

## **Configuration | PLC: Batch iT User Interface (Siemens)**

**PlantBatch iT**

**Version V9.00**



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# 1 Introduction

This chapter provides an overview of the data traffic process required for the recipe processing. It includes:

- How the PLC receives the recipe data from Batch iT
- Which data areas are affected for the recipe processing in the PLC
- How the recipe data is transferred to the user program

## 2 Order list: Providing the order data for processing in the PLC

The operator edits the orders with recipe details for the controller in the job list provided in the Operation Manager on the PC. The recipe used in an order has been previously created with the Operation Manager.

An order describes:

- Which recipe will be processed
- The production target of the batches

Several end stations for the products of a Batch iT process may be present in a plant (e.g. several ovens at the end of the dough production). When the production target is selected, the recipes are assigned to the end stations. This is necessary, in particular, when only products of a specific recipe can be processed in a production target.

### Example

Four ovens are available at the end of a production line. Based on the set passage speed and the baking temperature, two ovens are only suitable for baking bread rolls and the other two only suitable for baking bread.

Because the selection of the final production target is only made in the order list, it is possible that user programs in the PLC can specifically request batches for these targets at the appropriate time. Such a program can, for example, specify that the production of a batch should start only when the previous batch has arrived at the production target.

As soon as the operator has released the order at the PC, the individual batches can be forwarded from the order to the PLC.

### 3 Batch request

The number of batch buffers created by the configuring engineer determines the maximum number of batches that can be processed concurrently in the PLC. Each of these batch buffers can accept just one batch of an order. New started Batches will be accepted from the PLC while free batch buffers are available in the PLC.

Batch iT CCU provides two possibilities in the PLC for **requesting batches**:

- The automatic request
- The request by a user program

The type of the request is defined during the configuring phase. The definition is made for each process cell in the Configuration Manager on the PC.

#### Further information

Further information for this topic is contained in the following manual:



Configuration | Plant Modeling

#### 3.1 Automatic batch request from Batch iT CCU

The batches will be loaded automatically into PLC after Start (after checking the starting conditions).

There they will be started from Batch iT CCU.

#### 3.2 Requesting batches from the user program

A batch is started in the job list in the Operation Manager. This produces the following execution of the system function:

You can specify in the user program when a new batch will be loaded into the PLC.

- All batches started in the order list will be stored in the PLC (**DB721**).
- An interface function (**FC723**) will be called for those batches requested by the user program. This interface function contains the user program that you created.
- The user program can evaluate the input parameters of this function.
  - Case 1:  
Depending on these parameters, the user program can initiate the batch request. The batch will be loaded into the PLC batch buffer.
  - Case 2:  
Depending on these parameters, the user program can wait for the batch request. A message with the wait reason will be displayed in the order list.

### 3.2.1 Interface function (FC723)

This chapter provides a reference to the structure of the **FC723** (**DiT\_JobList\_UserIF**).

Batch iT CCU transfers the **input parameters** to the user program.

```
RecordNo      : INT; // Number of the record in the DB721
CellNo       : INT; // Number of the process cell
ProcessArea   : INT; // Process area
LineNo       : INT; // Line number
JobID        : DINT; // Order ID
BatchNo      : INT; // Batch number
ProcLineNo   : INT; // Procedure line number
ProcedureLink : DINT; // Liqu iT: Procedure link
              // Batch iT: Bill of materials link
RecipeLink   : DINT; // Recipe link
ProcedureNumber : INT; // Liqu iT: Procedure number
              // Batch iT: Bill of materials number
RecipeNumber  : INT; // Recipe number
MaterialID   : DINT; // Material-ID / Product link
ProdDestUnitClass : INT; // Production unit class
ProdDestUnitRec : INT; // Production unit record
ErrorCode    : INT; // Error code / Reason for waiting
IsUserCode    : BOOL; // 0 = ErrorCode generated by system
JobParameter  : Array [1..10] of DINT;
              // Values of 10 order parameters
```

The **output parameters** will be returned from the user program to the Batch iT CCU.

```
outJobReleased : BOOL; // 0 = Locked
              // 1 = Released
outIsWaiting   : BOOL; // 0 = ErrorCode contains an error
              // 1 = Reason for waiting
outErrorCode    : INT; // "Error code" or "Reason for waiting"
```

The default preassignment of the **FC723** interface function has the following function:

- The loading of all batches requested by the user program will be suspended.
- The symbol for the wait reason will be displayed in the batch line.
- The user-defined message 1 (from the **Plant iT System | JobList User errors** message group) will be displayed.

```
SET
R #outJobReleased
S #outIsWaiting
L 1
T #outErrorCode
```

### 3.2.2 Application example

#### Task

For certain orders, the batch request should be made by the user program.

