



## □ Transferring Data via RS-232, USB, Radio, Multiplexer – What Do You Really Need?

*Nowadays, you may use many different types of measuring equipment and measurement systems to record measured values. There are an overwhelming number of providers and types making it really hard for newcomers to choose. This article will provide some transparency.*

There are two groups of measurement systems.

1. Measuring instruments with a software running to fulfil the measuring task. After completing the task, the software stores the measurement and test data in files.  
Example: dimensional metrology
2. Measuring equipment or hardware boxes connected to the computer by cable or via radio. Measured values are transferred directly and the software has to process and store them.  
Example: gauge, outside micrometre, calliper, etc.

In order to transfer the data in the respective file format, you just need a Q-DAS file as an export file and you will be able to evaluate the data in the Q-DAS software. However, there are many options for a direct connection. These options are the main topic of this article.

### ● A Serial Port Is a Must-have, Isn't It?

You often hear people talking about “serial port“ when it comes to the direct connection of measuring equipment. However, this is actually a very old type of interface in the history of computers and you apply it for different purposes. Serial just means that data are recorded consecutively and not simultaneously.



9-pin serial connector

RS-232 is always a term used in this context. Even though there are numerous other serial port, RS-232 is traditionally referred to as the one and only “serial port” since it used to be the only standard interface for computers.

When you purchase new measuring equipment today, it will be very unlikely that it still has a 9-pin connector.

Since most of today's computers do no longer have such a connector, the most common connection is a USB port.



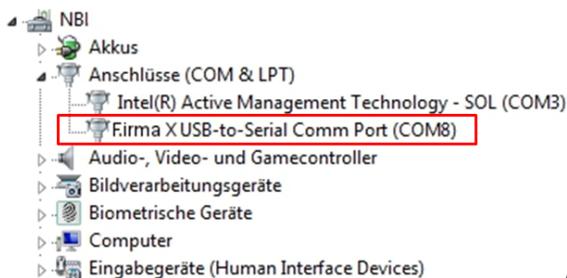
USB connector



RS-232 to USB adapter

Speaking of USB, the term “serial“ is at least part of its name (Universal Serial Bus). Maybe RS-232 and USB are actually quite similar with regard to their mode of transmission... Yes, indeed, they are, since a USB connector simulates a serial port. This simulation is either based on the provided software or on the software of an adapter.

In this case the Windows Device Manager indicates the application of an adapter. It also shows that the USB port simulates a COM8 port since this computer actually does not have a physical COM port.



Adapter indicated in the Windows Device Manager

## How Does the Transfer of Data Work?

Depending on the configuration, the device always transfers five to nine bits of data always by coding a single character. In most cases, the coding is based on ASCII. To put it simply, the device transfers a string including measured values and control characters (such as end of measurement, further characteristic, etc.).

### Example 1

**1.506[0A]**

The measured value amounts to 1.506 and [0A] indicates word wrap, i.e. the end of the measurement in this case.

### Example 2

**+ .000150[20] + .000141[20] + .000010[0D][0A]**

The measuring instrument sends three measured values; all of them are separated by a space character and word wrap.

The transmission technology is RS-232 standard; however, the contents are not standardized. Almost every manufacturer writes a different string. This is the reason why the software receiving the measured values must be able to handle the information properly. The Q-DAS software procella is able to handle the data provided by various manufacturers properly. Find some more information about this topic later in this article.

## Radio Transmission

Wireless data transmission directly from the measuring equipment to the software is very modern and widely applied. Actually, there is not any technical difference between wireless data transmission and the data transfer via USB. Both modes of transmission are integrated into the software, e.g. procella, in the same way. However, please consider to avoid radio transmission problems in the operating environment. Especially processes affected by electromagnetic influences, e.g. when induction furnaces are part of the process, cause these problems. We thus recommend you to test the radio system in the running production process first before you implement it.

## How to Apply Several Measuring Devices at a Test Station

In order to apply several measuring devices, you need an additional hardware device to connect the equipment. This device is referred to as HUB in the IT sector. In case of serial measuring equipment, it is most often called multiplexer box. The number of measuring devices that can be connected depends on the box. Moreover, the number of connections per box is always a power of 2, i.e. there are 2, 4, 8, 16, 32 etc. channels available to connect measuring equipment.

Steinwald DC-HI-NET  
Single Ind-4/8

This example shows eight ports to connect measuring equipment. Ports have different types of plugs so it is important to choose a device matching the plugs of your measuring equipment.

In order to stay flexible, some manufacturers offer a modular concept to combine various connection types.



Pedal

You frequently control the transfer of measured values by pedal. These pedals interact with the multiplexer boxes and the operator has his hands free for performing the measuring task.

There are static and dynamic versions of these multiplexer boxes. The static version takes over the original measured values and passes them. The dynamic version stores the values and is able to provide results, e.g. maximum value, average, etc.



Heidenhain MSE 1000

## Ethernet and RJ-45

Boxes and modular systems etc. offer a high flexibility in connecting various systems. However, there are even manufacturers who do not apply serial interfaces but Ethernet. These boxes are basically quite similar to the boxes including serial interfaces but the cable connecting the computer is different. It is a RJ-45 connector that is also applied to local area networks (LAN). "RJ" means Registered Jack and the number (45) refers to the exact connector type.



RJ-45 connector

You may cascade Ethernet systems individually in case you have to connect several boxes. In addition, you may synchronize these systems on a time scale of  $\mu$ s. This type of interface is often superior to RS-232, especially if these systems even have to perform control tasks in addition to the measuring tasks. Another advantage is that you may replace outdated BUS communication systems by Ethernet equipment, if required.



ADDI-DATA MSX-E3711

## Why Is a COM Connection Better than a Keyboard Signal?

What else can you use to transfer data? There are multiplexer boxes and measuring equipment transferring a measured value as a keyboard signal. At first, this method seems convenient since you do not have to connect the devices of each manufacturer to the software and the hardware is often cheaper: Insert the USB flash drive and there you go. However, you cannot assign the applied measuring equipment to a characteristic since the COM port and the channel number normally define the measuring equipment. A keyboard signal does not provide this information though. You should thus prefer a serial interface when applying several pieces of measuring equipment.

## procella for Recording Data Why Is a COM Connection Better than a Keyboard Signal?

The Q-DAS software supports all serial interfaces and Ethernet devices described in this article. It actually supports a total of 180 different types of measuring equipment and multiplexer boxes.

The IF G interface package of Q-DAS products already includes a high number of measuring equipment. In case you connect multi-channel multiplexers, you need an interface package for procella whereas

O-QIS already provides the IF M software package. IF I/O refers to measurements including hardware communicating with procella and vice versa, i.e. procella sending a signal to the hardware.

Interface packages		Short description	Included in
IF G		Simple hand-held gauges for length measurements with RS-232 data output or gauges with RS-232 interface for different data e.g. hardness testing, scales, force measurement, ...	All Q-DAS software products
IF M		Multiplexers connected to the PC or notebook to take over data from multiple gauges	O-QIS
IF I/O (requires IF M)		Multi-port boxes with connection to external signals or automation systems <i>Installation by Q-DAS required</i>	



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