Control and Management of Bristol Port Company's New Bulk Handling Terminal

Michael J. Newton, U.K.

1. Introduction

Concol Systems Limited, Chesterfield, U.K., are proud to have provided the comprehensive automation and management information system for the new bulk handling facility at Royal Portbury Dock, Bristol, U.K., as subcontractors to the Balfour Beatty/Birtley Joint Venture.

Details of the project are given in the articles by Mr. Bill Reading of Birtley (pp. 489-493) and Mr. P.J. Dowden of Strachan & Henshaw (pp. 494-495) in this issue so this article concentrates on describing the most up-to-date facilities provided for control and management of the project.

Central to the whole automation system is the ability to integrate all the different local control systems supplied with the different plant items so that apart from rail-loading, a single point of overall control is provided for the entire project. This in turn allows comprehensive management of the stockyard, with accurate record-keeping of cargoes received by ship, and individual loads despatched by train and by road. The system also ensures safe and efficient operation of the mechanical plant, through the distributed control system and its network of communication links (Fig. 1).

2. Control Room

Supervisory control and data acquisition is carried out by two Digital Equipment Corporation VAXstation 4000 computers, linked by Ethernet. Under normal operation, the operator uses the colour graphics displays of both VAXstations to display plant status and management information.

Mr. Mike J. Newton, Sales Manager
Concol Systems Ltd, Dunston House, Dunston Rd., Sheepbridge, Chesterfield S41 9QD, U.K.
Tel.: +44 246 260 270; Fax: +44 246 450 323.

Details about the author on page 665.

