

## Dairy Plant Project Summary

### Project Summary:

Logicon provided an combined automation system for re-automation of 2 Large Milk dryers, replacing existing obsolete systems. Each system was built using Accord on Simatic S7 platform using S7-317 CPU's with Accord ActiveX controls in InTouch Scada. An extensive Profibus based I/O bus was used also to implement the solution for both systems.

The systems were implemented with full Hot-Standby Redundancy, each Scada was normally dedicated to 1 Dryer, but was able to take over operation of the other Dryer in the event of a PC Fail.

Sector:	Dairy
Type:	Milk Powder Production
Customer:	Large Irish Dairy
PLC:	S7-300 x 2
SCADA:	Accord Server and ActiveX Controls (VB Version) in InTouch
Networks	Ethernet & Profibus
I/O count	800 I/O in each Dryer Plant

### Process Summary:

The dryer receives milk from evaporator or whey concentrate from crystallisation tanks and dries it to produce powder which is sent to powder silos.

The primary air for the dryer will be supplied by 1 (one) supply fan. The air is filtered through the air handling unit. The AHU is has two louvre sets supplying air, one taking air from within the building and the second taking air from outside the building. The air inlet is controlled by controlling the motors of the inlet louvers .

The primary air will then pass the steam heater. This heater will bring the air to the desired process temperature. After this heater the air will be brought in contact with the concentrate in the drying chamber, via the hot air duct and the air disperser.

The concentrate will be pumped from a concentrate tank(s) (outlet of the evaporator) to the wheel atomisation system in the drying chamber.

The exhaust air from the dryer, containing still an amount of powder, is lead through a Bag filter were the majority of the powder is filtered out of the air. By means of the main exhaust fan the air is then blown out of the building via a stack.

The powder collected in the Bag Filter will be fed to a so called middle pressure pneumatic powder transport system, by means of blow thru rotary valve. A blower transports this powder back to the Fluid bed into the mixing section or the outlet of the bed which can be selected by means of a switch valve.

The powder, produced in the drying chamber, not discharged by the exhaust air, will drop in the integrated bed where drying, until the required moisture content is reached, will take place.

Next the powder will drop in the external fluid bed, via a rotary valve and a drop chute where the powder if necessary is dried further and/or is cooled down to the required temperature.

The internal or integrated fluid bed has no separate air discharge, but the exhaust air will be part of the drying chamber exhaust air. The exhaust air of the external fluid bed will be sucked through the outlet duct in to the dryer exhaust duct at a higher level.

After the fluid bed the powder will enter the sifter ( via a rotary valve future). Oversized powder will be discarded. From the sifter the final powder will be transported to the powder silo's true a blow thru rotary valve by means of a middle pressure pneumatic powder transport (existing system).

product is a result of a ratio blending of 3 liquid initial ingredients, with a further blending with a powder agreement to a buffer hopper. The mixture is then fed to a packaging machine where a final element is added.

Holding vessels contain two of the initial liquids. These liquids are made by heating solid pellets which are fed from external hoppers. The vessels, and associated piping, are kept hot using direct steam injection and heated jacket heating.

