STANDARD BATCH REPORT PACKAGE
— REPORT FUNCTION FOR THE CENTUM CS —

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We have developed Standard Batch Report Package for CENTUM CS. This package is a useful report function for batch process which has an open interface. This papaer describes the concept, functions and effectiveness of this package.

INTRODUCTION

Report functions in process control are often positioned as part of the logger functions. However, plant operation data in a batch process should be not only logged regularly but also acquired and managed for each batch execution. The report function for logging plant operations in a batch process mainly comprises a function to print out plant operation data collected for each batch execution, and there are various approaches available to implement this function. As a key point in its implementation, it is necessary to take into account the various popular document creation software programs that run on personal computers (PCs). Such programs have inexpensive, advanced document output functions, and it is important to make the best use of them. Our Standard Batch Report Package is a report function developed in consideration of this aspect.

FEATURES

1. Concept

The developmental concepts of this package are as follows.
(1) To have a report function suited to batch processes that:

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- improves compatibility with CS Batch[*2]
- separates the report function from the logger function
(2) To implement an open architecture that:
  - enables users to take full advantage of PC software
  - supports all CENTUM CS-specific data formats
  - expands the types of data that can be handled
(3) To provide the most often used functions in an easy-to-use form

2. Architecture

Employing the aforementioned concepts, this package for the CENTUM CS has been structured as shown in Figure 1.
- In a distributed control system (DCS):
- the engineering workstation (EWS) is an engineering function;
- the information and command station (ICS) is an operation and monitoring function; and
- the field control station (FCS) is a control function.
(A) The builder function:
  (1) defines batch report formats using a spreadsheet method
  (2) creates the defined batch report format as a formatter
  (3) loads the formatter to the print-out function
(B) The print-out function:
  (4) accepts a command to start batch report printing
  (5) refers to the batch report format from the formatter
  (6) acquires data
  (7) forms a print image and outputs it to the printer
(C) The package along with the open link interface:
  (8) reads batch report definitions
  (9) outputs batch reports

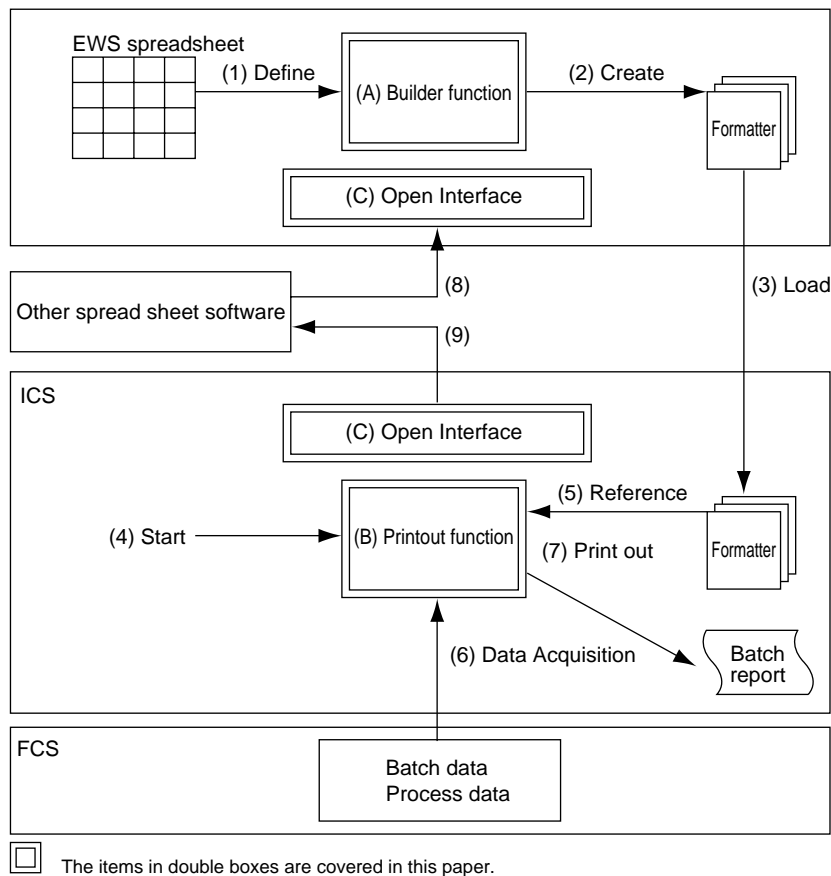The items in double boxes are covered in this paper.

Figure 1 Structure of the Standard Batch Report Package

3. Open Architecture

Figure 2 shows the structure of the open link interface of the standard batch report function. The interface covers the following:

(1) Acquired data

Data acquired by the print-out function are saved in a file format independent of the format of the CENTUM CS and can be accessed by other software. In this way, data can be read into increasingly popular personal computers and a more advanced report function can be constructed. For the implementation of an open architecture, it is important for this package to support all CENTUM CS-specific acquired data. The types of data that can be acquired, therefore, have been greatly increased.

