

## Basic Methods

One can use the following ways for acquiring moisture data, depending on whether a PC is available or not. Refer to the User's Guide and to the PC program **IRMA7Basic** User's Guide for details of each method. Other programs are also available, like **IRMA7Mini**. If more than one meter is connected to a local area network (LAN), all the data acquisition commands will affect all meters and you will need the **Advanced** or **Moisture Profiler** program. If one of the web, extra or head temperature or the expansion module signals is required to be collected as well, that will be done after selection of the proper channels. All data collected will be saved automatically, each channel into its own file whose name depends on time, date and channel. Each file has two headers indicating precisely the starting and ending times, meter serial number and all other important information including a few user accessible text lines.

### A PC is Available (IRMA7Basic program):

- o **The Acquire** operation is started with a button press on the page **Acquire**. One can collect data via the serial port in real-time. Any standard serial port used limits the throughput of data to about 20 samples / second. For faster measurements the use of the meter's Autotimer and memory banks is required. The data collection is stopped explicitly with the same button. Then the collected data is saved into an archive file for future use, either in this program or in any spreadsheet program. The maximum length of the series is 4096 samples. If the series is completed before one stops the collection, the samples are saved into a file and a new acquisition is started. This will continue until stopped and then only the data available is saved. You can use a preset count of samples if you wish to have a limited amount of data. Refer for details to the User's guide for the IRMA7Basic program.

One can do a lot of various things while collecting data with this method, done in the background, manage the archives, use the memory banks or make frequency analysis of the data available. The acquisition actually stops when the Keyboard mode is active (the Keyboard mode page).

This data acquisition method applies the so-called rubberbanding technique which always tends to keep the original calculated timetable for data samples. If any delay is caused between samples due to various things, like a loose cable, the acquisition algorithm fetches more data when available to fill in the sample gap. In this way it will catch the original timetable. If this was not done, the sampling timetable would be totally incorrect after any delay. This method is suitable for general purpose trend displays and for collecting slowly varying data typical in quality control. As all of the history is saved, no slower events can escape.

- o **The Memory Bank Method** functions in such a way that you first start the meter's Autotimer (use the button on the Memory Bank page) and after the preset number of samples have been collected, you press the Stop button. To download the bank data you can press one of the two Download buttons. The autotimer can be started with a hardware trigger pulse as well. If more than one meter is required to be used, they should be wired separately. The Start button command will start all slaves but there will be a slight delay between the slaves due to the separate commands to each slave. You need to have the Advanced program to manage several meters at the same time. The downloaded data is saved like above.

The temperature data is also automatically collected if the two autotimers are linked. To download the T Bank after copying to Bank4 use any of the two buttons for this purpose. The banks are cleared after each macro operation. The number of samples is 4096 points in the **Series** bank and 1024 points in the other banks (**Bank1** -

**Bank4**) and also in the T Bank data. The shortest time interval is 2.5 ms or 0.0025 s. It is recommended to use the **Batch** mode for collection as the autotimer will turn itself off after having the preset number of samples collected. Else, the collection will continue forever, always overwriting the old data from the start. This is the fastest way of collecting moisture samples in the **IRMA-7-D** meters. There is sometimes an indicator light on the meter's panel for the autotimer to help the user know when the collection is active. This can easily be seen on the Memory Banks page too. The temperature series is collected to its own special bank (size 1024 samples) with a rate of 16 samples /s. The older model D meters have only a fixed one second rate. While downloading data, the temperature series is copied to Bank4 and downloaded to PC. Both banks are then cleared. The sampling rate can not be adjusted. The source of the signal can be selected by switching on the Meter Status page the analog output source. It affects both the voltage output and the temperature autotimer source. If the setting is Moisture, then the signal to be used is the web temperature.

This method is most suitable for recording fast moisture transients utilizing the superior speed of the IRMA-7 model D meters.

o **The Frequency Analysis** method works just like the memory bank method. After downloading and saving the data, one performs the frequency analysis (press the button on the Frequency Analysis page) to find out any regular variations (frequencies) in the moisture signals. The spectrum of the signal shows them usually very clearly. Any of the memory banks can be used for this method after downloading the data.

