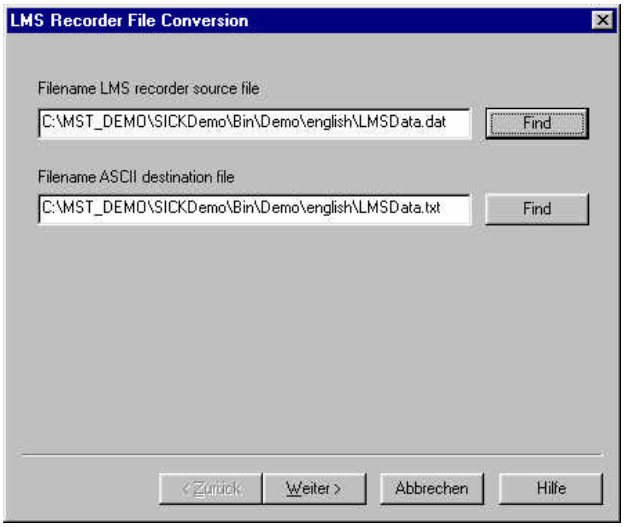




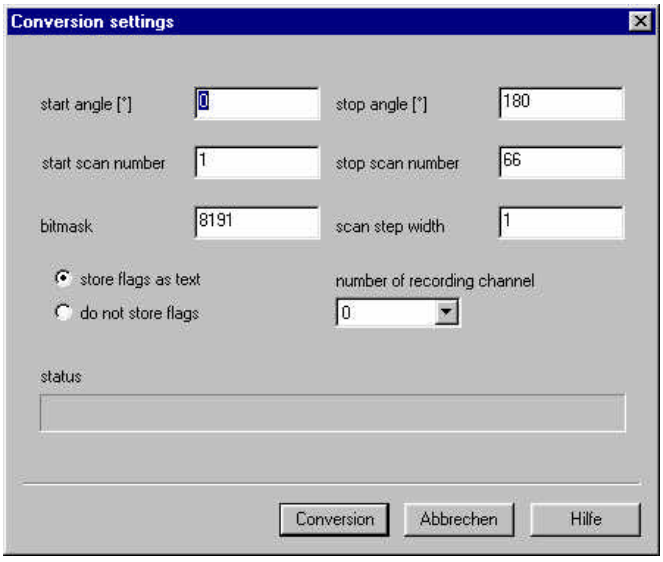
Press the “Find” button and select the **LMSdata.dat** file.



Press the **Open** button and then **continue** (if the displayed path is correct for your conversion file)



The next window shows the parameters for the conversion:



