OPC-UA Support for iQ Explorer 3

APPLICATION NOTE AN535

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Introduction

iQ Explorer 3 (iQE3) is a Windows application used by machine operators to control Dukane ultrasonic welding equipment and to collect data. It can be run on an HMI (Human-Machine Interface), which is an industrial PC running Windows, that contains a touchscreen and is usually attached to the welder on the factory floor. It can also be run on any PC that has Windows 10 or Windows 11 installed, connected to the same network as the welders.

OPC-UA Support

iQE3 operates as an OPC-UA Server. OPC-UA Clients will be able to establish sessions with the iQ Explorer Server, and to send Set/Get messages for various welder process parameters. Clients can also subscribe to "Cycle Data" messages, which contain a list of measurements collected each time a part is welded. These will be published when the weld takes place.

The clients will not necessarily have a one-to-one relationship with ultrasonic welders.

Installation

OPC-UA functionality is an optional feature in iQE3. To enable the OPC-UA server, run the iQE3 installer and choose "Custom". The "OPC-UA" option should be selected. For an existing iQE3, re-run the installer and choose "Modify". When upgrading iQE3 to a new version, make sure "Custom" is chosen and "OPC-UA" is selected.

Next, start the iQE3 application, click on the Options button (gear icon as shown below) and navigate to the "OPC-UA" tab. Verify that "Enable OPC-UA" is checked. The supported URL and port number are displayed but cannot be modified at this time.

Connecting iQ Explorer 3 to a OPC-UA Client

iQ Explorer 3 must be running for the OPC-UA Server to operate. If iQE3 is shut down and restarted, any existing node subscriptions are invalid; the node tree should be refreshed, and subscriptions will need to be re-added.

Point your OPC-UA client to the following URL:
opc.tcp://<*server*>:62542

If the client is on the same computer as iQE3 then the following URL will work:
opc.tcp://localhost:62542

User authentication is handled within iQE3. The OPC-UA Server doesn't require separate authentication at this time; the client can connect as "anonymous". Note that if iQE3 is not logged into a welder, OPC-UA access will be read-only.

Nodes

The Dukane welders will be visible in the following address space:

(Namespace: http://dukane.com/iQExplorer3/)

Path: Objects -> WelderParams -> <*Welder Name*>

Each welder will have the following four nodes:

- WelderParam
- CycleData
- WelderState
- Barcode

WelderParam

A selection of welder configuration parameters. These are numerical parameters meant to be fine-tuned for each welding application. Substantial modifications (such as changing the weld type) should be performed in iQE3.

Each WelderParam node will have a Value of DataType “Double”, which can be read and written to. iQE3 must be fully logged into a welder to write to the WelderParam nodes. Otherwise, the write will be rejected with error “BadNotWritable”

Each WelderParam node has a property called “Units”. This is a string with the unit abbreviation (for example “mm/s”). This property is always read-only. It can change from Metric to Imperial (“in/s”) or vice versa based on the current iQE3 setting.

The client can subscribe to parameters to modify values and monitor changes.

- **Supported parameters:**
  1) TOP_OF_STROKE_POSITION
  2) TRIGGER_FORCE
  3) SENSING_START_POSITION
  4) SENSING_SPEED
  5) TRIGGER_MAX_TIME
  6) WELD_FORCE_RATE_DISTANCE
  7) WELD_FORCE_RATE_FORCE
  8) WELD_FORCE_RATE_TIME
  9) WELD_POSITION_1
  10) WELD_MAX_TIME_1
  11) WELD_START_FORCE_DROP
  12) WELD_AMPLITUDE
  13) SERVO_TRAVEL_LIMIT
  14) WELD_SPEED_PROFILE_1
  15) WELD_SPEED_PROFILE_2
  16) WELD_SPEED_PROFILE_3
  17) WELD_SPEED_PROFILE_4
  18) WELD_SPEED_PROFILE_5
  19) WELD_SPEED_PROFILE_6
  20) WELD_SPEED_PROFILE_7
  21) WELD_SPEED_PROFILE_8
  22) WELD_SPEED_PROFILE_9
  23) WELD_SPEED_PROFILE_10

CycleData

A collection of nodes representing measurements taken during a weld cycle. These will be published when the cycle occurs and will be overwritten when the next cycle occurs. A client can subscribe to any or all nodes to receive updates as weld cycles are run.

Each column in iQE3's Cycle Data tab has a corresponding node in the OPC-UA server. Some nodes simply identify the cycle (examples include Welder Name and Part Count). Other nodes contain Process Limit weld measurements.

Process Limit measurement nodes have two properties each.

- One is Units (see WelderParam description)
- The other is Analysis (based on the current process limit settings). This will be "0" for "Good", "1" for "Suspect", and "2" for "Bad"

The corresponding process limits (high, low, and bad vs suspect) cannot be modified using OPC-UA. They can only be adjusted through iQE3.