Conditions:

- Production target of class 5 with record number 17
- Process line number 2 of the process cell number 1

If the conditions are not satisfied, a wait should be made for the batch request and the wait reason displayed. For all other orders, the order or the batch start should be released.

#### Implementation

- ☞ Create in the following message group, a new message with number 25. The message text should indicate the wait reason.

**Plant iT System | JobList User errors** message group

- ☞ Create the following user program in the **FC723** interface function.

```

SET
S #outJobReleased           // Default: Order start released
R #outIsWaiting
L0
T #outErrorCode

L1
L #CellNo                   // Check process cell number
<>I
spb END
L2
L #LineNo                   // Check process line number
<>I
spb END

L5
L #ProdDestUnitClass        // Check Unit-Class
<>I
spb END
L17
L #ProdDestUnitRec          // Check Unit-Record
<>I
spb END

// =====
UN "UserDB".DBX 10.0        // User flag "Release/Lock" !
spb END
// =====

R #outJobReleased           // Default: order start released
S #outIsWaiting
L 25                        // Number of message
T #outErrorCode
ENDE: BEA

```



### 3.3 Testing of new batches in the PLC

Prior to attempting to load a new batch into the PLC, the server checks the following: Is a buffer with adequate length present in the PLC?

When Batch iT CCU receives a new batch from the server as result of a request, this batch data will first be tested. If this test detects that processing will not be possible in the PLC, a message will be issued to the message system and the batch will be rejected with an error code in the response to the server.

The rejection of the batch will be signaled as symbol in the order list on the PC. Detailed information about the associated error will be displayed when this symbol is selected with the mouse.

| Error no. |       | Error text  | Cause, rectification  |
|-----------|-------|---|---|
| Hex.      | Dec.  |   |   |
| 7000      | 28672 | Batch is no longer required.  | No error, the request has already been satisfied.   |
| 7001      | 28673 | Invalid Batch iT process cell number  | Parameterize Batch iT process cell number in the DB400, DW2-8   |
| 7002      | 28674 | Batch buffer too small for batch  | Increase the length of all batch buffers to the maximum batch size  |
| 7003      | 28675 | No recipe has been requested for this process line number.  | Select the correct process line for the recipe in the Batch iT order list or for a request from the controller: Increase the record count in the DB411 ff |
| 7004      | 28676 | Invalid target for control command  | Batch iT telegram contents -> check PLC (system error)  |
| 7005      | 28677 | Invalid control command for complete batches  | Batch iT telegram contents -> check PLC (system error)  |
| 7006      | 28678 | Invalid control command for batch line  | Batch iT telegram contents -> check PLC (system error)  |
| 7007      | 28679 | Unknown telegram type Batch iT telegram   | Batch iT telegram contents -> check PLC (system error)  |
| 7008      | 28680 | Requested batch list not available  | No error, the requested batch has already completed (system error)  |
| 7009      | 28681 | No buffer present for the requested batch   | Increase the number of block buffers in PLC or increase the length of the block buffer  |
| 700A      | 28682 | Invalid type of the data in Teletype 3  | Batch iT telegram contents -> check PLC (system error)  |
| 700B      | 28683 | Batch for specified setpoint not available  | Batch iT telegram contents -> check PLC (system error)  |
| 700C      | 28684 | Invalid line status for correction  | (system error)  |
| 700D      | 28685 | Number of batch lines is Zero   | Correct the recipe in the recipe editor   |
| 700E      | 28686 | Unknown process unit class  | Batch iT telegram contents -> check PLC (system error)  |
| 700F      | 28687 | Process unit not present in the CCU   | Batch iT telegram contents -> check PLC (system error)  |
| 7010      | 28688 | Parameter record for process unit of the batch target from batch header not present in the PLC            | Define parameter record for the process unit in PLC or correct the recipe in the recipe editor  |
| 7011      | 28689 | Parameter record for process unit of the batch substitute target from batch header not present in the PLC | Define parameter record for this process unit in PLC or correct the recipe in the recipe editor   |

