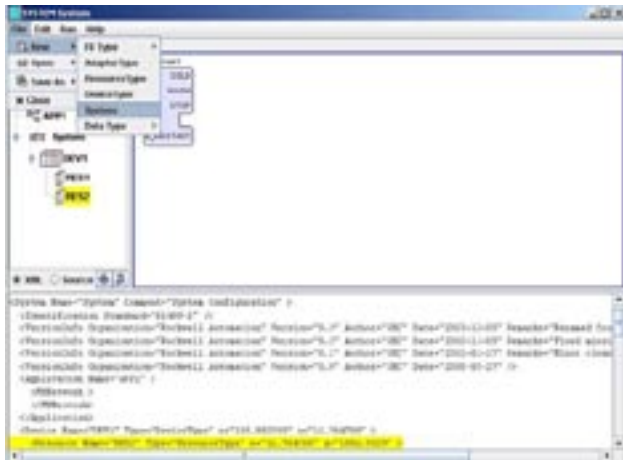


*Set up Function Block*

Programming the W2-FBC Function Block Controller is a simple process using the W2-FBDK Function Block Development Kit Software. The basic steps are:

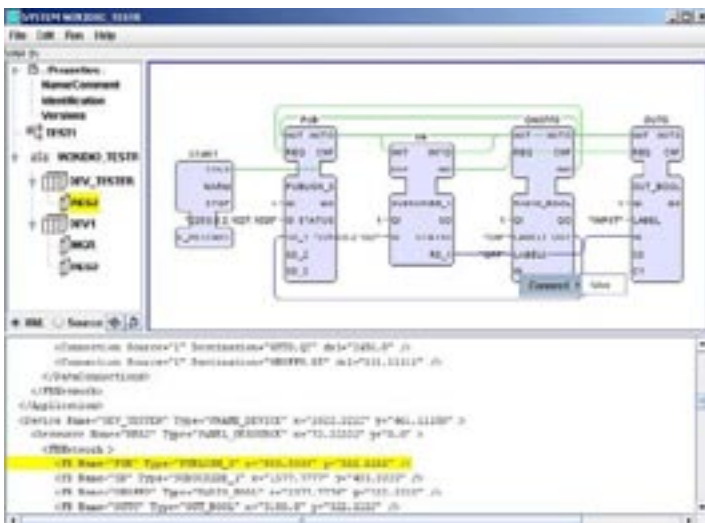
1. Create the system prototype for a W2-FBC using the Function Block Editor
2. Select the desired function blocks from the library of over 400 Function Blocks
3. Graphically create the linkages for the data flow and the “Top Hat” event triggers
4. Download the program that was automatically generated into the W2-FBC
5. Run the application



*Create system prototype*

One of the key attributes of the IEC61499 standard is the ability to distribute the application over the entire network of W2-FBC Function Block Controllers. Data and Event interprocessor communication over DeviceNet or Ethernet automatically occurs as a result of the linking of the function blocks data and event lines. By this we mean that the I/O for one function block can be derived from the I/O of a function block running on a different piece of hardware. Events can be defined as change of state of physical devices, computed commands, internal real-time clocks, or external interrupts providing great flexibility in control system design.

W2-FBDK is a licensed implementation from Rockwell Automation of the IEC61499 standard, which has been extended by WRC to work with the W2-FBC Function Block Controller hardware. The W2-FBC Function Block Controller is optimized to run Real-Time Java code generated by the W2-FBDK. The W2-FBC can also be programmed using modern JAVA. Engineers that want to extend their application beyond the 400+ Function Blocks provided are able to do so providing precise performance and control of your application.



