

**Software Operations Manual  
Plating Control System  
Norgren - IMI**

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## 1) General Information

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The following chapter discusses general information about the control system.

### What software is utilized?

The new control system utilizes a custom software package called Flextime™. Flextime is designed and configured by ASC Process Systems, Inc and is a full-featured crane and tank-line, fixed-timeway scheduler and control package.

*Note: Flextime utilizes ASC's leading CPC-NT™ control software package as a foundation. Much of the generic literature provided with Flextime also refers to CPC-NT.*

### What hardware is utilized?

The Flextime system is PC-based, and utilizes a Dell computer for man-machine interface, scheduling, and supervisory control. The main controller of the crane and tank-line is an Allen Bradley SLC 5/04 PLC (provided by CES).

The Flextime PC communicates to the PLC via an Ethernet network.

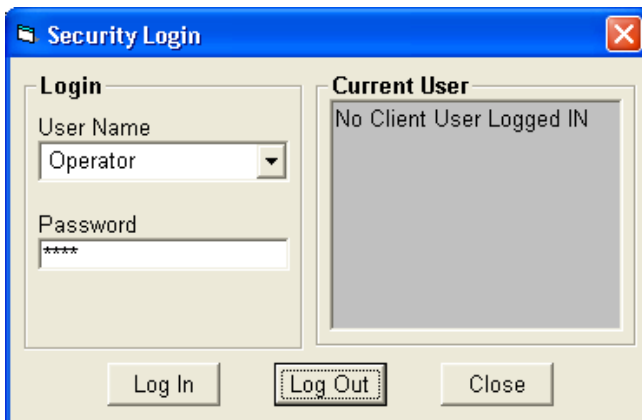
### How to launch the application

The Flextime/CPCNT application can be launched via the PC Desktop or via the Start menu.

1. Click the Start button in the lower-left of the screen
2. Select "Programs" from the menu. The programs menu will be displayed.
3. Select "CPC Client" from the menu. The CPC Client menu will be displayed.
4. Click the CPC Client application. The software will launch and should display the main page within 5-10 seconds.

### How to login to the application

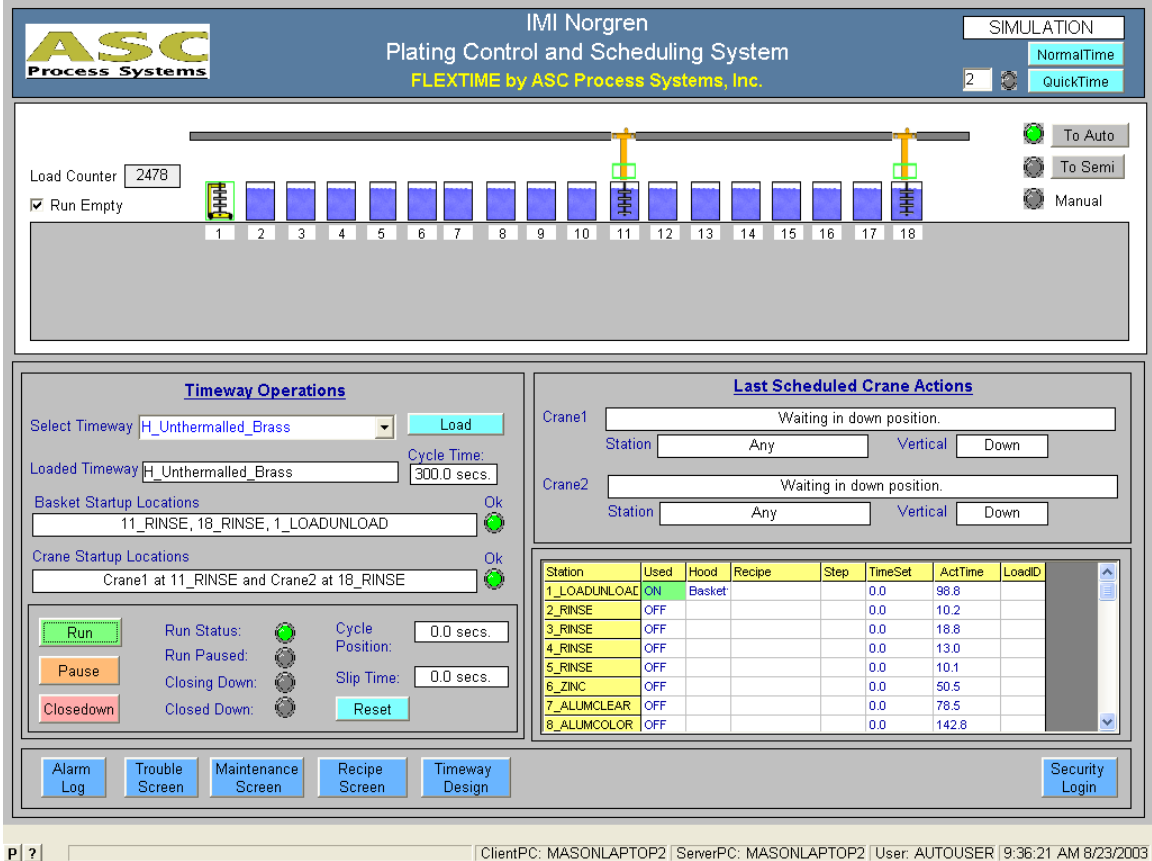
From the Main Screen, click the "Security Login" button to access the security login pop-up form.



1. Click the User Name pull-down and select your user name.
2. Type and enter the Password
3. Click Log In button

## 2) Main Screen

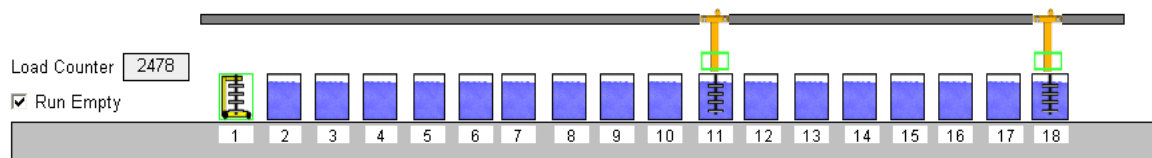
The following chapter describes the Main Screen and how to access the operation screens for the system.



The image above shows the Main Screen for the Flexitime™ software on the Penetrant Line. The screen is designed to provide immediate information to the operator during scheduling operations.

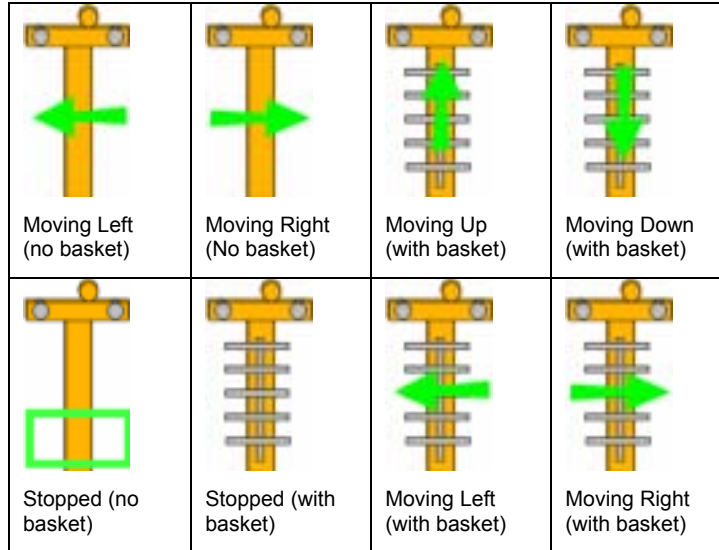
### Crane and tank animation

The white section at the top of the screen shows the current state of the crane and the tanks. The following information is displayed:



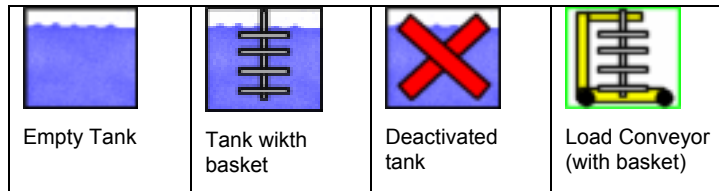
Crane Images

The crane image icon changes depending on the movement direction and the occupied status (ie. load grappled or degrappled).



Station Images

The station images will change depending on the status of the tank or station.



## Station Information

The station information grid shows the current station status:

Station	Used	Hood	Recipe	Step	TimeSet	ActTime	LoadID
1_LOADUNLOAD	ON	Basket			0.0	98.8	
2_RINSE	OFF				0.0	10.2	
3_RINSE	OFF				0.0	18.8	
4_RINSE	OFF				0.0	13.0	
5_RINSE	OFF				0.0	10.1	
6_ZINC	OFF				0.0	50.5	
7_ALUMCLEAR	OFF				0.0	78.5	
8_ALUMCOLOR	OFF				0.0	142.8	

### Station

Name of station

### Used

Whether a basket is in place

### Hood

Basket #

### Recipe

Selected recipe for the basket

### Step

Recipe in the timeway/step (0 = not running)

### Time Set

Setting for the tank/station

### ActTime

Actual elapsed time for the hood

### Load ID

Not used in current system

## Crane Stations & Positions

This display shows the last scheduled crane actions for Hoist/Crane #1 and Hoist/Crane #2.

<b>Last Scheduled Crane Actions</b>			
Crane1	Waiting in down position.		
Station	Any	Vertical	Down
Crane2	Waiting in down position.		
Station	Any	Vertical	Down

### Crane actions

The crane action display will indicate what action is currently being requested. Here are some examples:

*“Drop at 1\_LOAD”*

*“Premove to 7\_ALUMCLEAR”*

### Station

Tank name currently targeted.

### Vertical

Indicates whether current hoist target is UP (lift) or DOWN (drop)

### Neutral position

If a timeway is not running, the system will indicate that the Cranes can be at any station, but should be left in the down position.

## Timeway operations

This section is used to select, start, stop, pause, and reset the timeway operations.

The screenshot shows the 'Timeway Operations' control panel. At the top, there is a title 'Timeway Operations' in blue. Below it, a 'Select Timeway' dropdown menu is set to 'H\_Unthermalled\_Brass', with a 'Load' button to its right. Underneath, a 'Loaded Timeway' text box also displays 'H\_Unthermalled\_Brass', and to its right, a 'Cycle Time' field shows '300.0 secs.'. The 'Basket Startup Locations' section has a text box containing '11\_RINSE, 18\_RINSE, 1\_LOADUNLOAD' and a green 'Ok' indicator light. The 'Crane Startup Locations' section has a text box with 'Crane1 at 11\_RINSE and Crane2 at 18\_RINSE' and another green 'Ok' indicator light. At the bottom, there are three buttons: 'Run' (green), 'Pause' (orange), and 'Closedown' (red). To the right of these buttons are four indicator lights: 'Run Status' (green), 'Run Paused' (grey), 'Closing Down' (grey), and 'Closed Down' (grey). Further right are two text boxes for 'Cycle Position' and 'Slip Time', both showing '0.0 secs.', and a 'Reset' button.

### Select timeway

This pull-down menu is used to select a specific timeway to run. The list will display 2-crane and single-crane timeways.

Once selected, you will need to click “Load” to actually select the timeway for operations.

***Important:** You can only select a new timeway if the currently selected timeway is Closed Down (see light)*

### Loaded Timeway

This displays the currently loaded timeway.

The cycle-time of the timeway (time between new loading) is displayed to the right of the name.

### Basket Startup Locations

This describes to the operator the number and startup locations of the baskets. Prior to Running the timeway, the operator must insure that baskets are located in the indicated locations.

When the baskets are located properly, the OK light will indicate success (green).

### Crane Startup Locations

This describes to the operator the startup locations for the two cranes. Prior to Running the timeway, the operator should place the cranes in the indicated tank locations.

When the cranes are located properly, the OK light will indicate success (green).

### Run button

This starts the timeway, either from a ClosedDown or Paused state.

### Pause button

This pauses the running timeway at the current elapsed time. When paused, the system will complete the currently identified crane actions, but will not request another action until Run is pressed.

### Closedown button

Pressing close-down instructs the system to complete the current timeway cycle and then stop the timeway. The time until close-down can be estimated by subtracting CyclePosition from CycleTime.

### Reset button

This button is seldom used. It stops the timeway and resets all pointers to the start. If you push this button during timeway operations, all baskets will remain in their current locations – you will need to move them to the startup locations manually.

Only use this button if you want the timeway to stop (not pause) and you also don't mind the current basket locations.

### Run status light

This indicates that the loaded timeway is currently running or paused.

### Run paused light

This indicates that the loaded timeway is paused. The cycle position will show where the timeway is in the cycle.

### Closing-down light

This indicates that the running timeway is currently in a closedown mode. After  $\text{CyclePosition} = \text{CycleTime}$ , the Closed-Down light will turn on.

### Closed-down light

This indicates that the running timeway is closed-down or stopped. At this stage, the run status light will be off.

### Cycle position

This time indicates the current timeway location, with respect to the current cycle time. When  $\text{Cycle Position} = \text{Cycle Time}$ , the cycle will repeat.

### Slip time

This time indicates the total amount of slip that has occurred in the cycle. Slip is a term that defines time not accounted for in the timeway. For example, if the timeway expects the lift operation to take 5 secs and the actual lift takes 5.5 secs, then you will see a .5 sec slip every time a lift occurs.

Minimal slip is normal during operations, but if a crane is stuck (ie. waiting for conveyor), then the slip will increase and the ExcessiveSlip alarm will be generated.

## Operation modes

The following operations modes are displayed on the main screen.



### Auto Mode

Auto mode is used during automatic, timeway operations. While in auto mode, the system will direct the cranes from the running timeway.

