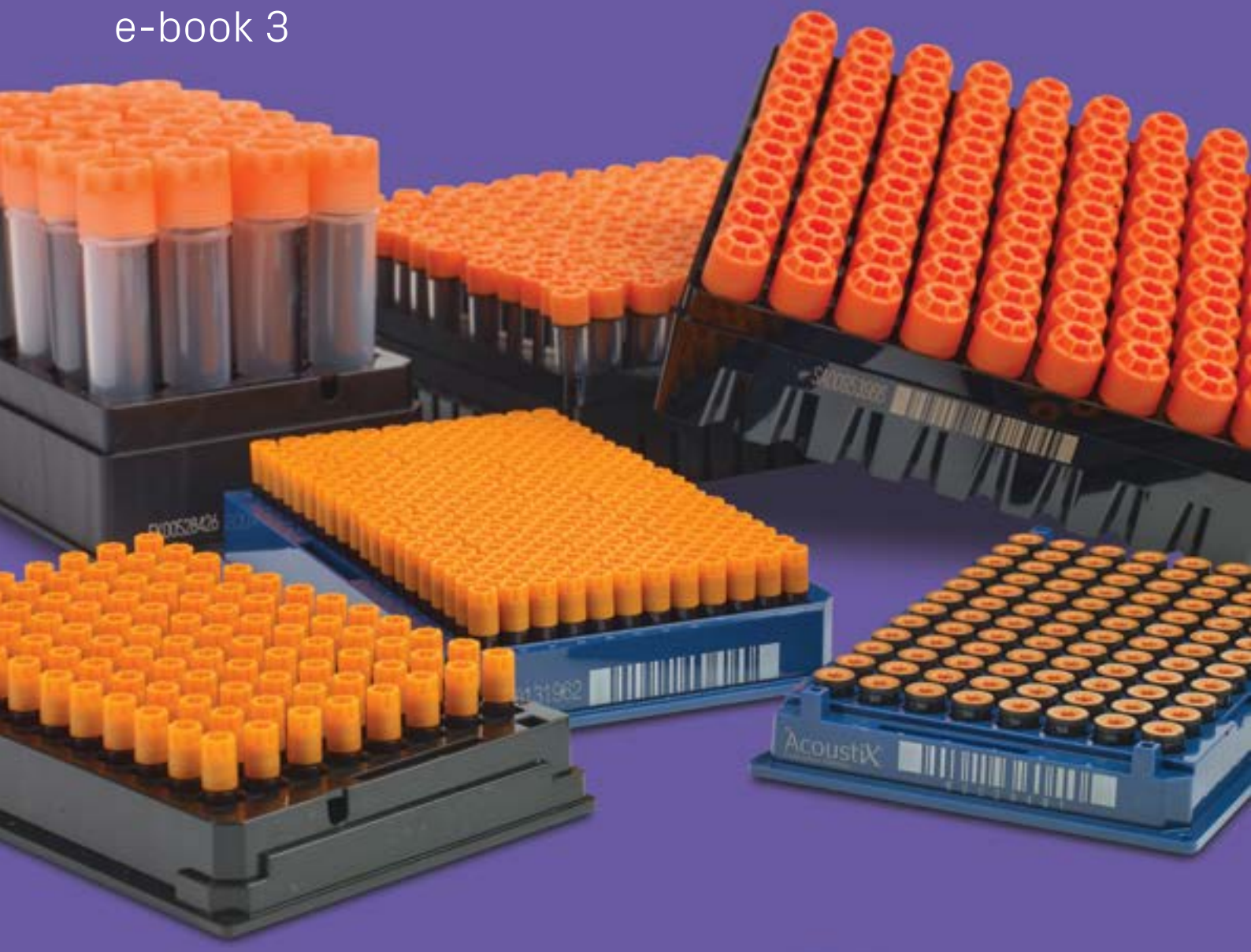


Sample Management

Getting the most from 2D coded tubes in the laboratory

e-book 3



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1 Common 2D code reading problems (and how to prevent them)

While 2D codes offer excellent all-round performance, from time to time scanning issues do happen. Here we highlight some of the most commonly encountered scanning issues – and how to avoid them.