The analysis can also be performed on the data collected via the serial port if the slower and more imprecise sampling interval is accepted. To see both the moisture data and its spectrum on the display, it is wise to set the scaling first. No data is lost, post-scaling is possible. The time interval of the display scale must be correct for an accurate study of the spectrum. One can analyze frequencies up to 200 Hz if the 400 Hz sampling is used in the autotimer. Slower phenomena can be studied with greater accuracy by lengthening the interval. This is a special feature not available presently with any other competitor's meters due to their slowness in sampling and lack of features. This method is most suitable for troubleshooting and fault analysis of paper machine rollers and felts.

o **The Manual** method is performed in the Keyboard mode alone (on the Keyboard mode page). The four-line text display shows both the moisture and temperature values and one can collect data to the memory banks, calculate statistics or just make notes of these values. Unless the banks are used afterwards for archiving the data, no other data saving is available. This method is most useful in field conditions when there is no PC available. Instead, one has a simple ANSI text terminal connected to the serial port. There is no reason to underestimate this method as the meter's internal features are available including help screens (press the **TAB** or the "?" keys) and the Composer expert system. This method is always available in those units which have the optional LCD and keyboard unit. Separate LCD & KBD units are available to be connected to the serial port (like **TEA-K30**). Pressing any key on the panel will force the Keyboard mode to take over and one can then use it without any terminal or a PC.

o **The Burst Method** is based on using the internal Autotimer but the samples are not added to the bank directly. They are accumulated and averaged and the average value is added to the current bank. The idea is to trigger the Autotimer ON when a sheet or some piece enters under the meter and a quick burst of samples is accumulated. Then the resulting average value represents the moisture value of this sheet without any effects from the gaps between the sheets. The time interval is set just like you would be arming the Autotimer. The Burst mode is turned on and the Burst count is set to the number of samples to be taken (1 to 32000) for the average. The resulting moisture value is offered to all interfaces, voltage output, serial port, Profibus DP and the memory bank. In this way you can create a system which shows the latest sheet value without the gaps interfering. This method overrides normal use of the Autotimer and all the interfaces as the value offered stays fixed until the next sheet appears. The Autotimer can be turned ON either with the software or with an external trigger pulse (TTL 5V logic, falling edge sensitive). An optical sensor is recommended for detecting the incoming edge.

#### A PC is not Available:

o **The Datalogger** method is performed in practice by connecting a datalogger unit to the voltage output of the meter. The voltage signal can be either moisture, web temperature, head temperature, extra temperature or the signal from the expansion module. The PC program is only required for selecting the calibration table and possibly the voltage scaling. The default scaling is 10 V / 100 % of moisture or 100 mV / 1 %.. The PC program and the meter can be used for any other purposes while measuring as long as one does not turn the meter into Low Power mode or change the calibration table. The voltage output signal is updated at a rate of 400 Hz independent of the filter used. The signal is filtered in the same way, of course. This method is suitable for an independent procedure for an old automation system if no other field bus or any PC is available. Any commercial datalogger with a voltage input (0..+10 V, 0..+5 V or +/-5 V range) can be used. This method can be used as a supporting method with any other method described here.

o **The Fieldbus** method **Profibus DP** offers a very efficient and standardized bus for factory automation. It can also be used for temporary data acquisition in various ways. The data rate is 12 Mbauds maximum and a great number of meters and other control or data acquisition instruments and controllers can be connected to the same bus to be used simultaneously. Usually, one master unit is controlling the whole system but multimaster operation is possible. The same command set is available as in the serial port.

Visilab has no standard solution to the master software for this bus, however. Each system is built according to special requirements of the customer for the user interface, acquisition speed etc. and also communications with other applications are usually important. Visilab's partners are capable of creating any control systems based on any industry standard buses and protocols or application generator tools. By using the fieldbus, one can either collect data very fast from the meter and one can also start the autotimer and then download the data to the master. This method is most suitable for use in large automation systems. Using this method is not exclusive. **One can use simultaneously any of the other methods.** We can also provide a terminal TEA-K30 for those customers who don't have any PC available for the installation but will need some way for configuring the meter frequently.

#### A Comparison Table for the Methods

Find on the following pages tables for comparing the features of each method described in this Technical Note.