| Error no. |       | Error text  | Cause, rectification   |
|-----------|-------|---|--|
| Hex.      | Dec.  |   |  |
| 7012      | 28690 | Parameter record for master recipe phase not present in the PLC   | Define parameter record for the master recipe phase in PLC or correct the recipe in the recipe editor  |
| 7013      | 28691 | Parameter record for source process unit not present in the PLC   | Define parameter record for the process unit in the PLC  |
| 7014      | 28692 | Parameter record for target process unit not present in the PLC   | Define parameter record for the process unit in the PLC  |
| 7015      | 28693 | Source process unit should be replaced by the batch target from the batch header, however, the batch target has been specified as zero.                     | Parameterize a target for this order in the Batch iT order list or correct the recipe in the batch header in the recipe editor                     |
| 7016      | 28694 | Target process unit should be replaced by the batch target from the batch header, however, the batch target in the batch header has been specified as zero. | Parameterize a target for this order in the Batch iT order list or correct the recipe in the recipe editor   |
| 7017      | 28695 | Source process unit contains a placeholder for the process unit number that does not lie in the range A-Z.  | Correct the recipe in the recipe editor  |
| 7018      | 28696 | Target process unit contains a placeholder for the process unit number that does not lie in the range A-Z.  | Correct the recipe in the recipe editor  |
| 7019      | 28697 | Parameter record for the path in the PLC not present  | Define parameter record for the path in the PLC or correct the recipe in the recipe editor   |
| 701A      | 28698 | Parameter record for the silo file is not present in the PLC (access using process unit search key)   | Define parameter record for the silo file in the PLC or correct the recipe in the recipe editor  |
| 701B      | 28699 | Parameter record for silo file not present in the PLC (access using raw goods search key)   | Define parameter record for the silo file in the PLC or correct the recipe in the recipe editor  |
| 701C      | 28700 | Invalid number for subpath 1  | Extend the subpath list in the PLC and increase the number of subpaths   |
| 701D      | 28701 | Invalid number for subpath 2  | Extend the subpath list in the PLC and increase the number of subpaths   |
| 701E      | 28702 | Invalid number for subpath 3  | Extend the subpath list in the PLC and increase the number of subpaths   |
| 701F      | 28703 | Invalid number for subpath 4  | Extend the subpath list in the PLC and increase the number of subpaths   |
| 7020      | 28704 | Invalid line number in the batch header   | Select the correct process line for the recipe in the Batch iT order list or increase in the PLC the number of process lines for this process cell |
| 7021      | 28705 | Invalid master recipe phase number  | Increase the number of master recipe phases in the PLC or correct the master recipe phase in the recipe using the recipe editor.                   |
| 7022      | 26706 | Invalid Batch iT service received   | Possibly an older Batch iT version is in the PLC than on the PC (system error)   |
| 70B1      | 28849 | Batch iT CCU: Received batch is already being performed in the PLC.   | An internal error has occurred. The batch must be deleted from the order list and recreated.   |
| 70B2      | 28850 | Batch iT CCU: Batch is entered in several batch buffers.  | An internal error has occurred. The batch must be deleted from the order list and recreated.   |
| 70B3      | 28851 | Batch iT CCU: Batch not present but not the first received block  | An internal error has occurred. The batch must be deleted from the order list and recreated.   |

| Error no. |       | Error text  | Cause, rectification   |
|-----------|-------|---|--|
| Hex.      | Dec.  |   |  |
| 70B4      | 28852 | Batch iT CCU: Incorrect batch block received                              | An internal error has occurred. The batch must be deleted from the order list and recreated. |
| 70B5      | 28853 | Batch iT CCU: Incorrect block length (<=4 bytes).                         | An internal error has occurred. The batch must be deleted from the order list and recreated. |
| 70B6      | 28854 | Batch iT CCU: More blocks received than the total count from the telegram | An internal error has occurred. The batch must be deleted from the order list and recreated. |
| 70B7      | 28855 | Batch iT CCU: Unknown error for blocked batch download                    | An internal error has occurred. The batch must be deleted from the order list and recreated. |

## 4 User-defined strategy for variable replacement in the batch line

In the following situations, the **FC912 (BTC\_UserStrategy)** is called for the variable replacement in the batch line.