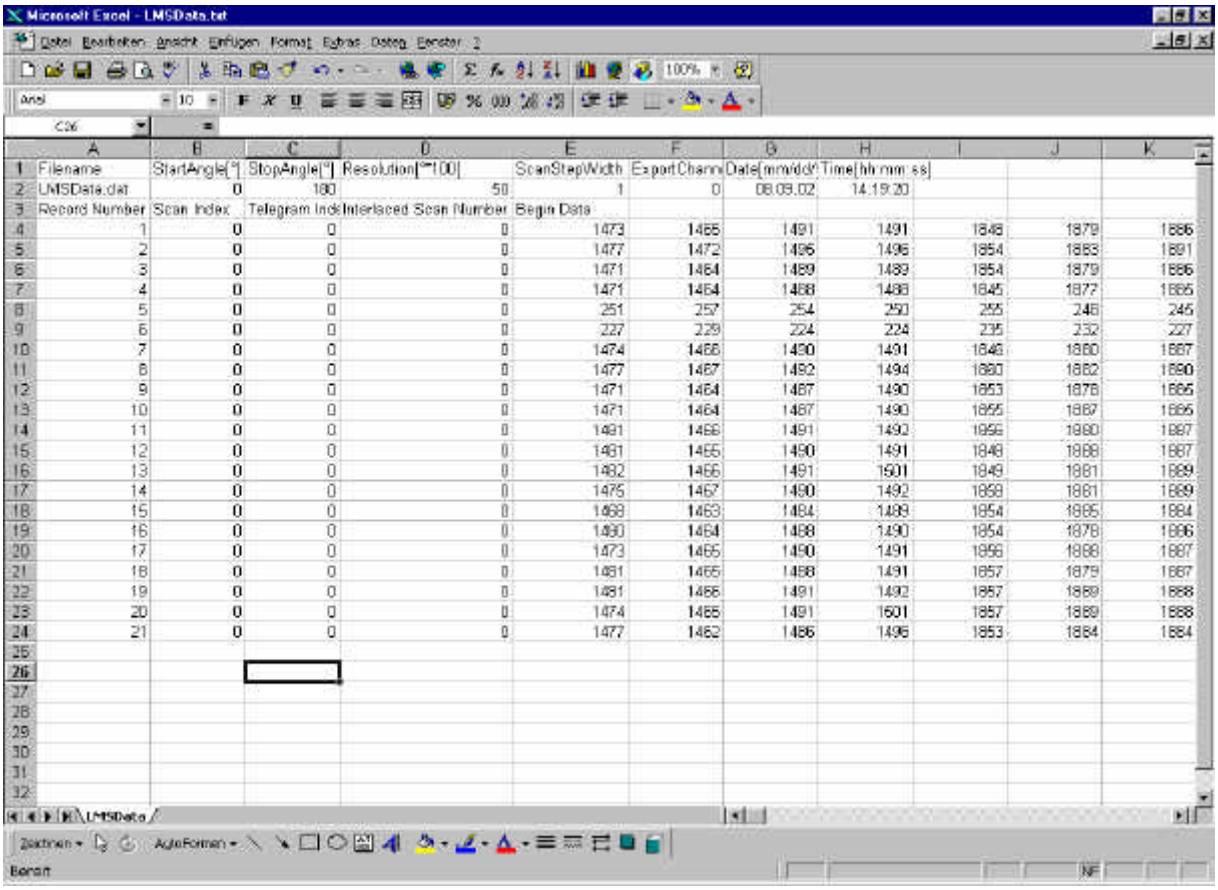
If you use the standard configuration you don’t have to change anything.

Note:
For the 32 m configuration you have to change the item bit mask to 32767

Press conversion to start the conversion process. Now you will find a **LMSdata.txt** in your home directory.

This text file can be read by any editor for text. If you use for example ‘Microsoft EXCEL’ you will get the values in a logical order.

As an example:

