EDGE Technical Guide
COMPACT, FLEXIBLE REMOTE AUTOMATION DEVICE

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1. Overview

1.1 Description

The latest offering from the Callisto series, the advanced EDGE remote provides seamless integration of analog, status, and control processing with flexible communications options. The unit is ideal for pole mount, panel mount, data concentration, and small substation applications. Specifically engineered to bridge the gap between low-cost, limited functionality units and expensive high-end devices, EDGE offers state-of-the-art automation technology at a highly competitive price.

In addition to supporting traditional, real-time SCADA information management, EDGE is optimized for the automation of motor-operated switches. Software routines enable the monitoring of historical switching events, leading to accurate maintenance scheduling and predictive failure analysis. EDGE is driven by the CallistoView configuration utility, which provides users with the protocols, programmable logic tools, and applications necessary for any type of installation.

1.2 Key Features

- 12 status inputs
- 12 analog inputs (AC or DC)
- 8 control outputs, configurable as:
  - 8 direct operate commands
  - 4 select-before-operate trip/close pairs
- Communications
  - 4 serial ports (RS232 or RS485)
  - USB port
  - Ethernet port
  - ArcNET port
- Asynchronous, byte or bit-oriented protocols
- Real-time and historical data
- IEC 1131-compliant PLC programmability
1.3 Technical Specifications

1.3.1 Processing

Hardware Platform
• ARM9-powered Printed Circuit Board (PCB)

Processors
• 200 MHz ARM9 Microcontroller
• 200 MHz SHARC DSP Processor

Operating System
• Thread X real-time, multi-tasking

Memory
• 16MB RAM
• 2MB Flash
• 64KB Serial Flash

Time Synchronization
• Real time clock maintains time and date during loss of power
• 1ppm crystal accuracy (1ms per 15 minute interval)
• Real time synchronization for all nodes on the LAN
• Maintains 1ms time-tagging accuracy for all events on the network

1.3.2 Communications

Serial Input / Output
• 4 independent serial communication ports, individually configurable as RS232 or RS485
• Up to 115200 bit/sec, individually configurable per serial port
• USB host port
• Ethernet IP port, 10/100 MB
• ArcNET port for compatibility with legacy DAQ products
• Byte or bit-oriented, asynchronous protocols
• Support for external modems, both leased line and/or PSTN circuits
• Support for fiber, radio, trunked radio, and packet radio media

1.3.3 Dimensions

Printed Circuit Board
• 2 standard 4-layer Double PCBs
  • 9 ½” x 9 ¾”
  • 8” x 9 ¾”

Enclosure
• 11 ½” x 9 ½” x 3”
1.3.4 Measurements / Controls

Analog Inputs
- 12 analog inputs (AC or DC), definable for transducer, PT, CT, battery, or line post sensor on a per point basis

Analog Calculations
- Average and RMS volts and amps
- Neutral current
- Single and three phase watts, VARS, VA, PF
- Positive, negative, and zero sequence voltages and currents
- 2nd through 31st harmonic and THD for voltage and current
- Fault currents up to 20x nominal

Digital Inputs
- 12 digital inputs, individually configured to monitor status, SOE, or Form A/C accumulator inputs
- Opto-isolation > 5kV input-to-input and input-to-ground

Digital Outputs
- 8 control outputs configurable as 8 direct operate commands or 4 select-before-operate trip/close pairs
- Relays: 1 Form A contact rated for 16 A @ 277 VAC

1.3.5 Additional Specifications

Isolation
- Surge withstand 5kV ANSI/IEEE C37.90.2002 SWC

Power
- 18 - 36 AC/DC directly
- 48 VDC, 120 VDC, 110 VAC via external power supplies or transformer

Environmental
- Operating range: -20 to +70°C
- Storage range: -20 to +70°C
- Relative humidity: 5 to 95% non-condensing
- Vibration: 5 to 65Hz
1.4 Protocol Support

The EDGE currently supports the following protocols:

Master Station and IED
- CDC Type II
- Conitel
- DNP 3.0 - serial and IP
- Modicon MODBus
- PMS-91
- QUICS IV
- SES-92
- Landis & Gyr 8979
- Valmet Series V

Master Station
- CDC Type I
- Harris 5000/6000
- IEC 870-5 Profile 103
- PG&E 2179

IED
- Cooper 2179
- Eaton Incom
- IEC 870-5 Profile 101 (Siemens)
- JEM 1
- PSE Quad 4 Meter
- Quantum Qdip
- Schweitzer Relay Protocol (221/251/351)
- SPABUS
- Transdata Mark V Meter

In addition to the protocols listed, DAQ can also accommodate special user requirements
2. Physical Configuration

2.1 Packaging

The EDGE unit is packaged in a painted steel casing that houses the various components. However, this casing has no NEMA rating and is only meant for basic protection of the electronics. The enclosure is not meant for outdoor installation of any kind and must be placed in an appropriate auxiliary cabinet if outdoor use is required.

2.2 Mounting

For user convenience, the EDGE module can be mounted on a back plane.

2.3 Unpacking

The following items are included in your EDGE kit:

- (1) Callisto EDGE in its enclosure
- (1) 5-foot serial communications cables
- (1) RJ45 to DB9 adapter kits

If any of these items is missing, please contact DAQ at 732-981-0050.
3. Panel Layout

3.1 Input Power Header

Power is provided to the EDGE module through the four-pin header at the top left side of the panel. The EDGE module will operate within an input voltage range of 18-36 VDC.

The two-position plug provided inserts directly into the panel input power header. The plug has an opening for each position into which a wire end is inserted. Above each opening is a captive screw, which secures the wire end to the plug when tightened.

If using a different power source, please observe the polarity markings for the input power and attach the power supply wires to the plug appropriately.

When input power is properly applied, all five LEDs in the POWER section at the upper left of the EDGE will be lit.

3.2 Reset Switch

The reset switch is located inside the unit, directly behind the input power header (S1/RESET). This switch will restart the RTU in one of two modes of operation:

1. Functional mode - pressing and releasing the reset switch one time will reboot the EDGE and place it into its normal operating mode. In this mode, all configured applications are active and the EDGE unit communicates with attached devices.