(2) Reading of batch report definitions

The package can read batch report definitions created with other software. (For example, a CSV format file[*3] created with Microsoft Excel[*4] can be read.) An instruction to acquire data can be given when defining a batch report simply by entering in a character string the logical name (tag name, etc.) of necessary data. In this way, batch report management can be easily carried out away from the CENTUM CS.

FUNCTION

1. Printed Data

Table 1 lists data items which can be printed in a batch report. A simple character string can be used to instruct the program to collect each data item found in the batch report definition so that, even when a batch report is defined by another software program via the open link interface, data can be acquired easily.
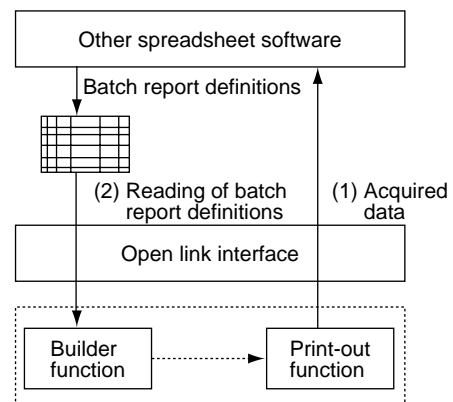

Figure 2 Open Link Interface

Table 1 Types of Printed Data Items

Classification	Printed data	Classification	Printed data
Constant	Character	CS Batch Common block data	Common block data
	Numeric string		Common block comment
Process data	process data		Common block item comment
	Tag comment		Common block engineering unit
	Tag item comment	CS Batch recipe header	Created item
	Tag engineering unit		Recipe name
Alarm/Event	Batch journal		Recipe comment
	Historical message		approval
Historical data	Trend data		Product name
	Printed data		Version
Calculated value	Arithmetic expression		Author
	Cell data		Security level
Time value	Printing time		Recipe description

2. Configuration of Batch Report

As shown in Figure 3, batch reports supported by this package comprise two parts having different formats. One is where the batch report format is in spreadsheet form and the other is where the format is free. A spreadsheet divides a sheet of paper into blocks called cells where data are distributed, thereby presenting a print format for an entire batch report. Spreadsheets are effective when the number and the format of data items can be decided beforehand.

The free-format portion is used when the number and the format of data items cannot be determined beforehand, as in the case of an alarm event. In addition, the following functions are available to make more advanced batch reports.

- Addition of headers and/or footers
- Addition of grid lines
- Separation of the spreadsheet into pages

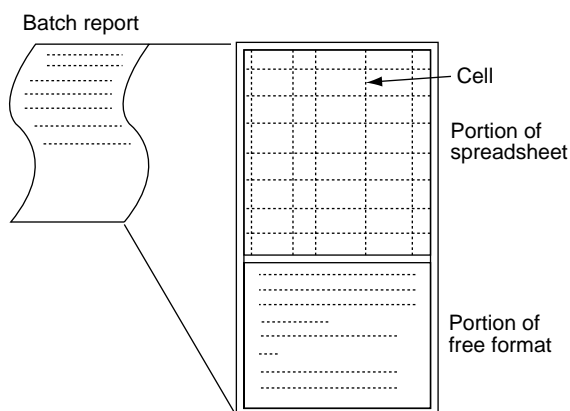Figure 4 shows an example of a printed batch report created with this package.