At Azenta, we think two-dimensional codes are pretty neat! Not only can they store more data than linear barcodes, but because they're located at the bottom of the tube, they can be quickly read without taking samples out of the rack. Their 2D design also means they're inherently more resistant to reading problems. But while they offer excellent all-round performance, from time to time reading issues do happen. Here we highlight some of the most commonly encountered scanning issues – and how to avoid them.



1.1 Poor 2D code contrast

Whether we're talking about bar service or code reading, to get the results you want quickly it's a good idea to stand out from the crowd. White on black (or black on white) gives the optimal colour contrast for 2D codes, and it's a combination that is in common use. However, we have seen some pretty unusual variations! Light grey on dark grey, grey on silver, or even black codes printed directly onto a clear tube with no contrasting background at all – these combinations aren't as effective at achieving a quick and easy scan. Although the algorithms we use in our software will help in these situations, if you are about to purchase some 2D-coded tubes it is worth checking that your scanner can read them!

“If you are about to purchase 2D-coded tubes, it's worth checking that your scanner can read them”



1.2 2D codes covered in ice

When you take a sample straight out of a minus 80 °C freezer, there is a good chance that it's going to be covered in a fair amount of ice. This can often obstruct the 2D code and prevent it from scanning properly. But rather than changing your tubes to a costly alternative there's a simple solution, which we highlight on the next page. To remove the ice, just use our cheap 'sponge and alcohol' technique – it works really well!

Another common problem is “fogging” of the scanner glass as condensation forms on the glass which has been cooled by the application of cold racks straight from the freezer. The best way to overcome this is to use glass with a proprietary coating that stops the fogging from occurring. Azenta offers such “cryoprotection” on all Ziath scanners as an option. The advantage of a coating is that unlike physical methods, such as blowing air over the surface, it will not heat up and potentially damage, delicate thermally-sensitive samples. In this image the scanner on the left has cryoprotection, whereas that on the right uses standard glass. The cold rack has caused a layer of condensate to form across the surface of the untreated glass.



1.2 2D codes covered in ice (*continued*)

2D code readers are all optical devices – they need to be able to ‘see’ the codes on the bottom of the tubes, otherwise they won’t work.

Any ice sitting on the bottom of your tubes is therefore going to be a problem. However, the ‘ice problem’ is simple to resolve with this cheap and easy to implement method, using some simple items that you will probably find in your laboratory – a small plastic storage box, some sponges and a bottle of alcohol.

Put a sponge into the bottom of the storage box and then add alcohol. You don’t want the sponge to be swimming in alcohol, but you do need it to be saturated.

Then take your rack and push it into the sponge; you need to get the alcohol soaking the bottom of all the tubes.

Then remove the rack from the storage box and gently tap it onto another dry sponge. This is to remove any excess alcohol from the rack as you don’t want it to drip onto your scanner.

Check that there are no ice crystals remaining on the bottom of your rack and then you can put it onto your scanner. This technique will allow you to scan your racks quickly and efficiently.



1.3 Tubes placed in incompatible racks

Laboratory 2D-coded sample tubes come in all sorts of shapes and sizes – with more models entering the market every month. However, this can be a problem if the manufacturer does not provide a suitable rack for the tubes. If tubes are placed in racks that aren't designed to hold them, codes can be obscured or held too high up in the rack. So if you are experimenting with a range of tubes from one manufacturer and racks from another, just check that the rack holes are wide enough for the scanner to read the whole of the barcode and that the barcode is not too far from the scanning window.

“Check that the rack holes are wide enough for the reader to read the whole of the code”



1.4 Wrong 2D code type

Historically, all 2D rack code scanners were designed to read DataMatrix codes. However, some manufacturers used to apply QR codes on their tubes, which cannot be read by these scanners. Whilst these barcodes may look similar, it's important to recognise the subtle differences. Unlike DataMatrix codes, QR codes are usually larger and contain three distinct squares in the corners (check out our handy spotter's guide below).