*Note: Auto mode cannot be initiated if the plating line is in manual mode.*

### Semi-Auto Mode

Semi-Auto mode is used when you want to manually move the cranes from one station to another by using the Flextime semi-automatic move buttons on the main screen.

*Note: Semi-Auto mode cannot be initiated if the plating line is in manual mode.*

### Manual Mode

Manual mode disconnects the Flextime software from any means of operating the cranes. In manual mode, the joystick and physical buttons can be used to jog the cranes from one location to another. No automatic positioning (via ICS meters) is performed.

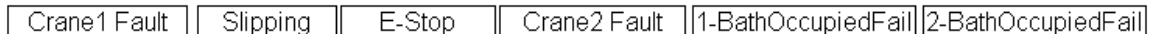
Manual mode can be actuated by pressing E-Stop or by selecting manual mode on the crane button panel.

## Other information

The following miscellaneous controls and displays are on the main screen.

### Alarm messages

The following alarms will be displayed blinking red at the top of the screen.



#### **Crane Fault**

This indicates that a fault occurred with the cranes movement. This fault can be anything that restricts the crane, including conveyor not in place, ICS5000 failure, or bath-occupied. See troubleshooting section at end of manual.

#### **Slipping**

This indicates that excess slip is occurring. This usually indicates that the action being requested by the timeway runner did not occur in the time expected.

#### **E-Stop**

This indicates that the E-Stop button has been pressed (or system has lost power). When an E-Stop occurs, the system goes to Manual mode (PLC control only).

#### **BatchOccupiedFail**

This alarm indicates that the system did not see a BathOccupied sensor indication, even though a basket is located at the station. This alarm will occur when the sensor fails, or if the software shows a basket at a station, even though no basket is at the station.

### Load counter

Load Counter

The load counter automatically counts the number of actual loads picked-up at the conveyor. The counter does not operate when the RunEmpty toggle is initiated.

### Run Empty

Run Empty

This toggles the mode which allows the cranes to pick-up at the conveyor without indication from the conveyor that a basket is present.

RunEmpty is always used to purge the line of remaining parts at the end of a specific timeway or part batch processing cycle.

### Silence Horn Button




This button is only displayed when the alarm horn sounds.

Click the button to silence the horn.

*Note: The horn will automatically silence 30 seconds after it sounds*

### Conveyor bypass

Conveyor   
Bypass

This button/mode is only displayed when the system is in Semi-Auto mode.

Conveyor bypass is used to turn the transfer conveyor on. It is usually used to transfer parts directly from the load conveyor to the dryer conveyor (bypassing the plating line).

## **Operation buttons**

The following buttons are used to access the other software screens



### Alarm Log

This button will display the alarm database screen. The database screen will show a list of alarms that have occurred in the current day.

### Trouble screen

This screen provides information useful in troubleshooting crane and line problems. If the crane stops during a timeway, chances are you can find the cause in the Trouble screen.

### Maintenance screen

This screen provides information on security setup, basket location initialization, I/O monitoring, and ICS camera diagnostics.

### Recipe screen

This screen shows all original process recipes. Though recipes are not used during timeway operations, they are the original format required to develop a new timeway.

### Timeway design

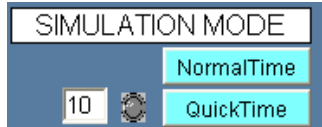
This screen is used to view and design timeways. The screen is usually locked from typical operators.

### Security Login

This button accesses the pop-up form used to log in and out of the system.

## **Simulation Information**

When the software is in simulation mode (turned on in Maintenance screen), the simulation information will be displayed in the upper-right region of the screen.



### Simulation

In simulation mode, the software will not communicate with the PLC or ICS cameras. Instead, it will simulate the movement of the cranes according to velocity and acceleration information stored in the software.

Important: Never initiate simulation when a timeway is running. Always confirm that the timeway is closed-down prior to initiating the simulation.

### Quicktime button

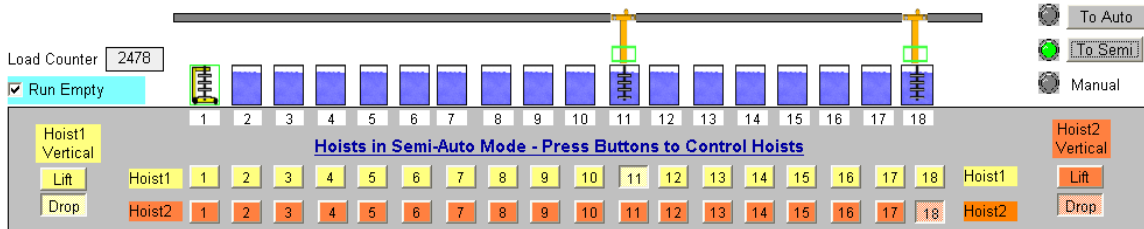
This button is used to select Quicktime simulation. In Quicktime (light shown in green), the clock is advanced at the specified multiple. For example, quicktime setting of 10 would simulate 10 seconds of operation time in 1 realtime second.

### Returning from simulation mode

When you turn off simulation mode, the cranes will immediately move to the current simulation positions. For this reason, prior to returning from simulation mode, you should move (semi-auto) the cranes in the software to match the actual crane location in the line – that way, the cranes won't move when you return to normal mode.

### 3) Semi-Auto intervention

The following chapter describes the semi-automatic operation capabilities of the software



#### How to place system in semi-auto

On the main screen, press the “To Semi” button. The green light will indicate the mode.

*Note: if “Manual” light is on, you will first need to place the crane(s) in auto mode (crane button panel).*

#### How to move the cranes

When you enter semi-auto mode, the main screen will display yellow and orange buttons, which can be used to manually control the cranes.

##### Moving cranes to a specific station

**Yellow** buttons are used to control crane #1, while **orange** buttons are used to control crane #2.

Click the specified numbered tank button to initiate a crane move to that station.

*Note: as the crane moves, you can press another station button to change the cranes target in-situ.*

##### Lifting and dropping

**Yellow** buttons are used to control crane #1, while **orange** buttons are used to control crane #2.

Click the Lift or Drop button to change the vertical location of the crane.

*Note: The crane must be at a station before the Lift and Drop will work properly.*

#### Crane movement interlocks

The following interlocks are provided:

##### Cranes can't move if not up or down

If the crane's vertical position is not fully up nor fully down, than horizontal movement won't function.

##### Crane #1 can't move if conveyor not ready

If Crane #1 is moving to the load station, it will stop prematurely if the conveyor and/or basket is not ready for pickup. The signal for pickup is generated by the PLC and proximity sensors.

*Note: you can bypass this check by selecting “Run Empty” on the main screen.*

##### Cranes can't lift or drop if not at a station

If the crane is not at or very near a station (ICS meter feedback), than the system will not allow vertical Lift or Drop actions.

Cranes can't drop if tank is occupied

The system will not allow down or drop actions if it thinks a basket is already at the current station.

**On Screen**

The system will not drop if the screen shows a basket in the current tank or basket (even if bathoccupied sensor reads empty)

**BathOccupied sensor**

The system will not drop if the bath occupied sensor shows a part is in place in the tank or load station.

Crane collision boundaries

The cranes are restricted from getting too close to each other. This collision control utilizes the current position of both cranes and calculates a collision boundary for the target.

## 4) Recipe Editing

The Recipe Screen is accessed via the “Recipe Screen” button on the Main Screen.

**TankLine - Recipe Editor**

Recipes

Add Delete

Copy Paste

- A\_SP47\_Zinc
- B\_SP74\_Alum\_Color
- C\_SP54\_Alum\_Clear
- D\_SealBowls
- E\_SP54\_Barstock
- F\_Thermalled\_Brass
- G\_Alum\_Clear\_Eaton
- H\_Unthermalled\_Brass
- I\_SP47\_Zinc\_NonPainted
- 1Crane\_A\_SP47\_Zinc
- 1Crane\_B\_SP74\_Alum\_C
- 1Crane\_C\_SP54\_Alum\_C
- 1Crane\_D\_SealBowls
- 1Crane\_E\_SP54\_Barstoc
- 1Crane\_Thermalled\_Bras
- 1Crane\_G\_Alum\_Clear\_E
- 1Crane\_H\_Unthermalled\_
- Copy\_of\_H\_Unthermalled\_

Name: A\_SP47\_Zinc ID:  Created: 5/18/2003 4:21:14 PM

Description:  Modified: 5/19/2003 9:04:34 PM

Author: AUTOUSER Last Run: Never

Type: Process

*Double-Click to add recipe row*

Position	MinTime	NomTime	MaxTime	DripTime	IncrLift
I_LOADUNLOAD					
10_PHOSCLEAN		21			
11_RINSE		28			
12_RINSE		6			
14_ALKCLEAN		12			2
14_ALKCLEAN		4		12	
13_RINSE		6			
12_RINSE		62			
6_ZINC		30			
6_ZINC		4			
5_RINSE		6			
4_RINSE		6			
3_RINSE		30		3	
2_RINSE		4		5	
I_LOADUNLOAD					

P | ? | Select recipe to edit or view | ClientPC: MASONLAPTOP2 | ServerPC: MASONLAPTOP2 | User: **Back**

### Screen information

The following information is displayed on the screen.

#### Recipes

The left-side of the screen shows the currently entered Recipes. Buttons for Adding, Deleting, Copying, and Pasting recipes is also provided.

Recovery recipes (ie. recipes automatically run when a hood is cancelled in a chemical tank) are indicated with a red check mark.

#### Recipe information

The information at the top of the screen indicates the information associated with the currently selected and displayed recipe.

Name – Name of recipe

Description – Description of recipe.

ID – Numeric identification used for RSVIEW recipe selection

Author – Original author of the recipe

Type – Indicates whether the recipe is a Process or Recovery recipe.

Created – Indicates recipe creation date/time

Modified – Indicates the last date/time of the recipe modification

Last Run – Indicates the last launch time for the recipe.

### Recipe grid

The recipe grid shows the stations and parameters for the selected and displayed recipe.

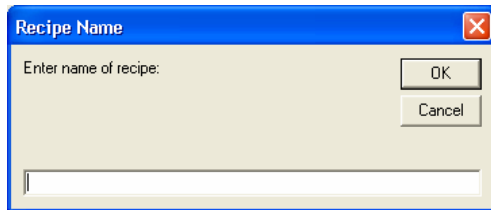
### Stations

The station boxes on the right-side of the screen are used to build a recipe format. By clicking, dragging, and dropping the specific station names on the recipe grid, you can build a sequence of tank/stand/booth stations for the recipe.

## **How to create a new recipe**

The following procedure is used to create a new recipe.

1. Click “Add” button
2. Enter the recipe name in the pop-up form.



3. The new recipe will be displayed in the listing on the left-side of the screen.

## **How to delete a recipe**

The following procedure is used to delete a recipe.

1. Select a recipe in the listing
2. Press the “Delete” button.
3. Answer “Yes” to the confirmation dialog box.

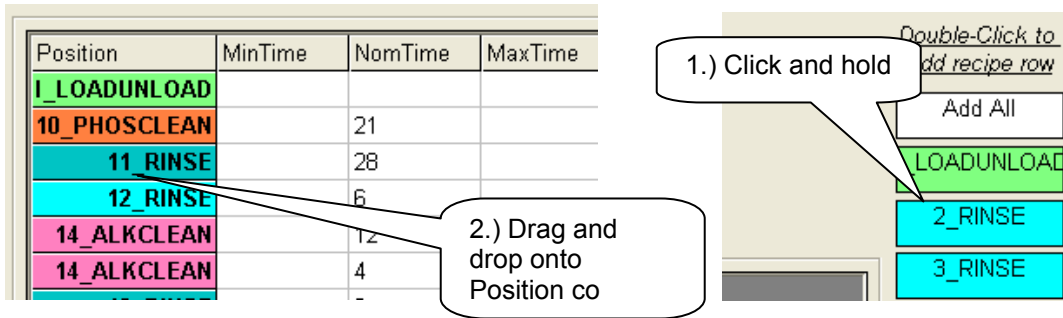
## **How to copy and paste a recipe**

The following procedure is used to copy a recipe

4. Select a recipe in the listing
5. Press the “Copy” button.
6. Click the listing to indicate the paste location for the new recipe.
7. Press the “Paste” button.

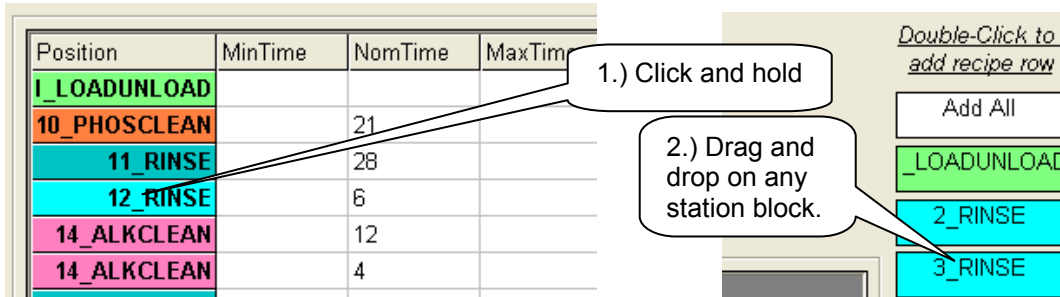
### How to add stations to a recipe

You can add a station row to the recipe by clicking, dragging, and dropping a stations block onto the recipe grid.



### How to remove a stations from a recipe

You can remove a station by clicking, dragging, and dropping the row from the grid back to the station block(s).



### How to move a station within the recipe

You can move a specific station by clicking, dragging, and dropping it from one row to another in the recipe grid.

### Recipe parameters defined

The following recipe parameters are provided:

#### MinTime

This is the minimum time in the station in units = seconds. The min time parameter is utilized for station alarming as well as the scheduling optimization routines.