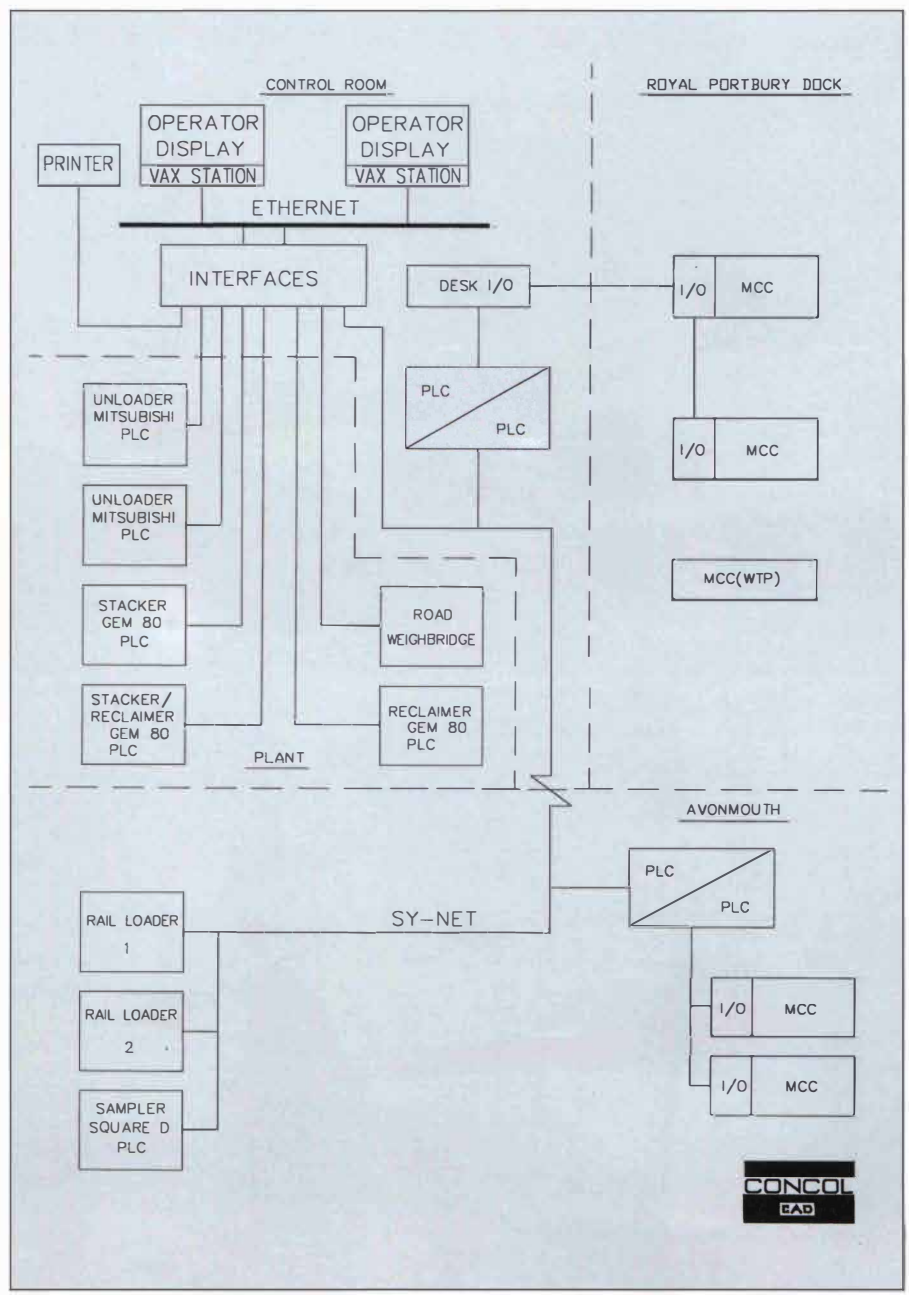

Fig. 1: Drawing of the system

Fig. 2: Stockyard overview

When a cargo is scheduled to arrive, the operator enters details of the cargo, material type, expected weight, origin and other information. When the ship has arrived at the allocated berth, the operator selects an area of stockpile and a conveyor route. The mobile machines are moved to the required positions, and when ready to handle material, with all safety interlocks satisfied, the operator initiates automatic startup of the selected conveyor route. Material is weighed by an in-line belt weigher as it is moved to the designated stockpile, and the computers record the total weight. The cargo record as originally entered is then linked with the stockyard location (or multiple locations) and with the actual measured weight. Colour-graphics display pages available to the operator show the status of the equipment, and an overview of the stockyard (Figs. 2 and 3). Immediate access to the details of each cargo stored is available by means of a "window" insert in the displays.

Fig. 3: Route overview

Reclaim of stored material is handled in a similar manner. The operator directs the reclaimer as to how much material is to be reclaimed from which area of the stockpile, as well as deciding to which silo it is to be moved. The selected reclaimer moves into position, and the conveyor route starts up automatically upon initiation. Material is weighed by in-line belt-weighers. The stockpile record is updated from details of loads despatched, as described below.

3. Rail Loading

There are two rail-loading tracks, each with a local storage silo. The rail loading operation is automated by two Square D programmable logic controllers (PLCs) supervised locally by a PC. All this equipment is linked to the central control room by communication links. The rail-loading operator is advised what material is being transported, and despatch notes are printed by the rail weighing system. In return, the PC advises the central computer of the identity of each train loaded, and the actual loaded weight (which is the figure used for updating the stockpile record). This information is then added to the central management information database.

Process interlocks and rail-loading plant status are also transmitted back to the central control room.

4. Lorry Loading

Despatch of material by road is monitored by a weighbridge which provides information to the central computer system. The weighbridge operator is informed by the control room operator as to the source of the material from the stockpile, and uses this along with the vehicle registration number and loaded weight to produce despatch notes. This information is returned to the central computer to update both the stockyard and the management database.

5. Conveyor Control

As the conveyors are relatively long, they are extensively monitored by transducers checking for safe operation. These transducers and the electrical control equipment are cabled to programmable logic controller remote input/output modules located in the substations. Safety interlocks are wired direct into the motor starter circuits, and monitored by the PLC equipment. As the site is spread out on both sides of the river, two duplicated PLCs are provided, and linked by a communications network to the central con-

trol room computers. Full information about transducer status etc is communicated to the operator by colour-graphic displays, alarms lists etc.

The PLCs are programmed to check all plant equipment interlocks, and to run the conveyors forming a particular route when instructed to do so by the computer. They also control and monitor other plant items, such as dust-suppression sprays and the status of the extensive electrical distribution network around the site.

6. Sampler

The plant is equipped with two samplers, each controlled by a PLC connected to the central computer. These PLCs are programmed with a number of different sampling regimes, depending on ship size etc.: the computer instructs them which regime to use for the particular cargo being unloaded.

7. Mobile Machines

The plant includes two continuous ship unloaders, a stacker, a stacker-reclaimer and a reclaimer. All machines are equipped with PLC control, which are linked back to the central computers by serial communication links. These links pass through the cable-reeling drums on each machine. The computer receives extensive status information from the machines, including alarms, as part of the overall plant monitoring function.

A very important task of the main control system is the anti-collision logic, which allows machines to pass if safe to do so, and prevents machines from colliding during normal operation.

8. Plant Condition Monitoring

Extensive plant condition monitoring is implemented on the system in order to assist in keeping the plant operating efficiently. Figures on the hours run and number of operations are accumulated by the central computer for all major plant items. These figures are checked against the declared maintenance interval for each item, and a report is produced on request, listing all those items in need of maintenance. When the action has been carried out, the operator simply "ticks the box" on the computer screen, and the figure is reset.

A list of spare parts in stock at the site is also available on the central computer, with information such as supplier(s) details, re-order levels etc.

9. Software

The central computer software is a package called CONWAY-DCS developed by Concol over many years for use in bulk material handling applications, and for general supervisory control and data acquisition tasks in a wide variety of other industries. Bulk handling application include grain, animal feeds, power station coal handling and installations at mines. The current version runs on Digital Equipment Corporation VAX computers and workstations. It is user-configurable, and provides the following functions

- serial and network communications to a wide variety of process plant controllers.
- colour-graphics operator and management information displays using modern "X-Windows" techniques. Operator command and data entry is also provided.
- process plant alarm monitoring and logging.
- data archiving of process trend and management information
- on-line digital & analogue calculations
- report generation.

In addition, the package includes specialist application modules for bulk material handling and storage.