- The batch line contains a placeholder for the source or target process unit.
- The process unit class has been defined so that a user program performs the variable replacement.

Location: **Configuration Manager** | **<Process cell>** | **Settings** | **Process unit classes**

### Parameterization

- Replacement time = replacement as late as possible (PLC)
- Strategy = PLC (user program)

The **DB410 (DB\_BTC\_WORK)** is open in the **FC912**. The data block contains the input and output values of the user function.

### 4.1 DB interface to the user program (DB\_BTC\_WORK, DB410)

#### Input parameters to the user interface (read)

| DB410     | Description  |
|-----------|--|
| DBB1705   | Number of the user strategy<br>Settings location: <b>Configuration Manager</b>   <b>&lt;Process cell&gt;</b>   <b>Settings</b>   <b>Process unit classes</b> |
| DBW1706   | The number of the process unit class for which the variable must be replaced   |
| DBW1708   | Operation number   |
| DBX1710.0 | 1 = process unit is a source for the operation.  |
| DBX1710.1 | 1 = process unit is a target for the operation.  |
| DBW1712   | Data block number of the batch buffer  |
| DBW1714   | Record number of batch line [0..n]   |



#### Note

If the operation is to be performed only on a single process unit, both signals are set: DBX1710.0 and DBX1710.1

**Output parameters from the interface (write)**

| DB410     | Description   |
|-----------|---|
| DBW1716   | Number of the process unit  |
| DBX1710.2 | 1 = Wait<br>A valid number has not yet been specified.                        |
| DBX1710.3 | 1 = Error<br>No process unit number is available for this process unit class. |

## 5 Interface to the user program

### 5.1 Preceding tasks in the configuring phase

This chapter describes the prerequisites that must be satisfied in order to implement the controller specifications from the batch lines.

Each batch line involves an action at a defined location in the process cell. Thus, a batch line describes an **operation** on a **process cell**, e.g.

- Outer silo 1 being filled  
Process cell = outer silo 1  
Operation = empty
- Container 2 being heated  
Process cell = container 2  
Operation = heat

The phase controller always assigned to each batch line performs the specified operation in single steps, the **phases**. In the example, **filling outer silo 1**, the phase controller could have the following structure:

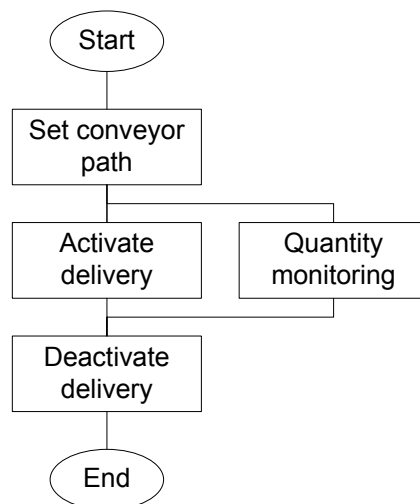


Figure 1

The phase controller here consists of four phases in which the actual triggering of the valves and motors occurs.

- Phase 1: Set conveyor path
- Phase 2: Activate delivery
- Phase 3: Quantity monitoring
- Phase 4: Deactivate delivery

Consequently, Batch iT CCU does not directly pass the details from the batch line to the user program but always first to the PHC management (PHC = phase controller).

The configuration for this example could have the following form in the **Configuration Manager**:

### 1st step: define operations and create procedure

All operations for the batch lines must first be defined in the tree view under **Operations**.

The procedure that will later be present for processing as batch in the PLC is then created under **Unit procedures**. Each displayed rectangle defines a batch line.

**Configuration Manager: Class definitions | Procedural components | Process unit classes**

### 2nd step: assign operations

The operations are now assigned to the individual batch lines. All batch lines used here operations on the same process unit (outer silo 1).

