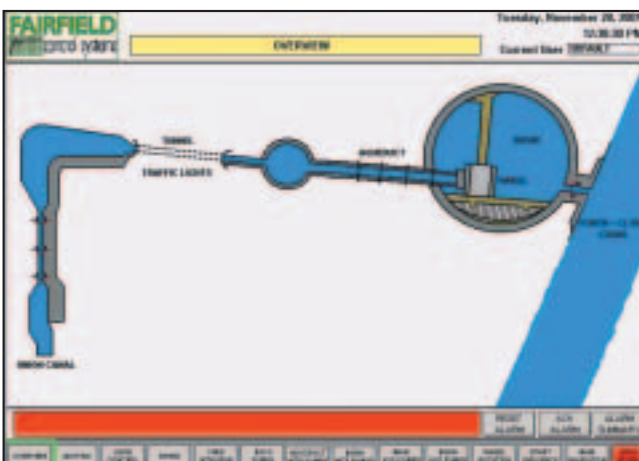




The Millennium Link Project will restore the Forth & Clyde and Union Canals to their former glory. It will link the West and East Coasts of Scotland with fully navigable waterways for the first time in 35 years. This £78 million project (supported by the Millennium Commission) is the largest canal restoration ever undertaken in the UK. The project includes the construction of a new section of canal, two aqueducts, three locks, a tunnel, railway bridge and canal basin, but the centrepiece of the project is the 'Falkirk Millennium Wheel Boat Lift'.

The Falkirk Millennium Wheel Boat Lift is the world's first rotating boat lift, measuring an impressive 35 metres in height. It was designed to 'bridge the gap' between the canals, restoring the waterway between the cities of Glasgow and Edinburgh. Not only is the boat lift a feat of engineering, the first to be built in Britain since the Anderton Boat Lift in 1875, it is a sculpture for the 21st Century. Four years in the planning, the boat lift is a collaboration between some of the UK's best architects and engineers. Fairfield Control Systems were awarded the contract to design and install the electrical system to control the hydraulic motors responsible for wheel control and water management. From this system all other major functions can be viewed and controlled including the lighting system, CCTV, fire and intruder alarms, and the tunnel.



SCADA Screen Shot

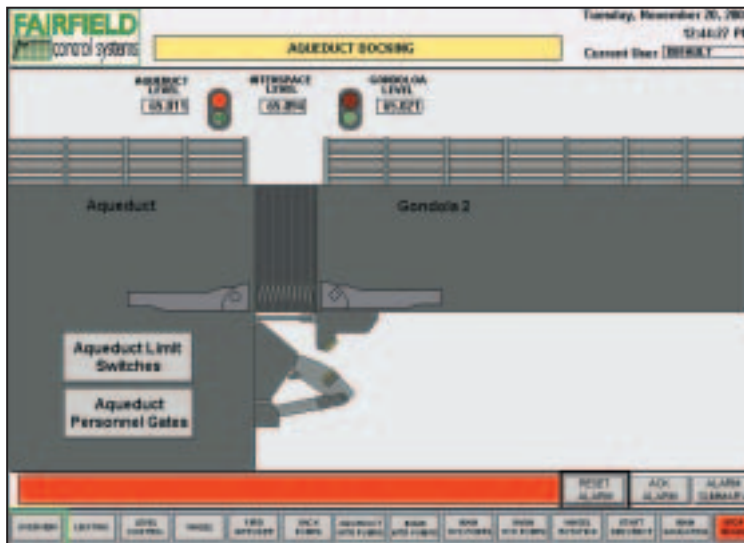
The circular basin in which the boat lift stands is 100 metres wide and has moorings for more than 20 boats. Construction materials for the boat lift include 7,000 cubic metres of concrete, 1,000 tonnes of reinforced steel and 1,200 tonnes of prefabricated steel. The boat lift consists of two massive support arms, each weighing approximately 500 tonnes and measuring 38 metres in diameter, nicknamed "dog bones" because of their shape. These are linked by one load bearing axle that is centrally located and measures 26 metres in length by 3.8 metres in diameter and is of hollow construction.

