DAQSTATION DX100P/DX200P COMPLIANT WITH 21 CFR PART 11

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We have developed DAQSTATION DX100P/DX200P paperless recorders for pharmaceutical (DX-P) and dedicated software DAQSIGNIN complying with the requirements of 21 CFR Part 11 which is the regulation for electronic records and electronic signatures set by the Food and Drug Administration (FDA) in the USA. With the enhancement in security and audit trails, DX-P and DAQSIGNIN have earned the FDA compliance statement from a consulting firm, Stelex Inc. DX-P and DAQSIGNIN are expected to accelerate the digitalization of data for quality control and process control among the pharmaceutical and food industries. Many pharmaceutical companies have already started trial operations and some have adopted them.

This paper outlines items necessary to meet the requirements of 21 CFR Part 11, how DX-P meets these requirements and introduces DX-P's remote control function and DAQSIGNIN software for DX-P.

INTRODUCTION

As groups of sensors in the field became intelligent and capable of handling not only simple data, but also so-called "information" with added values such as error detection and statistical analysis, recorders became required to play a role in transmitting such information. The DAQSTATION DX Series that YOKOGAWA released in 1999 are paperless recorders meeting this need.

Also as to the food and pharmaceutical industries that had been said to be difficult to digitize quality control or process control data, the Food and Drug Administration (FDA) of the USA issued 21 CFR Part 11 (Electronic Records; Electronic Signatures) as a guideline for magnetic media for recording during the manufacture of pharmaceuticals in 1997. This time, with the enhanced security functions of the DX paperless recorders, we have developed the DX-P Series, the first in the world to be 21 CFR Part 11 compliant. They are shown in Figure 1.

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REQUIREMENTS OF 21 CFR PART 11

(1) Logical Security

Access to a system that creates, modifies, manages, and/or retrieves electronic records must be limited to authorized

Figure 1 The DX100P and DX200P

Table 1 Validation Documents

Document Title	Description
White Paper	Document explaining that a product complies with 21 CFR Part 11
IQ (Installation Qualification)	Regulation for approval of the installation method of equipment
OQ (Operational Qualification)	Regulation for approval of the operation method of equipment

persons only. It is also necessary to perform an authorization check to assure that a person authorized to access that system is appropriate to the access authorization level.

(2) Traceability and Audit Trails
Information originally recorded must not be tampered with by changes made to electronic records. Audit trails are required which automatically record the date and time of operations made by every operator who creates, modifies, or deletes an electronic record.

(3) Record Maintenance
Electronic records need to be stored in a system that allows retrieval to be made during a given retention period.

(4) Electronic Signatures
The FDA has acknowledged that electronic signatures applied to electronic records have the same legal validity as handwritten signatures placed on paper records. Therefore, signatures applied to electronic records must be appropriately managed to prevent forged signatures or copy to another record securely.

DX-P'S COMPLIANCE WITH THE REQUIREMENTS

It has been approved by Stelex Inc., a consulting firm in the USA, that the DX-P Series complies with the requirements of 21 CFR Part 11.

(1) Logical Security
The DX-P configures security using combinations of user names, user IDs, and passwords. This allows access to a system to be strictly limited to authorized users.
For passwords, the DX-P allows expiration dates of passwords to be set, preventing the same password from being used beyond the expiration. Moreover, if a user enters a wrong password three times, the access right of that user becomes invalid and a warning message appears on the DX-P's screen. To allow this user subsequent access to the DX-P, an administrator must set his/her access right again.
The DX-P recorders allow a maximum of three administrators and 30 general users to be registered. A general user cannot modify his/her own access right. Furthermore, the DX-P stores combinations of up to 1500 past user IDs and passwords to prevent duplications. This enables a single person to be uniquely identified based on individual electronic signatures.

Table 2 Network Server Functions

Server Name	Description
Setting server	Allows the same operations as keystrokes on a DX-P recorder. Note that it cannot make a connection during a login made with keystrokes on the recorder.
Monitor server	Allows only monitoring of measured data. It makes a connection even during a login with keystrokes on the recorder.
FTP server	Functions supported: Directory output (DIR) File acquisition (GET)
Web server	Displays the screen image of a DX-P recorder. It allows only switching of a screen and requires a dedicated user name and a password.

(2) Traceability and Audit Trails
The DX-P stores all alarms, alarm confirmations, error messages, setting modification records of equipment, operational records of equipment, and user registration information in binary files. The contents of these files can be observed using the DAQSIGNIN application software, but no user or administrator can modify them. Acquired data such as temperatures are also stored in a specific binary format, and stored values cannot be modified. If an attempt is made to open a file whose binary data has been directly modified, through a DX-P or using DAQSIGNIN, a warning message appears on the screen and no data is displayed.

