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CC-Link NORTH AMERICA
IN ACTION

CC-Link Demonstration Laboratory Established at URS Corporation

A *CC-Link* distributed systems development laboratory has been established by URS Corporation in Austin, Texas and the *CC-Link* Partner Association (CLPA). This 900 square-foot dedicated facility includes over fifty *CC-Link* system building blocks, a class 100 clean room and a fume hood area to support chemical process automation. The *CC-Link* laboratory was established to accelerate systems development and deployment for a broad range of industries.

URS and CLPA Engineers in the Lab

The breadth and diversity of URS' business base coupled with their business model of providing contract engineering services is an ideal environment for the introduction of *CC-Link* distributed control technologies into many industries. For example, the URS Analytical and Electronics Services (AES) group provides leading-edge process characterization and optimization services along with integrated automated systems integration for the semiconductor, nanotechnology, petrochemical and power industries. AES uses distributed control technologies to modularize their solutions and accelerate the development process. *CC-Link* distributed control technologies are an ideal choice for URS engineered control systems for a number of reasons. *CC-Link* provides:

- fast data transfer speeds of up to 10Mbps
- a high level of determinism
- ease of implementation without requiring detailed protocol knowledge
- intuitive memory-mapped architecture
- a broad range of products from numerous manufacturers
- global support provided by the *CC-Link* Partner Association

URS distributed systems projects vary in scope and complexity. A typical project may involve development of novel enabling technologies, process optimization, system functional decompositions, definition of control topologies and performance requirements, component selection, performance predictions and validation, software development, systems integration and technology transfer to the client.

A representative *CC-Link* distributed control system to support the application can be quickly configured to provide for system validation testing and demonstrations. Devices that may be under development, or unavailable, can be represented on the development network as Reserve Stations. This approach helps to ensure that network performance, even in the early phase of development, is consistent with the final system that has been envisioned. Furthermore, additional Reserve Stations can be included in the deployed network to act as "place holders" for future sensors and actuators. The basic structure and representative building blocks associated with developing a distributed system are shown in Table 1.

Table 1
Distributed System Building Blocks

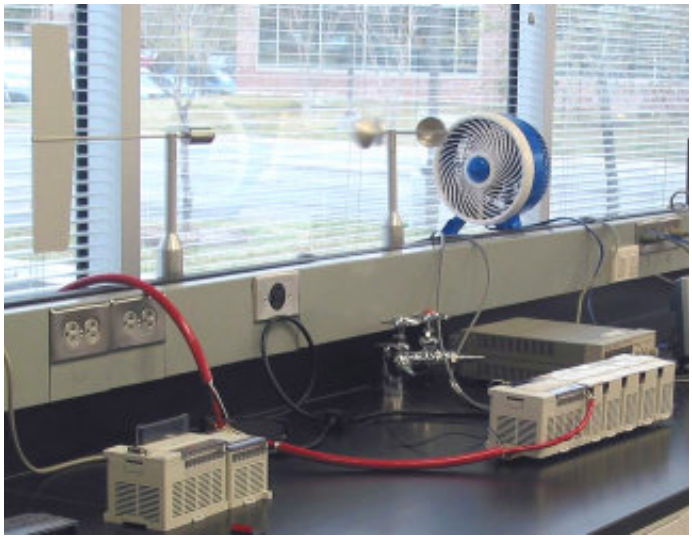
Component	Functions	Configuration and Development Tools	Hardware
SCADA	Supervisory control; operator/engineer interface; trend displays	MC-Worx; WebHMI; Microsoft Visual C++	Tower PC System
Connectivity	Interconnect SCADA system, field control and remote I/O	GX Developer; MX OPC server	*CC-Link* network modules for Q-Series controllers and PC system; 10/100 Base T Ethernet adapter
Field Control	Sequencing; regulatory control	GX Developer	FX and Q-Series controllers
Field HMI	Plant-floor operator interface	GT Designer2; E-Designer	GOT and E300
Remote I/O	Analog, discrete I/O	GX Developer	Various analog and discrete I/O modules

A demonstration network (shown below) consisted of multiple *CC-Link* devices. A computer with a *CC-Link* PCI board was used to provide the SCADA functions, generate application specific ladder logic, configure network devices, and monitor status. Master network control was provided by a Mitsubishi Q Series PLC which also included an industrial PC running Windows 2000 OS. The network included a variety of digital and analog input/output devices along with two graphical user interfaces.