2. Factory mode - pressing and releasing the reset button five times in rapid succession reboots the EDGE and places it into the default-operating mode. In this mode, only core EDGE applications are running and no communication occurs between the EDGE unit and attached devices. This mode is useful for diagnostic procedures and troubleshooting.

3.3 Heartbeat LED

The Heartbeat LED (top right SYSTEM) indicates proper execution of software functions in the microprocessor and is also used to determine the present mode of operation.

In functional mode, the heartbeat LED will continuously toggle on for one second, then off for one second. In default mode, the toggle rate will be approximately twice as fast (on for one-half second, off for one-half second).
3.4 Diagnostic LEDs

Beneath the Heartbeat LED are five diagnostic LEDs. When power is applied to the EDGE or the EDGE is reset, combinations of these LEDs will be on while the EDGE is booting. After a successful boot, and during normal operation, all five diagnostic LEDs will be off. If any of the diagnostic LEDs stays on for more than 60 seconds, the EDGE has malfunctioned and should be reset.

3.5 ArcNET Expansion Ports

The ArcNET expansion ports consist of two RJ-11 jacks and are located on the bottom right of the panel. These jacks are physically and electrically identical, and allow quick and simple interfacing between other EDGE modules or any other Callisto series RTU.

The ArcNET cable provided with the EDGE module allows simple interconnection from EDGE unit to EDGE unit. To tie together two modules, plug one end of the ArcNET cable into either one of the two RJ-11 jacks on one EDGE, then plug the other end of the cable into either RJ-11 jack on the second EDGE. To add in more units, just plug one end of an additional ArcNET cable into the unused RJ-11 jack of one of the existing EDGE units, and the other end into either RJ-11 jack of the new EDGE unit.

Expanding to other Callisto series RTUs is just as easy, but it will be necessary to use the correct type of ArcNET cable. Please contact DAQ for details.

*Note: ArcNET expansion, as described above, requires that each node has a unique ArcNET address. Additionally, proper termination of the ArcNET bus is also necessary.*

3.6 RS-232/RS-485 Communication Ports

3.6.1 Signals

The EDGE module provides four RJ-45 jacks for communication between the EDGE module and connected IEDs and Master Stations.

When the module is sitting with the heartbeat and power at the top, Port 1 is the leftmost RJ-45, and Ports 2-4 go left to right. The ports provide simultaneous RS-232 and RS-485 signals. Therefore, setting up the port for either RS-232 or RS-485 communication involves selecting the appropriate signals from the RJ-45 jack. This is easily accomplished with proper cabling.

Looking at the communication ports on the panel straight on, the communication signals are arranged in each RJ-45 jack as shown below:
PIN | Signal | Corresponding Wire Color in Cable
--- | --- | ---
1 | Data Carrier Detect (DCD) | Green-White
2 | Receive Data (RXD) | Green
3 | Transmit Data (TXD) | Blue-White
4 | RS-485 (-) | Orange-White
5 | Ground | Blue
6 | RS-485 (+) | Orange
7 | Request to Send (RTS) | Brown-White
8 | Push to Talk (PTT) | Brown

### 3.6.2 Cabling

The EDGE module is supplied with two 5-foot serial communications cables. When plugged into the communications ports, these cables will bring out all available signals. The user will have access to RS-232 and RS-485 signals, depending upon what type of cable, connector, or adapter is used.

*Note: it is possible to use either RS-232 or RS-485 communication from the same port, but not simultaneously.*

**RS-485**

For RS-485 communications between the EDGE and an IED, simply cut off the RJ-45 connector from one end of the supplied cable and connect the RS-485 (+) and RS-485 (-) wires (orange and orange-white) to the IED.

**RS-232**

Two RJ-45 to DB9 adapter kits are provided with the EDGE. It is highly recommended that the user make a PC configuration cable with one of these adapters and one of the supplied serial communication cables. This cable is necessary for downloading node configurations from a PC to the EDGE. The procedure is as follows:

1. Insert the black wire from the plastic hood into the hole marked “2” on the back end of the DB-9 connector (the back end is the end with the larger holes) until it locks in place.
2. Insert the orange wire, into the hole marked “3” on the back end of the DB-9 connector, until it locks in place.

3. Insert the green wire into the hole marked “5” on the back end of the DB-9 connector, until it locks in place.

4. Individually tape off all remaining wires (to prevent shorting), and tuck into the plastic hood, or preferably, cut away the remaining wires.

5. Snap the DB-9 female connector into the plastic hood.

6. Plug the RJ-45 connector from one end of the supplied serial communication cable into the RJ-45 socket on the RJ-45 to DB-9 adapter.

The second serial communication cable and RJ-45 to DB-9 adapter are provided to facilitate connecting an IED or any other communication requirement. For additional cabling needs, please contact DAQ.

The wire colors for signals in the RJ-45 to DB-9 adapter are:

<table>
<thead>
<tr>
<th>Signal</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Carrier Detect (DCD)</td>
<td>Blue</td>
</tr>
<tr>
<td>Receive Data (RXD)</td>
<td>Orange</td>
</tr>
<tr>
<td>Transmit Data (TXD)</td>
<td>Black</td>
</tr>
<tr>
<td>RS-485 (-)</td>
<td>Red</td>
</tr>
<tr>
<td>Ground</td>
<td>Green</td>
</tr>
<tr>
<td>RS-485 (+)</td>
<td>Yellow</td>
</tr>
<tr>
<td>Request to Send (RTS)</td>
<td>Brown</td>
</tr>
<tr>
<td>Push to Talk (PTT)</td>
<td>White</td>
</tr>
</tbody>
</table>

3.6.3 LEDs

Three LEDs are located directly above each communication port, for indication of Transmit Data (TX), Receive Data (RX), and Good Message (MSG) states. These are useful in determining if proper communication has been established between the EDGE and the attached device or station.