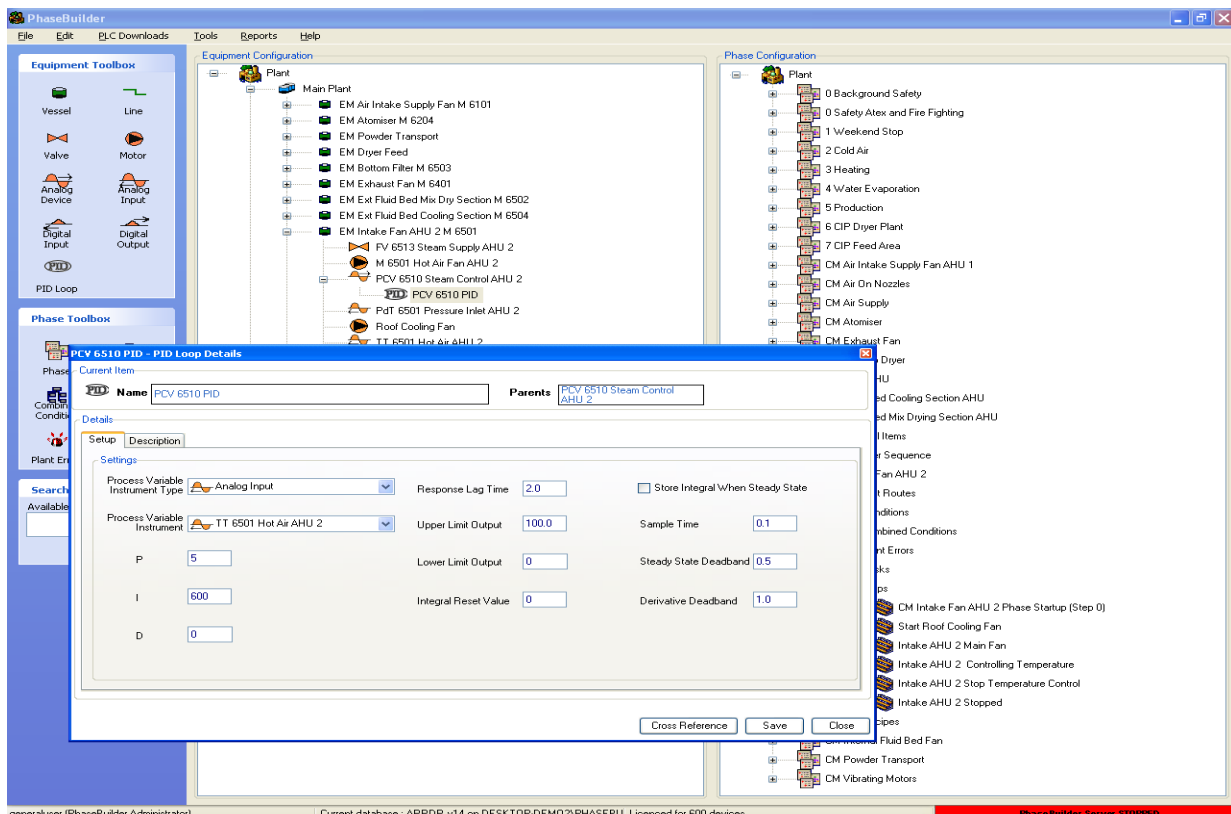
The liquids are mixed in a mixing tank by adding the ingredients sequentially, the amount being added being measured by the weight of the vessel. The blend in the mixing tank is further blended at the hopper, with a third liquid ingredient, and the blending is implemented using speed controller on the feed pumps, which continuously push the required amount of each of the two liquids to the buffer.

## Accord - Equipment Configuration

The systems are complex, each with many steps for run-up, drying and run-down. The systems were represented in S88 format, It was decided to represent the systems in an S88 format, with valves, motors, instruments being grouped into appropriate sections in the equipment configuration. In this way an error would only cause an error in the appropriate section and not affect the operation of the rest of the plant. This approach was extended to the feed, or wet, area.

## Accord - Program Configuration - Equipment Modules

These are small programs that are used to control individual sections of the plant. These programs are started and put into appropriate steps by the sequence programs. Each Equipment Module contains the activations for the equipment items in step activations, and setpoints for PID controllers and analog outputs in its Program parameters in Program recipe. In this manner the activations or setpoint changes are easy to find and modify. This is important in a process which has over 30 process steps from weekend stop to full production to diverting to water. It is much more convenient to configure a system in this way, such that a valve is activated in say 3 steps in an Equipment Module rather than in 20 steps of a main process sequence. This approach would also allow the rest of the plant, other Equipment Control modules to continue in the event of a valve or motor or analog wire break error in one section. The particular section will go into error, and local items in that section may be stopped rather than having to affect the entire plant.