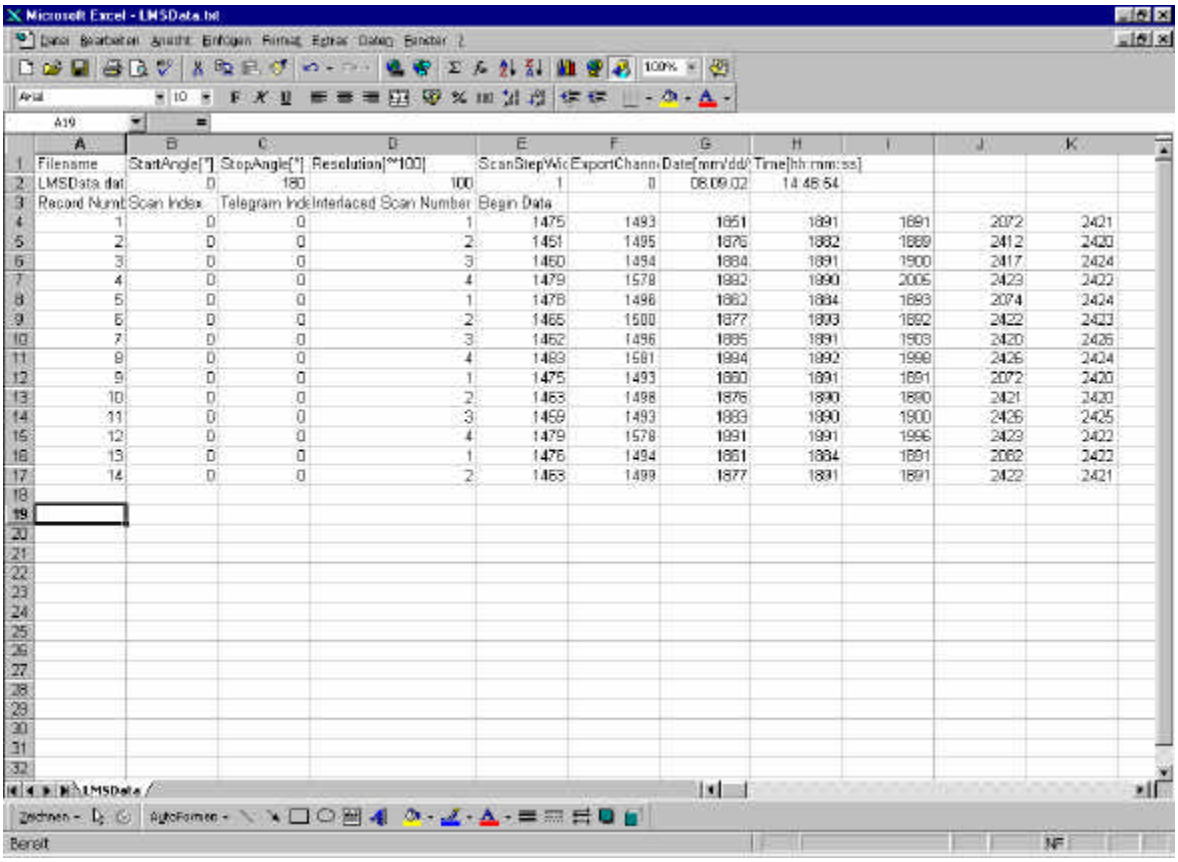


	A	B	C	D	E	F	G	H	I	J	K
1	Filename	StartAngle[°]	StopAngle[°]	Resolution[*100]	ScanStepWidth	ExportChann	Date[mm/dd/	Time[hh:mm:ss]			
2	LMSData.dat	0	180	50	1	0	08.09.02	14:19:20			
3	Record Number	Scan Index	Telegram Ind	Interlaced Scan Number	Begin Data						
4	1	0	0	0	1473	1465	1491	1491	1848	1879	1886
5	2	0	0	0	1477	1472	1496	1496	1854	1883	1891
6	3	0	0	0	1471	1464	1489	1489	1854	1879	1886
7	4	0	0	0	1471	1464	1488	1488	1845	1877	1885
8	5	0	0	0	251	257	254	250	255	246	245
9	6	0	0	0	227	229	224	224	235	232	227
10	7	0	0	0	1474	1466	1490	1491	1848	1880	1887
11	8	0	0	0	1477	1467	1492	1494	1880	1882	1890
12	9	0	0	0	1471	1464	1487	1490	1853	1876	1885
13	10	0	0	0	1471	1464	1487	1490	1855	1887	1886
14	11	0	0	0	1491	1468	1491	1492	1956	1880	1887
15	12	0	0	0	1481	1465	1490	1491	1848	1888	1887
16	13	0	0	0	1482	1466	1491	1501	1849	1881	1889
17	14	0	0	0	1475	1467	1490	1492	1859	1881	1889
18	15	0	0	0	1468	1463	1484	1489	1854	1885	1884
19	16	0	0	0	1480	1464	1488	1490	1854	1878	1886
20	17	0	0	0	1473	1465	1490	1491	1856	1888	1887
21	18	0	0	0	1481	1465	1488	1491	1857	1879	1887
22	19	0	0	0	1481	1466	1491	1492	1857	1889	1888
23	20	0	0	0	1474	1465	1491	1501	1857	1889	1888
24	21	0	0	0	1477	1462	1486	1496	1853	1884	1884

In default setting of 0,5° resolution and 180° angular view you get a similar picture. In the displayed example you find the first distance data point of the 0° shot at cell E4. E5 shows the 0,5° shot . E6 shows the 1° shot and so on. The row 5 shows the next scan. The following table shows the number of distance values you receive per scan.