- RX - blinks on whenever data is received on the communications port
- TX - blinks on whenever data is transmitted out of the communications port
- MSG - blinks on whenever the EDGE decodes a message on the port that was intended for it to process

3.7 Ground Lug

This screw terminal is provided for bringing an earth ground connection to the module when required. The screw is accessible with a small Phillips head screwdriver.

3.8 Platform Boards

The EDGE is connected to external analog inputs via removable “platform” boards that plug into the EDGE termination board. Platform boards contain calibrated amplifiers that convert the analog input
voltage to a voltage compatible with the EDGE analog to digital converter. Accordingly, platform boards must be selected that accommodate the analog input that you intend to connect to the EDGE. There are ten different platform boards available, each with a different maximum input voltage ranging from as low as .64V to as high as 360V. The user should install platform boards that can handle the maximum voltage expected for the analog input. If in doubt, a higher capacity platform board should be installed. Platform boards can vary from channel to channel within the EDGE and do not need to be all one type. For additional platform board options, please contact DAQ.
4. Internal Link and DIP Switch Setup

4.1 Removal of Top Cover

In order to access the links LK1, LK4, LK7-10, JP3, JP4, and the DIP switch SW1, it is first necessary to open the top cover of the EDGE case. To do this, turn the thumbscrew at the top of the case counterclockwise until it disengages from the case and then open the top cover rearwards until it is free from the case. The thumbscrew is held captive in the top cover, so there is no danger of losing it.

4.2 Watchdog Enabled/Disabled Link (LK1)

This link is provided with a shorting jumper installed as shipped from the factory. The shorting jumper should not be removed. This link is provided for purposes of program debugging, and is intended for use by qualified personnel only.

4.3 Port 1 - Port 4 RS-485 Line Biasing/Termination Link (JP3, JP4)

The JP3 and JP4 link is utilized when one or more communication ports have been set up for RS-485. It is recommended, however, that these jumpers be installed even if all ports are used as RS-232 ports. This link group provides 3.3 VDC and 0 Volts line biasing for better electrical noise immunity, and also properly terminates the communication line by placing a 120 ohm resistance in parallel with the high and low signal lines.

This is a 16-pin (8 by 2) link, and is arranged as follows:

<table>
<thead>
<tr>
<th>JP3</th>
<th>JP4</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 4 6 8</td>
<td>2 4 6 8</td>
</tr>
<tr>
<td>* * * *</td>
<td>* * * *</td>
</tr>
<tr>
<td>* * * *</td>
<td>* * * *</td>
</tr>
<tr>
<td>1 3 5 7</td>
<td>1 3 5 7</td>
</tr>
</tbody>
</table>

Port: [ 4 ] [ 3 ]

- Link Pair 1-2: Port 4 RS-485 (-)
- Link Pair 3-4: Port 4 RS-485 (+)
- Link Pair 5-6: Port 3 RS-485 (-)
- Link Pair 7-8: Port 3 RS-485 (+)

Port: [ 2 ] [ 1 ]

- Link Pair 1-2: Port 2 RS-485 (-)
- Link Pair 3-4: Port 2 RS-485 (+)
- Link Pair 5-6: Port 1 RS-485 (-)
- Link Pair 7-8: Port 1 RS-485 (+)
As supplied from the factory, shorting jumpers are installed across all eight link pairs. In most cases, communication should be satisfactory between the EDGE and other connected RS-485 devices. However, if the RS-485 devices are chained together and one or more of them are already terminated, communication may be impaired. If this is the case, try removing the shorting jumpers for the RS-485 port in use. If problems still persist, contact DAQ for assistance.

### 4.4 ArcNET Bus Termination Link (LK5, LK6)

The ArcNET Termination Link is used to properly electrically terminate an ArcNET bus, particularly when two or more EDGE units or a mix of EDGE units and other Callisto RTUs are linked together via the ArcNET ports and twisted-pair cabling.

Typically, the node at each end of an ArcNET chain is terminated with a 120 ohm resistance and all other nodes within the chain are left unterminated.

LK5 and LK6 are arranged as follows:

<table>
<thead>
<tr>
<th>LK5</th>
<th>LK6</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

LK5 1-2: ArcNET(-)  
LK6 3-4: ArcNET (+)

If the EDGE is at the end of an ArcNET chain in which the nodes are connected together with twisted pair cabling, install shorting jumpers across links LK5 and LK6.

If the EDGE resides within the ArcNET chain (not an end node), remove the shorting jumpers across links LK5 and LK6.

### 4.5 ArcNET TX Enable Positive/Negative Drive Link (LK4)

The ArcNet TX Enable Positive/Negative Drive link is used to select either positive or negative TX Enable signal driving of externally connected devices, such as a Fiber-Optic converter.

As shipped from the factory, this link is set for Positive Drive, which is compatible with all current DAQ devices.
4.6 Node Address/Port 1 Bit-Byte/Start Bit Polarity Switch (SW1)

SW1 is an eight-position DIP switch that handles setup of the node address. The eight switch positions are laid out as illustrated below:

The 8 switch segments of the DIP switch are used to set the EDGE node address. The node address is determined by the mathematical sum of the bit values of all switches that are in the "ON" position. As an example, in the illustration above, the “2”, “4”, “8” and “64” value switches are in the “ON” position, therefore the node address for the EDGE would be:

\[2 + 4 + 8 + 64 = 78\]

78 is the node address

The available node address range is 1 through 255.

In the case where the EDGE is the only node in the system (no other nodes connected via ArcNET communication), then the node address must be set to a value of 1.

If there are several nodes connected together via ArcNET (EDGE or other Callisto series), then the EDGE may be set for any convenient address, provided that the selected address is not shared by any other node in the system. If two or more nodes share the same address, ArcNET communication problems will result.

4.7 Port 1 - Port 4 PTT/12V on Pin 8 (LK7 - LK10)

The link provides either +12V or Push to Talk (PTT) to Pin 8 of the corresponding RS-232/RS-485 communications port. When the link has a shorting shunt between Pins 1 and 2, Pin 8 of the corresponding communication port is connected to the PTT circuit. When the link has a shorting shunt between Pins 2 and 3, Pin 8 of the corresponding communication port is connected to the +12V.