#### MaxTime

This is the maximum time in the station in units = seconds. The max time parameter is utilized for station alarming as well as the scheduling optimization routines.

#### NomTime

This is the nominal time in the station in units = seconds. The nominal time parameter is utilized for specific scheduling and optimization algorithms to favor a specific target time for the station.

### DripTime

This is the dripping time used for the specific tank in units = seconds. If the driptime remains blank, than no drip is scheduled.

### **Using part attributes or variables**

The Flextime recipe system supports the use of part attributes and variables to replace time, drip, and tilt entries.

### Entry format

Enter the name of the part attribute or variable in the recipe entry in order to instruct the system to automatically use the attributes value when the recipe is scheduled.

### What part attributes can be used?

The current system does not have any part attributes.

## 5) Timeway Design

This chapter explains how you convert a pre-defined recipe into a running timeway.

**Timeway Design Screen**

Recipes

- A\_SP47\_Zinc
- B\_SP74\_Alum\_Color
- C\_SP54\_Alum\_Clear
- D\_SealBowls
- E\_SP54\_Barstock
- F\_Thermalled\_Brass
- G\_Alum\_Clear\_Eaton
- H\_Unthermalled\_Brass
- I\_SP47\_Zinc\_NonPainted
- 1Crane\_A\_SP47\_Zinc

Recipe Information

Name: A\_SP47\_Zinc      Created: 5/18/2003 4:21:14 PM      View

Description:       Modified: 5/19/2003 9:04:34 PM

Author: AUTOUSER      Last Run: Never

---

Intermix Operations

Cycle Time: 176      Start: 52.44784

Reset      Save

1_LOADUNLOAD	3.5
10_PHOSCLEAN	17.5
11_RINSE	28.0
12_RINSE	6.0
14_ALKCLEAN	12.0
14_ALKCLEAN	4.0
13_RINSE	2.3
12_RINSE	61.7
6_ZINC	34.0
6_ZINC	4.2
5_RINSE	11.8
4_RINSE	6.0
3_RINSE	32.4
2_RINSE	8.6

By Load | By Station | By Vehicle

P | ?      ClientPC: MASONLAPTOP2 | ServerPC: MASONLAPTOP2 | User:      Back

### Screen information

The following general information is displayed on the screen:

#### Recipe list

This lists all recipes on the system.

#### Recipe information

This displays information fields associated with the currently selected (blue highlight) recipe. The information includes Name, Description, Author, Created, Modified, and LastRun.

#### View button

This button will access the Recipe Screen in order to view the currently selected recipe contents.

#### Recipe contents

This lists each station and the current time-way step times for each station.

*Note: the times in the timeway may differ from the original recipe's nominal times*

## Intermix operations

This section provides controls and entries to for the currently selected timeway/recipe. The information includes:

### **Cycle-time entry**

This shows the current cycle-time for the timeway. The cycle-time represents the elapsed time between successive loads. For a fixed timeway schedule, all actions are duplicated for successive cycles.

You can change the cycle time, and the graphic will reflect the change.

### **Cycle-time slider**

This slider is used to change the current cycle-time in order to provide a better mix of crane and station utilization.

### **Start time entry**

This represents the starting or close-down point in the cycle. A red line is shown to indicate the 0 (zero) time in the cycle.

### **Reset button**

This button resets the current timeway to a single-line timeway based on the original recipe. All previously saved changes to the timeway will be lost.

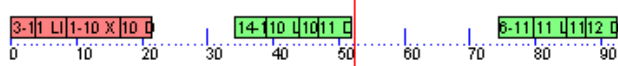
### **Save button**

This button saves the timeway changes so that they will be retained on leaving the timeway design screen.

## Understanding the graphic timeway

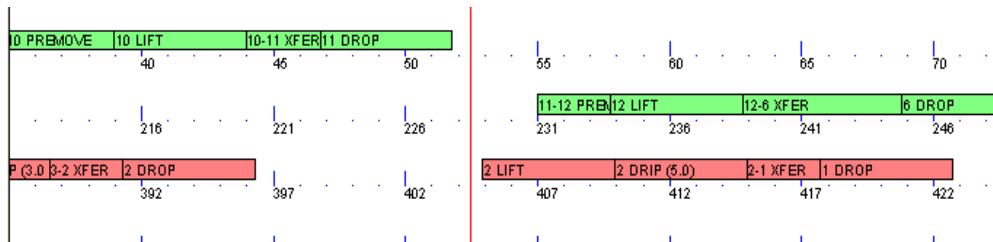
The timeway designer is graphical, and represents a new way of writing and generating timeways. The following information is useful in understanding the timeway image.

### Crane actions



Crane actions are shown by orange and green boxes. The boxes are segmented into different actions, which collectively represent a transfer of the basket from one station to another. Orange = Crane1, Green = Crane2.

You can zoom the display to show the specific actions associated with each transfer. The zooming bar is the vertical bar on the right-side of the screen.:



The action bars also indicate elapsed time of the actions by showing the number of seconds in parantheses (ie. "(5.0)")

The following crane actions are defined:

#### Lift

This is the action of lifting a basket from a tank or load/unload station to full height. Lift time is a fixed time defined in initial configurations.

#### Drip

This is the action of holding a basket above a station for a pre-defined period of time.

#### Transfer

Shown as XFER, this is the action of moving the basket from one station to another.

#### Drop

This is the action of dropping a basket into a tank or load/unload station. Drop time is a fixed time defined in initial configurations (usually the same as lift time)

#### Postmove

This is the action of moving the crane in the down position from the last drop (or postmove) station to current lift station.

#### LiftIncr, DropIncr

This is the action of moving the crane away from the drop station immediately after a drop. A postmove is required to get a crane out of the way of another crane (collision avoidance) or for clearing the load/unload station so that the conveyor can operate.

These actions occur together, and are used to agitate a basket in a station. The actions lifting the basket up a short distance and then drop it back in the station. Actual lift distance can be adjusted by changing the LiftIncr and DropIncr time.

### Action Group

An action group is a collection of actions that serve a common purpose, and that cannot be separated. In the timeway, a group will consist of the following actions:

*Premove-Lift-Drip-Transfer-Drop-Postmove*

### Process Time

The total process time is defined as the time required to process a single basket through the line. On the design screen, you can identify total process time by viewing the time associated with the end of the last crane action to be performed for the selected recipe. For example, the process time for SP47Zinc on page 5-2 is approx. 423 secs.

### Cycle Time

The cycle time is represented by the width of the graphic display (top line only). For SP47Zinc for instance, the cycle time = 176 secs.

### Basket quantity

Because a new basket is loaded each cycle, it stands to reason that the number of baskets used for the timeway is equal to the number of cycles required to process a basket through the process line.

Graphically, the number of baskets is represented by the number of cycle-time rows required to process the specified timeway.

### Overlap actions

Though the graphical timeway shows crane actions for the process on multiple rows, in reality the crane actions will all occur during a single timeway cycle. Because of this, care should be taken in insuring that actions on different rows don't occupy the same vertical space.

### Space conflicts

If any action on one row conflicts or uses the vertical space of an action on another row, than the timeway will not run properly. When designing a timeway you will need to move crane transfers to insure that the actions fit vertically.

*Note: later versions of the software will automatically identify conflicts*

### Crane boundary conflicts

Moving from left to right in the cycle time, you should insure that the two cranes do not conflict with each other (ie. in the same station space vertically). This is achieved by scanning left to right and identifying crane location by the particular action that is occurring. The cranes must always be 4 stations apart.

### Start line

The red startline indicates the closedown position of the timeway. This is generally positioned so that the baskets are in rinse tanks and not in chemical tanks.

When the timeway actually runs, the cycle timer will be normalized to the start time position. For example, in SP47Zinc the starttime = 52.44 secs. During the run, the cycle timer will be zero (0) secs at the starttime position.

### Identifying basket start locations

Each row indicates a separate basket. To identify basket startup locations (ie. basket locations at start/closedown of timeway, scan backwards on each row until you see the

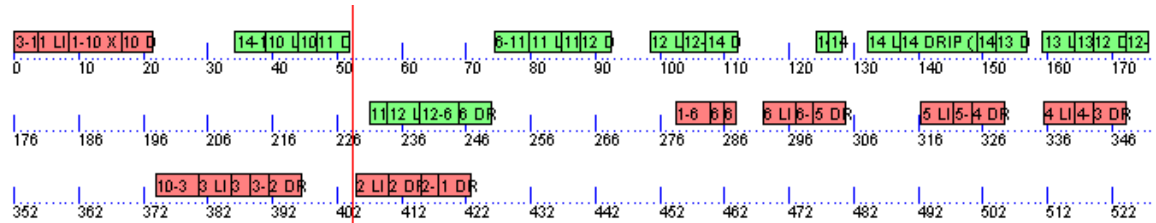
first drop action The drop location is a basket startup location. For example, on SP47Zinc, the startup locations are 11, 3, and 2. *Note: if there isn't a drop action to the left of the line, then you may need to loop back to the end of the row and find the last drop position.*

### Identifying crane startup locations

To identify crane startup locations, scan backwards from the starttime line and the destination station of the closest action for each crane indicates the startup location. *Note: if there isn't any action for a particular crane to the left of the line, then you may need to loop back to the end of the timeway and scan backwards from there.*

### How to read the timeway

Here is an excersize on how to read the following timeway – A\_SP47\_Zinc.:



### Crane #1 actions

*The following are not normalized to starttime.*

CycleTime	Description
0 secs.	Premoves from 3 to 1, lifts, transfers to 10, and drops at 10 (Recipestep = 1)
22 secs:	Premoves from 10 to 3, lifts, transfers to 2, and drops at 2 (Recipestep = 13)
53 secs:	Lifts at 2, Drips at 2, transfers to 1, drops at 1 (Recipestep = 14)
102 secs:	Premoves from 1 to 6, Liftincr/Dropincr (agitate) (Recipestep = 9)
115 secs:	Lifts at 6, transfers to 5, drops at 5 (Recipestep = 10)
141 secs:	Lifts at 5, transfers to 4, drops at 4 (Recipestep = 11)
159 secs:	Lifts at 4, transfers to 3, drops at 3 (Recipestep = 12)

### Crane #2 actions

*The following are not normalized to starttime.*

CycleTime	Description
34 secs.	Premoves from 14 to 10, lifts, transfers to 11, and drops at 11 (Recipestep = 2)
54 secs:	Premoves from 11 to 12, lifts, transfers to 6, and drops at 6 (Recipestep = 8)
74 secs:	Premoves from 6 to 11, lifts, transfers to 12, and drops at 12 (Recipestep = 3)
97 secs:	Lifts at 12, transfers to 14, drops at 14 (Recipestep = 4)
123 secs:	Liftincr/Dropincr (agitate) at 14 (Recipestep = 5)
132 secs:	Lifts at 14, Drips at 14, transfers to 13, drops at 13 (Recipestep = 6)
159 secs:	Lifts at 13, transfers to 12, drops at 12, postmove to 14 (Recipestep = 7)

### Starttime

52 secs. During a run, the cycle timer will be normalized to the starttime.

### Basket startup locations

- Row #1: 11
- Row #2: 3
- Row #3: 2

### Crane startup locations

- Crane #1: 2 (see row #3)
- Crane #2: 11 (see row #1)

### First action during run

- Because the system normalizes the cycle timer to the starttime, the first movements for the cranes on timeway start will be:
- Crane #1 – Lift at 2
  - Crane #2 – Preremove from 11 to 12

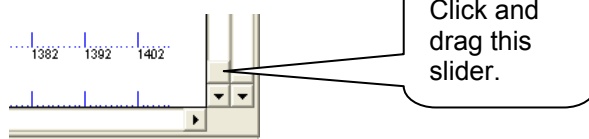
### How to select a timeway

Click on the recipe in the Recipe List to select a Recipe and accompanying time-way. If a timeway doesn't exist for the recipe (ie. new recipe), then a single-line timeway will be generated and displayed in the graphic area.

### Editing the timeway

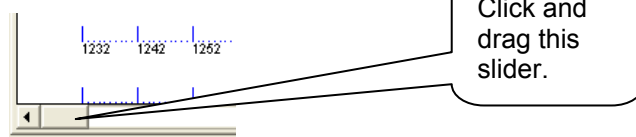
The following actions can be used to change timeway information:

#### How to zoom in and out



Drag the left-hand slider up or down to zoom in and out of the timeway.

#### How to pan the timeway left and right



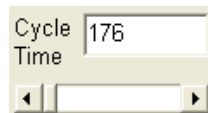
Drag the lower horizontal slider left and right to pan the timeway graphic.

#### Changing the start-time

Right-click on the graphic display (not on an action) and select "Add Start" from the drop-down menu. The starttime will move to the new position.

You can also type the starttime into the starttime entry.

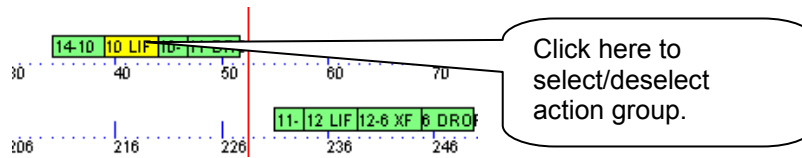
#### Changing the cycle-time



You can change the cycle-time by scrolling the cycle-time bar or by entering a cycle time. The range of cycle time will be 0 to max process time.

*Note: When you change the cycle-time, you will undoubtedly change the station and crane conflicts.*

### Selecting an action group



You can select an action group by clicking on the “LIFT” action block. Once selected, the color of the LIFT action will be yellow. Click again to deselect.

### How to change the group’s crane

You can change the crane that is used for an action group by double-clicking on the LIFT action after selecting the group.

1. Select the group
2. Right-click on the LIFT action and select “Change Crane”. The color and crane allocation of the group will change.
3. Select the group again to force the system to calculate new pre/post moves as required.