2D DataMatrix code



QR code



1.5 2D code printed too close to tube edge

Sometimes we all need a bit of space to work effectively, and this is certainly true of barcodes. In order to scan properly, all barcodes (be they linear or 2D DataMatrix codes) require a small amount of surrounding blank space so that the scanner knows where the code begins and ends. This 'quiet zone' also ensures scanners don't mistake text or other markings on the tube or label for information. For DataMatrix codes, this white space should be at least the size of two 'modules' (the black and white pixels that make up the 2D grid). Codes that are printed too near the edge of the tube can impinge on this white space, and just like putting too many eggs in a basket, the results aren't pretty.

Despite the impressively reliable performance of 2D codes, reading issues can and do happen. Thankfully, through good laboratory practice, the use of appropriate equipment and consumables, and the occasional crafty trick, these challenges can be overcome.



2 Choose your perfect 2D code reader

If you are thinking of, or have already adopted, sample management using 2D coded tubes how do you choose the best reader for your application? With many different reader models available it can be hard to pick the right one. And not all readers are compatible with all tube formats.

Firstly it is a question of which reader fits best into your daily workflow and secondly it will be largely determined by the rack format you want to use. There are two basic rack formats: So-called “SBS” format – actually correctly called SLAS/ANSI format – and secondly, Cryoboxes. This latter actually encompasses several similar but slightly different rack formats. Within these formats there are a choice of tube densities. In the Cryobox rack you can place 81, 100 or 196 tubes depending on the tube volume and cap type. In the SBS format, racks start with 24 large tubes and progress through 48, 96, 138, 240 to 384 very small sample tubes. Even in these denser formats each tube carries a unique 2D code laser etched onto the base for easy identification.

Cryoboxes

For cryogenic storage, the choice of Cryobox is important as it will need to fit the freezer(s) in use. There will likely be a size of Cryobox that makes optimal use of the shelf space or racking and is still compatible with your typical sample size. The most common cryotube sizes tend to be 2ml and 5ml. The 5ml tubes are therefore held in significantly higher boxes and you will get less boxes into any given freezer compared to the 2ml version. The tube type is also a factor here. There are two basic types – internally-threaded and externally-threaded. The external threads keep your sample away from the screw thread opening part of the tube, which is good for reducing cross-contamination, but the caps are wider than internally threaded versions. So you can fit less of the external threaded ones into a standard Cryobox – usually 81, whereas the same footprint Cryobox could accept 100 internally-threaded tubes.



2 Choose your perfect 2D code reader (*continued*)

It is important to remember also that not all available readers can read a whole Cryobox. Azenta offers the Ziath Cube reader for these and it can accept all the currently-available Cryoboxes on the market. This is achieved by using interchangeable rigid plastic templates, known as masks, which clip over the glass platen of the reader. Masks are available for 9 x 9 tubes, 10 x10 and three different 14 x 14 rack types that all differ slightly in their overall dimensions. The Ziath Cube comes pre-loaded with software templates for all these formats so that the instrument knows exactly where each tube code should be. With powerful AI-driven empty well detection, the Cube can easily distinguish between a tube covered in ice, for example, and a vacant space in the rack. Cryoboxes are designed for long-term cold storage and do not easily lend themselves to automated workflows without custom automation.

SBS Racks

Because SBS racks are made in the internationally-recognised SLAS/ANSI (SBS) format, there are many more options for full-scale laboratory automation using this format. There are several instruments from Azenta for reading this type of tube rack. Ziath offers the Express



reader, which has the smallest footprint of any available SBS rack reader, for situations where it is desirable to integrate the reader directly onto the deck of a liquid-handling robot or where space is at a premium. Integration drivers are also readily available for the whole Ziath range. With a planform just a little longer than the SBS format, the Express reader should be the choice for integration with other machines or where bench space is tight. With four cameras, the Express offers excellent resolution too and can easily decode a full rack of 384 tubes.

2 Choose your perfect 2D code reader (*continued*)

If space is not so critical, or the unit will mostly be used in standalone mode, then the budget-conscious lab professional may wish to look closely at the Ziath Mirage range from Azenta.

The Mirage is an SBS format reader that offers an economical price with great features and performance.

With a single camera combined with Ziath's patented 45 degree mirror system, the Mirage combines a low height on the bench, making it stable and comfortable to use, with excellent optical performance that can read

all SBS formats except 384. As with the Cube and Express readers,

Ziath's proprietary Cryoprotection passive anti-fogging system is available on the Mirage too. Cryoprotection should always be specified where samples are likely to come straight from cold storage, be that, -18C, -80C or even vapour-phase LN2 at -195C. The Cryoprotection coating prevents water condensing on the underside of the cold glass and causing misting which impairs reading. The passive system uses no heat so will not damage precious samples.