*Link Function Block data and event triggers*

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## W2-FBDK Available Function Blocks

### Event Handling

- Event-driven Chronometer
- Event-Driven Up Counter
- Periodic(cyclic)Generation of an Event
- Delayed propagation of an event-Cancellable
- Event demultiplexer
- Event-driven Data(D)Latch
- Event-Driven Frequency Divider
- Boolean falling edge detection
- Merge(OR)of multiple events
- Generation of a finite train of separate events,table driven
- Permissive propagation of an event
- Rendezvous of two events
- Generation of Restart Events
- Event-driven bistable, Reset dominant
- Boolean rising edge detection
- Selection between two events
- Split an event
- Event-driven bistable
- Switch(demultiplex)an event
- Generation of a finite train of events, table driven
- Event to UINT converter (1 of 4)
- Generation of a finite train of events
- Boolean rising/falling edge detection

### Human-machine Interface

- Table CHOICE input
- Compute Color Hue
- Compute Color Saturation
- Output Qualified Event+Data to Console
- E\_CTU with display and label
- A diagnostic log with time stamping of conditions, acknowledgments and repair times
- An orientable single bar graph
- GUI label
- An orientable array of rectangular LEDs
- A slider input
- Abstract superclass for HMI elements containing a table.
- Top level window
- Data input from TextField
- ARRAY input from TextField-see IN\_ANY
- Boolean Input Checkbox
- Drop-down WSTRING input
- COLOR input from drop-down list

### Human-machine Interface —cont'd

- Enumerated data input from dropdown list
- Control block for IN\_ENUM
- Event-issuing push button
- MATRIX input from table
- WSTRING input from TextArea
- STRING input from TextArea-see IN\_TEXT
- Tabular MATRIX I/O
- Tabular MATRIX I/O
- Data output to TextField
- ARRAY Output to TextField
- Boolean Output Color Box
- COLOR Output
- Event Output Flasher
- Tabular MATRIX output
- WSTRING Output to a TextArea
- STRING Output to a TextArea-see OUT\_TEXT
- Radio Button BOOL Input
- 3-Pen Strip Chart Recorder
- 4-Pen Strip Chart Recorder
- Test wrapper for IEC 61131-3 FBs

### Interoperability Test Application

- Console Output Service Interface
- Simple Device Front Panel
- Device Management Service Interface
- Remote Device Management Client
- Remote Device Management Kernel
- Device Management Kernel Block
- Multi-purpose LED Flasher
- 4-LED output emulator
- XML Query Template Generator
- FBMGT Request Generator
- Listener for a Multicast UDP Socket
- Ring Feed Control
- Peg/Ring Assembly Inspect/Reject Control
- Peg/Ring Sort Control

### Machine Control Examples

- Controller for Simple Assembly Station with Dual-Cylinder Transport
- Locally Coupled and Clocked Diagnostics for a Dual-Stroke Cylinder
- Model for a Double-Stroke Cylinder, Externally Clocked
- Model for a Double-Stroke Cylinder, Externally Clocked
- Proxy for a Remote Double-Stroke Cylinder

### Machine Control Examples —cont'd

- Double-Stroke Cylinder Server for a Remote DSCYL\_PRXY
- Lifter Pallet Transfer and Fault Simulation Logic
- Workpiece LOAD Solenoid Control
- Cycle Control for a Machine with Fixed Tool
- Transfer Bar Control
- Transfer Bar Model with Locally Coupled Data+Clocked
- Transfer Slide/Clamp Sequence
- Transfer Slide Model with Locally Coupled Data+Clock

### Math functions

- Event-driven COLOR selection
- Event-driven STRING selection
- Event-driven UINT selection
- Event-driven WSTRING selection
- DINT Addition
- INT Addition
- REAL Addition
- Boolean AND
- Concatenation of WSTRING inputs
- DINT Division
- INT Division
- REAL Division
- Boolean Equality
- REAL Comparison
- REAL Comparison
- DINT Multiplication
- INT Multiplication
- REAL Multiplication
- Test for COLOR Inequality
- Boolean complement
- Boolean OR
- REAL to UINT conversion with limiting
- ANY Selection (Inputs; Outputs must be consistent)
- BOOL Selection
- COLOR Selection
- DINT Selection
- INT Selection
- REAL Selection
- STRING (8-bit) Selection
- TIME Selection
- UINT Selection
- WSTRING Selection