- LK7 - Port 4
- LK6 - Port 3
- LK5 - Port 2
- LK4 - Port 1
5. Software Configuration

5.1 About CallistoView 5.5

Created by DAQ Electronics, CallistoView 5.5 is a powerful 32-bit Remote Terminal Unit (RTU) configuration utility providing the necessary tools to configure and maintain an DAQ Callisto RTU. Designed for operation on Windows 98/NT4/XP/2000 platforms, version 5.5 offers new features to help simplify RTU configuration and provide a more extensive selection of options.

*Please note that the latest full version of CallistoView is always available in the Downloads section of the DAQ website at www.daq.net (registered users only). Critical update packs are also available from this page. Non-critical updates are provided directly to users as required.*

5.2 Getting Started

When CallistoView is first launched, the user is presented with an initial RTU configuration screen:

Before exploring specific configuration options or applications, it is recommended that new users familiarize themselves with the main features of this screen. Note that detailed information about the main configuration screen and all of its menu options can be accessed in the CallistoView Help Files, which are available for download from the DAQ website.

- **Adding / Configuring Nodes**
  The basic task of adding a node to an RTU can be accomplished from the main RTU configuration screen. Once a node has been added, highly customizable configuration options can be accessed and defined according to the needs of the user (see sections 5.3 through 5.7). CallistoView provides configuration functions that are designed specifically to the type of node.
- **Adding / Configuring Applications**
  For SCADA communications modules, including the EDGE unit, configuration includes the adding of client, server, and utility applications that are designed for communications with a wide array of protocols (see section 5.8 Client, Server, and Utility Applications).

- **Compiling and Downloading**
  Once complete, configuration files must be downloaded to the RTU. This can be accomplished using the options provided in the *Communicate* menu of the main RTU configuration screen (see 5.9 Downloading a Configuration).

### 5.3 RTU Configuration

Using the menu options available at the top of the RTU Configuration screen, along with other on-screen functions, the user can open and modify a previously created RTU configuration file (.cvd) or create a new one.

When creating a new RTU configuration, the main configuration screen serves as a starting point. The user can add (or delete) nodes from this window and assign each node a descriptive name, if desired.

#### 5.3.1 Creating a New RTU Configuration File

The user can create a new configuration file by selecting the *New RTU* option from the *File* pull-down menu at the top of the main configuration screen. This command item is used to create a blank template in the RTU configuration screen for use in the creation of a new RTU configuration. If this option is selected after changes have been made to an existing configuration and not yet saved, CallistoView will prompt the user to save or discard these changes.

![Warning](image)

Once any changes have been saved or discarded, a blank configuration screen will appear.

#### 5.3.2 Opening an Existing RTU Configuration

The user can open an existing configuration file by selecting the *Open…* option from the *File* pull-down menu at the top of the main configuration screen. This command item is used to open and display existing RTU configuration files (.cvd filename extension). Selecting this item displays the *Open RTU* dialog box.
By default, CallistoView looks in the folder 'DAQTools\CallistoView\RTUConfigurations' for .cvd files. The user can locate specific folders and files using the standard Windows navigation tools. Once a file is located and selected, clicking the Open button will launch and display the RTU configuration. Alternately, double-clicking on the file will also open the configuration.

5.3.3 Adding an EDGE Node

Once a new or existing RTU configuration file has been opened, an EDGE node can be added to the node list. If an EDGE node already exists, please skip ahead to section 5.4 EDGE Configuration Basics.

The user can add an EDGE node to the configuration by selecting the Add option from the Node pull-down menu at the top of the main configuration screen. Selecting this option will bring up the New Node window, where users can select desired node types and numbers and add them to the list of nodes.
The node address can be changed using the left and right arrow buttons (the left button decreases the node number, while the right button increases it). A value can also be directly entered into the Node No. text box. Note that the address designated here must match the physical address assigned to the corresponding hardware device using SW1 (see section 4.6 Node Address/Port 1 Bit-Byte/Start Bit Polarity Switch (SW1)).

The Module Type text box allows the user to define the type of node that is being added to the RTU. Clicking on the down-arrow button at the right side of the Module Type text box displays a drop-down menu listing the node types that can be selected. In this case, the user should select the “Edge” option.

The Name text box can be used to assign the node an informative name or description, if desired. It is strongly recommended that node names be assigned from the New Node window when they are originally created. Changing or adding names later by typing into the Node Name field associated with a specific node on the main RTU configuration screen, while possible, may present complications.

Before a node can be added to the list, it is necessary to make it the “active” node. This is accomplished by either clicking the Add button or placing a checkmark in the Active checkbox before clicking on the Close button. Either of these methods will add the new node to the list and make it active for configuration editing. Clicking Close before selecting Add or placing a checkmark in the Active checkbox will return the user to the main RTU configuration screen without adding a node.

It is also possible to add a node that has been previously saved in the node library. Clicking the Add from Lib button will bring up the Add Node From... dialog box.
By default, CallistoView looks in the folder 'DAQTools\CallistoView\NodeLib' for .cvn files. The user can locate specific folders and files using the standard Windows navigation tools. Once a node file is located and selected, clicking the Open button will add this node to the configuration. Alternately, double-clicking on the file will also add the node.

5.4 EDGE Configuration Basics

After an EDGE node has been added to the node list, configuration is initiated by clicking the “Edge” configuration button on the main RTU configuration screen. Alternately, configuration can be started by selecting Configure from the Node pull down menu (before selecting this option, it is important to select the Edge node by making it “active” - this can be accomplished by clicking to the left or right of the node's configuration button, which will cause the gray horizontal band to move to the node).

Either method will launch the Edge main configuration screen:
If an EDGE configuration has already been defined for the node, the existing configuration can be accessed by clicking on the desired application in the Applications text box and selecting Properties. Alternately, double-clicking on the desired application will also provide access to the existing configuration. The user can remove an existing configuration by selecting an application and clicking the Remove button.