A new addition to the range is the RiTrack Mirage. This revolution in sample management uses RFID tags embedded in the SBS racks to store the tube ID and position for every tube in the rack. This means that a rack from cold storage can still be read even if it is heavily iced-up, as the RiTrack chip will still contain all the data from the last scan on the Mirage. RiTrack tags are available separately and will fit into most commercially-available 2D tube racks in the SBS format, freeing scientists to choose their own labware.

Single Tubes

Depending on how samples are received and treated in the workflow, it may be a good idea to have one or two Single-Tube Readers available in addition to a whole rack reader. These are simple plug-and-play devices which allow a single 2D code to be read quickly and easily, the result is then sent directly to any open application (e.g. Excel file, web page, LIMs) on the PC desktop using Microsoft "Keyboard Wedge" technology. The Ziath Uno does just that, while the Ziath Duo also offers a laser scanner for the 1D barcodes that are often found on the edge of each rack.

2 Choose your perfect 2D code reader (*continued*)

Probably Ziath's most powerful reader is actually our Handheld device, now in its third generation. This harnesses the power of an Android phone and combines it with a custom optics pack housed in a rugged shell and packed with intuitive modern software to read tube codes, review or edit the tube contents and use pre-loaded "pick lists" to check off individual tubes as they are retrieved from the freezer.



Further Possibilities

Once you have read the tube IDs, it is worth considering what you are going to do with that data. All Ziath DP5 readers can export the data in nine different formats, so it is easy to import it into your LIMS system. Alternatively, FreezerPro from Azenta offers a direct integration driver to the full Ziath reader range. This will enable you to keep track of your stored samples more easily. Graphical representations are used throughout FreezerPro to show types of sample and physical locations and the data is fully searchable by custom search terms you can enter yourself.

The Cube, Express and Mirage also connect seamlessly to Ziath's semi-automatic tube picker, the Mohawk. This enables a pick list to be sent to the Mohawk and the tubes will then be popped up from their rack. They can be withdrawn by hand and placed in a destination rack which, in turn, can then be read by the connected reader. A report showing where each tube was located first and where it is now is then generated. Very useful for keeping track of your samples!

As you can see there are various ways to get the sample ID information from the tubes into your laboratory workflow. If you would like a free consultation on the best way for your lab or a demo, why not contact us [here](#)?



<https://www.azenta.com/contact-us>

3 Push caps or screw caps? Five things to consider

One of the most important things you need to assess is how often you are likely to want to access the sample. Push on caps and septum caps are easy to apply, but they can be more difficult to remove. Azenta supply quality instruments such as IntelliXcap SP that are specifically designed to apply and remove septum cap mats and these are compatible with standard laboratory automation. Manual septum and push cap removal devices are also available from Azenta and other manufacturers, but a quality device is recommended to control any potential cross contamination issues.



Rather than remove a push cap, it is also possible to pierce them with a needle to extract liquid samples from the tube. These are so-called ‘septum caps’. These can be very convenient to use and Azenta supplies a range of septum cap mats in TPE which may be easily pierced and do not exhibit “coring” that can block the needle. Cheaper cap mats may not offer this and there are some other potential issues to bear in mind, such as how to prevent the whole tube and cap being taken with the needle as it is removed (you

will need a method to hold down the tube) and using a needle that won’t push the cap into the tube or pull it out as it exits. Also, don’t under-estimate the possibility of creating a small vacuum within the tube when withdrawing sample – you may find that the amount transferred may not be as large as you thought it was.

There are a number of instruments available from Azenta that will reliably remove and replace screw caps. The IntelliXcap™ Automated Screw Cap Decapper/Recapper 96-format can remove and replace all 96 caps in one operation, with options for Azenta Acoustic and extended height tubes. It is also available in 24- and 48-tube format. By contrast, the Single Channel Semi-Automated Screw Cap Decapper/Recapper will remove one row or one column of caps at a time. For handheld use, Azenta offers the IntelliXcap™ Semi-Automated Handheld Screw Cap Decapper which removes one column of 8 caps in each operation.