## W2-FBDK Available Function Blocks

### Math functions —*continued*

- DINT Subtraction
- INT Subtraction
- REAL Subtraction
- UINT to INT conversion with limiting
- UINT to REAL conversion
- Boolean XOR
- N-bit multimode Flasher
- Service Interface to java.util. Hashtable
- A Structured Data Type Representing a Matrix of REAL
- Add two matrices of REAL
- Retrieve a Matrix Element
- Solve the matrix equation  $IN1 * OUT = IN2$  for OUT by inverting IN1
- Multiply two matrices of REAL
- Matrix Setup
- Subtract two matrices of REAL
- Gets the Nth element from a list of strings
- Packs 8 BOOLS into a BYTE
- Packs 16 BOOLS into a WORD
- Single variable sampling
- 2-variable sampling
- 3-variable sampling
- 4-variable sampling
- Unpacks a BYTE to 8 BOOLS
- Unpacks a WORD to 16 BOOLS
- Weighted Average

### MVA framework sample

- Clocked delayed propagation of an event-Cancellable, Locally Clocked
- Simple Conveyor Model for 1 Workpiece
- Locally-Coupled Conveyor Model (without Gate) for 1 Workpiece
- Locally-Coupled Conveyor Model with Gate for 1 Workpiece
- Clocked delayed propagation of an event-Cancellable
- Event-driven Workpiece Load/Unload Model
- Event-driven Workpiece Load Selection
- Local channel publisher for workpiece loading
- LOADL with QI Enable
- Diagnostic for a Unidirectional Mechanism (Clocked)
- Diagnostic for a Unidirectional Mechanism with local Clocking and Publication

### MVA framework sample —*cont'd*

- Locally Coupled and Clocked Diagnostics for a Bidirectional Mechanism
- Motion/Fault Model of a Bidirectional Linear Mechanism (Externally Clocked)
- Proxy for a Remote Bidirectional Mechanism
- Bidirectional Mechanism Server for a Remote MECH2\_PRXY
- HMI for testing MECHC\_VIEWL
- View of a Linear Mechanism with Clamping
- Linear Mechanism View with Clamping; Local Data Publish/Subscribe
- HMI for testing MECH\_VIEWL
- View of a Linear Mechanism
- Linear Mechanism View with Local Data Publish/Subscribe
- Workpiece position sensor
- Locally-Coupled and Clocked Diagnostics for a Solenoid
- Solenoid Model
- Locally-Coupled Solenoid Model
- Solenoid View with Local Data Publish/Subscribe
- VSTYLE presence sensor
- Periodic Workpiece Emitter
- Random Workpiece Generator
- Workpiece presence and style sensor
- Abstract Superclass for a Transfer Component
- A spacer object with center and edge labels

### Ethernet

- Client for newline-terminated double-byte strings
- Event Interlock Client Interface
- Single-RD Client Interface
- Single-Item Client Interface
- 1-Input,0-Output Client Interface
- 1-Input,4-Output Client Interface
- Two-Item Client Interface
- Client Interface with 2 SD, no RD
- Client Interface with 2 SD, 1 RD
- Three-Item Client Interface
- 3 SD/0 RD Client Interface
- 3 SD/1 RD Client Interface
- 3 SD/2 RD Client Interface
- 3 SD/4 RD Client Interface
- 3 SD/5 RD Client Interface

### Ethernet —*continued*

- Four-Item Client Interface
- 4 SD/1 RD Client Interface
- 5 SD/3 RD Client Interface
- 5 SD/4 RD Client Interface
- Event-only Local Publisher
- Event-only Publisher
- Two-Variable Publisher
- Three-Variable Publisher
- Four-Variable Publisher
- Five-Variable Publisher
- Six-Variable Publisher
- Event-only Local Publisher
- Single-Variable Local Group Publisher
- Two-Variable Local Group Publisher
- Three-Variable Local Group Publisher
- Four-Variable Local Group Publisher
- Five-Variable Local Group Publisher
- Server for newline-terminated double-byte strings
- Event Interlock Server Interface
- Server with 1 RD, no SD
- Server with 2 RD, no SD
- Server with 3 RD, no SD
- Single-Item Server Interface
- 2 RD/1 SD Server Interface
- 3 RD/1 SD Server Interface
- 4 RD/1 SD Server Interface
- Two-Item Server Interface
- 3 RD/2 SD Server Interface
- Three-Item Server Interface
- 3 SD/5 RD Server Interface
- 4-input,4-output Server Interface
- 4-input,1-output Server Interface
- 4-input,2-output Server Interface
- 4-input,3-output Server Interface
- 4-input,5-output Server Interface
- 5 SD/RD Server Interface
- 5-input,3-output Server Interface
- Event-only Local Group Subscriber
- Single-variable Local Group Subscriber
- Two-variable Local Group Subscriber
- Three-variable Local Group Subscriber
- Four-variable Local Group Subscriber
- Five-variable Local Group Subscriber
- Event-only Subscriber
- Single-variable Subscriber