### Moving action blocks

Movement of action blocks is technique used to avoid station and crane conflicts. The system allows you to move a single action group (lift-transfer-lower), or move all future groups.

### How to move an action group and all future moves

When designing the timeway, you may want to move a specific action, and also have all other future action blocks move the same amount of time.

1. Select the action group.
2. Click and drag the LIFT action of the block
3. The block and all future steps in the proces will move synchronously.

*Note: When you move the blocks, the system will automatically recalculate and redraw all premove and postmove actions that have changed as a result of the move.*

### How to move action group independently

You can also move a single action block. This will reduce time for the previous process station, and add equal time to the current action’s station.

This action is useful in vertically fitting moves so that there is no crane conflicts.

1. Select the action group.
2. Hold down the <Ctrl> key on the keyboard.
3. Click and drag the LIFT action of the block
4. The block group will move independently.

*Note: When you move a block, the system will automatically recalculate and redraw all premove and postmove actions if the move created a different pre or post location for the crane.*

#### How to change the lift and drop times

The lift and drop times for the timeway is automatically generated based on the pre-configured lift and drop times. If you wish to change a specific lift or drop time, the system provides an easy way of doing this.

1. Select the group
2. Right-click on the LIFT or DROP action.
3. Select “Change Lift Time” or “Change Drop Time” from the menu
4. Enter the new time (non-zero) in the pop-up box.

#### How to change a lift/drop to a liftincr/dropincr

You can change a lift to a liftincr and a drop to a dropincr, though this is usually only done if there was a mistake in the original recipe.

1. Select the group
2. Right-click on the LIFT or DROP action.
3. Select “Change to LiftIncr” or “Change DropIncr” from the menu

#### How to change or add a postmove for an action group

In order to move the crane away from the last station of the move, you can add a PostMove action to the group. You can also change the location of the currently configured post-move.

1. Select the group
2. Right-click on the DROP or POSTMOVE action.
3. Select “Change Postmove Time” from the menu.
4. Enter the number of the station that you want to move to.

*Note: You can enter a zero (0) or the current station # if you want to cancel the post-move for the specified action group.*

## 6) Alarm Log Viewing

This chapter discusses the Event Viewing capabilities of the Flextime software. You can access the Event Viewer screen by clicking the “Alarm Log” button on the Main Screen.

Color	Date	Type	Group1	Tag	Text
	8/4/2003 11:55:00 AM	Alarm	SYSTEM	POW480	System lost 480 Volt Power (possible ESTO
	8/4/2003 11:51:28 AM	Alarm	SYSTEM	POW480	System lost 480 Volt Power (possible ESTO
	8/4/2003 11:51:28 AM	Alarm	SYSTEM	POW120	System lost 120 Volt Power
	8/4/2003 11:44:49 AM	Alarm	CRANE1	BARINTNK1	Crane #1 Bar in Tank Alarm
	8/4/2003 11:44:01 AM	Alarm	CRANE1	OCCUP1	Crane #1 Station Occupied
	8/4/2003 11:34:11 AM	Alarm	2_ULTRA	LWLVL	Low Tank Level Alarm
	8/4/2003 11:34:06 AM	Alarm	2_ULTRA	HITEMP	High Temp Limit

### What are events?

Events are actions and alarms that occur during the normal course of operation. The Flextime software records specific events to an Event Log file so that the history of the system can be analyzed post-run.

### What file is used for the events?

The event log utilizes a new file every day, named with a pre-configured prefix and the current date (ie. “CraneLog\_YYYY-MM-DD.mdb”).

### Database format

The file format used on the system is Microsoft Access database file. These files can be opened and reported with any current Microsoft Access application.

## Event fields

The following event fields are provided:

### Color

This is the color number associated with the specific task. The number is saved to the database.

### Date

This is the time and date when the event occurred. It is standard Microsoft Date format.

### Type

This is the type of message. Most messages will be “Alarm” type.

### Group1

This will indicate the general grouping for the alarm. The groups provided are: CRANE1, CRANE2, and SYSTEM.

### Tag

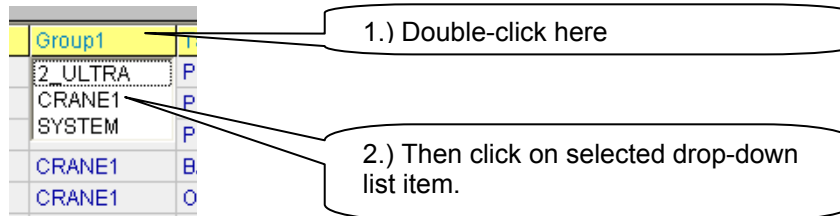
This indicates the specific component that generated the alarm. For example, a vertical drive fault will be “VERTDRVFAULT”

### Text

This is the actual alarm message displayed for the alarm. t.

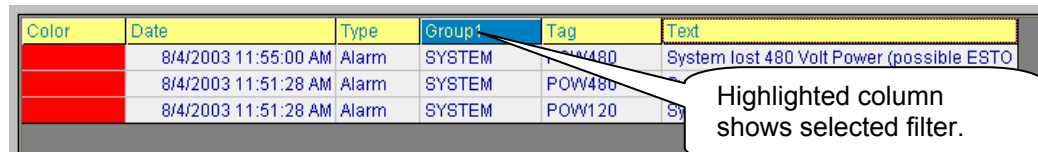
## How to use filtering to display specific events

The system provides an easy way to filter the view so that only specific information is displayed.



### Selecting a new filter

1. Double-click the column title. The system will display a drop-down listing of all of the unique entries for that column.
2. Click the selected item that you want to view (ie. “LoadStart”)
3. The system will now display the filtered events.



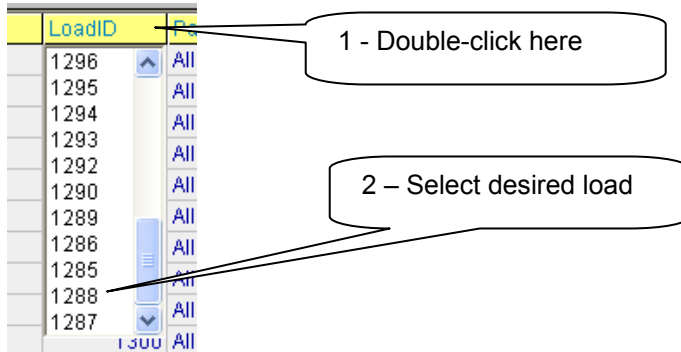
### Removing the filter

You can remove the filter by double-clicking on the filtered column’s title.

## Showing all actions for a specific load

You can use the filter capability to show all actions associated with a load.

- Identify the LoadID for the load you want to view. If you want to view actions for a current load, identify the LoadID by viewing the “Current Hood Information” grid. *Note: if the load was run on a different day, you will first need to change the currently viewed log file (see next section).*
- Double-click the column title of the “LoadID” column and select the specific ID number from the drop-down menu.



- The display will now show all actions associated with that Load. *Note: recovery recipes will be launched as a new load.*

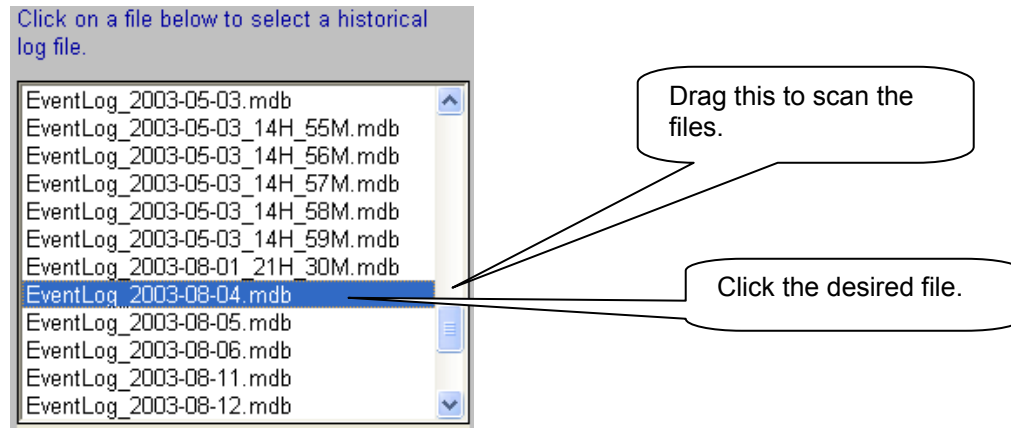
Date	Tmr	Color	Vehicle	Action	HorizStation	VertStation	Duration	Payload	LoadID	Part	Recipe	RecipeStep
5/3/2003 7:40:43 PM	4825			LoadEnd				0 Hood3	1288	Alloy2000	Recipe4	5
5/3/2003 7:40:41 PM	4811			Drop	HU1			0 Hood3	1288	Alloy2000	Recipe4	5
5/3/2003 7:40:28 PM	4683			Pickup	T19_Dryer		1094.52	Hood3	1288	Alloy2000	Recipe4	4
5/3/2003 7:38:39 PM	3600			Drop	T19_Dryer		1081.127	Hood3	1288	Alloy2000	Recipe4	4
5/3/2003 7:38:09 PM	3314			Pickup	T23_SprayF		71.63979	Hood3	1288	Alloy2000	Recipe4	1
5/3/2003 7:38:02 PM	3245			Drop	T23_SprayF		69.8004	Hood3	1288	Alloy2000	Recipe4	1
5/3/2003 7:37:50 PM	3130			Pickup	T21_Inspec		963.4693	Hood3	1288		Recipe4	0
5/3/2003 7:37:47 PM	3106			LoadStart			0	Hood3	1288	Alloy2000	Recipe4	0
5/3/2003 7:33:16 PM	540			LoadSchedu			0	Hood3	1288	Alloy2000	Recipe4	0

## How to view historical event logs

A new event log file is created at midnight every day. The most current log file will be displayed on the screen.

Selected Alarm Log File:  
c:\Data\EventLog\_2003-05-17\_14H\_21M.mdb

In general, you will be viewing the most current log file. You are however able to select a historical file to view.



### Selecting a historical file

1. Drag the listing to identify the specific day that you are interested in
2. Click the desired file. The Event Viewer will immediately update the display to show the events for that day.

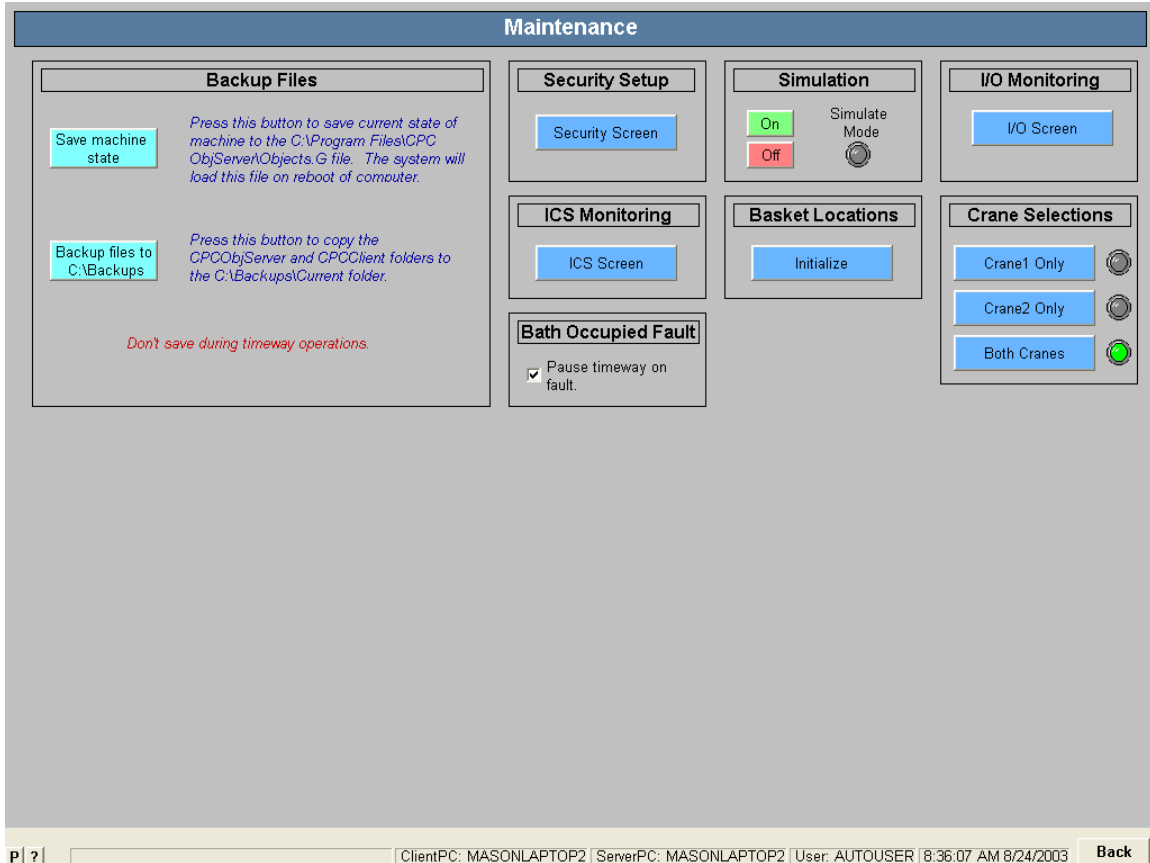
### Selecting the current file

If after viewed historical events you want to return to viewing today's events, then scan and click on the that file.

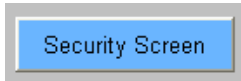
## 7) Support & Maintenance

This chapter discusses the support and maintenance functions of the system. You can access these functions by clicking on the “Maintenance Screen” button on the Main Screen.