The screenshot displays the PhaseBuilder software interface. The main window is titled "PhaseBuilder" and shows a hierarchical tree structure of the plant configuration. The "Equipment Configuration" panel on the left lists various equipment items, including fans, motors, and PID controllers. The "Phase Configuration" panel on the right shows a sequence of steps, such as "0 Background Safety", "1 Weekend Stop", "2 Cold Air", "3 Heating", "4 Water Evaporation", "5 Production", "6 CIP Dryer Plant", and "7 CIP Feed Area".

A detailed "PID Loop Details" window is open, showing the configuration for the "PCV 6510 PID" loop. The "Current Item" is "PCV 6510 PID" and its "Parents" are "PCV 6510 Steam Control" and "AHU 2". The "Setup" tab is active, displaying the following parameters:

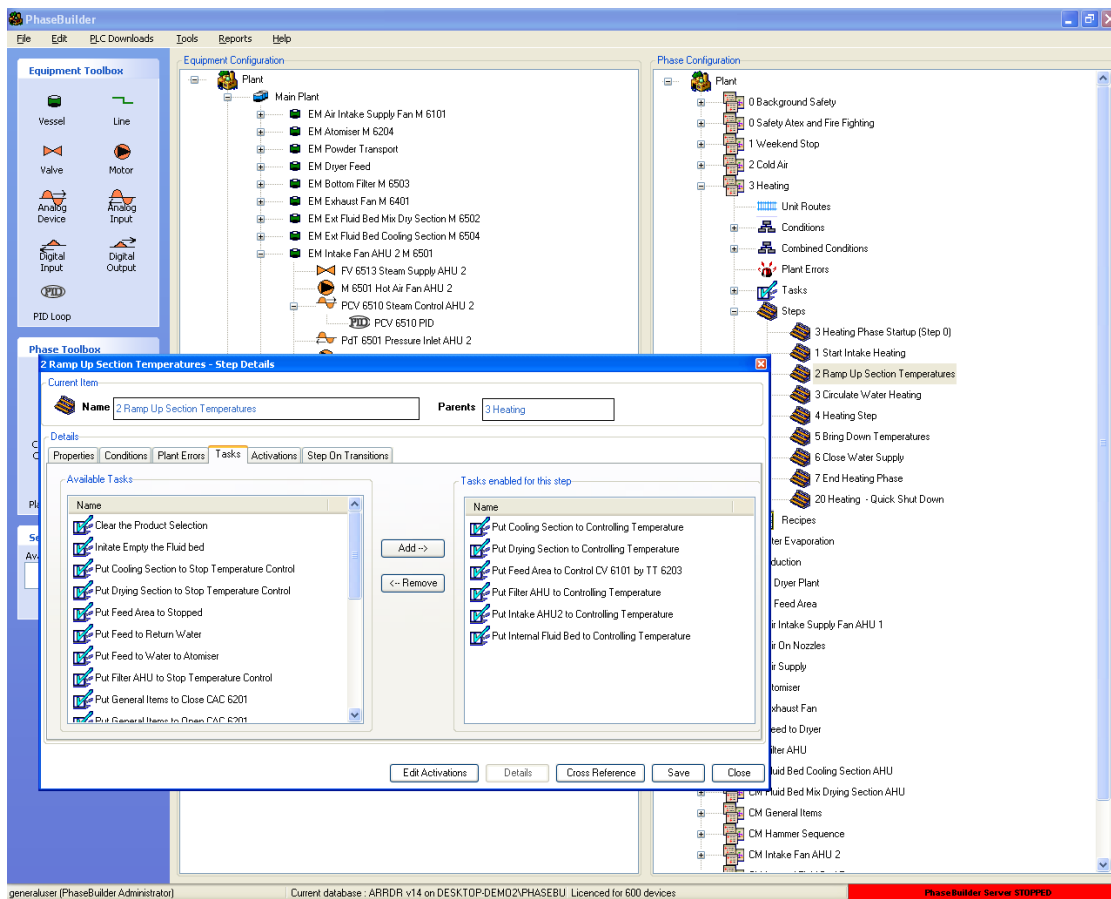
Parameter	Value
Process Variable Instrument Type	Analog Input
Response Lag Time	2.0
Store Integral When Steady State	<input type="checkbox"/>
Process Variable Instrument	TT 6501 Hot Air AHU 2
Upper Limit Output	100.0
Sample Time	0.1
P	5
Lower Limit Output	0
Steady State Deadband	0.5
I	600
Integral Reset Value	0
Derivative Deadband	1.0
D	0

