

# FCS DATA SETTING/ACQUISITION PACKAGE FOR RECIPE MANAGEMENT

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*It is almost impossible for a single recipe management software package to cover every kind of recipe management application for differing plant scales and complexity. Our objective for the development of a recipe management package for the CENTUM CS 1000 was to design an uncomplicated package with an open interface that would be suitable for small- and medium-scale plants, the target market of the CENTUM CS 1000 distributed control system. The result of this development is PICOT, an FCS data setting/acquisition package that uses Microsoft Excel<sup>®2</sup> as the user interface. This report gives an outline of the PICOT software package.*

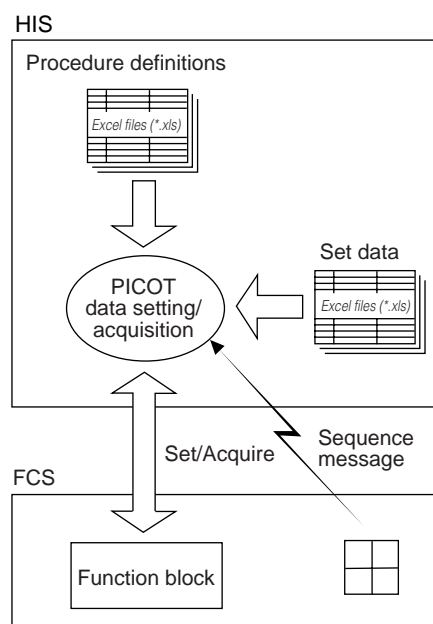
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## INTRODUCTION

Recipe management software refers to the computer software used to manage product names and their corresponding recipes and set the recipe data in the control system in order to control the operations of a plant in which multiple materials are blended to manufacture a number of different products. In the last few years, recipe management software has become more comprehensive and complex in order to cover all kinds of plants and all possible functions. However, not all plants need all functions. A simple function for setting groups of tag data in field control stations (FCSs) is sufficient for some plants.

PICOT, the FCS data setting/acquisition package introduced in this report, is a versatile software package. It can be used alone to provide the simple function of setting groups of tag data in

FCSs and collecting the values of those data, or it can be combined with the FCS control function and easily configured to provide the complete range of recipe management functions.



**Figure 1** Overview of PICOT

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\*1 Industrial Automation System Business Division

\*2 Microsoft and Excel are registered trademarks of Microsoft Corporation, U.S.A.

## FEATURES OF PICOT

### Open Interface

All of the user interfaces of PICOT are spreadsheets of Microsoft Excel 97. This means that all of the settings needed to run PICOT are made and the collected data values viewed on familiar Excel 97 worksheets. This makes it easy for the user to define settings and modify data values. In addition, this enables the user to manage recipes from any computer installed with Excel 97, regardless of whether it is a human interface station (HIS) of the CENTUM CS 1000.

PICOT also features interfaces for the other applications of an HIS, thus allowing supervisory computers to communicate with PICOT and result data to be saved to auxiliary media.

### Application to Other Purposes

The PICOT's extensive tag-data access capabilities are not restricted to recipe management but can also be used for a wide range of other purposes such as setting high- and low-limit alarms, saving group data during a test, as well as data acquisition and printing.

### Assured Security

Using two or more HISs, a master/slave configuration can be built in order to ensure data security.

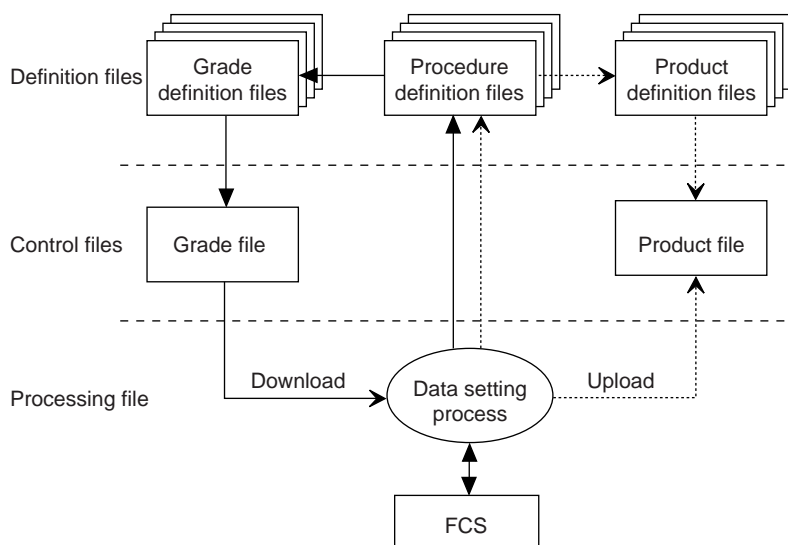
### Support of Earlier Field Control Station Models

PICOT not only supports the FCSs of the CENTUM CS 1000 but also any FCS model supported by an HIS.