*Note: This screen may be security locked from certain personnel.*



### Security setup



You can click the “Security Screen” button to access the security system.

### Simulation enable



The simulation selection is used to turn ON and OFF the simulator. The green light indicates that the simulator is enabled.

When the simulation is enabled, the I/O operations are disabled (ie. communications to PLC) and the system utilizes simulated crane operations. *Warning: Do not enable simulation during a timeway or during movement.*

## Basket location initialization

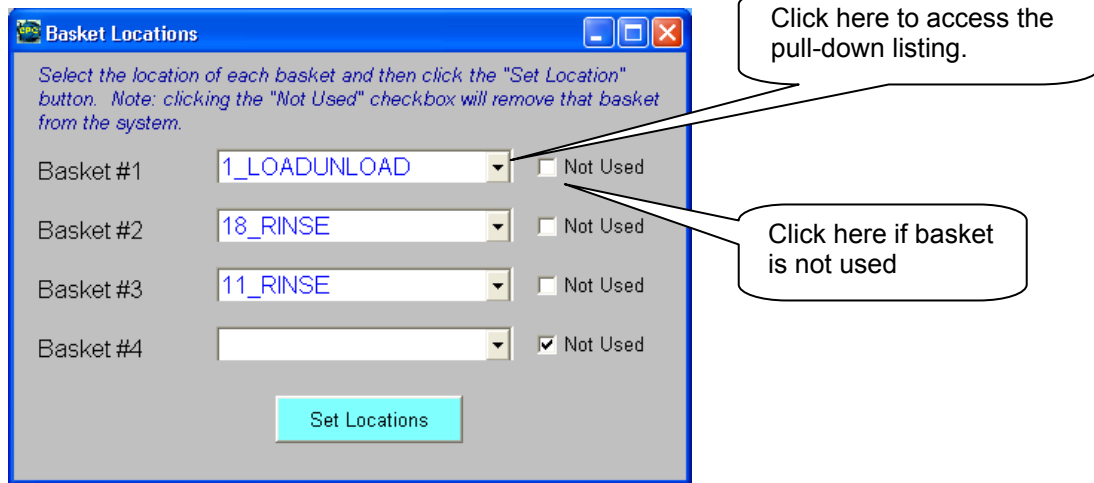
It is vitally important that the system be told where the actual baskets are located in the line. The initialization pop-up form is used to instruct the system where all baskets are located.



Press the “Initialize” button to access the pop-up form used to set current basket locations.

### Basket initialize form

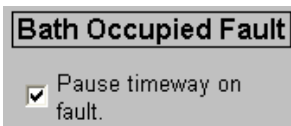
The basket initialization pop-up form is used to designate the location of each basket in the plating line.



Select a station for a basket, or click the “Not Used” check-box to indicate that the basket is not used.

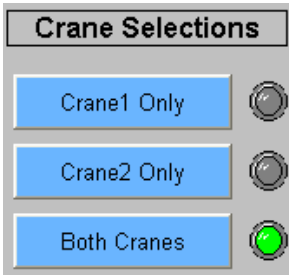
1. For basket #1, click and select a station from the pull-down listing or click “Not Used”.
2. For basket #2, click and select a station from the pull-down listing or click “Not Used”.
3. For basket #3, click and select a station from the pull-down listing or click “Not Used”.
4. For basket #4, click and select a station from the pull-down listing or click “Not Used”.
5. Click the “Set Locations” button to finalize the change.

## Bath-occupied fault interlock



When this setting is checked, the system will automatically pause the timeway if the bath-occupied sensor fails, or there is a mismatch between what basket is showing on the screen, and what basket is in the tank.

## Selecting single-crane operation

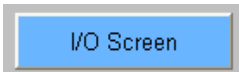


You can select operation by both cranes, or a single crane.

Only make this selection if a timeway is not running and the cranes are not moving.

*Note: When you select single-crane operation, you MUST utilize the single-crane timeways for operation.*

## I/O Monitoring



This screen displays all digital On/Off information coming from the PLC.

The image shows the "PLC I/O Screen" interface. It features a table with two columns: "Tag Name" and "Value". The table lists various digital inputs and outputs from the PLC, such as "BSKT\_STP\_ROLL\_DN\_PB" (OFF), "ESTOP" (ON), "H1\_REV\_JS" (OFF), "H1\_OVR\_TRVL" (ON), "H1\_FWD\_OVR\_TRVL" (OFF), "H1\_REV\_OVR\_TRVL" (OFF), "H1\_SAFETY" (ON), "H1\_BRAKE" (OFF), "H1\_UP\_LIM" (OFF), "H1\_DN\_LIM" (ON), "H1\_AM" (ON), "H1\_BATH\_OCC" (ON), "H1\_FWD\_JS" (OFF), "H1\_UP\_JS" (OFF), "H1\_DN\_JS" (OFF), "H2\_AM" (ON), "H2\_BATH\_OCC" (ON), "H2\_BRAKE" (OFF), "H2\_DN\_JS" (OFF), "H2\_DN\_LIM" (ON), "H2\_FWD\_JS" (OFF), "H2\_FWD\_OVR\_TRVL" (OFF), "H2\_OVR\_TRVL" (ON), "H2\_REV\_JS" (OFF), "H2\_REV\_OVR\_TRV" (OFF), "H2\_SAFETY" (ON), "H2\_UP\_JS" (OFF), "H2\_UP\_LIM" (OFF), "BSKT\_STP\_ROLL\_UP\_LIM" (ON), "LOAD\_CONV\_AUTO" (ON), "CONV\_JOG\_FWD\_PB" (OFF), "CONV\_JOG\_REV\_PB" (OFF), "CONV\_SAFETY\_PHOTO\_EYE" (ON), "CONV\_BSKTCNT\_PHOTO\_EYE" (ON), and "LD\_SEQ\_EN\_FROM\_CONV\_SYS" (OFF).

Tag Name	Value
BSKT_STP_ROLL_DN_PB	OFF
ESTOP	ON
BSKT_STP_ROLL_UP_PB	OFF
H1_REV_JS	OFF
H1_OVR_TRVL	ON
H1_FWD_OVR_TRVL	OFF
H1_REV_OVR_TRVL	OFF
H1_SAFETY	ON
H1_BRAKE	OFF
H1_UP_LIM	OFF
H1_DN_LIM	ON
H1_AM	ON
H1_BATH_OCC	ON
H1_FWD_JS	OFF
H1_UP_JS	OFF
H1_DN_JS	OFF
H2_AM	ON
H2_BATH_OCC	ON
H2_BRAKE	OFF
H2_DN_JS	OFF
H2_DN_LIM	ON
H2_FWD_JS	OFF
H2_FWD_OVR_TRVL	OFF
H2_OVR_TRVL	ON
H2_REV_JS	OFF
H2_REV_OVR_TRV	OFF
H2_SAFETY	ON
H2_UP_JS	OFF
H2_UP_LIM	OFF
BSKT_STP_ROLL_UP_LIM	ON
LOAD_CONV_AUTO	ON
CONV_JOG_FWD_PB	OFF
CONV_JOG_REV_PB	OFF
CONV_SAFETY_PHOTO_EYE	ON
CONV_BSKTCNT_PHOTO_EYE	ON
LD_SEQ_EN_FROM_CONV_SYS	OFF

At the bottom of the screen, there is a status bar with the following information: "P | ?" on the left, "ClientPC: MASONLAPTOP2 | ServerPC: MASONLAPTOP2 | User: AUTOUSER | 8:36:46 AM 8/24/2003" in the center, and a "Back" button on the right.

## ICS 5000 distance meter monitoring

### What is the ICS5000 distance meter?

The Trimble # ICS5000 distance meter/controller is used to control the crane positions. The system has two (2) distance meters, which utilize a beam and reflector to measure the exact distance and position of the cranes.

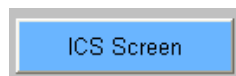
#### Connection and communications

The ICS5000 meters communicate to the Allen Bradley PLC via DeviceNet communications. *Note: ASC did not provide these components.*

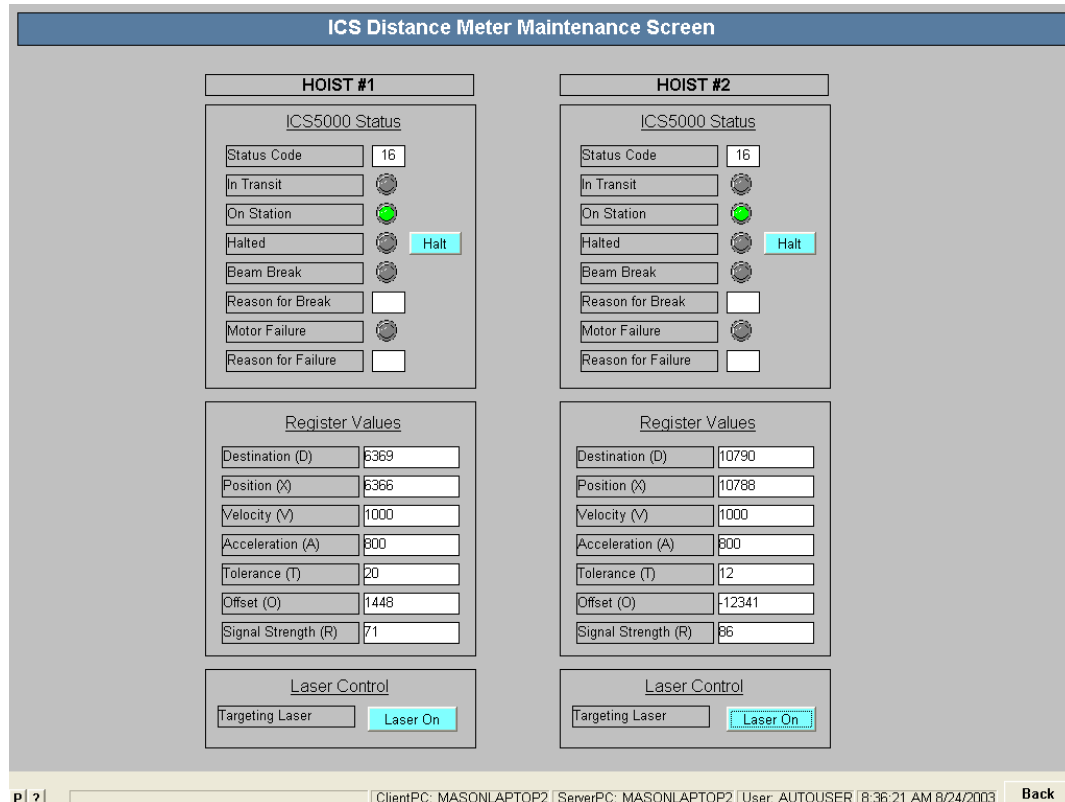
#### Software communications

The Flextime software sends position setpoints to the PLC and receives distance and ICS status information via the Ethernet connection.

### Distance meter status screen



This button accesses the ICS5000 monitoring screen.

The screenshot shows the "ICS Distance Meter Maintenance Screen" with two columns for "HOIST #1" and "HOIST #2". Each column contains an "ICS5000 Status" section with fields for Status Code (16), In Transit (off), On Station (on), Halted (off), Beam Break (off), Reason for Break, Motor Failure (off), and Reason for Failure. Below this is a "Register Values" section with fields for Destination (D), Position (X), Velocity (V), Acceleration (A), Tolerance (T), Offset (O), and Signal Strength (R). At the bottom of each column is a "Laser Control" section with a "Targeting Laser" field and a "Laser On" button. The status for both hoists is consistent: Status Code 16, On Station is active, and Laser On is active. The status bar at the bottom shows "ClientPC: MASONLAPTOP2 | ServerPC: MASONLAPTOP2 | User: AUTOUSER | 8:36:21 AM 8/24/2003" and a "Back" button.

#### Status Code

The status code is an integer # that defines the current operational state and status of the distance meter. The expected numbers are 1,2,4,8,and 16.

#### In Transit (8)

This status indicates the crane is traveling toward a destination.

### On Station (16)

This status indicates that the crane has reached its targeted station.

### Motor failure (4)

This status warns that the meter was unable to move to the target properly. This is often caused by drive failure, motor problem, or PLC not being in auto mode.

### Beam Brake (2)

This status indicates that something caused the meter's positioning beam to not see the reflector properly. This is usually caused by a dirty reflector, dirty lens, obstacle, or missing reflector.

### Halted (1)

This status indicates that the movement of the meters was halted (with Halt command). The halt command occurs when system goes into manual.

### Halt button

This button is used to halt the meter.

### Register Status

The following PLC/ICS register information is displayed:

Destination – mm target setpoint from software

Position – mm position of the crane

Velocity – mm/sec speed setting

Acceleration – mm/sec<sup>2</sup> setting during moves

Tolerance – mm dead-band used by the meter for final targeting

Offset – mm shift of position, used for calibrating and normalizing position

Signal Strength - % of beam signal – measured only when not travelling

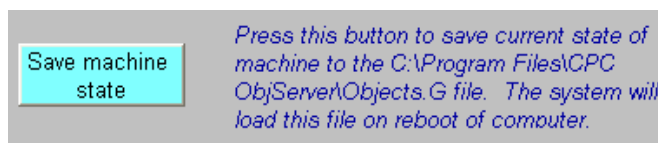
### Laser control

Push the laser button to force the meter to turn on its targeting laser.

*Note: this should only be considered during maintenance and/or adjustment of the meters.*

## How to save the machine state

This support function is used to save the current status of the Flextime software.



### When to save state

The machine state should be saved whenever you have made changes to the software that you would like to retain. For example, changes to configurations, settings, offsets, positions, and recipes should be retained by use of this function.