The two gondolas are supported on a roller track which runs in two circular cut-outs at each end of the support arm. It is these water filled gondola's, each weighing a massive 160 tonnes and capable of carrying 250 tonnes of water that transfer the boats between the varying levels of the canals, which can reach differences of up to 30 metres. The boat lift is able to carry eight or more boats at a time and a single trip will take about 15 minutes.



Circular Cut-Outs in Support Arm

Crucial to the operation of the whole facility is the management of the water. The boat lift relies on the descending gondola balancing the ascending gondola, this is achieved by the accurate control of the water levels in both the basin and aqueduct. By monitoring and controlling these water levels to a very close tolerance, a smooth flow of craft through the interchange is guaranteed.



SCADA Screen Shot

On each gondola is a Schneider Micro PLC that performs control activities and also data collection and relay. The remainder of the system is made up of a number of Schneider Momentum nodes which relay I/O back to the master Schneider Premium PLC. The PLC is housed within the main hydraulic MCC located in the central wheel building.

Operators are able to control and monitor the Union Canal locks, the tunnel and aqueduct, the boat lift, basin and associated locks into the Forth & Clyde Canal from one of three SCADA systems. This

control software was fully developed by Fairfield's experienced design engineers, to meet the demands of BS IEC 61508-1– standards for functional safety of electrical/ electronic/programmable electronic safety-related systems. The system as a whole has an I/O count of over 600 points.

On the boat lift, the operation of the aqueduct, gondola and basin gates are sequenced with the operation of the boat traffic lights. Only when all safety locks are confirmed operational is the boat lift allowed to rotate.

The rotation of the boat lift is enabled from the operators console and electronic signals are sent via the communication systems to run the pumps for the hydraulic motors which power the boat lift. The hydraulic power pack is fitted with two 45 kilowatt motors and this engages a drive bearing which is coupled to the central axle, which in turn is coupled to the boat lift structure. In the unlikely event of one of the motors failing, the second unit is capable of running the power pack. The boat lift needs surprisingly little power in order to rotate as it is in almost perfect equilibrium. A smooth ride