LMS mode		Number of transferred measurement data values
Angular range	Angular resolution	
0°..100°	1°	101
0°..100°	0.5°	201
0°..180°	1°	181
0°..180°	0.5°	361
0°..180°	0.25°	4 packages of 181

There is one specialty in the data display if you select the mode for 0,25° resolution and 180° angular view. In this mode the scanner is in the so-called interlaced mode. Due to hardware reasons the scanner transfers the data in four separate packages. Every package has an angular shift to the preceding package of 0,25 °. In this case your file looks similar to the following:



The column D in line 4 shows values from 1 to 4. The number ‘1’ in row D indicates there are 181 values following starting with 0°;1°; 2°.....180°. The number ‘2’ in row D indicates there are 180 values following starting with 0,25°; 1,25°; 2,25°.....179,25°. The number ‘3’ in row D indicates there are 180 values following staring with 0,5°;1,5°; 2,5°.....179,5°. And finally the number ‘4’ in row D indicates there are 180 values following starting with 0,75°; 1,75°; 2,75°..... 179,75°. The positive effect is in case of limitations of your editor due to the amount of columns you will only get a maximum of 185 columns per scan.

Note: It is possible that MS Excel does not allow you to open more than 255 columns per file. In this case use the configuration above (0.25°,180°).

D. Appendices:

1. LMS in High-Speed Mode

Warning: Once the LMS baudrate is changed to 500 kBaud, it is **not possible to communicate** with the LMS without the MOXA high-speed serial interface card!

To return to the default baud setting of 9600 baud, it is necessary to restart the LMS (power off/on).

To use the high-speed LMS communication mode, it is necessary to use one of the following special serial communication boards as supplied by SICK:

Item/Specification	**Description**	**SICK order number**
MOXA card for 500 kBaud **(ISA bus (old PC standard))**	2 x RS422, opto-decoupled, high-speed (500 kBaud)	6011807
Quatech card for 500 kBaud **(PCI bus (new PC standard))**	2 x RS 422, high Speed (500kBaud)	6022515
PCMCIA card for 500 kBaud SIO-card RS485-SICK	Order at: CSM GmbH Raiffeisenstrasse 34, 70794 Filderstadt Germany, Tel.: ++49 71177964-0	

Connection to the LMS data interface cable:
Both PC cards have 9 pin connectors to connect a data interface cable.
However different pinnings apply for the MOXA and the Quatech cards!

a. **MOXA card**

The MOXA card provides 2 serial RS422 interfaces for 500 kBaud. The card can be installed in PCs which have a free ISA-bus adaptor.

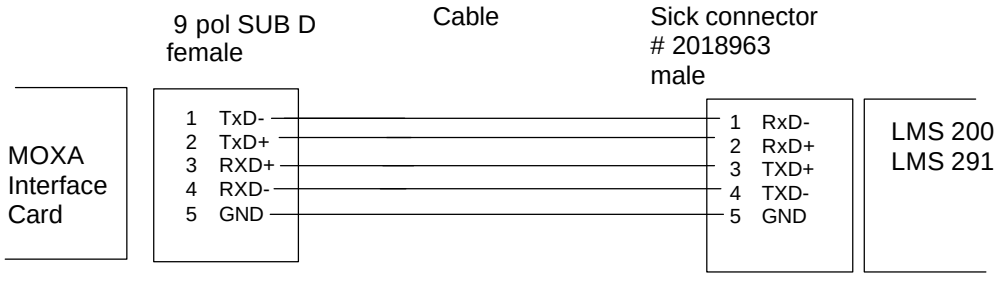


Fig.: Pinning of the data interface MOXA card → LMS

Note: !! PIN 7 and PIN 8 need to bee linked together in SICK Connector!!
! RS 422 can only be used if the pinning fits to the PC side!

b. **Quatech card**

The Quatech card provides two serial RS422 interfaces for 500 kBaud. The card can be installed in PCs which have a free PCI-bus adaptor.