The bottom status bar shows the user is "generaluser (PhaseBuilder Administrator)", the current database is "ARRDR v14 on DESKTOP-DEMO2\PHASEBU", and the software is licensed for 600 devices. The server name is "PhaseBuilder Server 1101950".

## PID loop for Temperature control in Air Handling Unit

### Accord - Program Configuration - Process Programs:

The process is composed of a number of stages of plant operation; Weekend Stop, Cold Air, Hot Air, Water Evaporation, Production. When the plant is Running Up it runs from each stage to the next based on operator actions and process readings – that temperatures are achieved. Each of these general stages is represented by a Program, each of which in turn is composed of steps. These steps are mostly composed of commands to the Equipment Modules, which are formed using Operations. For example in the screen shot the step “Ramp Up Section Temperatures” in the Heating Program is composed of 6 Operations to put the Control Modules for Cooling Section, Drying Section, Feed Area, Filter AHU, Intake AHU, and internal Fluid Bed to appropriate (Temperature Controlling) steps. The respective Equipment Modules would each have device activations and PID or Analog Output setpoint loading.

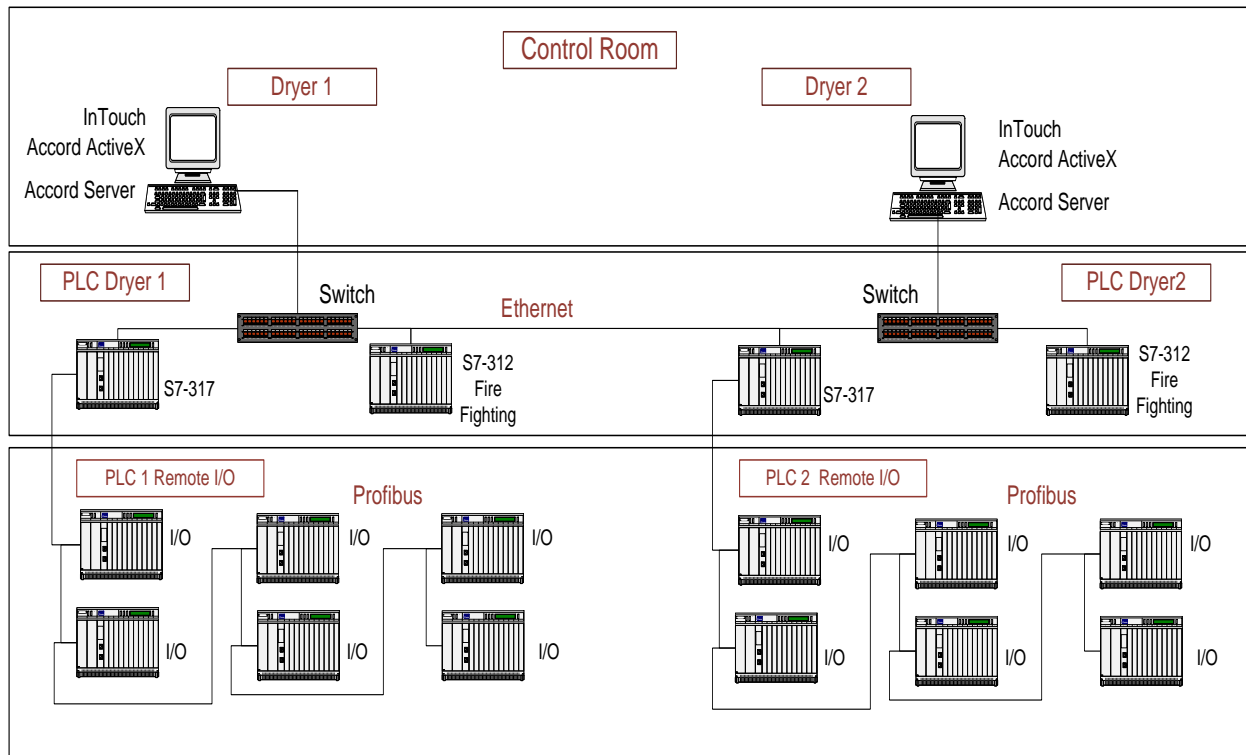


Operations in a Program which put the section Equipment Modules into required steps.

## System Architecture

The installed systems are composed of Scada PC's and Dryer PLC's and smaller Fire Fighting PLC's. The Scada PC's host Accord Builder, Accord Server service, InTouch Scada system which contains Accord ActiveX controls.