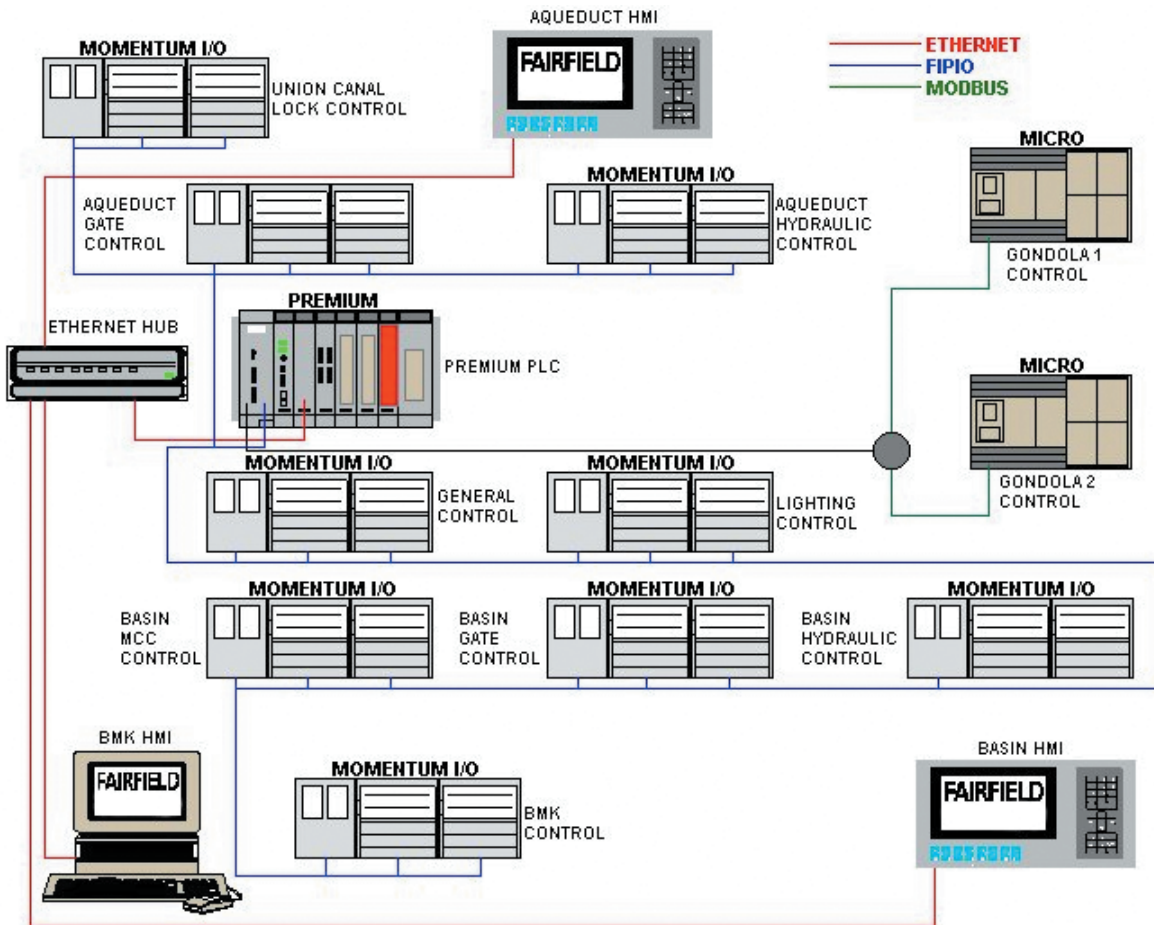
The Hydraulic Power Pack

is guaranteed by using an 'S' curve to slowly accelerate the boat lift to full speed and then gradually decelerate it to a stop.

There are two further power packs each fitted with two 9.2 kilowatt motors that are responsible for driving the boat lift ancillaries which include the gondola doors and the water pumps. The boat lift braking mechanism is hydraulically operated and electronically controlled. Once in the docking position, the gondolas are clamped and pinned into position to prevent any movement. The expanding seals come out to extend the aqueduct to the gondola and the water levels are balanced before opening the embarkation gates. As a further safety precaution, nine emergency stop buttons are placed at strategic locations around the site

A detailed diagnostic system provides early warnings to the operator of abnormal events, and all events are automatically logged for later analysis. In the event of a mains power supply failure, a standby UPS was incorporated into the scheme in order to maintain critical supplies, until the backup generator has started. This enables the boat lift to be safely returned to its park position.

The Falkirk Millennium Wheel Boat Lift enjoys widespread public interest and is fast becoming one of Scotland's most popular tourist attractions. It is also another example of the engineering expertise of Fairfield Control Systems.



System Configuration

System Specification

PLC System	Schneider Premium, Micro and Momentum
I/O Count:	Over 600
Communications:	FIPIO,
Networks:	Ethernet & Modbus
HMI:	3 RSVIEW SCADA applications being run on 2 industrial PCs and a Desktop PC.

Business Activities Include:

- SPECIFICATION
- CONSULTANCY
- HARDWARE DESIGN & BUILD
- SOFTWARE DESIGN
- INSTALLATION
- COMMISSIONING
- TRAINING

● SERVICE SUPPORT

Service support is your insurance against prolonged plant outages, which could cost you vast sums of money. Because we understand control systems and work with them daily we have been able to build up a vast expertise, which enable us to quickly diagnose and fix faults, sometimes without even attending the site. Our service Support Contracts are flexible and designed to meet our client's particular requirements up to and including immediate callout responses available twenty four hours a day, seven days a week.

NOTES

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