*Important: Do not save the machine state during timeway operations, except in case of imminent power-failure.*

### Objects.g file

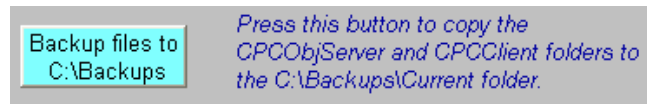
As with most ASC software products, the system state is saved to a file called **Objects.g**. This file is often referred to as the "objects" file.

### Automatic saving

The system is currently configured to automatically save the machine state every 5 minutes, except during timeway operations. This means that if you stop a timeway, the system (and current basket locations) will be saved within 5 minutes.

### **How to save backup files**

This support function is used to backup the current program directories to another directory on the hard-drive (or server).



### Where are backup files located

The backup function saves the current CPC ObjServer and Client directories to an alternate directory on the hard-drive. The backup directory is typically C:\Backups\Current.

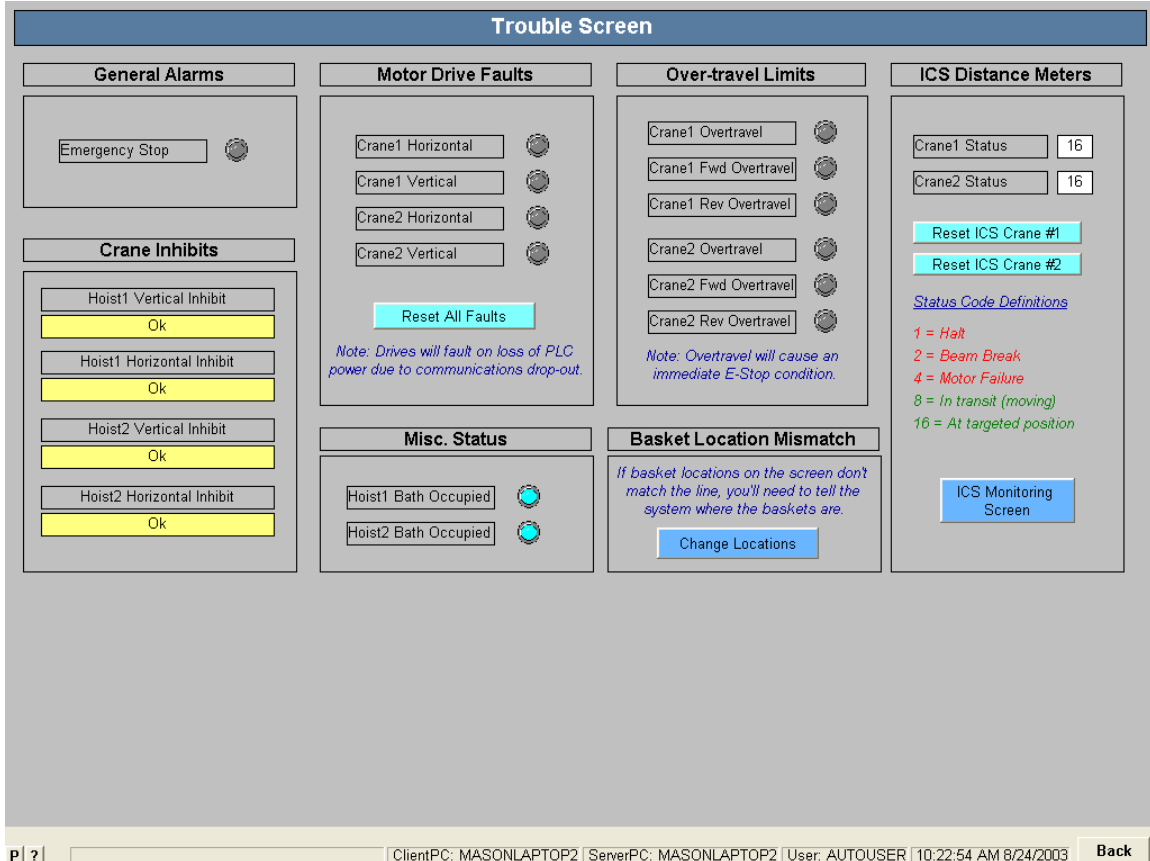
If a second hard-drive partition is utilized (ie. D), than this drive will be selected for the backup.

### When to backup the files

It is recommended that you backup the files after saving the machine state, but ONLY IF THE CURRENT SYSTEM CONFIGURATION HAS BEEN TESTED AND IS WORKING PROPERLY..

## 8) Trouble Screen

The trouble screen is used to identify and display the most common trouble issues with the line.



### Emergency Stop

This indicates that the PLC E-Stop signal has been interrupted. The system will revert to manual mode during an ESTOP condition.

#### What causes an E-stop

- Estop button is pushed.
- Loss of power to crane
- A crane overtravel limit has been actuated

### Motor drive faults

This section shows whether any of the variable-frequency drives on the vertical and horizontal crane motors has faulted.

#### Reasons for faults

- The drives can fault on over-current, especially on dropping a heavy load.
- The drives can also fault if PLC power is interrupted.
- The drives can also fault on loss of DeviceNet communications, which is the same communications link used for the ICS5000 meters.

### Reset button

The reset button will issue a global reset of all drives.

## **Overtravel limits**

The over-travel limits are switches positioned on the crane that are hard-wired to perform an E-stop on actuation.

### Overtravel vs Fwd/Rev overtravel

The Overtravel input will be illuminated if any overtravel occurs, including the Up/Down and Fwd/Rev overtravel.

*Note: There is not a separate Up/Down overtravel input.*

## **ICS distance meters**

The ICS meter information is provided to identify current status of the meters. *Note: See Maintenance Screen chapter for more information on ICS status.*

### Reset button

The reset buttons are used to reset the meters, especially following a fault condition (2,4).

Do not reset meters while the cranes are moving.

## **Crane inhibits**

This section shows the possible reasons why the crane or cranes are not moving. The possible displayed messages are:

### Reasons for vertical inhibit

#### **Crane in manual mode**

Check Auto/Manual switch or Estop on panel

#### **Conveyor is in bypass mode**

The cranes are disabled whenever the conveyor is placed in bypass mode.

#### **Conveyor not ready for pickup**

This occurs when Crane #1 is in 1\_Load station, but the conveyor is not indicating that it's ok to pickup the load.

#### **Horizontal not at station**

The vertical Up or Down control will not function unless the horizontal position matches an actual station (+/- 20mm).

#### **Basket in tank sensor**

Vertical down movement is disallowed, because system thinks there is already a basket in the station. Check basket, bath-occupied sensor, or basket location on screen.

### Reasons for vertical inhibit

#### **Crane in manual mode**

Check Auto/Manual switch or Estop on panel

#### **Conveyor is in bypass mode**

The cranes are disabled whenever the conveyor is placed in bypass mode.

**Conveyor not ready for pickup**

This occurs when Crane #1 tries to go to 1\_Load station, but the conveyor is not indicating that it's ok to pickup the load.

**Vertical not at station**

The horizontal movement is restricted if the crane is not UP or DOWN. To correct this, go to manual, move crane UP or DOWN, and then return to Auto control.

**Miscellaneous status**

This shows the bath-occupied sensor status.

**Basket location mismatch**

This accesses the basket initialization screen. See Support & Maintenance chapter for more information on this.

## 9) Objects Tutorial

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CPC is the base software used by Flextime. This chapter provides some general information on objects, object structure, and object editing used for all configuration of the Flextime package. This is by no means a comprehensive discussion of all objects in the system.

### CPC object defined

The CPC object is a discreet software component that includes data (properties), functions (methods), and customer programmed events (quickscripts).

#### Object elements

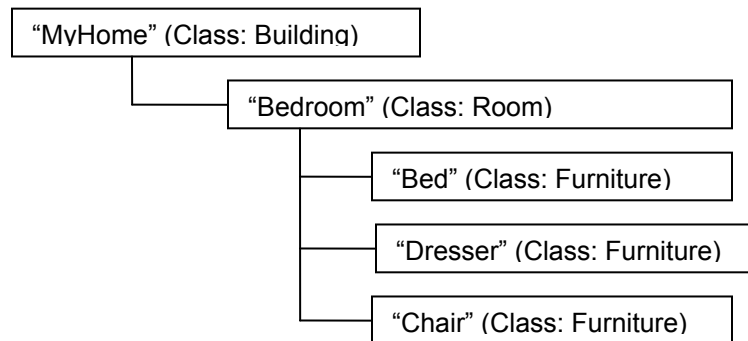
**Property** – This is a data element that is used by the object’s functionality. The property can be text, numeric, or an array.

**Method** – This is a pre-configured function of the object. Methods are named according to their action (ie. Do\_Read).

**QuickScripts** – This is a soft-programmed script that runs automatically upon the event defined by its name. For example, a theoretical “House” object would have a quickscript called “OnEntry” that would run whenever someone entered the house.

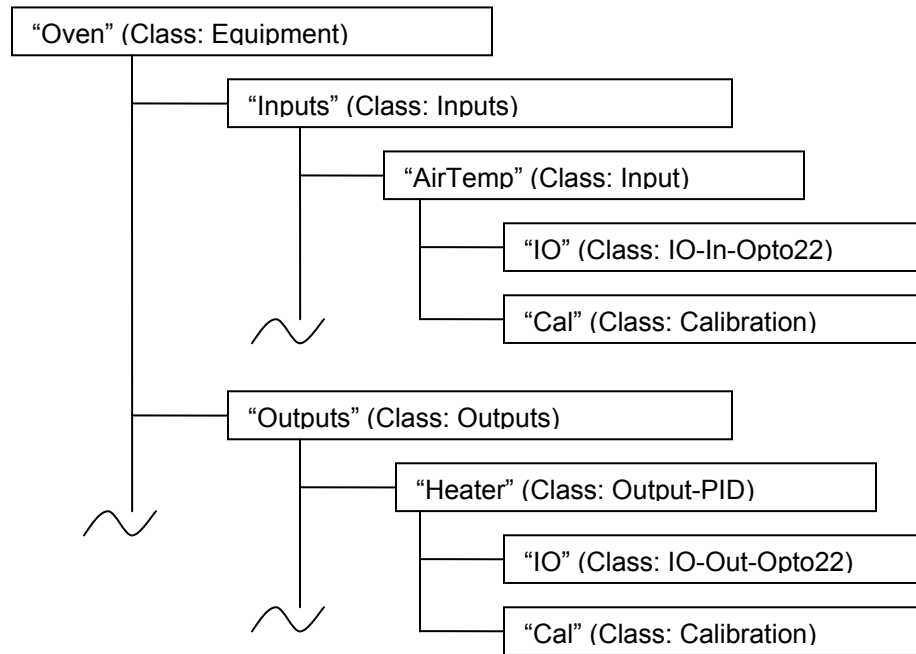
#### Object parent-child relationships

The CPC objects utilize a parent-child structure to denote the precedence and/or ownership of the objects. See the following structures:



In this object structure, MyHome is the parent of Bedroom. Bedroom is the parent of Bed, Dresser, and Chair.

In an oven control system configuration, the following structure may be shown:



## CPC class defined

A CPC Class is a template that defines the structure and elements of a CPC object. There are hundreds of types of objects that can be used for CPC configuration, and each one has an associated class.

### Class information

A CPC class contains the following information:

- List of object elements. This includes properties, methods, and quickscript events.
- For each object element, the class also defines how these are edited, what happens when they are copied, what help information is displayed for the element, and other information.

### How to edit a class

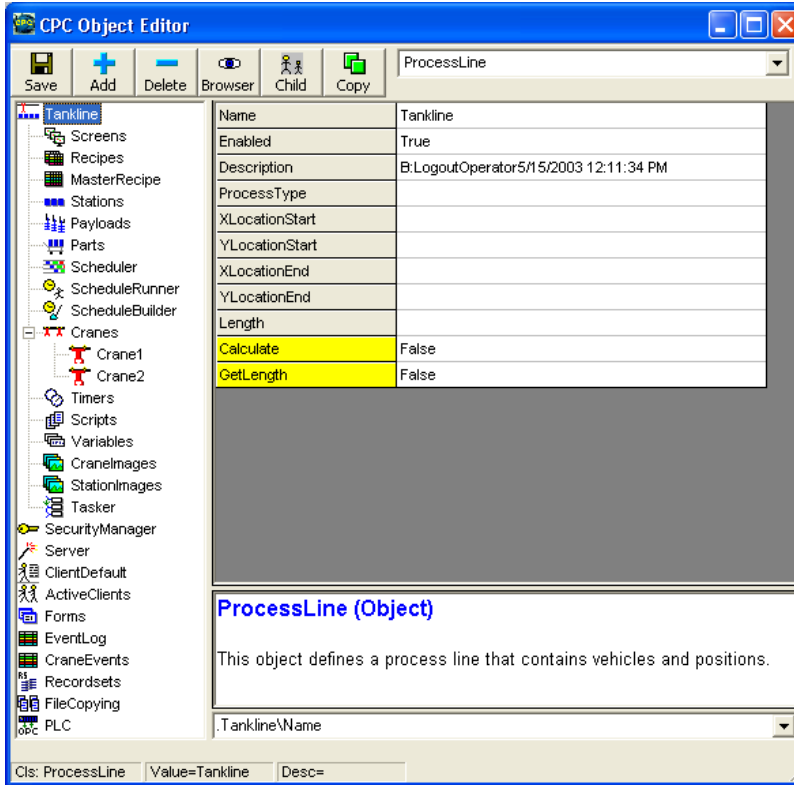
Though not recommended, you can access the Class Editor by the following procedure:

- 1.) From the MMI main screen move the mouse to the top of the screen and right-click.
- 2.) Select "Exit Screen" from the pulldown menu. The system will leave the MMI system and display the main foundation form for CPC client.
- 3.) Right-click and select "Show Class Editor" from the menu. The system will display the class editor.