Accord Builder  
 Accord Server Service  
 Scada based on Accord Controls



## System Architecture

The connection between the switches allows for full Redundancy for Scada control of PLC's.

## Project Implementation using S88

This was a complex system and the approach of using the S88 model, grouping items into appropriate sections made the configuration much better, as section visibility and individual control is now available to the plant personnel.

Each system was discussed for a number of days with the client and implemented over 2 weeks at Logicon and was commissioned over the course of two months to production requirements. The Accord Builder application has been retained by the client on the Scada PC in order to allow them to modify the configuration and to allow them to print all required GAMP documentation as they require.

During the project the following additions were made to Accord platform

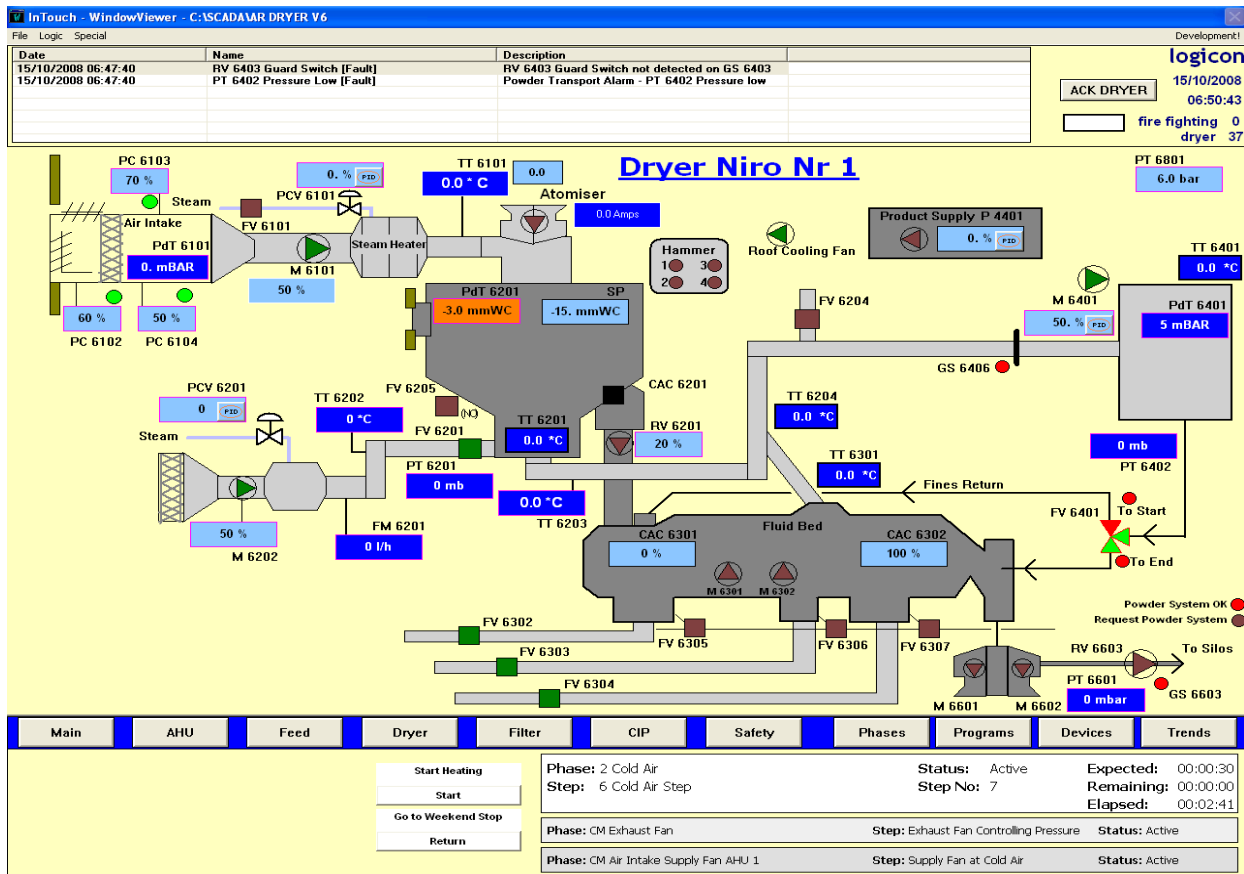
1. A Ramp function Operation to allow fan setpoints to be incremented or decremented linearly, with variable step changes and step times.
2. A Condition to determine if a Value was within a parameterisable deadband of a setpoint.
3. A Condition to determine if a Value was outside a parameterisable deadband of a setpoint.
4. An ActiveX control to represent 3 way valves.
5. An ActiveX control to allow operators to write manual production data to the MIS at configurable intervals. This data is then available to be included in the configurable MIS reports generated by Accord Reports.