- **Available Cycle Data nodes for Cycle identification:**
  1) BARCODE (optional, barcode support must be enabled in iQ Explorer)
  2) FAULT (fault code if available. Defaults to "0" if no fault is reported.)
  3) LOT_BARCODE (optional)
  4) NOTES (optional, set in the iQ Explorer "Notes" tab)
  5) PART_ANALYSIS (for the cycle as a whole. "0" for "Good", "1" for "Suspect", "2" for "Bad")
  6) PART_COUNT
  7) RECORD_COUNT (0-based, increments each weld cycle)
  8) SEQ_COUNT (total steps in the sequence)
     (Example: when the Part Count column is "3 (1 of 2)" then
     PART_COUNT = 3, SEQ_INDEX = 1, and SEQ_COUNT = 2)
  9) SEQ_INDEX (when iQ Sequence is enabled, starts with 1 for each sequence)
  10) SERIAL_NUMBER
  11) SETUP_NAME
  12) TIME_OF_RESULT (DateTime, UTC)
  13) USER_NAME (optional)
  14) VERSION (currently 3)
  15) WELDER_NAME

- **Available Cycle Data nodes for Process Limit measurements on Servo welders:**
  1) DOWNSTROKE_TIME
  2) FORCE_AT_DYNAMIC_HOLD (only if supported by the welder)
  3) FORCE_AT_SENSING_START_POS
  4) FORCE_AT_STATIC_HOLD (only if supported by the welder)
  5) FORCE_AT_TRIGGER
  6) HOLD_DISTANCE
  7) HOLD_TIME
  8) POSITION_AT_TRIGGER
  9) SYSTEM_CYCLE_TIME (no limits defined, will not have an "Analysis" property)
  10) TOTAL_CYCLE_TIME
  11) TOTAL_STROKE_DISTANCE (if supported)
  12) TRIGGER_DELAY_DISTANCE
  13) TRIGGER_DELAY_TIME
  14) WELD_COLLAPSE_DISTANCE_1
  15) WELD_END_POSITION_1
  16) WELD_ENERGY_1
  17) WELD_PEAK_FORCE_1
  18) WELD_PEAK_POWER_1
  19) WELD_TEMPERATURE (only if supported by the welder)
  20) WELD_TIME_1

Welder State

A collection of nodes representing the state of the welder and its associated features. All these nodes are read-only and have a DataType of Boolean (true/false).

- **Available Welder state nodes for status monitoring:**
  1) ESTOP
     - This node will be set to true if E-STOP has been activated, and false when E-STOP is cleared.
  2) ServoNotReady
     - This node is applicable to Servo welders only. It will be set to true if the servo is not in a ready-to-weld state. It will be set to false if the welder is not servo-based.
  3) ReadyToWeld
     - This node will be set to true when the welder, as a whole, is ready to weld. It will be set to false during a weld cycle, or if the welder is otherwise not ready to weld.
  4) InCycle
     - This node will be set to true during the weld cycle (from start to end), and false when the weld cycle completes.
  5) NewCycleData
     - This node will be set to true when the Cycle Data nodes are populated with valid cycle data from the most recent weld cycle. It will be set to false if the cycle data nodes have not been populated.
  6) ReadyForBarcode
     - This node is only applicable if Barcode support is enabled (see below). It will be set to true if the welder is expecting a barcode to be entered, and false when the barcode has been entered, or if barcode support is disabled in iQE3.

Barcode

A collection of nodes representing barcode strings. These are not used unless barcode support is enabled in iQE3. If barcode support needs to be enabled, click on the Options button (see above) and navigate to the “Barcode” tab. Then select “Enable Barcode Support”. Under “Barcode Specifications”, choose “Enable barcode scan to store per cycle”. (The features “Enable barcode scan to activate setup” and “Enable lot identification by barcode scan” are not supported through the OPC-UA server.)

- **Available Barcode nodes for processing barcodes through OPC-UA:**
  7) NewlyScanned
     - This is a writable node that will accept a string representing the latest scanned barcode. It provides an alternative method to enter a barcode into iQE3. (Traditionally a scanner is used, which must be connected to a serial port on the PC running iQE3.) If a barcode cannot be accepted for any reason, the write will be rejected with error “BadNotWritable”.
     - This node is writable even if the end user does not have write access to iQE3. This will allow any user to scan barcodes with a scanner connected to the OPC-UA client.
     - If a scanner is used, this node will display the barcode read by the scanner.
  8) InUse
     - During a weld cycle, this will display the barcode of the part currently undergoing a weld. This node will be cleared when the weld cycle completes. This node is read-only.

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