3 Push caps or screw caps? Five things to consider (*continued*)

Take account of the temperature at which you plan to store your valuable samples. Push caps don't perform well below -20°C , because of the material they are made from and if you are going below -80°C , they are certainly not suitable. Screw caps on the other hand are eminently suitable for deep cold storage down to vapour phase LN2 levels.

As indicated above, from a financial point of view, push caps are economical choice. They can also be applied easily and will form a good seal at normal laboratory and standard refrigerator temperatures. Screw caps are more expensive and are more difficult to manually place onto the tube, but they will form a reliable seal that can work down to liquid nitrogen temperatures and are much better suited to automation.



4 How to get the best out of your Ziath reader

Most users of Ziath scanners find the setup of their scanner simple and easy and don't need our help to get it working (though if you ever get stuck get in touch please; we're only an email/phone call/carrier pigeon away!). You should find that our scanners are easy to get up and running but did you know that there are several cool options you can use to customise your scanner's behavior? Here we list some of the less well known features.

Automatic File Export



If you only learn one thing from this e-book, then make it this one! On the menu above you can see the automatic export option, on this select 'if no read errors occur'. This means that when a successful read (all wells read or empty) is complete the results file will be saved. The more astute amongst you will note the "if no read errors" bit and ask why? The reason for this is that the majority of read errors are due to ice build-up on the bottom of the tube and a quick clean will remove this. You don't want to clutter up your results with these files as you will have to scan again after you have cleaned the rack.

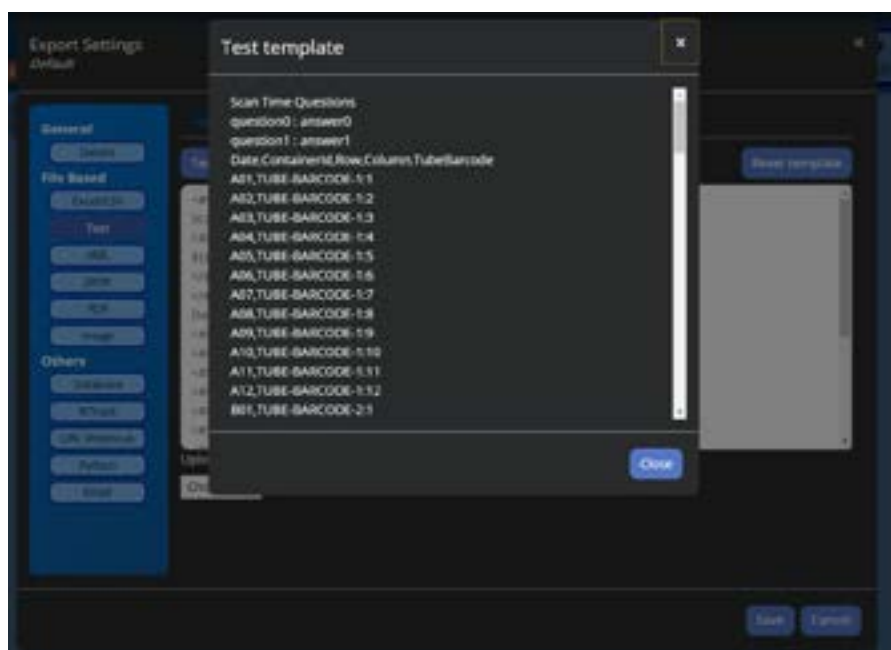
4 How to get the best out of your Ziath reader (*continued*)

Open file after Saving

This feature was added as a response to customer feedback and has proved very popular and useful. Basically, it means that if you have automatic file saving activated and this option set to 'on', then the file will open in the computer's default program for the results file. So, if you have Excel files automatically saved and this box ticked, then right after scanning the Excel file will be opened- allowing you to view/edit the barcodes straight away. If you've got an Excel macro to add data and then upload scanned data to your database this is a great way to do it.