All the requested additions to the functionality of Accord Builder were implemented without disruption to the commissioning or production.

The control system was commissioned on schedule and the system generated usable product at first attempt. The built-in Register status facility, allowing commissioning personnel to monitor and modify all data (without PLC addressing knowledge) was very useful during this time.

## Scada Implementation

The visualisation layer of the system was implemented using the Accord Server service and associated Accord controls in InTouch. These controls were used to automatically link to all PLC objects, without any PLC tagging being required. The equipment controls were used for Valves, Motors, Switches, Instruments, Drives, PID loops and Trends. The Program controls allowed complete control of the automatic sequences and Equipment Control Programs, including access to Parameters and Step Times, either from a single object or from multiple objects placed in the relevant Scada pages. Controls for Alarms as well as Multicontrol showing Overall Items in Manual and Items in Simulation were also used.



Scada plant screen composed of Accord Device and Program controls



InTouch - WindowViewer - C:\SCADAMR DRYER V6

File Logic Special

Date	Name	Description
15/10/2008 06:47:40	RV 6403 Guard Switch [Fault]	RV 6403 Guard Switch not detected on GS 6403
15/10/2008 06:47:40	PT 6402 Pressure Low [Fault]	Powder Transport Alarm - PT 6402 Pressure low

ACK DRYER

15/10/2008 06:51:53

fire fighting 0  
dryer 47

### Sequences

Phase	Step	Status	Remaining	Elapsed	Step Time
0 Background Safety	Background Functions	Hold	00:00:00	00:00:00	00:00:00
0 Safety Atex and Fire Fighting	Safety Monitoring	Hold	00:00:00	00:00:00	00:00:00
1 Weekend Stop	Inactive	Inactive	00:00:00	00:00:00	00:00:00
2 Cold Air	6 Cold Air Step	Active	00:00:00	00:03:52	00:00:30
3 Heating	Inactive	Inactive	00:00:00	00:00:00	00:00:00
4 Water Evaporation	Inactive	Inactive	00:00:00	00:00:00	00:00:00
5 Production	Inactive	Inactive	00:00:00	00:00:00	00:00:00
6 CIP Dryer Plant	Inactive	Inactive	00:00:00	00:00:00	00:00:00
7 CIP Feed Area	Inactive	Inactive	00:00:00	00:00:00	00:00:00