Although CallistoView will allow the user to add more than one application of a specific type (more than one Edge Status Client, for example), doing so will result in an error after downloading the configuration to the RTU. Users should only add one of each type of application per EDGE node.

If an initial configuration has not been defined, the following steps must be taken. Before continuing the node configuration process, a build must be assigned. Note that it is important that the selected build version matches the build actually installed in the EDGE. Clicking on the down-arrow at the right of the Build text box will display a drop-down menu.

Note that “Edge Core” is the build normally installed in this board. After a build is assigned, clicking the Add button will launch the next configuration screen:
5.5 EDGE Status Client

The Edge Status Client allows the user to define digital input processing parameters for the EDGE unit, which is capable of processing up to 12 physical digital inputs with time-tagging accuracy to one millisecond. Points can be individually configured as status, SOE, or Form A or Form C pulse accumulators.

From the Callisto Application List window (see section 5.4 EDGE Configuration Basics), clicking on “Edge Status Client” to highlight it in the Available applications text box and clicking OK will launch the Edge Status Configuration window. Alternately, double-clicking on “Edge Status Client” will also launch the window.
5.5.1 Input Points

The *Input points* tab provides options for adding, removing, and editing digital inputs.

**Add Button**

Clicking the *Add* button will add one digital input at a time to the configuration (the parameters of an added input will reflect those currently selected in the *Add points with these parameters* section at the top of the screen). When more than one point has been added, users can navigate between them using keyboard arrow keys or by clicking on specific points using the mouse. A blue box will highlight the active point.
The *Edge Status Configuration* screen allows for the setting of several parameters (see Input Point Parameters below) as points are added to the system. This is accomplished using the options provided in the *Add points with these parameters* text box. After setting each of these fields to the desired parameters, any new points added to the configuration will have these attributes (*note that these names and values can be individually edited later*).

**Add All Button**

Clicking the *Add All* button will add all 12 digital inputs at once (with each configured with the parameters shown in the *Add points with these parameters* section at the time the button is clicked).

**Remove Button**

Selecting the *Remove* button will delete the last point in the list.

**Remove All Button**

Clicking the *Remove All* button will remove all of the points in the *Input contacts* list. When this option is selected, a confirmation box will appear prompting the user whether they would like to remove all points.

![](image)

**Input Point Parameters**

Information relating to each status point is provided in the *Point Name*, *Contact*, *Device Type*, *Debounce Time*, *Inverted?*, and *Fail State* columns of the *Edge Status Configuration* window. These parameters can be edited for each point. For example, a point can be renamed by double-clicking on the point in the *Point Name* column. This will bring up a text field where a point name can be entered or edited. Hitting *Enter* after editing the point name will update the list with the new name.

Similarly, the previously assigned debounce time for each status point can be adjusted on an individual basis. Double-clicking directly on a number in the *Debounce Time* column brings up an editable value. Hitting *Enter* after editing the value will update the list.

- **Contact/Device Type**
  The available contact/device type options are Status, SOE, Form A Accumulator, Form C Accumulator, and Not Used, which eliminates the point from the local database of the EDGE.

- **Debounce Time**
  The *Debounce time (mS)* parameter allows application of a contact debounce time, in milliseconds, to points in the *Input contacts* list.
• **Invert Status**

  *Invert status* allows the application of inverted or non-inverted point reporting for all added points. A non-inverted point returns a value of zero (0) for an open contact and one (1) for a closed contact. An inverted point returns a value of one (1) for an open contact and a value of zero (0) for a closed contact.

• **Invalid points report as...**

  This configurable parameter determines how a failed status input point is written to the EDGE I/O database. The three options are "Open", "Closed", and "Last Valid" (see section 5.5.2 Contact Validity below). The selected option for this parameter is displayed in the *Fail State* column.

5.5.2 Contact Validity

Clicking the *Contact Validity* tab in the *EDGE Status Configuration* window provides the user with additional configuration options.

Invalidate Inputs

Using this section, users can adjust settings that determine when a status input point is considered invalid.
• **Make input Invalid if contact chatters for X ms**
  The time entered for this parameter is applied globally to all status input contacts. This parameter sets the time limit for a chattering contact to stabilize. Status data is not written to the EDGE I/O database until the amount of time entered in this scroll box expires. If a point is still chattering after this time elapses, the input point is considered invalid.

• **Restore validity if contact stable for X ms**
  The time entered for this parameter is applied globally to all status input contacts. This parameter sets the time required for a contact that has been marked as invalid to remain in the stable state before being restored as a valid contact. If a point is stable after this time elapses, the input point is considered valid.

• **Make input Invalid if contact changes more than X times/min**
  The value entered for this parameter is applied globally to all status input contacts. This parameter sets the maximum number of times in a minute that a contact is allowed to change state without being flagged as invalid.

Either or both of the two invalid contact parameters described above can be selected. Invalidated points can be configured to be reported as "Open", "Closed", or the value of the last valid state.

**Housekeeping Points**

The user can elect to specify the inclusion of "housekeeping" points, indicating that a condition occurred which invalidated an input (or inputs). These points, if selected, become available in the EDGE I/O database, and can be mapped in a server application for transmission to a Master Station.
• **Include housekeeping point for Chatter**
  This selectable item gives the user the option of providing an internal status point for monitoring input contacts for a chatter condition. If any status input contact chatters for a time longer than that specified in the *Make input invalid if contact Chatters for XXXX ms* parameter, this housekeeping point will change state, indicating that at least one point has been invalidated as a result of chatter.

• **Include housekeeping point for Number of changes per minute**
  This selectable item gives the user the option of providing an internal status point for monitoring input contacts for an excessive change-of-state condition. If any input contact changes state within one minute more times than that specified in the *Make input Invalid if contact changes more than XXXX times/min* parameter, this housekeeping point will change state, indicating that at least one point has an excessive change-of-state condition.

  After one minute, this point will reset. If the excessive change-of-state condition persists, this housekeeping point will again change state, indicating an excessive change-of-state condition. This will repeat until the contact is stabilized.