Demonstration Network Example

A dedicated application was developed on a Mitsubishi FX2n series PLC and incorporated into the network. Analog and digital inputs representing wind direction and wind speed were fed into and processed by the PLC. A user interface module with integral keypad was connected directly to the PLC. This displayed wind direction/speed data and allowed the operator to set warning and alarm thresholds. The PLC continuously delivered the processed data over the *CC-Link* network along with the operator inputs. Another user interface on the *CC-Link* network displayed wind speed/direction and alerts when values fell outside a defined range.

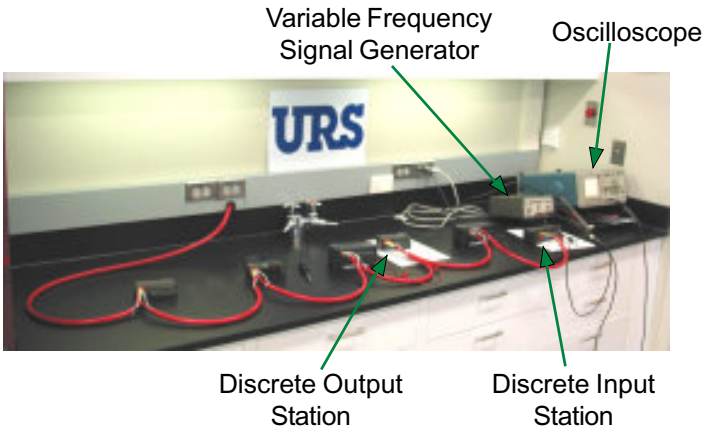
One advantage of CC-Link is that devices like HMIs can retrieve information directly from the network without needing to be routed through the Master Station.



Process simulation using a wind vane & anemometer

Operator Interface (HMI)

Proper system design requires an understanding of deterministic response. In the lab, combinations of digital and analog tests were conducted to verify system level determinism and latency of the demonstration system. System level performance is dependent on a number of conditions and will be unique to every configured system. For example, detection of an asynchronous assertion of a digital input may take place immediately before or after a *CC-Link* scan cycle. (In the lab the input signal rate can be adjusted by a variable frequency signal generator.) The asserted signal traverses very quickly through the *CC-Link* network and arrives at the master controller. This arrival is asynchronous to the master controller which may be processing significant amounts of information using ladder logic. The digital input signal could occur between execution of master controller ladder code cycles, in which case it would be responded to immediately. Or it could occur during processing of the ladder code, in which case it would not be acted on until the next ladder code cycle. (There are ways to minimize this uncertainty using interrupts, but for clarity these options are not discussed here.) Eventually the asserted digital input is processed in the master controller and a response is made. In the URS demonstration system the response was to assert a digital output on a network device. The assertion of the digital output is another asynchronous event with respect to *CC-Link* cycles. It may be picked up immediately or it may have to wait until the next cycle. A two channel digital scope was used to measure both latency and determinism associated with detecting, processing and responding to a discrete input signal.



The URS Analytical and Electronic Services group brings a systems engineering perspective to developing applications using distributed control. They are currently developing control system solutions using *CC-Link* for a variety of internal and external clients. The success of these systems has been greatly advanced by the performance attributes of *CC-Link* technology along with ease of integration. The addition of the URS CC-*Link* laboratory provides another resource for development and systems engineering to both *CC-Link* product suppliers and *CC-Link* users.

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URS Overview

URS Corporation, with 25,000 employees in over 20 countries worldwide, provides comprehensive professional services in planning, engineering, architecture, environmental and applied sciences, and program and construction management to a diverse group of public and private clients. URS provides these services for infrastructure projects involving surface, air, rail, and water transportation systems; institutional, industrial, and commercial facilities; and water resources and pollution control and hazardous waste management programs. URS serves national and local government agencies as well as clients in the chemical, manufacturing, pharmaceutical, forest products, mining, oil and gas, water supply, commercial development, and power industries.

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