i-Vu Automated Demand Response v1.3 for the i-Vu Pro application

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Important changes are listed in **Document revision history** at the end of this document.

Contents

What is the i-Vu Pro Automated Demand Response add-on?

The i-Vu® Pro Automated Demand Response add-on supports OpenADR® 2.0 and enables the i-Vu® Pro system to participate as a virtual end node (VEN) in various utilities' Automated Demand Response (ADR) programs. Each program produces specific signals that notify upcoming demand events. An ADR event from the utility can have one or more signal types in it, such as Simple or Load Control. For a list of currently supported signals, see Signal types.

The number of demand response programs you can participate in is determined by your Automated Demand Response add-on license. For each ADR program you plan to participate in, an Automated Demand Response Account must be created in the add-on. In the Account, you designate your Server, Market Context, and Profile; then attach your ADR Resources to your profile in order to participate in the events. An ADR resource is a piece of equipment participating in an Automated Demand Response program; it must contain the appropriate Automated Demand Response symbol files to receive the event.

Signal types and control programs for automated demand response

The following signal types are supported by the Automated Demand Response add-on. To use the ADR data, you must install the necessary control programs. These control programs can be obtained from the Universal Controller SAL using Equipment Builder.

Profile A or B	Signal name	Signal type2	Values	Universal Controller SAL-Control Program
A & B	Simple	Level	0, 1, 2, 3	**Simple Signal 10 Intervals**
B	Electricity_Price	Price PriceRelative PriceMultiplier	Any	**Electricity Price Signal 10 Intervals**
B	Energy_Price	Price PriceRelative PriceMultiplier	Any	**Energy Price Signal 10 Intervals**
B	Load_Control	LoadContolCapacity LoadContolLevelOffset LoadContolSetpoint LoadContolPercentOffset	0.0-1.0 Integer Any +/- 0.0-1.0	**Load Control Signal 10 Intervals**
B	Load_Dispatch	Setpoint Delta Multiplier Level	Any Any Any Integer	**Load Dispatch Signal 10 Intervals**

Requirements

You will need the following information before you begin:

- Set up SSL Mutual Authentication if your utility company requires you to use their certificate for client authentication; see *Appendix* (page 18).
- Determine which ADR profile you will participate in: profile A or profile B.
- Determine which signals and types you will be using; see *Signal types and control programs for automated demand response* (page 1) for a list of supported signals and types.

Your i-Vu® Pro system:

- Is v6.5 or later system with the latest cumulative patch.
- Has the necessary ADR resource control; see *Signal types and control programs for automated demand response* (page 1).

Browser support:

- Google™ Chrome™ v71 or later.
- Internet Explorer v11 or later. You must add the i-Vu® Pro server as a trusted site. In Internet Explorer, go to **Tools** > **Internet Options,** then click **Security** > **Trusted sites** > **Sites**.
- Mozilla® Firefox® v59 or later.
- Microsoft® Edge®.

Launching the Automated Demand Response add-on

In a web browser, type the address of your i-Vu® Pro system followed by `/openadr_2.0`.

After accepting the end-user license agreement, you are ready to set up the Automated Demand Response add-on.

NOTE `/openadr_2.0` is case sensitive.

Setting up the Automated Demand Response add-on

To set up the add-on, you must configure the system and set up the Automated Demand Response account for the i-Vu® Pro site; then add its resources, targets, and groups.

To configure the system

Enter your system's configuration information.

1 Click **Admin** > **System Config** to configure the add-on (see table below).

2 Click **Save Config**.

Field	Description
Verbose	No = Display a limited amount of information. Yes = Display additional details. **NOTE** For additional details, check the log entries and the i-Vu Pro Server **Output** tab.
Log Level	Number referring to the list of messages written to the log file: ○ 0 = No messages ○ 1 = Fatal errors only - application does not work ○ 2 = All errors - fatal and non-fatal ○ 3 = All errors plus warnings ○ 4 = All errors, warnings, plus additional status information ○ 5 = All errors, warnings, additional status, and debugging information ○ 6 = All messages **TIP** Level 3 is recommended for normal use.
Resource Check Time	Frequency in minutes to check whether to re-download an event in case of a module reset. For example, if a controller is reset due to issues such as power loss or memory download, the current ADR events are lost. The re-download restores those events.
Client Name	Client identifier in messages to the OpenADR® server; optional.
Use Public Certificate	If using 2-way authentication, select **Y**. See *Appendix* (page 18) for more information.
Certificate Bundle File Password	If field above is **Y**, enter your private key password. See *Appendix* (page 18) for more information.
Location of Certificate Bundle	Path is automatically filled in if using a private key.