• **Housekeeping point closed indicates valid/invalid**
  The two radio buttons provided with this option allow the user to set housekeeping points to indicate either "Valid" or "Invalid" when in the closed state.

Once all configuration parameters have been completed for all desired points in the *Edge Status Configuration* window, clicking **OK** will return the user to the EDGE main configuration screen.

If further modifications are needed, clicking on "Edge Status Client" to highlight it in the *Applications* text box and clicking **Properties** will return the user to the previously defined configuration. Alternately, double-clicking on "Edge Status Client" will also launch the configuration window. Selecting **Remove** with "Edge Status Client" highlighted will bring up a warning prompting the user whether they would like to remove the configuration.
5.6 EDGE Control Client

The Edge Control Client allows the user to define control points for the EDGE unit. The EDGE is capable of controlling up to 8 command relay outputs, configurable as 4 on/off pairs with select-check-execute protection or as 8 direct-operate commands. The EDGE can be configured with 8 on-board Form-A or Form-B relays (one contact output per point), or it can drive external relay coils installed on various command output termination boards.

From the Callisto Application List window (see section 5.4 EDGE Configuration Basics), clicking on “Edge Control Client” to highlight it in the Available applications text box and clicking OK will launch the Edge Control Configuration window. Alternately, double-clicking on "Edge Control Client" will also launch the window.
5.6.1 Control Points

The Control points folder provides options for adding, removing, and editing control points.

Add

Clicking the Add button will add one control point at a time to the configuration (the default duration setting of an added point will reflect the current setting in the Default duration (mS) scroll box at the top of the screen). When more than one control point has been added, users can navigate between them using keyboard arrow keys or by clicking on specific points using the mouse. A blue box will highlight the active point.
The **Default duration (mS)** scroll box allows selection of a trip/close signal duration (in milliseconds) that will be applied globally to all added points. Prior to adding control points, the desired time duration can either be scrolled to or manually entered via keyboard entry. Any points now added to the **Relay outputs** list will be configured with the selected time duration (*note that these values can be individually edited later*).

**Add All**

Clicking the **Add All** button will add all 8 control points at once (with each configured with the trip/close signal duration shown in the **Default duration (mS)** scroll box at the time the button is clicked).

**Remove**

Selecting the **Remove** button will delete the last control point in the list.

**Remove All**

Clicking the **Remove All** button will remove all of the control points in the **Relay outputs** list. When this option is selected, a confirmation box will appear prompting the user whether they would like to remove all points.

![IoC Configuration](image)

Information relating to each control point is provided in the **Control Name**, **Control No.**, and **Duration (mS)** columns of the **Edge Control Configuration** window. A point can be renamed by double-clicking on the point in the **Control Name** column. This will bring up a text field where a point name can be entered or edited. Hitting **Enter** after editing the point name will update the list with the new name. Alternately, the renaming text field for a point can be accessed by using the mouse to select the point (or navigating to the point using the arrow keys) and pressing F2 on the keyboard.

Similarly, the previously assigned close/trip signal duration for each control point can be adjusted on an individual basis. Double-clicking directly on a number in the **Duration (mS)** column brings up an editable value. Hitting **Enter** after editing the value will update the list.

Once all configuration parameters have been completed for all desired points in the **Edge Control Configuration** window, clicking **OK** will return the user to the EDGE main configuration screen.
If further modifications are needed, clicking on "Edge Control Client" to highlight it in the **Applications** text box and clicking **Properties** will return the user to the previously defined configuration. Alternately, double-clicking on "Edge Control Client" will also launch the configuration window. Selecting **Remove** with "Edge Control Client" highlighted will bring up a warning prompting the user whether they would like to remove the configuration.
5.7 EDGE Analog Client

The Edge Analog Client allows the user to define analog processing parameters for the EDGE unit. The EDGE is capable of processing up to 12 analog inputs supplied from AC, DC, or line post sensor sources.

From the Callisto Application List window (see section 5.4 EDGE Configuration Basics), clicking on “Edge Analog Client” to highlight it in the Available applications text box and clicking OK will launch the Edge Analog Client window. Alternately, double-clicking on “Edge Analog Client” will also launch the window.
The twelve analog inputs may be as simple as twelve independent voltage channels, or as complicated as voltages and currents from two three-phase circuits. In the EDGE Analog Client configuration, the user must designate what inputs are connected and which measurements are to be performed.

The EDGE Analog Client configuration window has three tabs: *Analog Input Types*, *Physical*, and *Logical*.

### 5.7.1 Analog Input Types Tab

The *Analog Input Types* tab is used to generally describe the types of inputs to the EDGE (for example, a brand of PT or CT or whatever sensor the user intends to connect to the EDGE). The *Name* field allows the user to designate a meaningful name for the input, and the *Description* field can simply contain any note the user wishes to add. Both of these fields can be edited by double-clicking in the appropriate column.

![Image of EDGE Analog Client configuration window](image)

The *Platform Type* should be selected as the type of platform board that has been installed (see section 3.8 *Platform Boards*). Double-clicking in this column calls up a drop-down list of available types. For reference, a list of the available platform board types is included in the lower right of the window with their associated DAQ part numbers.
New input types can be added to the list using the Add button. Once a blank row has been added, the user can edit each parameter by double-clicking in the appropriate column. Once completed, the new input type will be available in the Physical tab as a selectable option in the Analog Input Type column.

The Zero Point and Phase Shift fields are used to describe the generic analog input type. Zero Point is normally more important for DC inputs, and represents the voltage at the input to the EDGE that you wish to be recorded as a 0 in the measurement data. For example, if a temperature sensor that outputs 5 VDC at a calibration temperature of 50 degrees has been connected, the user might want to store the measurements as relative to 50 degrees. In this case, the user would enter 5 as the “Zero Point”; an input voltage of 5 would then result in a measurement value of 0.

Similarly, Phase Shift is the phase shift that sensors of the type connected to the EDGE ideally impart to their outputs. For example, a current sensor might have an output voltage that lags its input current by 90 degrees. In this case the user would enter -90 for the “Phase Shift” (lagging outputs are negative, leading outputs are positive).