3. Format of Printed Data

The format of the data to be printed in each cell can be designated in detail by the position of the data in a cell, the number of digits, and the position of the decimal point. However, if the printed data are for plant operations, it is general practice for the format to be designated separately during the engineering operation due to the display format for the operation and monitoring function. Therefore, it is troublesome to designate the format again at the time of batch report definition. This package

```
••••••••••••••••••••••••••••••••••••••••••••••••••••••••
••••         B A T C H   R E P O R T (Batch ID=B950101-001)         ••••
••••••••••••••••••••••••••••••••••••••••••••••••••••••••

    RECIPE NAME      RECIPE01       START TIME        09:00:00
    BATCH No.             1         END TIME          10:00:00

a. Initialization

    ┌─────────────────────────────────────────────┐
    │ Start Time   09:00:01   Temperature   0.0F   │
    │ End Time     09:05:30   Pressure      0.0mmHg │
    └─────────────────────────────────────────────┘

b. Charge

    ┌─────────────────────────────────────────────┐
    │ Start Time   09:06:00   Temperature   0.0F   │
    │ End Time     09:20:00   Pressure      0.0mmHg │
    └─────────────────────────────────────────────┘

c. Agitaion & Heating

    ┌─────────────────────────────────────────────┐
    │ Start Time   09:20:30   Temperature   0.0F   │
    │ End Time     09:45:30   Pressure      0.0mmHg │
    └─────────────────────────────────────────────┘

d. End

    ┌─────────────────────────────────────────────┐
    │ Start Time   09:55:01   Temperature   0.0F   │
    │ End Time     09:59:50   Pressure      0.0mmHg │
    └─────────────────────────────────────────────┘

*** Alarm Event ***
1619 95.01.01 08:30:00 Gr.05 B950101-001 RECIPE01 RESERVE
1619 95.01.01 09:00:00 Gr.05 B950101-001 RECIPE01 LOAD
1424 95.01.01 09:00:00 Gr.05 B950101-001 RECIPE01 READY      old=RESERVED
1421 95.01.01 09:00:00 Gr.05 B950101-001 RECIPE01 Start
1424 95.01.01 09:00:00 Gr.05 B950101-001 RECIPE01 ACTIVE     old=READY
1621 95.01.01 09:00:00 Gr.05 B950101-001 RECIPE01 No.01 LOAD
1434 95.01.01 09:00:00 Gr.05 B950101-001 RECIPE01 No.01 READY      old=ASSIGNED
1431 95.01.01 09:00:00 Gr.05 B950101-001 RECIPE01 No.01 Start
1434 95.01.01 09:00:00 Gr.05 B950101-001 RECIPE01 No.01 ACTIVE     old=READY
1434 95.01.01 09:05:30 Gr.05 B950101-001 RECIPE01 No.01 LOG        old=ACTIVE
1434 95.01.01 09:05:30 Gr.05 B950101-001 RECIPE01 No.01 COMPLETE old=LOG
1432 95.01.01 09:05:30 Gr.05 B950101-001 RECIPE01 No.01 End
1621 95.01.01 09:06:00 Gr.05 B950101-001 RECIPE01 No.02 LOAD
1434 95.01.01 09:06:00 Gr.05 B950101-001 RECIPE01 No.02 READY      old=ASSIGNED
1431 95.01.01 09:06:00 Gr.05 B950101-001 RECIPE01 No.02 Start
1434 95.01.01 09:06:00 Gr.05 B950101-001 RECIPE01 No.02 ACTIVE     old=READY
1434 95.01.01 09:06:00 Gr.05 B950101-001 RECIPE01 No.02 LOG        old=ACTIVE
1434 95.01.01 09:06:00 Gr.05 B950101-001 RECIPE01 No.02 COMPLETE old=LOG
1432 95.01.01 09:06:00 Gr.05 B950101-001 RECIPE01 No.02 End
1424 95.01.01 10:00:00 Gr.05 B950101-001 RECIPE01 LOG        old=ACTIVE
1424 95.01.01 10:00:00 Gr.05 B950101-001 RECIPE01 COMPLETE old=LOG
1422 95.01.01 10:00:00 Gr.05 B950101-001 RECIPE01 End
```

Batch report

Figure 3 Structure of a Batch Report

Figure 4 Example of a Printed Batch Report

Figure 5 Formatter Creation Screen

Table 2 Batch Report Print Startup Methods

Classification	Time
Auto	CS Batch recipe end
	CS Batch unit recipe end
	Scheduler
Manual	CS Batch operation
	Function key
	Graphic panel
Event driven	Sequence massage

has a function for deciding the format according to the display format defined beforehand in the plant operation data.

4. Builder Function

The objective of the builder function is to create a file called a formatter that defines the printed data and format of a batch report and loads it to the print-out function.

(1) Man-machine interface
A formatter is created by defining the printed data and format in each cell in a spreadsheet. Figure 5 shows a formatter creation screen.

(2) Open link interface
The open link interface can read a text file described in a fixed format and define a formatter. By doing this, the batch report definition created by the text editor or another batch report creation program can be read into this package. The text file is in the widely used CSV format.

(3) Preview function
There is a preview function provided to check the defined formatter print image on a builder-function screen. Since data acquisition is not carried out, plant operation data are considered to be provisional. However, the preview function is very effective in checking the print format.

5. Print-out function

The print-out function collects data, forms a print image, and outputs it to the printer according to the formatter file created by the builder function.

(1) Print start
Manual starts, automatic starts, and event-driven starts are available. Table 2 lists the startup methods.

(2) Open link interface
The open link interface can save the printed result of a batch report as a text file. Furthermore, an external software tool can access the text file at the same time as it is output to a printer.

(3) Debug function
The debug function allows necessary batch reports to be printed with a command at any desired time. In this way, only a printed batch report is debugged beforehand. Furthermore, the debug function retains error information on data acquisition and other items as a text file.

CONCLUSION

In this paper, we described the concepts, functions, and effectiveness of the report function in a batch process. On the basis of the concepts of the package as a report function, development will proceed according to user needs which will become more diversified in the future. ◆

REFERENCE

(1) Sakamoto, H. and T. Kano. SP88 and CS Batch. Yokogawa Technical Report No. 21 (1996), pp. 1 to 4.
(2) Terashima, N. Management Information Functions of CENTUM CS. Yokogawa Technical Report No. 21 (1996), pp. 23 to 26.

*3 CSV is an abbreviation for Comma Separated Values, meaning the text format in which data are delimited by a comma.
*4 A registered trademark of Microsoft Corporation, USA.