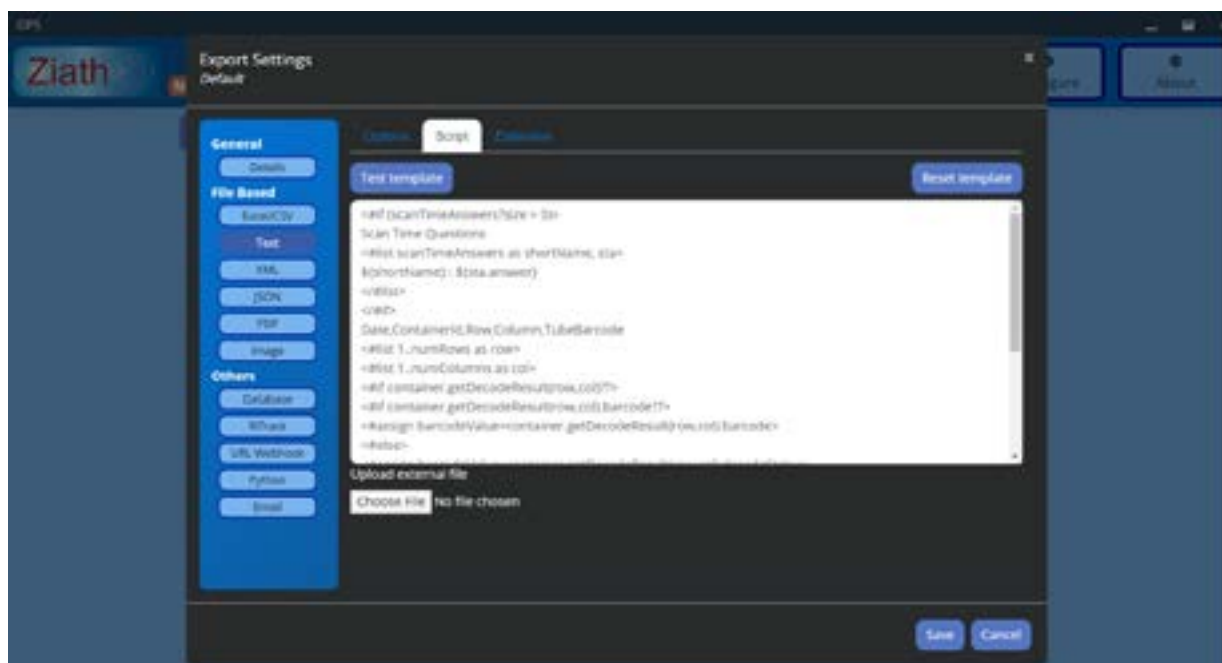
Text File Format

In the case where you want to customise the output of your scan results to fit in with your LIMS system or robot control software; this option will allow you to change the export format. The current output looks like this:

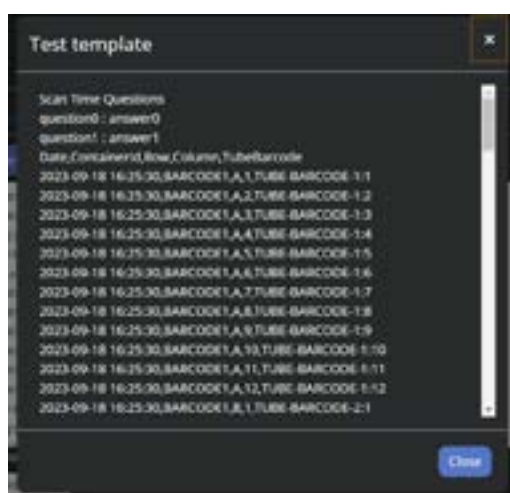


4 How to get the best out of your Ziath reader (continued)

However, suppose you need to have 'MY EXPORT DATA' on the top line and BARCODE="" around every code, you can easily do this as shown below:



Now the results look like this:



Many of our customers have made great use of this feature, which has made everybody's life easier!