The Data Base Full Scale field is used to scale the EDGE output measurements. EDGE measurements are reported as 16-bit signed values for a range of -32768 to 32767. The measurement value 32767 represents the voltage that is entered in the “Data Base Full Scale” field.

5.7.2 Physical Tab

The Physical tab is used to describe every input channel for the EDGE. Within this window, users can navigate between the various input points using keyboard arrow keys or by clicking on specific points using the mouse (a blue highlight will highlight the active input number).
The **Channel #** field corresponds to the Analog Input Point number on the EDGE cover; points 1 to 6 are on the left of the EDGE and points 7-12 are on the right.

There are several parameters that can be edited for each channel. By double-clicking in the **Name** column, the user can assign the point a descriptive name (up to 11 characters). Once the name has been entered/modified, hitting **Enter** will assign the name to the point. The default names reflect the recommended channel assignments for measuring two three-phase circuits; the first circuit is measured on channels 1-6 that are connected on the left side of EDGE and the second circuit is measured on channels 7-12 that are connected on the right side of EDGE.

It is important to note that channels with “Current” in their default names, 4, 5, 6 and 10, 11, 12, are recommended for the three phase current inputs. This is because the EDGE hardware automatically samples inputs 4, 5, 6 and 10, 11, 12 twice: once with normal gain, and once with an attenuation of 20. This allows faults where abnormally high currents occur to be captured by the attenuated sample, even though they are so high as to saturate the normal sample. The root average squared (RMS) value of the attenuated inputs for channels 4, 6, 7 and 10, 11, 12 is available in the EDGE output measurements if the channel is configured as “Active” (see section 5.7.3 Logical Tab).

Double-clicking in the **Analog Input Type** column activates a drop down list of all the analog input types defined in the **Analog Input Types** tab (see section 5.7.1 Analog Input Types Tab). It is important to ensure that the analog input type selected reflects the platform board actually installed for the channel. Typically, several channels will have the same analog input type selected.

The **Zero Correction** and **Phase Correction** parameters are corrections to the “Zero Point” and “Phase Shift” entered for the analog input type. These are fine adjustments for variation between specific units of the same type. For example, if a current sensor ideally has a 90 degree phase lag, the user may have entered -90 for the Phase Shift on the **Analog Input Types** tab. However, when viewing the actual current sensors that are being used, the user may see that current sensor A on channel 4 has a 89 degree lag, and current sensor B on channel 5 has a 87 degree lag. The user should then enter a “Phase Correction” of +1 for channel 4 and +3 for channel 5. Similarly, the “Zero Correction” is used to adjust the zero value for variation from sensor unit to sensor unit.

The **Gain Correction** field corrects for sensor gain variations among sensor units of the same type. For example, say step down transformers that have a nominal 1:100 output to input ratio are being used to measure two 500 peak voltage lines. An output maximum of 5V is expected, so on the **Analog Input Types** tab the user would create a type named “1:100 Transformer”, select and install 5V (or 10V to be safe) platform boards, and set the “Data Base Full Scale” field to 5. When the user installs the real transformers, the transformers show that the one on channel 1 has been calibrated and found to have a 1:99 output/input ratio and the one on channel 2 has a 1:103 ratio. For channel 1, the user would enter the “Gain Correction” of the ratio of actual transformer output 1/99 to the nominal output 1/100 or (1/99) / (1/100) = 100/99 = 1.01. Similarly, for channel 2 the user would enter (1/103) / (1/100) = .97. In all cases, the user should enter the ratio of the actual sensor gain to the nominal sensor gain, and then treat the EDGE measurements as if they all came from an ideal sensor (in this example, treat all measurements as if they came from a 1:100 transformer).

For detailed information on this process (**Zero Correction, Phase Correction, and Gain Correction**), please see the **Analog Measurement Scaling and Calibration** document, which is available for download from www.daq.net.
5.7.3 Logical Tab

The Logical tab enables the user to select which channels should be monitored, how channels are related to each other (e.g., the voltage and current of a single phase), and which measurements are made. The tab shows the 12 EDGE input channels as connected to two three-phase circuits. The top of the window shows the input points on the left side of the EDGE enclosure, channels 1-6, grouped together to measure one three-phase circuit, and the bottom of the window shows the input points on the right side of the EDGE enclosure, channels 7-12, grouped together to measure another three-phase circuit. Note that for three phase measurements, the input points must be connected as shown.

It is convenient to think of the set of three phase measurements as coming from a logical three-phase measuring device; EDGE has two such logical three-phase measuring devices. Likewise, you can think of each of the phases as being measured by a logical single-phase device, and the output of the three single-phase devices being fed into the three-phase device. Each single-phase device is in turn fed by two single-channel devices. The window shows these logical devices in a tree like diagram.

The window initially shows all devices as “Inactive”, meaning no channels are being monitored and no measurements are being recorded. A three-phase measurement set (three phase logical device) can be made “Active” by double clicking on the white rectangular area beneath the “Three Phase” label. The
rectangle becomes blue and marked “Active” and the three single-phase boxes and six single-channel boxes to its left become black and marked “Allocated”. These are the single-channel and single-phase logical devices that feed the three-phase device. Devices marked “Active” or “Allocated” are monitored and the user can select measurements to be made by these devices from the list at the right of the window. A measurement is selected from the list by clicking its check box on the left of the list. *Note that the measurement list has a Device Name title at its top that tells you which of the logical devices generates the measurements.*

Once a three-phase device has been made “Active” a set of buttons will appear above the Device Name parameter. These buttons allow the user to control the display of possible measurements in the measurement selection list. A three-phase measurement set can contain around 200 possible measurements and it may be difficult to find specific measurements in the list. The left most button, when pressed, allows only the measurements you have selected to be displayed; this is useful when you do a final check of your selections. The next three buttons, labeled “A”, “B”, and “C”, control the display of measurements from the single-phase devices, while the final six buttons control the display of measurements from the six voltage and current single-channel devices.