*Note: Don't modify the classes until further training. You can view the classes and the underlying elements, but you shouldn't change anything. The classes are stored in the Classes.g file.*

## Object editor

The object editor is used to view, create, and edit the object structure.



### How to access the object editor

- 1.) From main screen, move mouse to top of screen and right-click
- 2.) Select "Show Object Editor" from the menu.

*Note: operators are not given access this this menu option.*

### Editor information

The object editor shows the following information:

**Object Tree** – The tree on the left is the list of root-level objects. You can expose object children by double-clicking on the desired object.

**Property List** – This list shows the elements of the currently selected object. These are properties (white), methods (yellow), and quickscripts (green)

**Buttons** – These buttons are used for object creation, deletion, and editing.

**Class list** – The upper-right combo box shows the class of the currently selected object. Clicking the box exposes a list of all available object classes.

**Help information** – The lower-right portion displays help information for the currently selected object/element. *Note: The help information is stored in the class definition (classes.g), and is not available for all objects and/or incomplete.*

**Cls** – This indicates the class of the currently selected object.

**Value** – This indicates the value of the currently selected property. If the property contains a path link to another property, the value of the linked property will be displayed.

Desc – This is user tip information for the specific class. This information is created and stored in the class definition and is not complete.

## Buttons

The following buttons are provided:

Save – This button saves the current object configuration to the Objects.g file (same as Save button on the server form)

Add – This button adds a new object as a sibling (or child if “Child” button is depressed) to the currently selected object. The type of object created will be based on the current class selection (combo box in upper-right). If the copy button is depressed, you will add a copy of another object.

Delete – This button deletes the currently selected object. **Important:** *to speed configuration duties, ASC did not create a confirmation to the delete operation. Also, this operation is nonrecoverable so.. be careful.*

Browser – This button accesses another object editor which is used for browsing and selection of path links for properties.

Child – This toggle (in/out) is used to indicate whether the Add button adds the new object as a sibling or a child. *FYI: “Add” Child does not work with copied objects.*

Copy – This toggle is used to identify the object to copy.

## Object tree browsing

You can expose the children of objects by double-clicking on them in the object tree. There are usually many levels of objects for a typical configuration:

Name	ICS5000
Enabled	True
Description	
PositionCommand	6369
VelocityCommand	1000
AccelerationCommand	800
Position	6366
Velocity	1000
Acceleration	800
Status	16
Simulate	False
DelayTime	0
MoveTime	2.548
LastTime	1813668.32573665
Calculate	False
SetMoveTime	False
PositionCommandLW	6369

The editor above is displaying the ICS5000 object (Class: ICS5000). This object is the child of Horizontal object, which is a child of the Crane1 object, and so on...

## Path link defined

A path link is a type of property that describes another property by use of an object path.

For example, the “Target” property in the editor view on the previous page is a path link property.

## Property path

The following path targets the “StationSetpointAuto” property of Crane1’s Horizontal object:

```
.Tankline.Cranes.Crane1.Horizontal\StationSetpointAuto
```

You will notice that the period ( . ) is used to identify a node on the tree. The starting period is required to indicate the root of the tree.

The backslash is the prefix to the object element (ie. property, method, or quickscript).

## Where to use path links

Path links are used throughout the configuration with many objects that require interaction with other objects or properties. For example, a screen button may target a “StartTimeway” method on the Scheduler object. In this case, the “Value” property of the button would have a path link to the “StartTimeway” method:

```
.Tankline.Scheduler\StartTimeway
```

Path links are also used throughout script programming. Scripts are custom logic programs written in CPC Scripting language.

## **How to “run” an object method**

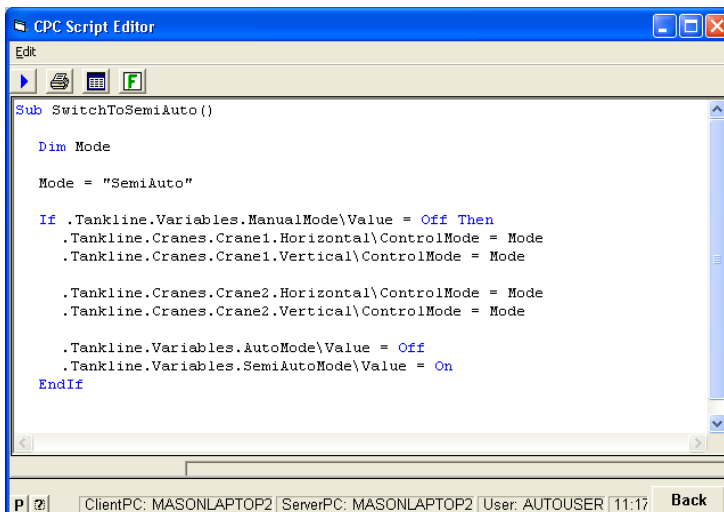
You can manually run an object method (yellow) in the object editor by double-clicking on the method. When a method runs, it’s value will change from False to True to False.

## **What is a script?**

A script is a program that is running within Flextime/CPC that performs custom logic for the particular system being controlled.

Scripting utilizes a custom language designed by ASC which is very similar to Microsoft’s Visual Basic™.

Here’s a sample script program, shown in the CPC Script Editor:



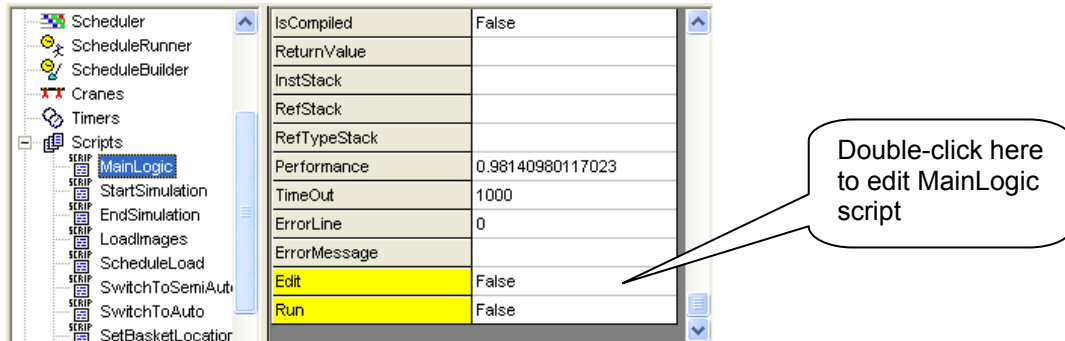
```
CPC Script Editor
Edit
Sub SwitchToSemiAuto()
    Dim Mode
    Mode = "SemiAuto"
    If .Tankline.Variables.ManualMode\Value = Off Then
        .Tankline.Cranes.Crane1.Horizontal\ControlMode = Mode
        .Tankline.Cranes.Crane1.Vertical\ControlMode = Mode
        .Tankline.Cranes.Crane2.Horizontal\ControlMode = Mode
        .Tankline.Cranes.Crane2.Vertical\ControlMode = Mode
        .Tankline.Variables.AutoMode\Value = Off
        .Tankline.Variables.SemiAutoMode\Value = On
    EndIf
EndSub
P | z | ClientPC: MASONLAPTOP2 | ServerPC: MASONLAPTOP2 | User: AUTOUSER | 11:17 | Back
```

## How to edit a script

There are two types of scripting in CPC/Flextime. One type utilizes a special object called a “Script” object; the other type is a QuickScript that is actually a property of an object.

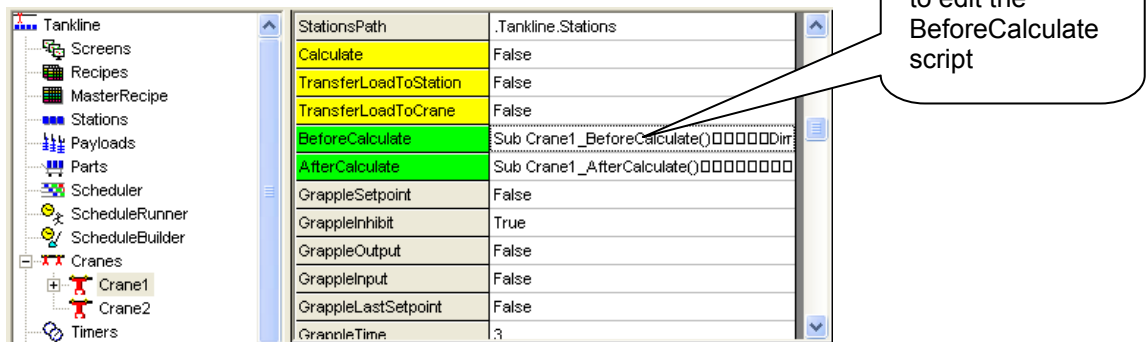
### Editing a script object

There is an Edit method of any script object. Double-click the Edit method to access, view, and edit the specific script.



### Editing a quickscript

To edit a quickscript, double-click on the actual quickscript in the object.



## 10) Scripting in system

---

The following logic represents the main operational logic that affects crane movement and system operation. *There are a number of one-shot scripts in the system that are not displayed in this chapter.*

### Crane\_BeforeCalculate

This quick-script is in the Crane1 and Crane2 objects:

```
Dim VerticalSetpoint

' ** get vertical setpoint
If Me.Vertical\ControlMode = "Auto" Then

    VerticalSetpoint = Me.Vertical\StationSetpointAuto

Else

    VerticalSetpoint = Me.Vertical\StationSetpointSemiAuto

    If .Tankline.Scheduler\TimewayRunning = Off Then
        Me.Vertical\StationSetpointAuto = Me.Vertical\StationSetpointSemiAuto
        Me.Horizontal\StationSetpointAuto = Me.Horizontal\StationSetpointSemiAuto
    EndIf

EndIf

' ** set max and min limits
Me.Horizontal\PositionSetpointMax = Me.Horizontal.Stations.18_RINSE\Position
Me.Horizontal\PositionSetpointMin = Me.Horizontal.Stations.1_LOADUNLOAD\Position

' ** default inhibit movement
Me.Vertical\InhibitLow = Off
Me.Vertical\InhibitHigh = Off
Me.Horizontal\Inhibit = Off
Me.Variables.ReasonForVertInhibit\Value = "Ok"
Me.Variables.ReasonForHorizInhibit\Value = "Ok"

If .Tankline.Variables.ManualMode\Value = On Then
    Me.Horizontal\Inhibit = On
    Me.Vertical\InhibitHigh = On
    Me.Vertical\InhibitLow = On
    Me.Variables.ReasonForVertInhibit\Value = "Crane in manual mode."
    Me.Variables.ReasonForHorizInhibit\Value = "Crane in manual mode."
EndIf

If .Tankline.Variables.ConveyorToBypass\Value = On Then
    Me.Horizontal\Inhibit = On
    Me.Vertical\InhibitHigh = On
    Me.Vertical\InhibitLow = On
    Me.Variables.ReasonForVertInhibit\Value = "Conveyor is in bypass mode."
    Me.Variables.ReasonForHorizInhibit\Value = "Conveyor is in bypass mode."
EndIf

' ** don't pickup at 1 unless load is ready for pickup
If Me\HorizontalStation = "1_LOADUNLOAD" Then
    If .Tankline.Variables.LoadReadyForPickup\Value = Off And
    .Tankline.Variables.RunEmpty\Value = Off Then
        Me.Vertical\InhibitHigh = On
        Me.Variables.ReasonForVertInhibit\Value = "Conveyor not ready for pickup"
    EndIf
EndIf

' ** dont allow horiz move if not up or down
If Me\VerticalStation = "" Then
    Me.Horizontal\Inhibit = On
    Me.Variables.ReasonForVertInhibit\Value = "Vertical not up or down"
```

```

EndIf

' ** dont allow vert move unless horiz is on station
If Me\HorizontalStation = "" Then
    Me.Vertical\InhibitHigh = On
    Me.Vertical\InhibitLow = On
    Me.Variables.ReasonForVertInhibit\Value = "Horizontal not at station"
EndIf

' ** inhibit drops if bar is in tank
If Me.Vertical.BathOccupied\Value = On And Me.Vertical\AtStationHigh = On Then
    Me.Vertical\InhibitLow = On
    If Me.Vertical\StationLast <> Me.Vertical\StationLow Then
        Me.Variables.ReasonForVertInhibit\Value = "Basket In Tank sensor"
    EndIf
EndIf

' ** get Occupied property of current station
If Me\HorizontalStation <> "" Then
    Me.Variables.BathOccupied\Value = GetChildProp(.Tankline.Stations,
Me\HorizontalStation, "Occupied")
Else
    Me.Variables.BathOccupied\Value = Off
EndIf

' ** inhibit drops if station already Occupied
If Me.Variables.BathOccupied\Value = On And Me.Vertical\AtStationHigh = On Then
    Me.Vertical\InhibitLow = On
    If Me.Vertical\StationLast <> Me.Vertical\StationLow Then
        Me.Variables.ReasonForVertInhibit\Value = "Station already occupied"
    EndIf
EndIf

' ** remember last valid station - needed because of bridge drift
If Me.Horizontal\StationLast <> NullString Then
    Me.Variables.LastValidStation\Value = Me.Horizontal\StationLast
EndIf

```

## Crane\_AfterCalculate

This quick-script is in the Crane1 and Crane2 objects, and serves primarily to change the crane graphics displayed on the main screen:

```

Alias Images = .Tankline.CraneImages

' ** set crane images
If Me\Occupied = True Then
    ' ** parts
    If Me\LoadID <> "" Then

        ' ** crane with parts
        If Me.Horizontal\IsMovingHigh Then
            Me\Image = Images.PartMovingRight\Filename
        Else
            If Me.Horizontal\IsMovingLow Then
                Me\Image = Images.PartMovingLeft\Filename
            Else
                If Me.Horizontal\IsMovingHigh Then
                    Me\Image = Images.PartMovingRight\Filename
                Else
                    If Me.Vertical\IsMovingLow Then
                        Me\Image = Images.PartMovingDown\Filename
                    Else
                        If Me.Vertical\IsMovingHigh Then
                            Me\Image = Images.PartMovingUp\Filename
                        Else
                            Me\Image = Images.Part\Filename
                        EndIf
                    EndIf
                EndIf
            EndIf
        EndIf
    EndIf
EndIf

