The practical application of Control Devices
By Mark Chisnall

In previous publications I have explained the benefit of different types of control device used in modern control systems. In this issue l look closer at a recent installation within a flour mill to show how individual control devices are applied to benefit the entire operation.

To face the challenge of increased demand for its quality flour and its own need for recipe based home baking products, Wrights Flour Mill needed the greater flexibility and efficiency that would be gained from modern control technology. Existing control measures were applied through an outdated relay based control system that was making production modifications difficult and time consuming. Control panels and field wiring were also past their best and were becoming less reliable.

In phase one of the improvements it was decided to remodel the existing wheat intake, screen room and wheat conditioning control systems. A procedure was required to enable the wheat to be conditioned on a recipe/job scheduling basis after normal working hours, without the intervention of an operator. The automation of the production areas would deliver many advantages including 24-hour working, automatic shut down and start up of plant (saving on power and extending the life of the machinery), reliability and improved use of space within the facility.

In summary the following advantages were identified,

* PLC/SCADA control – enabling easier, less expensive product modifications
* Automatic control - for job scheduling and recipes
* Improved reporting – enabling reliable detailed product reconciliation
* Documentation assistance – quicker fault finding leading to less downtime
* Hygiene – Higher levels of control
* Less manual intervention - leading to improved efficiency

The reliability of the Rockwell Automation control equipment was specified for this project, using their Allen Bradley range of motor starters and the SLC 500 range of PLC's. SMC-3 soft start units were used for drives of 11kw and above. The SMC-3 is a smart and compact 45mm wide soft start unit, with an integrated design that reduces the number components required, optimising panel space and making installation quick and easy.

The SMC-3 provides a choice of start and stop modes including soft start to allow the motor to be raised from an adjustable initial torque value to full voltage over an adjustable ramp time from 2 to 15 seconds. A 'current limit' start option was chosen to limit the start current to between 150% and 450% of full load capacity.

SMC-3 SOFT STARTER

SLC500 PLC

In specifying the PLC we selected from the SLC 500 range because of flexibility of the wide memory options, the I/O capacity, the instruction set and number of communication ports available. This decision allowed us to tailor a control system to the exact application requirement with future expansion options available as required. The choice of control system was not an experimental one. The application had to work in an industrial environment and had to respond reliably to all that was asked of it. The SLC range has a strong reliability history covering thousands of installations in a broad range of applications.

To enable the control system to be installed with minimum disruption to flour production the system was split over three control panels. This enabled the panels and field wiring to be installed within normal working hours, then over pre-arranged shutdown periods each section was brought on-line. The control system was split into the following sections,

Panel 1 - Midds (wheatfeed) and Screenings, this was the first control panel to be installed and was temporarily interlocked to the existing control system.

Panel 2 - Wheat Intake - was then installed, temporarily interlocked to the existing control system and networked to panel 1 via remote I/O (RIO).

Panel 3 - Screenroom and Conditioning, was the last control panel to be installed, this was added to the RIO network and the temporary interlocks were then removed.

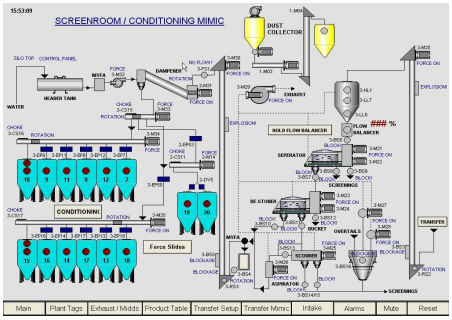
PANEL 2 – WHEAT INTAKE

SCADA SOFTWARE

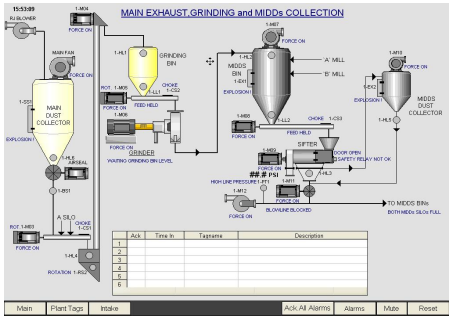
Overall control was via Intellution iFix SCADA (now known as GE Fanuc Proficy); iFIX delivers a powerful process visualization, data acquisition and supervisory control. Based on Client/Server distribution and open architecture, it easily and quickly integrates with your existing operation and offers a broad range of additional features.

One SCADA node was installed within the wheat silo area and a remote client was installed within the mill control room allowing the system to be controlled locally and remotely. The SCADA software was developed to give the following,

Plant Graphics
A plant mimic was developed for each section of the operation enabling operators to start/stop sections of plant, view the status of the plant and when necessary force devices which are password protected.



SCREENROOM AND CONDITIONING MIMIC



EXHAUST, GRINDING AND MIDDS MIMIC

Alarm Handling
Activated alarms are displayed to the operator within an alarm list. If the alarm is related to a plant device i.e. motor fault or rotation sensor then this will be indicated on the plant graphics allowing quick identification of the problem source.

Product Tables
When the wheat is delivered to the intake its storage silo is added automatically to the product table, this enables the software to determine which silo to use when blending and conditioning the wheat. The product table also enables the operator to determine the silo priority for the same wheat types and even 'hold' silos, to stop them from being used.

Recipes
The recipes contain the recipe name, recipe code, flow balancer setpoint, MYFA setpoint and up to five wheat types.

Job Schedule
The job schedule allows operators to add recipes and destination bins to a queue, the software then sources the wheat from the intake silos dependant on the priority given in the product table. Once the wheat has been transferred from the source silos through the screen room to the conditioning silo the job schedule would automatically move to the next recipe in the queue. On completion of transfer all relevant data is stored to a Microsoft access database.