## FUNCTION OVERVIEW

### Software Configuration

Figure 1 shows an overview of PICOT's function, and Figure 2 shows how it is configured. The definition files are



**Figure 2** Software Configuration

**Table 1** Commands

Command	Function
Assign Grade Definition File Name	Copies the specified grade definition file to the grade file.
Assign Product File Name	Copies the specified product definition file to the product file.
Download	Downloads the specified group of data to FCSs.
Upload	Uploads the values of the specified function blocks from the FCSs and stores them to the product file.
Write Time Data	Writes the current time to the product file.
Check Flag Status	Checks the status of the specified internal switch and quits the procedure if the internal switch is not in the specified status.
Set Flag	Sets or resets the specified internal switch.
Check Cell Status	Checks the content of the specified cell in the grade file and quits the procedure if it is not in the specified status.
Set Production Volume	Sets the value acquired from the specified function block, in the grade file.
Start Process	Runs the specified process.
Start Macro	Runs the macro in the grade file or product file.
Check Host Name	Reads the character string in the specified function block, and quits the procedure if the character string does not agree with the local host name.
Quit Procedure	Stops the procedure.

Excel worksheets filled with the settings made by the user. The control file is a copy of definition files. The meaning of each file is outlined below.

#### (1) Procedure Definition Files

The strings of commands to be carried out by the data setting process (see Table 1) are defined in these files. A procedure definition file is prepared for each sequence message.

#### (2) Grade Definition Files

The tag information and data values to be set for each tag data item are defined in these files.

#### (3) Product Definition Files

The tag information to be set for data acquisition is defined in these files.

#### (4) Grade File

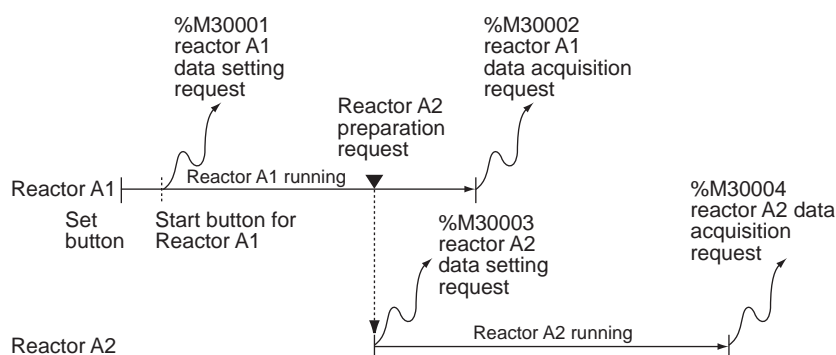
The grade file is created as a copy of all of the grade definition files. The data values contained are edited by commands and set in the tags of an FCS.

#### (5) Product File

When the command for acquiring tag data is carried out, a product file is created as a copy of the corresponding product file and the acquired data values are stored.

### Data Setting Procedure

- (1) Upon receipt of a sequence message from an FCS, the data setting process accesses the procedure definition file corresponding to the message number and carries out the commands defined in that file.
- (2) The Assign Grade Definition File Name command copies the specified grade definition file to create the grade file. The data values in the grade file will be edited by the consequent commands.



**Figure 3** Operation Time Chart of Polymerization Reactors A1 and A2

- (3) The Check Flag Status command checks the status of the specified internal switch of the specified FCS and quits carrying out all other commands if the required conditions are not met.
- (4) The Download command sets the contents of the grade file into the specified tags of the FCSs.
- (5) The Set Flag command sets or resets the specified internal switch of the specified FCS and requests a sequence table for a particular action.
- (6) The Quit Procedure command stops the procedure.

#### Data Acquisition Procedure

- (1) Upon receipt of a sequence message from an FCS, the data setting process accesses the procedure definition file corresponding to the message number and carries out the commands defined in that file.
- (2) The Assign Product File Name command copies the specified product definition file to create the product file.
- (3) The Upload command collects the values of the specified tag data from the FCSs and stores them to the product file according to the definitions in the product file.
- (4) The Start Process and Start Macro commands, if defined, run the procedures for editing the collected values and saving them to the specified locations.
- (5) The Quit Procedure command stops the procedure. The product file is stored until the user deletes it.

### APPLICATION TO RECIPE MANAGEMENT

The following gives an example of recipe management using PICOT.

#### Process Overview

Assume that two polymerization reactors A1 and A2 are connected in series. Figure 3 shows the operation time chart of reactors A1 and A2 and the times when the %M30001 to %M30004

sequence messages are to be notified to PICOT.