### Control Modules for Equipment

Phase	Step	Status	Remaining	Elapsed	Step Time
CM Air Intake Supply Fan AHU 1	Supply Fan at Cold Air	Active	00:00:00	00:02:42	00:00:00
CM Air On Nozzles	Inactive	Inactive	00:00:00	00:00:00	00:00:00
CM Air Supply	Activate SV 6801 and SV 6802	Active	00:00:00	00:04:22	00:00:00
CM Atomiser	Inactive	Inactive	00:00:00	00:00:00	00:00:00
CM Exhaust Fan	Exhaust Fan Controlling Pressure	Active	00:00:00	00:02:42	00:00:00
CM Feed to Dryer	Inactive	Inactive	00:00:00	00:00:00	00:00:00
CM Filter AHU	Filter AHU at Hi Speed	Active	00:00:00	00:04:12	00:00:00
CM Fluid Bed Cooling Section AHU	Cooling AHU at Hi Speed	Active	00:00:00	00:04:12	00:00:00
CM Fluid Bed Mix Drying Section AHU	Drying AHU at Hi Speed	Active	00:00:00	00:04:12	00:00:00
CM General Items	Inactive	Inactive	00:00:00	00:00:00	00:00:00
CM Hammer Sequence	Inactive	Inactive	00:00:00	00:00:00	00:00:00
CM Intake Fan AHU 2	Intake AHU 2 Main Fan	Active	00:00:00	00:04:22	00:00:00
CM Internal Fluid Bed Fan	Internal Bed Fan at Hi Speed	Active	00:00:00	00:04:17	00:00:00
CM Powder Transport	Inactive	Inactive	00:00:00	00:00:00	00:00:00
CM Vibrating Motors	Inactive	Inactive	00:00:00	00:00:00	00:00:00

0 l/h	Feed Forward Flow
0.0 mBAR	Air Inlet Pressure
5.0 mBAR	Filter Pressure
0.0 °C	Air Inlet Temperature
0 °C	Air Exhaust Temperature

Phase: 0 Safety Atex and Fire Fighting	Status: Hold	Expected: 00:00:00
Step: Safety Monitoring	Step No: 2	Remaining: 00:00:00
		Elapsed: 00:00:40

Start End Restart Hold Step On Step To Set TimeHold

Main AHU Feed Dryer Filter CIP Safety Phases Programs Devices Trends

Start Heating	Phase: 2 Cold Air	Status: Active	Expected: 00:00:30
Start	Step: 6 Cold Air Step	Step No: 7	Remaining: 00:00:00
Go to Weekend Stop			Elapsed: 00:03:52
Return	Phase: CM Exhaust Fan	Step: Exhaust Fan Controlling Pressure	Status: Active
	Phase: CM Air Intake Supply Fan AHU 1	Step: Supply Fan at Cold Air	Status: Active

Scada screen Accord controls for Alarms, Sequences and Equipment Module Programs

The buttons in the bottom banner are Accord controls also, allowing one-step error-free configuration of single large buttons. The Program controls in the bottom banner show single programs, one of which also is configured for control of the Program.



InTouch - WindowViewer - C:\SCADAMR DRYER V6

Date	Name	Description
15/10/2008 06:47:40	RV 6403 Guard Switch [Fault]	RV 6403 Guard Switch not detected on GS 6403
15/10/2008 06:47:40	PT 6402 Pressure Low [Fault]	Powder Transport Alarm - PT 6402 Pressure low