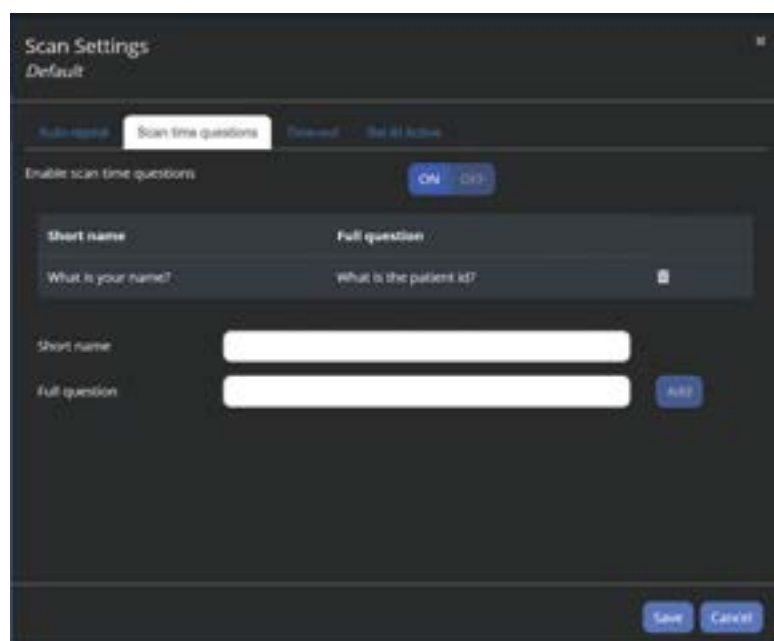
4 How to get the best out of your Ziath reader (*continued*)

Activator

This is another feature suggested by a Ziath user and is something we should have talked about a bit more because it is cool! For this to work you need the Ziath Linear barcode scanner attached; you can then configure this option so that when a rack with a linear barcode is dropped on the scanner it will automatically detect the barcode and scan the rack. So, if you've got freezer or contaminated gloves on; you don't need to touch the keyboard or fiddle with a button – just drop the rack on the scanner. This works with all our whole rack scanners and makes scanning so much easier!

Scan Time Questions

This option allows you to ask the user or operator a question before a scan happens and the result is then recorded in the output file. Thus, in the above example; when you click scan the following dialog box appears:



You can enter these details and they are exported with the scan result data. This gives you a quick and easy way to attach data to a scan result without needing a complex LIMS system.

There are many more features available but not listed above such as a scan alarm, direct DB export and time out settings. All of these are detailed in the DP5 Users Guide which comes with each instrument, however that is what we are here

for; if there is something you want to do that your Ziath reader cannot do please ask. If the feature doesn't already exist, then we can consider it for inclusion in future versions; as illustrated above.

5 Summary

We hope you have found this third Ziath e-book illuminating and useful. If you would like to see more useful hints and tips, you can check out our Blog posts at www.ziath.com or sign up for our regular but infrequent newsletters also on the site.



6 About Ziath

Ziath, from Azenta Life Sciences, is a leading provider of 2D code readers, software, tubes, and tube devices for efficient sample management. Our robust and innovative solutions help to prevent sample management issues from occurring, giving you confidence that your important sample information is accurately recorded and securely stored.

Get in touch with our team today to see how we can develop a customisable sample management system tailored to your laboratory's needs.

www.azenta.com



Take the stress out of managing your samples. Leave it to us

Ziath's robust and reliable products are designed to integrate into existing workflows and are primed for automation. We pride ourselves on providing high-level technical support to ensure that our customers' sample tracking processes run smoothly and efficiently. Our commitment to the development of innovative products allows us to provide a truly bespoke experience for each customer. We can provide scanners to read every available rack and box format on the market with speed and accuracy.

Detailed information and technical specifications on all of our products are contained within our product data sheets and our e-Books provide useful hints and tips relating to sample tracking and information management for life science. Please visit our website at www.ziath.com to download your copies.



DP5 CUBE
2D barcode reader
for all racks and boxes



DP5 EXPRESS
Small, automation-friendly 2D
barcode reader



DATAPAQ™ EXPRESS
NMR RACK READER
2D barcoded NMR reader



DP5 MIRAGE
Economical 2D barcode camera
rack reader



RiTrack MIRAGE
Locate tubes with RFID
even if covered in ice



UNO AND DUO
Single tube readers



ZIATH HANDHELD
Handheld 2D
barcode reader



ZIATH CYCLOPS
1D rack
barcode scanner



MOHAWK
Semi-automated
tube picker



FreezerPro®
Sample Management
System



e-book 1
Sample management
tips and tricks