The EDGE can also be configured to measure single phases that are not part of a three-phase measurement, or can measure independent single channels. To make single phase measurements, the user can activate a single channel device by double-clicking it (if the three phase device is already active, the user should de-activate it by double clicking it). Then the user can select measurements from the list. The buttons above the measurement list again control which of the possible sets of measurements are displayed; the “V” button displays measurements available from the voltage channel and the “I” button displays measurements from the current channel. To make measurements from a single channel only, the user can double-click the single channel device connected to that channel and select the desired measurements from the list.

5.7.4 Completing Analog Configuration

Once all configuration parameters have been completed for all desired points in the Edge Analog Client window, clicking OK will return the user to the EDGE main configuration screen.
If further modifications are needed, clicking on "Edge Analog Client" to highlight it in the Applications text box and clicking Properties will return the user to the previously defined configuration. Alternately, double-clicking on "Edge Analog Client" will also launch the configuration window. Selecting Remove with "Edge Analog Client" highlighted will bring up a warning prompting the user whether they would like to remove the configuration.

![Remove Application](image)

### 5.8 Client, Server, and Utility Applications

The EDGE unit supports a growing list of client, server, and utility applications. For information on incorporating these applications into your RTU configuration, please access the CallistoView Help Files available for download from www.daq.net. Within this interactive help guide, navigate to the SCADA/IoE2 section, and locate the specific application you are adding from the appropriate client, server, or utility folder. Details on all screens and functions provided for the application are provided.

### 5.9 Downloading a Configuration

Once the EDGE has been configured, changes can be saved using the Save or Save As options from the File pull-down menu in the main RTU configuration screen. After saving, the configuration will be ready for compilation and downloading to the RTU.

Using the Communicate menu, users can compile and download completed configurations to an RTU, upload existing configurations from an active RTU, and execute several other communications-related functions.
5.9.1 Download

**Download → All**

Clicking the *Download → All* command item initiates compilation of all nodes in the currently open RTU configuration file. When compilation is complete, the user is asked to confirm that they wish to download the compiled RTU file to the RTU.

Clicking the *Yes* button in the *Callisto RTU Configuration* window begins the download of the complete configuration to the RTU. *Although it can take longer, it is always safest to use the Download → All option when time permits. This will assure that all files in all nodes agree.*

The *Also download my configuration file as a backup* checkbox gives the user the option to include the configuration data for the compiled RTU in the download process. This option is useful in instances when the RTU configuration file is lost or corrupted. Checking this option before downloading will supply the
necessary information to the RTU so that, if desired, the configuration of the RTU can be uploaded back to the PC from the RTU.

Information on using the **Dial-up** button, which enables the user to download an RTU configuration to an RTU through the use of a dial-up modem connected to the RTU, is available in a separate documentation package.

**Download → Selected Node**

Clicking the **Download → Selected Node** item enables the user to compile and download individual nodes from the configuration. This option should be used when it is necessary to change the settings of only one node at a time, such as when "tweaking" a node for better operation (changing communication port timings, for example). This saves a significant amount of time when compared to using the **Download → All** option.

Before selecting this option, it is important to select the node to be compiled by making it "active". This can be accomplished by clicking to the left or right of the node's configuration button, which will cause the gray horizontal band to move to the node. Once the correct node is active, the **Download → Selected Node** command item can be selected from the **Node** menu.

When compilation is complete, the user is asked to confirm that they wish to download the compiled node configuration to the RTU.

![Callisto RTU Configuration](image)

Clicking **Yes** begins the download of the selected node configuration to the RTU.

Information on using the **Dial-up** button, which enables the user to download an RTU configuration to an RTU through the use of a dial-up modem connected to the RTU, is available in a separate documentation package.

**Download → Specific Nodes**

Clicking the **Download → Nodes** command item launches the **Download Nodes** window, which allows the user to select a grouping of nodes to download.
By holding down the **CTRL** key and clicking on node names, the user can select or de-select the various available nodes. Once the correct nodes have been selected, clicking the **Download** button initiates compilation of the selected node configurations only. When compilation is complete, the user is asked to confirm that they wish to download the compiled node configurations to the RTU.

Clicking **Yes** begins the download of the selected node configurations to the RTU. When downloading is complete, clicking the **Done** button in the **Download Nodes** window returns the user to the main RTU configuration screen.

Information on using the **Dial-up** button, which enables the user to download an RTU configuration to an RTU through the use of a dial-up modem connected to the RTU, is available in a separate documentation package.

**Download → Retry Previous**

Clicking the **Download → Retry Previous** item allows the user to download whatever configuration was last compiled, without having to recompile. This is useful if, for example, the user has waited for the compile to occur, but has neglected to plug in the download cable. After reconnecting the cable, this option can be used to initiate an immediate download.
Download → Update Firmware

In rare cases, it may be useful to update the firmware of a Callisto board for maintenance purposes. Firmware refers to the software component that contains base-level code for booting and other hardware-related functions. In most cases, unless a new version of CallistoView has recently been installed, utilizing this option will have no affect, as the module should already have the appropriate firmware installed.

If this option is selected, the user will be prompted to confirm that they wish to download the compiled configuration to the RTU.

Clicking Yes button begins the download of the configuration to the RTU.

Information on using the Dial-up button, which enables the user to download an RTU configuration to an RTU through the use of a dial-up modem connected to the RTU, is available in a separate documentation package.

5.9.2 Upload

The Upload menu item allows a downloaded RTU configuration to be read back to a PC via the PC’s comm port and the CallistoView application. This is useful in instances when the original configuration file has been lost or damaged. Upon clicking this item, the user is prompted to verify that a configuration cable is connected to the configuration port of the RTU.

Clicking OK initiates the upload process. Once completed, the configuration data from the RTU is displayed on the CallistoView configuration screen. Note that there is no filename associated with this uploaded configuration. Saving this configuration as a file requires the user to commit the configuration to disk with the Save As... command (the Save command is not available until the file is given a name).
6. Appendix

6.1 Connection Diagrams