ACK DRYER 15/10/2008 06:52:44  
fire fighting 0  
dryer 38

### Sequences

Phase	Step	Status	Remaining	Elapsed	Step Time
0 Background Safety	Background Functions	Hold	00:00:00	00:00:00	00:00:00
0 Safety Atex and Fire Fighting	Safety Monitoring	Hold	00:00:00	00:10:29	00:00:00
1 Weekend Stop	Inactive	Inactive	00:00:00	00:00:00	00:00:00
2 Cold Air	6 Cold Air Step	Active	00:00:00	00:04:41	00:00:30
3 Heating	Inactive	Inactive	00:00:00	00:00:00	00:00:00
4 Water Evaporation	Inactive	Inactive	00:00:00	00:00:00	00:00:00
5 Production	Inactive	Inactive	00:00:00	00:00:00	00:00:00
6 CIP Dryer Plant	Inactive	Inactive	00:00:00	00:00:00	00:00:00
7 CIP Feed Area	Inactive	Inactive	00:00:00	00:00:00	00:00:00

### Control Modules for Equipment

Module Name	Status	Expected	Remaining	Elapsed	Step Time
CM Intake Fan AHU 2	Active	00:00:00	00:00:00	00:05:11	00:00:00
CM Fluid Bed Cooling Section AHU	Inactive	00:00:00	00:00:00	00:00:00	00:00:00
CM Fluid Bed Mix Drying Section AHU	Inactive	00:00:00	00:00:00	00:00:00	00:00:00
CM General Items	Inactive	00:00:00	00:00:00	00:00:00	00:00:00
CM Hammer Sequence	Inactive	00:00:00	00:00:00	00:00:00	00:00:00
CM Intake Fan AHU 2	Active	00:00:00	00:05:11	00:00:00	00:00:00
CM Internal Fluid Bed Fan	Active	00:00:00	00:05:06	00:00:00	00:00:00
CM Powder Transport	Inactive	00:00:00	00:00:00	00:00:00	00:00:00
CM Vibrating Motors	Inactive	00:00:00	00:00:00	00:00:00	00:00:00

CM Intake Fan AHU 2 Properties

Phase: CM Intake Fan AHU 2  
Step: Intake AHU 2 Main Fan

Status: Active  
Step No: 3  
Expected: 00:00:00  
Remaining: 00:00:00  
Elapsed: 00:05:11

Start End Restart Hold Step On Step Io Set TimeHold

Step Selection

[01] CM Intake Fan AHU 2 Phase Startup (Step 0)  
 [02] Start Roof Cooling Fan  
 [03] Intake AHU 2 Main Fan  
 [04] Intake AHU 2 Controlling Temperature  
 [05] Intake AHU 2 Stop Temperature Control  
 [06] Intake AHU 2 Stopped

Ok Cancel

Value	Parameter	Phase	Status	Expected	Remaining	Elapsed
0 l/h	Feed Forward Flow	Phase: 0 Safety Atex and Fire Fighting	Hold	00:00:00	00:00:00	00:00:00
0.0 mBAR	Air Inlet Pressure	Step: Safety Monitoring	Step No: 2	00:00:00	00:10:29	00:00:00
5.0 mBAR	Filter Pressure					
0.0 °C	Air Inlet Temperature					
0 °C	Air Exhaust Temperature					

Main AHU Feed Dryer Filter CIP Safety Phases Programs Devices Trends

Start Heating  
Start

Go to Weekend Stop  
Return

Phase: 2 Cold Air Step: 6 Cold Air Step	Status: Active Step No: 7	Expected: 00:00:30 Remaining: 00:00:00 Elapsed: 00:04:41
Phase: CM Exhaust Fan	Step: Exhaust Fan Controlling Pressure	Status: Active
Phase: CM Air Intake Supply Fan AHU 1	Step: Supply Fan at Cold Air	Status: Active

Scada screen showing Accord controls for 1 Program, with Step Selection panel.

Scada screen for CIP showing Accord Controls for valve and Scada Decisions for CIP options.

### Client Satisfaction

Following commissioning Logicon have not been called back for any issues with the system. Any modifications have been carried out in 1 day, without any disruption. The system has met all the client expectations and the facility to view production reports is very good in this type of plant.