(3) Record Maintenance
Records stored in the DX-P or using DAQSIGNIN are managed using batch names to facilitate backups or data retrieval.
The DX-P is equipped with a file transfer protocol (FTP) function to enable data files to be automatically transferred to a network server that is security controlled. Transferred files can only be observed by a DX-P recorder or DAQSIGNIN.

(4) Electronic Signatures
The DX-P allows three levels of electronic signatures to be written in data files, and the level at which users can sign-in is assigned by an administrator. Storing user registration information in a data file allows an electronic signature to be made not only through a DX-P recorder but also using DAQSIGNIN.

(5) Validation Document
Table 1 shows the documents required in manufacturing pharmaceuticals complying with the FDA regulation. As an optional accessory, the Validation Document is available as a tool for simplifying preparation of these documents.

NETWORK FUNCTIONS COMPLIANT WITH 21 CFR PART 11

Separation of the network functions into a setting server and a monitor server allows setting changes and control to be carried out using communication commands. To be compliant with audit

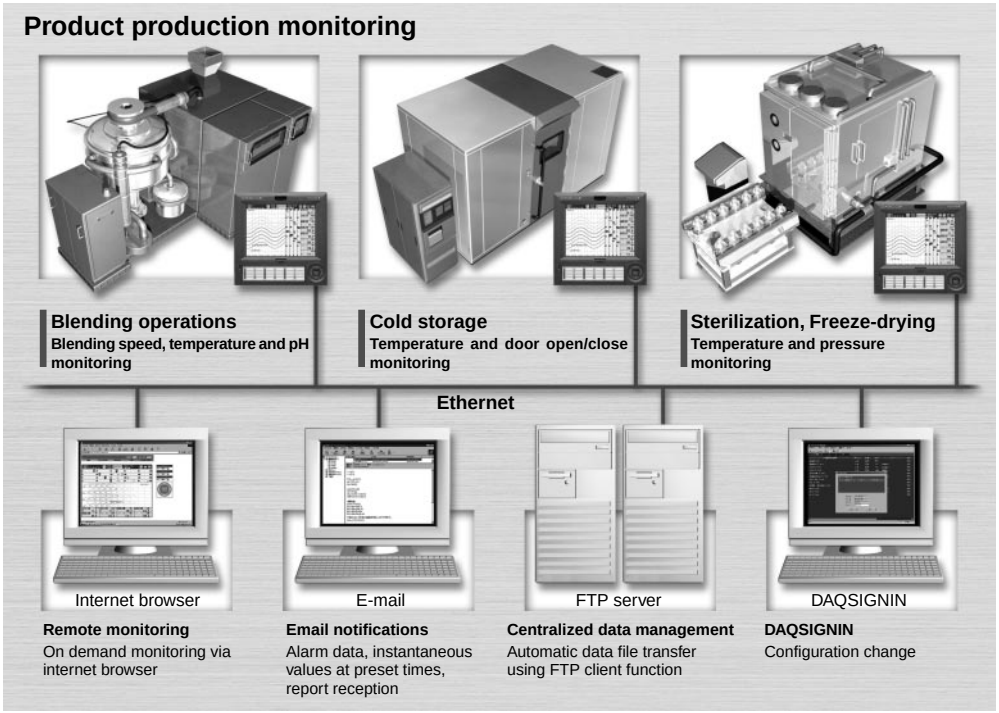

Figure 2 Examples of the Use of DX-P in Network Environments

trails, logging in must be through the setting server and with exclusive keystrokes, restricting the number of users that can operate a DX-P recorder to be always one.

Provision of a monitor server that can be continuously connected also allows measured values in the DX-P to be monitored. Table 2 shows the network servers provided for the DX-P Series.

As shown in Figure 2, the combined use of the web browser-based monitoring function, e-mail communication function, and FTP client function, which have been incorporated from the DX Series, allows remote monitoring within the network environments. However, the DX-P is an instrument that is to be basically used in a closed network and thus needs to be controlled so that only persons having access rights to the DX-P recorder can gain access even when it is used in a network configuration.

IMPROVEMENTS IN INPUT METHODS USING THE REMOTE CONTROL TERMINAL

In order to support electronic signatures as required by 21 CFR Part 11, the DX-P is equipped with an infrared remote control function to improve the character input method. This feature allows remote control equivalent to keystrokes on a DX-P recorder in addition to simplified character input, which also improves the operability of the recorder. Moreover, the DX-P can incorporate the dust-proof and drip-proof specifications (IEC 529-IP65) of the front panel, one of the features of the existing DX Series because the remote control terminal is of the wireless type. Figure 3 shows the remote control terminal.