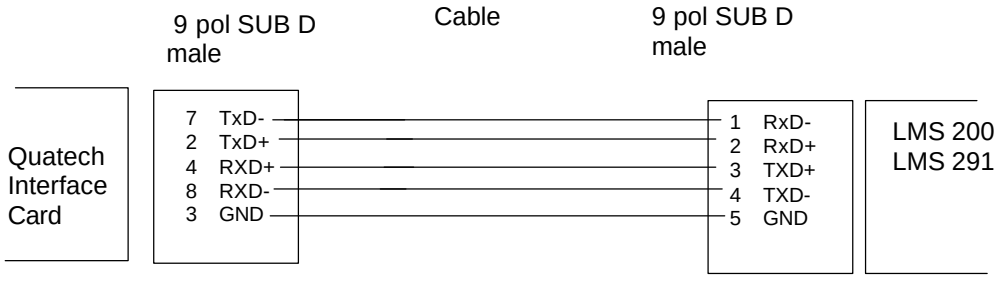


Fig.: Pinning of the data interface Quatech card → LMS200/LMS291

Note: !! PIN 7 and PIN 8 need to bee linked together in SICK Connector!!
! RS 422 can only be used if the pinning fits to the PC side!

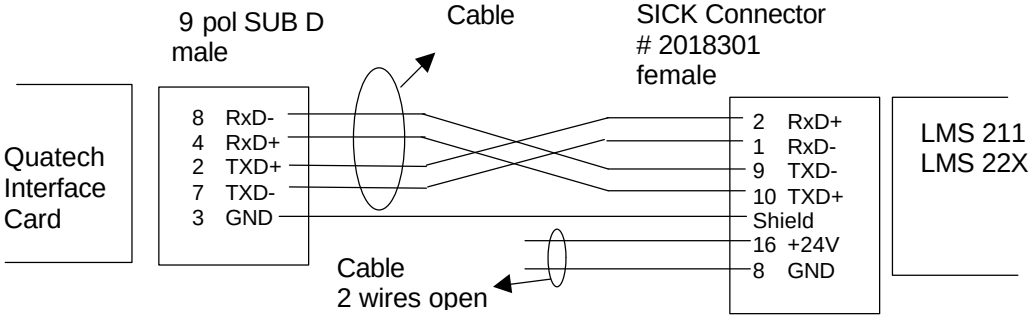


Fig.: Pinning of the data interface Quatech card → LMS211/LMS220/LMS221

Note: !! PIN 3 and PIN 11 need to bee linked together in SICK Connector!!
! RS 422 can only be used if the pinning fits to the PC side!

Note: After setting the LMS baudrate of 500 kBaud, change your PC program to access to the LMS via the MOXA high-speed serial interface card. It is required to use the MOXA card to change the baudrate back to a lower value. Another possible way to reset the LMS back to 9600 baud is power off/on.

The MOXA, Quatech and PCMCIA cards operate with a NON-STANDARD baudrate. When using own software (i.e. setcom() routines in C++) to set the baudrate of these cards, it is not possible to use the standard setting values. To set the target baudrate of 9600,19200, 38400 or 500k, use the respective baudrate values as indicated in the table below.

Target baudrate →		**9600**	**19200**	**38400**	**500k**
Use baudrate value	MOXA and Quatech card	1075	2212	4300	56000
	PCMCIA SIO-RS485-SICK	2150	4301	8602	115000

Note: When using SICK software for LMS (LMSIBS or MST driver) the above values are already implemented.

Benefit of the 500 kBaud communications mode:
The LMS collects measurement data of the defined scan range 75 times per second. In the 180°/0.5° resolution mode, there are 361 measurement values (2 bytes per value plus framing) per scan. (refer to D.2. LMS output format for details)
Due to the large quantity of data generated by the LMS, it is ONLY possible to transfer all acquired data in the 500 kBaud communications mode. In lower speed communications modes, only a subset of the actually acquired data is transferred via the serial interface.

This means, to use the **full capabilities** of the LMS, it is necessary to use the MOXA high-speed serial interface card for PC communication.

2. Further information and documentation

For more detailed information on LMS, the following documents are available from SICK.

- ***Technical Description Laser Measurement Systems***
  SICK order no.: 8 008 970
- ***Telegram listing***
  (only on request)
- ***Technical Description Measurement Software Tool MST 200 for PC Version 2.0***
  SICK order no.: 8 008 464
- ***MST Demo Manual and Software***
  (only on request)

In case of questions or orders, please do not hesitate to contact your local SICK representative.