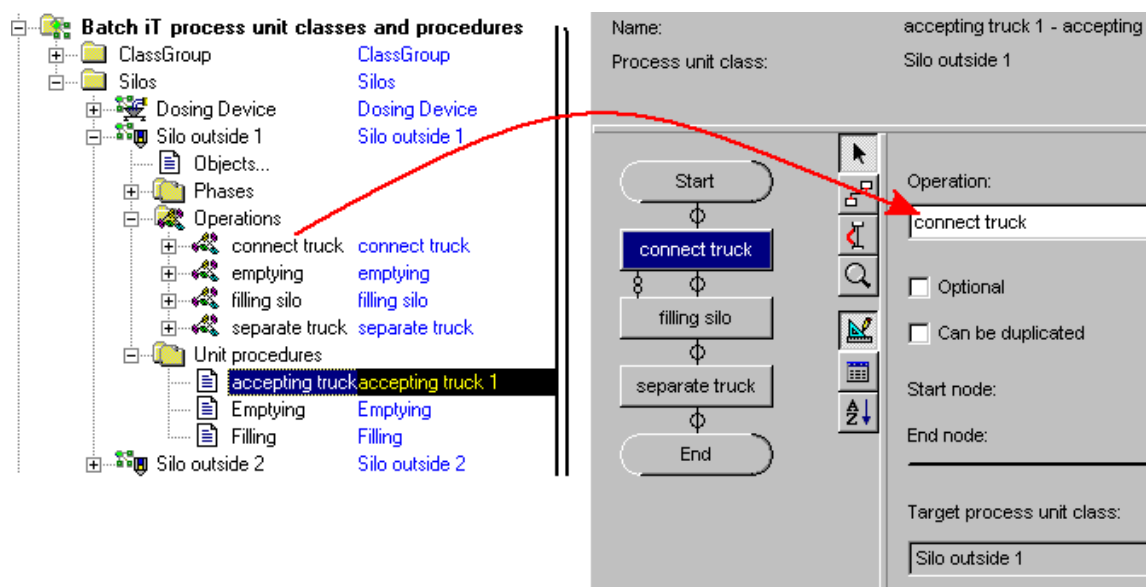


Figure 2

### 3rd step: configure phase controller

The PHC management is a system class of Plant iT that can manage and execute one phase controller per instance. Such instances can be seen above under operations in the tree view.

As an example, the fully configured phase controller is represented here for the **silo filling** operation as it was previously defined at the start of this chapter.

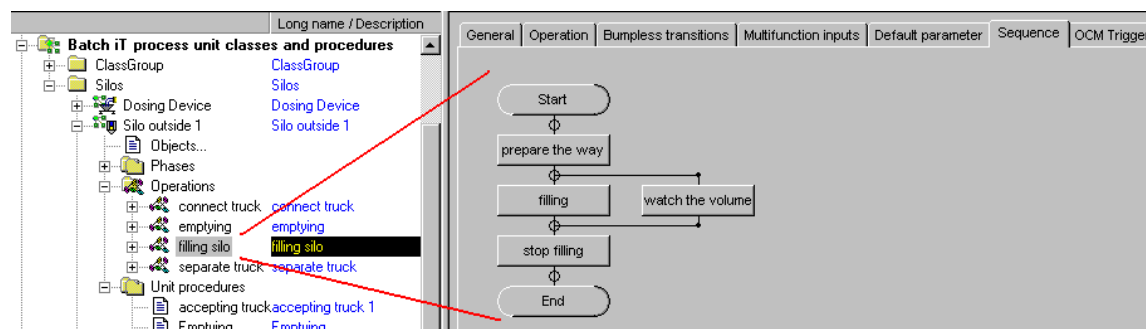


Figure 3

The individual phases have been previously defined under **Phases** in the tree view and then in the editing mode assigned to the operation.

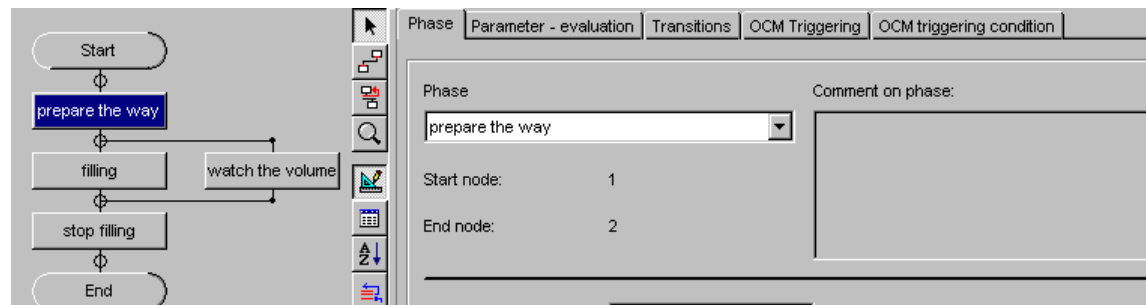


Figure 4

#### 4th step: assign user program

For the controller implementation in the PLC, in the configuration phase at least one (maximum three) user programs are assigned to each operation and thus each phase controller.