The remote control terminal allows operations of all keys on a DX-P recorder. The use of an ID code for identifying a model and an ID code set on a DX-P recorder allows a maximum of 32 DX-P recorders to be operated.

DAQSIGNIN APPLICATION SOFTWARE

DAQSIGNIN is the standard software provided with the DX-P that facilitates the placing of electronic signatures on data files created on a DX-P recorder by means of a PC. This software allows you to check data, check audit trails, and place your electronic signature on data using a PC. Moreover, in Rev. 3.01 and later a function to send configuration data to the DX-P recorder has been added. This software consists of the following four types of software:

Figure 3 The Remote Control Terminal for DX-P

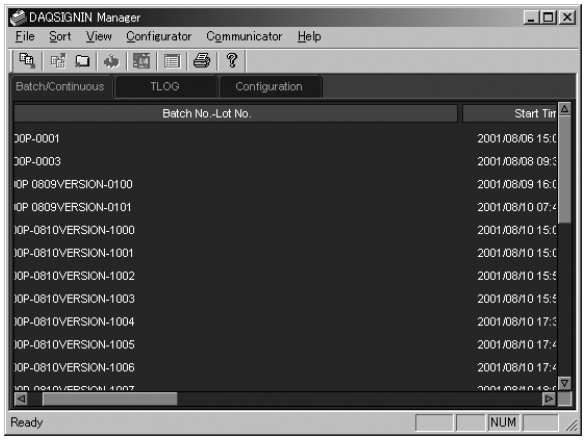

Figure 4 Manager Software

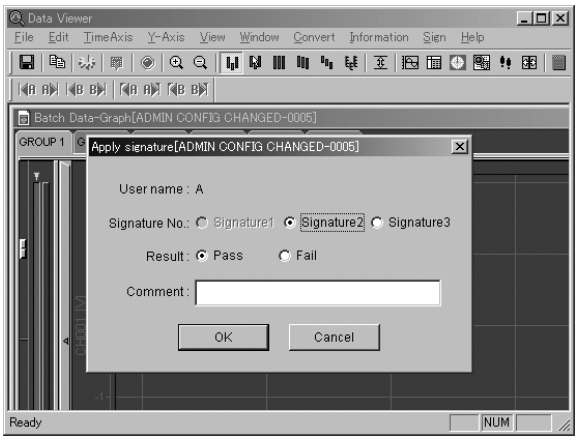

Figure 5 Data Viewer Software

(1) Manager Software (Figure 4)
Manager Software is used to browse data files created on a DX-P recorder. It manages data under a batch name and on a lot number basis so that the user is not required to be aware of file names, which improves the retrievability. For each batch data it allows checking of the start time and end time, whether data has been tampered with, the progression of electronic signatures, etc.

(2) Data Viewer Software (Figure 5)
Data Viewer Software allows you to check the measured/ calculated data, alarm history, message history, and audit trails of batch data acquired on a DX-P recorder. It also has a function to place an electronic signature on data files. For an audit trail check, if there is a history of the setting modifications made on the DX-P recorder, you can directly start Hardware Configurator to check the contents. Moreover, for the measured or calculated data or various histories, the Data Viewer Software allows them to be printed out or converted to Excel data, etc.

(3) Hardware Configurator
Hardware Configurator allows you to check the setting data stored in a DX-P recorder or to create new setting data. To cope with audit trails, it is designed that the editing of setting data using the Hardware Configurator can be detected by printout.

(4) Communicator
Communicator facilitates access to a DX-P recorder via a network. This access is limited to users with administrator rights. After login processing, an authorized user with administrator rights can send and receive setting data or initialize a user whose access right has become invalid.

CONCLUSION

This paper has described the DAQSTATION DX100P/ DX200P paperless recorders developed for the food and pharmaceutical industries, centering on their compliance with 21 CFR Part 11. The DX-Ps are the world's first paperless recorders compliant with 21 CFR Part 11, and have already undergone trial operation by a number of pharmaceutical manufacturers as they are expected to accelerate the digitization of quality control and process control data. In Japan, work toward meeting the requirements of 21 CFR Part 11 has been delayed, but we anticipate that there are positive moves toward the practical application of the DX-P.

In future, we plan to work toward making the DX-P a standard tool for the food and pharmaceutical industries by incorporating feedback from the users who have been involved in the trial operations. ◆

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