TIPS:

- To locate an item in the list, type the item in the **Search** field:

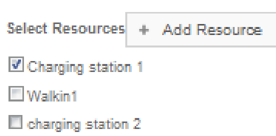
- To change the number of items displayed in the list, select a different number in the **Display** drop-down list.
- To view pages of events before or after the current page, click the single arrows. To view the first or last page, click the double-arrows:

- To delete an item, either click **Delete** ( ) under **Actions**, or check one or more boxes in the first column and click **Delete Selected**..

To set up the i-Vu® Pro Automated Demand Response account

You must set up a i-Vu® Pro Automated Demand Response account to define an Automated Demand Response program. The license determines how many accounts can be set up.

1. Click **Configure** > **Manage Accounts**.
2. Click **Add Account** and complete the fields for an OpenADR® Program using the table below.
3. Check the resources' checkboxes to be attached to this account. For example, charging station #1 below is attached to this account, but #2 is not.



4. If no resources are listed, click **Add Resource**; see *To add an ADR Resource* (page 7) and start at step 2.
5. Click **Save Account**.

TIP To delete, edit, or view the account details, do one of the following:

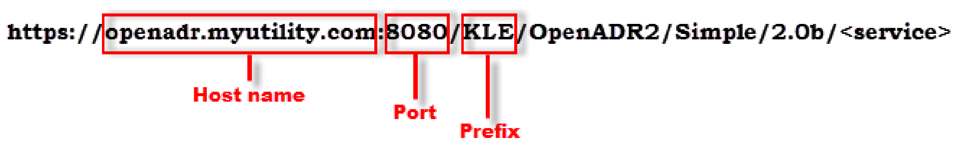
- Use the buttons ( ) under **Action**
- Select one or more boxes in the first column and click **Delete Selected**

Field	Description
Description	Automated Demand Response program description
Host Name*	Provided by utility - if utility has specified a URL, see below
Port*	If the VTN is using a port number other than 80, enter it here; otherwise, leave field blank (see below)
Prefix*	Optional field - if provided by utility; if not provided, leave field blank. (If utility has specified a URL, see below)

Field	Description
Connection TimeOut	Adjust if timeouts are occurring on a particular connection
Market Context	Provided by utility
Poll Rate	Polling rate, in seconds, of how often to poll the server—this value will be adjusted automatically if the utility specifies a maximum polling rate slower than what is configured
Account Enable	Enable the account to receive signals from the utility Disable to stop the polling, but not delete it
Virtual End Node ID	VEN ID assigned by utility **NOTE** If utility requests a VEN ID to be presented during registration, enter it here
Profile	OpenADR profile (2.0a or 2.0b)
Reply Limit	Maximum number of events a VEN can accept from server in a single message
Virtual Top Node ID	VTN ID assigned by utility
VEN Client Name	Profile b only: Enter client name that appears in polls to the server; utility may specify the name
Query Registration	Profile b only: Enable if a query registration is required before registering
Authorization	If the utility requires username/password authentication, check the checkbox and enter your username and password provided by the utility

* **Utility-provided URLs**

A Port and a Prefix fields are specified, In this case the URL sent to you may look like this:

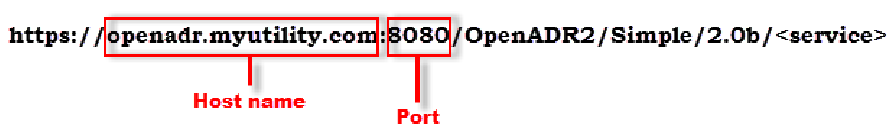


Host name = `openadr.myutility.com`

Port = `8080`

Prefix = `KLE`

The Prefix field is not specified. In this case, the URL sent to you may look like this:

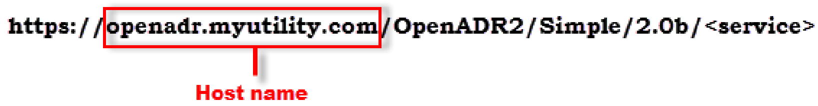


Host name = `openadr.myutility.com`

Port = `8080`

Prefix = `[leave field blank]`

The Port and Prefix fields are not specified. In this case the URL sent to you may look like this:



Host name = `openadr.myutility.com`

Port = `[leave field blank]`

Prefix = `[leave field blank]`

To add an ADR resource

You must set up an ADR Resource for each piece of equipment to be targeted. Resources can be created ahead of time following the steps below, or added during the set-up process using the **Add Resource** button; see *To set up an Automated Demand Response account* (page 5).

1. Click **Configure** > **Configuration Wizard** > **Single Resource Wizard** and follow the steps to setup the ADR Resource and select the targets and signals related to it.
2. Follow the instructions in the wizard using the tables below.
3. Close window and repeat this procedure for each additional resource.