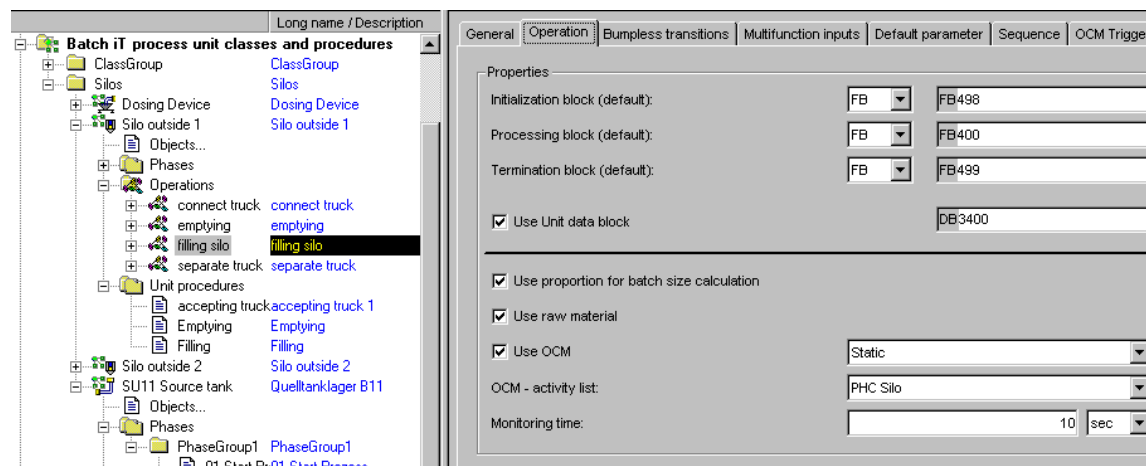


Figure 5

The FB/FC for the processing block must always be configured. The FB/FC is optional for each of the initialization and termination blocks. The same FB/FC can also be assigned to all three module types.

#### 5th step: assign unit data block

The use of a unit data block can be specified for the simplified access to recipe and equipment parameters in the PLC. This selection obviates the supply of the data block for the **DB992** equipment parameter and the data block for the **DB993** recipe parameter.

An area for user-defined data can also be created in the unit data block.

The graphical processing of the phase controller, input parameters of the process cell and transition conditions are also configured in the Configuration Manager on the PC and then, independent of the procedures, downloaded into the PLC.



## 5.2 Call of the user programs in the PLC

The following relationship between batch, PHC instance and user program can be shown in the PLC.