```

```
                EndIf
            EndIf
        EndIf
    EndIf
Else
    ' ** crane with bar
    If Me.Horizontal\IsMovingHigh Then
        Me\Image = Images.OccupiedMovingRight\Filename
    Else
        If Me.Horizontal\IsMovingLow Then
            Me\Image = Images.OccupiedMovingLeft\Filename
        Else
            If Me.Horizontal\IsMovingHigh Then
                Me\Image = Images.OccupiedMovingRight\Filename
            Else
                If Me.Vertical\IsMovingLow Then
                    Me\Image = Images.OccupiedMovingDown\Filename
                Else
                    If Me.Vertical\IsMovingHigh Then
                        Me\Image = Images.OccupiedMovingUp\Filename
                    Else
                        Me\Image = Images.Occupied\Filename
                    EndIf
                EndIf
            EndIf
        EndIf
    EndIf
EndIf
Else
    ' ** crane empty
    If Me.Horizontal\IsMovingHigh Then
        Me\Image = Images.EmptyMovingRight\Filename
    Else
        If Me.Horizontal\IsMovingLow Then
            Me\Image = Images.EmptyMovingLeft\Filename
        Else
            If Me.Horizontal\IsMovingHigh Then
                Me\Image = Images.EmptyMovingRight\Filename
            Else
                If Me.Vertical\IsMovingLow Then
                    Me\Image = Images.EmptyMovingDown\Filename
                Else
                    If Me.Vertical\IsMovingHigh Then
                        Me\Image = Images.EmptyMovingUp\Filename
                    Else
                        If Me.Vertical\StationLast = "Up" Then
                            Me\Image = Images.EmptyUp\Filename
                        Else
                            Me\Image = Images.EmptyDown\Filename
                        EndIf
                    EndIf
                EndIf
            EndIf
        EndIf
    EndIf
EndIf
EndIf
EndIf
```

## Horizontal\_OnStationChange

This quick-script is in the Horizontal object under both Crane1 and Crane2 objects:

```
.Tankline.Variables.LastCraneToMove\Value = MyParent\Name
```

## Horizontal\_OnStationMoveComplete

This quick-script is in the Horizontal object under both Crane1 and Crane2 objects:

```
' ** check for bathoccupied failure
Dim IsOccupied

If MyParent.Vertical\StationLast = "Down" Then
  IsOccupied = GetChildProp(.Tankline.Stations, Me\StationSetpoint, "Occupied")
  If IsOccupied = True Then
    If MyParent.Vertical.BathOccupied\Value = Off Then
      MyParent.Variables.BathOccupiedFail\Value = On
    EndIf
  EndIf
EndIf
EndIf
```

## Horizontal\_OnPositionChange

This quick-script is in the Horizontal object under both Crane1 and Crane2 objects:

```
Me.ICS5000\HaltCommand = -1
Me.ICS5000\PositionCommand = Me\PositionSetpoint
Me.ICS5000\SetMoveTime
Me\TimeToMove = Me.ICS5000\MoveTime
Me\AtPosition = False
```

## Horizontal\_BeforeCalculate

This quick-script is in the Horizontal object under both Crane1 and Crane2 objects:

```
Alias Crane2Horiz = .Tankline.Cranes.Crane2.Horizontal

Me.ICS5000\Calculate
Me\Position = Me.ICS5000\Position

Dim PosDelta
PosDelta = Me\Position - Me\PositionSetpoint

If .Tankline.Variables.Simulation\Value = Off Then
  If Me.ICS5000\Status = 16 Or Me.ICS5000\Status = 1 Or Me.ICS5000\Status = 4 Then
    If Abs(PosDelta) < 40 Then
      Me\AtPosition = On
    EndIf
  Else
    Me\AtPosition = Off
  EndIf
Else
  If Me.ICS5000\Status = 16 Then
    Me\AtPosition = On
  Else
    Me\AtPosition = Off
  EndIf
EndIf
```

## Vertical\_AfterSetpointChange

This quick-script is in the Vertical object under both Crane1 and Crane2 objects:

```
If .Tankline.Variables.Simulation\Value = On Then
    Me\AtStationHigh = Off
    Me\AtStationLow = Off
EndIf
```

## Vertical\_AfterMoveComplete

This quick-script is in the Vertical object under both Crane1 and Crane2 objects:

```
If Me\AtStationLow = On And Me\StationSetpoint = "Down" Then
    If MyParent\HorizontalStation <> NullString Then
        MyParent\TransferLoadToStation
    Else
        MyParent\HorizontalStation = MyParent.ManualTrack\NearestHorizStation
        MyParent\TransferLoadToStation
        MyParent\HorizontalStation = NullString
    EndIf
EndIf

If Me\AtStationHigh = On And Me\StationSetpoint = "Up" Then
    If MyParent\HorizontalStation <> NullString Then
        MyParent\TransferLoadToCrane
        If MyParent\HorizontalStation = "1_LOADUNLOAD" And
.Tankline.Variables.RunEmpty\Value = Off Then
            .Tankline.Variables.LoadCounter\Value =
.Tankline.Variables.LoadCounter\Value + 1
        EndIf
    Else
        MyParent\HorizontalStation = MyParent.ManualTrack\NearestHorizStation
        MyParent\TransferLoadToCrane
        If MyParent\HorizontalStation = "1_LOADUNLOAD" And
.Tankline.Variables.RunEmpty\Value = Off Then
            .Tankline.Variables.LoadCounter\Value =
.Tankline.Variables.LoadCounter\Value + 1
        EndIf
        MyParent\HorizontalStation = NullString
    EndIf
EndIf
```

## Vertical\_OnTimeout

This quick-script is in the Vertical object under both Crane1 and Crane2 objects:

```
If .Tankline.Variables.Simulation\Value = On Then

    If Me\StationSetpoint = Me\StationHigh Then
        Me\AtStationHigh = On
    EndIf

    If Me\StationSetpoint = Me\StationLow Then
        Me\AtStationLow = On
    EndIf

EndIf
```

## Main Logic

The following logic is located in Tankline→Scripts container object:

```
Alias Crane1 = .Tankline.Cranes.Crane1
Alias Crane2 = .Tankline.Cranes.Crane2

If .Tankline.Variables.NoEstop\Value = On Then
```

```
.Tankline.Variables.Estop\Value = Off
Else
.Tankline.Variables.Estop\Value = On
EndIf

If Crane1.Variables.PLCAuto\Value = Off Or Crane2.Variables.PLCAuto\Value = Off Or
.Tankline.Variables.Estop\Value = On Then
.Tankline.Variables.AutoMode\Value = Off
.Tankline.Variables.ManualMode\Value = On
.Tankline.Variables.SemiAutoMode\Value = Off
Else
.Tankline.Variables.ManualMode\Value = Off
EndIf

If .Tankline.Variables.AutoMode\Value = Off Then
.Tankline.Cranes.Crane1.Vertical.VertSpeed\Value = 0
.Tankline.Cranes.Crane2.Vertical.VertSpeed\Value = 0
EndIf

' ** disable auto mode if conveyor is in bypass mode
If .Tankline.Variables.ConveyorToBypass\Value = On Then
.Tankline.Variables.AutoMode\Value = Off
EndIf

' ** let conveyor PLC know that a load is in place
If .Tankline.Stations.1_LOADUNLOAD\Occupied = On Then
.Tankline.Variables.BasketPlacedAtLoadUnload\Value = On
Else
.Tankline.Variables.BasketPlacedAtLoadUnload\Value = Off
EndIf

' ** check whether ok to bypass conveyor
If .Tankline.Variables.AutoMode\Value = On Then
.Tankline.Variables.OkToBypassConveyor\Value = Off
Else
.Tankline.Variables.OkToBypassConveyor\Value = On
EndIf

' ** reset drive faults
If .Tankline.Variables.DriveFaultReset\Value = On Then
If Crane1.Variables.HorizDriveFault\Value = Off And
Crane1.Variables.VertDriveFault\Value = Off Then
If Crane2.Variables.HorizDriveFault\Value = Off And
Crane2.Variables.VertDriveFault\Value = Off Then
.Tankline.Variables.DriveFaultReset\Value = Off
EndIf
EndIf
EndIf

' ** this does a synchronous write to the PLC for up and down. Needed due to the
' ** lift incremental feature.

If .PLC.H1_PC_Outputs.GoUp\Value <> .Tankline.Cranes.Crane1.Vertical\IsMovingHigh
Then
.PLC.H1_PC_Outputs.GoUp\Do_WriteNow
EndIf

If .PLC.H1_PC_Outputs.GoDown\Value <> .Tankline.Cranes.Crane1.Vertical\IsMovingLow
Then
.PLC.H1_PC_Outputs.GoUp\Do_WriteNow
EndIf

If .PLC.H2_PC_Outputs.GoUp\Value <> .Tankline.Cranes.Crane2.Vertical\IsMovingHigh
Then
.PLC.H2_PC_Outputs.GoUp\Do_WriteNow
EndIf

If .PLC.H2_PC_Outputs.GoDown\Value <> .Tankline.Cranes.Crane2.Vertical\IsMovingLow
Then
.PLC.H2_PC_Outputs.GoUp\Do_WriteNow
```

```

EndIf

' ** fault indications
.Tankline.Variables.Hoist1InFault\Value = Off
If Crane1.Variables.HorizDriveFault\Value = On Then
    .Tankline.Variables.Hoist1InFault\Value = On
EndIf
If Crane1.Variables.VertDriveFault\Value = On Then
    .Tankline.Variables.Hoist1InFault\Value = On
EndIf
If .PLC.IO_Inputs.H1_OVR_TRVL\Value = Off Then
    .Tankline.Variables.Hoist1InFault\Value = On
EndIf
If Crane1.Horizontal.ICS5000\Status = 1 Or Crane1.Horizontal.ICS5000\Status = 2 Or
Crane1.Horizontal.ICS5000\Status = 4 Then
    .Tankline.Variables.Hoist1InFault\Value = On
EndIf

.Tankline.Variables.Hoist2InFault\Value = Off
If Crane2.Variables.HorizDriveFault\Value = On Then
    .Tankline.Variables.Hoist2InFault\Value = On
EndIf
If Crane2.Variables.VertDriveFault\Value = On Then
    .Tankline.Variables.Hoist2InFault\Value = On
EndIf
If .PLC.IO_Inputs.H2_OVR_TRVL\Value = Off Then
    .Tankline.Variables.Hoist2InFault\Value = On
EndIf
If Crane2.Horizontal.ICS5000\Status = 1 Or Crane2.Horizontal.ICS5000\Status = 2 Or
Crane2.Horizontal.ICS5000\Status = 4 Then
    .Tankline.Variables.Hoist2InFault\Value = On
EndIf

' ** excessive slippage
If .Tankline.ScheduleRunner\SlipTime = .Tankline.Variables.LastSlipTime\Value Then
    .Tankline.Timers.ExcessiveSlip\Reset
EndIf
.Tankline.Variables.LastSlipTime\Value = .Tankline.ScheduleRunner\SlipTime

If .Tankline.Timers.ExcessiveSlip\Done = On Then
    .Tankline.Variables.ExcessiveSlip\Value = On
Else
    .Tankline.Variables.ExcessiveSlip\Value = Off
EndIf

.Tankline.Variables.Horn\Value = Off

' ** silence horn after time period
If .Tankline.Timers.AlarmSilence\Done = On Then
    .Tankline.Variables.SilenceHorn\Value = On
EndIf

If .Tankline.Variables.Estop\Value = On Or .Tankline.Variables.Hoist1InFault\Value
= On Or .Tankline.Variables.Hoist2InFault\Value = On Or
.Tankline.Variables.ExcessiveSlip\Value = On Then
    If .Tankline.Variables.SilenceHorn\Value = Off Then
        .Tankline.Variables.Horn\Value = On
    EndIf
Else
    .Tankline.Variables.SilenceHorn\Value = Off
    .Tankline.Variables.Horn\Value = Off
    .Tankline.Timers.AlarmSilence\Reset
EndIf

' ** ok to load timeway
If .Tankline.Scheduler\TimewayRunning = True Then
    .Tankline.Variables.OkToLoadTimeway\Value = False
    .Tankline.Variables.OkToRunTimeway\Value = True
Else
    .Tankline.Variables.OkToLoadTimeway\Value = True

```

```
    If .Tankline.Variables.AutoMode\Value = On And  
.Tankline.Scheduler\CranesAtBaseStation = True And  
.Tankline.Scheduler\LoadsAtBaseStation = True Then  
    .Tankline.Variables.OkToRunTimeway\Value = True  
Else  
    .Tankline.Variables.OkToRunTimeway\Value = False  
EndIf  
EndIf  
EndIf  
  
' ** stop timeway if bath occupied failure  
If .Tankline.Variables.PauseOnBathSensorFail\Value = True Then  
    If .Tankline.Scheduler\TimewayRunning = True Then  
        If Crane1.Variables.BathOccupiedFail\Value = True Then  
            .Tankline.Scheduler\PauseTimeway  
        EndIf  
        If Crane2.Variables.BathOccupiedFail\Value = True Then  
            .Tankline.Scheduler\PauseTimeway  
        EndIf  
    EndIf  
EndIf  
EndIf  
  
' ** save objects whenever timeway is not running  
If .Tankline.Scheduler\TimewayRunning = Off Then  
    .Server\AutoSaveEnabled = On  
Else  
    .Server\AutoSaveEnabled = Off  
EndIf
```