#### Recipe Reservation Window

To achieve recipe management using PICOT, a recipe reservation window must be prepared using a graphic window of the CENTUM CS 1000. The recipe reservation window serves as the user interface for reserving recipes. In the example shown in Figure 4, up to five recipes can be reserved. To reserve a recipe, the user must set the previously defined recipe name and batch ID in this window. In this example, the user can

select one of the three pre-defined brands. The batch ID is an arbitrary four-digit number. Clicking the Set button moves the recipe reserved in reservation No. 1 to the control recipe for reactor A1. As a follow-up to this action, the remaining reservations are shifted up by 1.

#### Function Blocks to Be Prepared for PICOT

The following function blocks must be prepared for the recipe reservation window and PICOT:

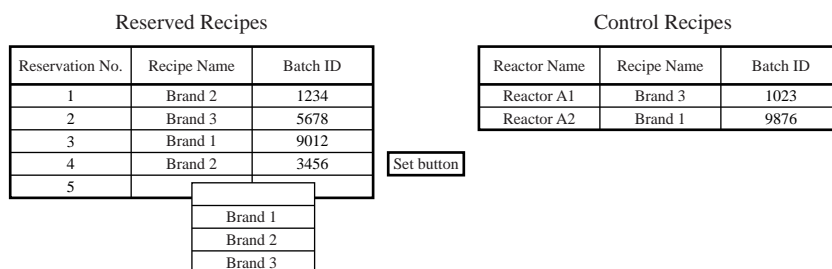
- Storage buffers for reserved recipe names
- Storage buffers for reserved batch IDs
- Buffer for grade file name
- Buffer for product file name

The data setting definitions in each grade definition file must be coded such that the data values are set in the user-defined data items of a unit instrument block in an FCS. Likewise, the data acquisition definitions for the result data must be coded such that the values of the user-defined data items of a unit instrument block are collected from an FCS.

#### Files to Be Prepared for PICOT

The following files must be prepared for use by PICOT:

- Four procedure definition files each for reactors A1 and A2: For data setting and acquisition
- Six grade definition files each for reactors A1 and A2: For the files of three products
- Two product definition files each for reactors A1 and A2: For data acquisition



**Figure 4** Recipe Reservation Window

### Operations of Recipe Management Application

The following outlines the operations of the recipe management application in this example:

- (1) In the Recipe Reservation window, the user reserves recipes.
- (2) When the Set button is clicked, the recipe name and batch ID reserved as No. 1 are moved to the corresponding cells for reactor A1 in the table of control recipes, and the reserved recipe is set for the control recipe for reactor A1. At this time, a sequence checks that reactor A1 is not running. If it is running, the operation is rejected as an illegal operation.
- (3) Starting reactor 1 via the operation window for reactor A1 raises the %M30001 sequence message. Upon receipt of this message, PICOT downloads the recipe data for reactor A1 to the unit instrument block for reactor A1 according to the control recipe. The control sequence for reactor A1 then starts.
- (4) During the control sequence for reactor A1, the %M30003 sequence message is raised to request preparation of reactor A2. Upon receipt of this message, PICOT downloads the recipe data for reactor A2 to the unit instrument block for reactor A2 according to the control recipe. At the same time, the recipe name and batch ID displayed for reactor A1 are displayed as those for reactor A2 in the Recipe Reservation window.
- (5) When the control sequence for reactor A1 is complete, the sequence raises the %M30002 message. Upon receipt of this message, PICOT collects the result data for reactor A1.
- (6) In the same manner as for reactor A1, the sequence raises the %M30004 message to have the result data for reactor A2 collected by PICOT when the control sequence for reactor A2 is complete.

Before these operations can be carried out, the recipe data must be set in the grade definition files of all three products. In addition to the production control procedure, a batch report can be printed using the print function of Excel once all of the result data for reactors A1 and A2 have been collected.

### Practical Example

This practical example shows how PICOT was used to develop application software for the recipe management of a polymerization process. The contents of this application software are as described in the above procedure. Using this example as a base for the engineering of a batch system employing PICOT, will greatly facilitate your engineering work.

### USE FOR OTHER APPLICATIONS

PICOT is also useful in various other applications besides recipe management.

When switching the product to be produced, the high- and low-limit alarm settings of the related function blocks may need to be changed all at once. PICOT can do this if a grade definition file is prepared and a sequence message raised for each brand.

During the development of the application software, the same data may be set many times over to repeatedly test that the settings are correct. By defining those data items in a product definition file and grade definition file, the values of the necessary data items can be collected whenever desired and then set in the data items as many times as necessary.

### CONCLUDING REMARKS

This report gives an overview of PICOT, the new FCS data setting/acquisition package, and examples of how PICOT can be applied to recipe management and other applications. As is mentioned above, PICOT was designed to be versatile and easy-to-use. We believe that users will be able to devise many different ways of using PICOT for a broad range of purposes and that PICOT will prove extremely helpful. ◆

### REFERENCE

1. SAKAMOTO H., et. al., "SP88 and Batch," Yokogawa Technical Report, Vol. 39, No. 1 pp. 3-6 (1995)