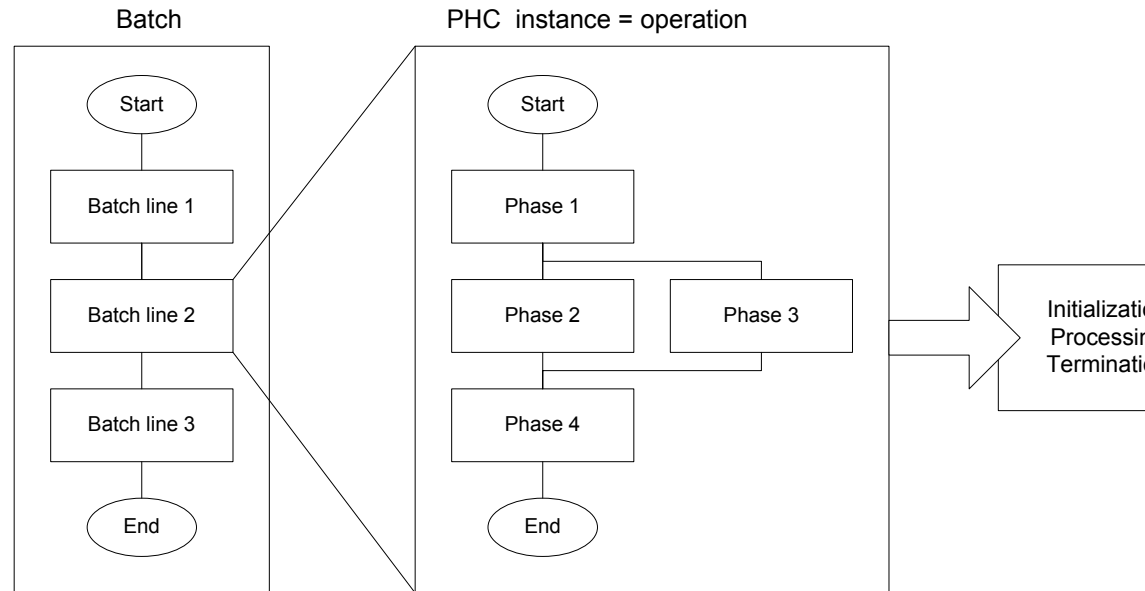


Figure 6

As a result of the configuration work using the example, the following initial situation resulted in the PLC:

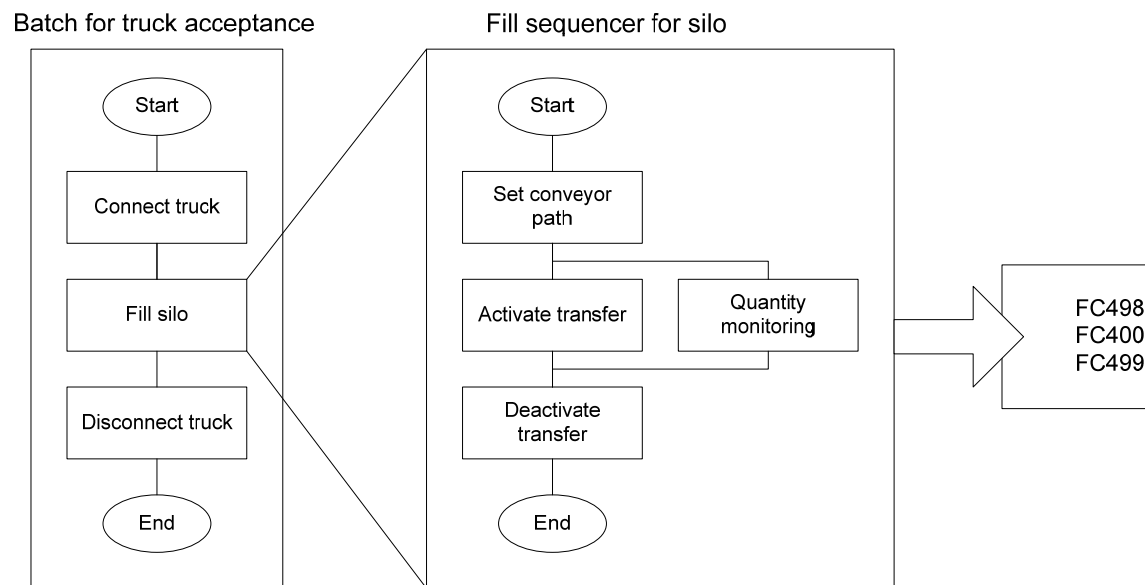


Figure 7

The associated user programs are called only when the phase controller has been started, i.e. when the associated batch line is active.

**Note**

The user programs are **not** called when the phase controller was started in simulation mode. Instead of the user programs, a corresponding simulation program of the system then runs.

The simulation operation can be activated at the level of a single operation, a single Batch iT order or for all Batch iT orders.

For an active phase controller, the FC for the initialization (here **FB498**) will be called just once per cycle. The call is made before the phases are processed, namely directly after the start nodes.

The FB for processing is called once per active phase, thus, this FB (here **FB400**) may be called several times successively in a cycle. The phase number is also passed to the user program for each call.

After all active phases have been processed, the FC for the termination (here **FC499**) is called just once per cycle. Thus, the call is made directly before the end node.

**Further information**

Further information for this topic is contained in the following manual:



Configuration || Class C20 PHC, Phase Controller

## 5.3 DB interfaces to the user program (C20 PHC)

This manual describes the interface to the user software that should provide the control implementation of the details from the batch lines.

**Further information**

Further information for this topic is contained in the following manual:



Configuration || Class C20 PHC, Phase Controller