## W2-FBDK Available Function Blocks

### Ethernet —continued

- Two-variable Subscriber
- Three-variable Subscriber
- Four-variable Subscriber
- Five-variable Subscriber
- Six-variable Subscriber IEC 61131-3
- IEC 61131-3 Boolean AND
- IEC 61131-3 Bitwise AND
- IEC 61131-3 Bitwise AND
- IEC 61131-3 Bitwise AND
- IEC 61131-3 Bitwise AND
- Test Boolean AND,OR,XOR
- IEC 61131-3 Boolean NOT
- IEC 61131-3 Bitwise NOT
- IEC 61131-3 Bitwise NOT
- IEC 61131-3 Bitwise NOT
- IEC 61131-3 Bitwise NOT
- IEC 61131-3 Boolean OR
- IEC 61131-3 Bitwise OR
- IEC 61131-3 Bitwise OR
- IEC 61131-3 Bitwise OR
- IEC 61131-3 Bitwise OR
- Abstract superclass for IEC 61131-3 bit shift functions
- IEC 61131-3 Boolean Exclusive OR
- IEC 61131-3 Bitwise Exclusive OR
- IEC 61131-3 Bitwise Exclusive OR
- IEC 61131-3 Bitwise Exclusive OR
- IEC 61131-3 Bitwise Exclusive OR

### Process

- Scale Analog Input Value to Engineering Units
- Scale from Engineering Units to Analog Output Value
- Controller Faceplate
- PID with Bumpless Transfer and Anti-Reset Windup, REAL PV+XOUT
- View of a Pipe Segment
- Simple Pump Animation Model
- End View of a Rotating Pump
- Model for a Rotating Shaft
- End View of a Rotating Shaft
- 4-Pen Strip Chart Recorder
- Tank Fill/Drain Model
- Integer Unscaling of an integer input of 0-100%
- Valve Position Display

### Specialty

- Composite XOR Function Block Type
- Multi-purpose LED Flasher
- Sequence of Events
- A variable-size stack of INTs
- A variable-size stack of INTs (with ECC)
- Device Type for testing TEST\_RES2
- Compute  $X^2 - Y^2$  (event-driven)
- Compute  $X^2 - Y^2$  (INT)
- Compute  $X^2 - Y^2$  (scanned)
- Compute  $X^2 - Y^2$  (scanned, ST language)
- Compute  $X^2 - Y^2$  in FBD
- Compute  $X^2 - Y^2$  in Java
- Compute  $X^2 - Y^2$  in Java without ECC
- Compute  $X^2 - Y^2$  in ST

### Template

- Adapter Interface
- An Array Data Type
- Basic Function Block Type
- Composite Function Block Type
- Device Type
- A Directly Derived Data Type
- An Enumerated Data Type
- Proxy Function Block Type
- Service Interface Function Block Type
- A Structured Data Type
- A Subrange Data Type

### WRC W2 Function Block Controller

- W2 Analog Input Interface
- W2 Analog Output Interface
- Service Interface to One Bank of W2 Digital Input
- Service Interface to One Bank of W2 Digital Output
- Scale Analog Input Value to Engineering Units
- Scale from Engineering Units to Analog Output Value
- 8 Bit Boolean to Integer Converter
- Integer to 8 Bit Boolean Converter

Western Reserve Controls will be adding additional function blocks over time. Licensees will be provided access to the current library found at <http://www.wrcakron.com>

WRCoutsource <http://www.wrc.cc> offers turn-key design, development, manufacturing, and on-going support services: <http://www.wrc.cc>