**TABLE 7 - 1 Comparison of various measuring methods for IRMA-7 model D and its derivatives. The methods relying on the IRMA7Basic program.**

method:	max. sampling speed	temporal accuracy small scale	temporal accuracy large scale	trigger for the autotimer
<b>Acquisition</b>	low 5 - 20 Hz	low	superior	-
<b>Memory Bank</b>	fast 0 - 400 Hz	good	good	HW or SW required
<b>Burst mode</b>	fast 0 - 400 Hz	n.a.	n.a.	HW or SW required
<b>Frequency Analysis</b>	fast 0 - 400 Hz	good	good	HW or SW required
<b>Manual</b>	on display: low 1 Hz to banks: fast 0 - 400 Hz	fair good	good good	- HW or SW required
<b>Datalogger</b>	fast 0 - 400 Hz	good	good	-
<b>Fieldbus</b>	real-time: fast 0 - 200 Hz mem. banks: fast 0 - 400 Hz	good good	superior superior	- HW or SW available

method:	amount of data saved	starting of collection	stopping of collection	web T, head T extra T, exp. mod. signal
<b>Acquisition</b>	small to large	button	button	any available as selected
<b>Memory Bank</b>	small	button or HW trigger	automatic in <b>Batch</b> mode	<b>one</b> available as selected if autotimers linked
<b>Burst mode</b>	small to average	button or HW trigger	<b>automatic</b>	available for Vout if selected/autotimers linked
<b>Frequency Analysis</b>	medium	manual or HW trigger	automatic in <b>Batch</b> mode	separate signals from archives
<b>Manual</b>	on display: none to banks: none unless downloaded	- manual or HW trigger	- manual or automatic in Batch mode	one available as selected if autotimers linked
<b>Datalogger</b>	medium to huge	-	-	select one: Moisture, web T, head T, extra T or exp. signal
<b>Fieldbus</b>	real-time: medium mem. banks: medium	SW SW or HW	SW automatic in Batch mode	any available at any rate

**TABLE 7 - 2 Comparison of various measuring methods for IRMA-7 model D and its derivatives. The methods relying on IRMA7Basic program. Simultaneous multiple slave operation requires the Advanced software.**

method:	PC required	multiple slaves supported	saved data format	trend display
<b>Acquisition</b>	yes	yes	archiving & spreadsheet LVM, Active-X, Datalog-files optionally	yes
<b>Memory Bank</b>	yes	yes	archiving & spreadsheet LVM, Active-X, Datalog-files optionally	afterwards
<b>Burst mode</b> (using Acquire)	not necessary yes if Acquire	yes	archiving & spreadsheet LVM, Active-X, Datalog-files	yes
<b>Frequency Analysis</b>	yes	primary slave only	archiving & spreadsheet LVM, Active-X, Datalog-files optionally	yes
<b>Manual</b>	PC or terminal or the LCD&KBD unit	primary slave only	none	latest value only
<b>Datalogger</b>	no	yes if each slave is wired	unknown	unknown
<b>Fieldbus</b>	no	yes	tailored	tailored

Simple HTML reporting available with high-quality graphics.

method:	adjust display scales while running	maximum size of the data series	key/ way to interrupt	on-line filtering of channels
<b>Acquisition</b>	yes	4096 samples	<b>button</b>	Moisture only
<b>Memory Bank</b>	yes	4096 samples	turn off the autotimer	none
<b>Burst mode</b> (using Acquire)	like Acquire	4096 samples	<b>button/configuration</b>	moisture only
<b>Frequency Analysis</b>	yes	4096 samples	turn the autotimer off	none
<b>Manual</b>	-	4096 samples when using memory banks	turn the autotimer off	none
<b>Datalogger</b>	unknown	-	-	-
<b>Fieldbus</b>	tailored	no limits	SW/user	tailored

TABLE 7 - 3 Comparison of various measuring methods for IRMA-7 model D and its derivatives. The methods relying on IRMA7Basic program.

**SIMULTANEOUS USE:**

method:	Acquisition	Memory Bank	Freq. Analysis
Acquisition	-	X	X
Mem. Bank	X	-	X
Freq. Analysis	X	X	-
Manual	-	X	only afterwards
Datalogger	X	X	X
Fieldbus	X	X	X
Burst mode	X		nonsense

method:	Manual	Datalogger	Fieldbus	Burst mode
Acquisition	-	X	X	
Memory Bank	X	X	X	
Frequency Analysis	-	X	X	
Manual	-	X	X	
Datalogger	X	-	X	
Fieldbus	X	X	-	
Burst mode		X	X	-

**LEGEND:**

**X = ALLOWED**

**- = NOT POSSIBLE OR IDEM**

**EMPTY = NOT ALLOWED**

Note that the **Advanced** program has a great number of useful tools and analysis methods not mentioned here and not to be found in the **IRMA7Basic** software. Note also that the Burst mode is a special operating mode and overrides or affects many other uses of the sensor. The **Moisture Profiler** program is a lean version of Advanced but has some scanner-specific features, available only in this program.