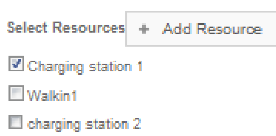
Resources must be 'attached' to the account after adding them; see *To attach a resource to an account* (page 8).

Step		Notes
1	**Resource Identifier**	**Resource Name**—Equipment name, example: charging station 1 **Profile for Resource**—2.0a or 2.0b
2	**Select Equipment**	Select control program that contains the event interfaces for each signal type supported by this equipment
3	**Select Targets**	Select or add target icon and drag it to the **Target List** **NOTES** If the item is not listed, click **Add** (), then **Save**. See table below To delete an item from the **Target List**, click **Delete** () See table below for list of possible types of targets
4	**Select Signal**	Specify the number of intervals supported by the signal type; symbols provided support up to 10 intervals
5	**Confirmation**	Verify information. To edit any fields, click **Previous**, then **Next** to confirm.

Profile	Targets
A & B	Group ID, Resource ID, Party ID
B	Aggregated Pnode, End Device Asset, Meter Asset, Pnode, Service Area, Service Delivery Point, Service Location, Transport Interface, Group Name

To attach a resource to an account

1. Click **Configure** > **Manage Accounts**.
2. Locate the account and click **Edit Account** ( ).
3. Scroll to the bottom of the **Edit Account** page and check the resource to be added to the account.



4. Click **Save Account**.

To manage targets

1. Click **Configure**.
2. Click **Manage Targets** and expand.
3. Select a target and click **Add**.
4. Click **Save**.

TIPS:

- To locate an item in the list, type the item in the **Search** field:

- To change the number of items displayed in the list, select a different number in the **Display** drop-down list.
- To view pages of targets before or after the current page, click the single arrows. To view the first or last page, click the double-arrows:

- To delete an item, either click **Delete** ( ) under **Actions**, or check one or more boxes in the first column and click **Delete Selected**.

Managing the system

To view your status

1. Click **Alerts** ( ).

   NOTE a number in upper-right indicates number of active alerts.

2. Click **View System Status** to view the following information:

Field	Description
Id	Unique alert ID given by the Automated Demand Response add-on
Description	Brief description of the alert
Details	Additional details about the alert
Acknowledgment	Indicates whether the alert has been acknowledged
Actions	Delete the item, view its brief description, or acknowledge the alert

TIPS:

- To locate an item in the list, type the item in the **Search** field:

- To change the number of items displayed in the list, select a different number in the **Display** drop-down list.
- To view pages of alerts before or after the current page, click the single arrows. To view the first or last page, click the double-arrows:

To view account status

1. Click **Configure**.
2. Click **Manage Accounts** to view a list of accounts.

TIPS:

- To edit the details of one of the items in the list, click **Edit** ( ) under **Actions**.
- To view the details of one of the items in the list, click **View Details** ( ) under **Actions**.
- To delete an item, either click **Delete** ( ) under **Actions**, or check one or more boxes in the first column and click **Delete Selected**.

To view resources

1 Click **Configure**.

2 Click **Manage Resources** to view a list.

NOTE If **Delete** ( ) appears under **Actions,** the resource has not yet been attached to an account on the Account Management page. See *To attach a resource to an account* (page 8).

TIPS:

- To edit the details of one of the items in the list, click **Edit** ( ) under **Actions**.
- To delete an item, either click **Delete** ( ) under **Actions**, or check one or more boxes in the first column and click **Delete Selected**.

Managing events

To view current events

1. Click **Events**.
2. Click **Current Events** to view the following event information:

Field	Description
Event Id	The name of the event given by the utility
Mod Date Time	Date and time the event was modified by the VTN
Mod Number	Sequential number starting with zero that indicates how many times the event has been modified by the VTN
Priority	Event priority with zero being no priority
Event Start	The start time the event is issued by the utility server
Duration	Duration of the event displayed in standard notation of time issued by the server (ISO8601 time)
Event Status	Displays the status (far, near, active, or canceled)
Actions	Opt out of an event by checking the checkbox and clicking **Click to OptOut**

TIPS:

- To locate an item in the list, type the item in the **Search** field:

- To change the number of items displayed in the list, select a different number in the **Display** drop-down list.
- To view pages of events before or after the current page, click the single arrows. To view the first or last page, click the double-arrows:

- To delete an item, either click **Delete** () under **Actions**, or check one or more boxes in the first column and click **Delete Selected**.
- To view detailed event information, click **Event History**

To view event history

To view current or past events, do one of the following:

- Click **Events Calendar** ( ), then click either **You Have Events** (current) or **More Events** (history)
- Click **Events**, then click **Current Events** or **Events History** to view the following event information:

Field	Description
Event Id	The name of the event given by the utility
Mod Date Time	Date and time the event was modified by the VTN
Mod Number	Sequential number starting with zero that indicates how many times the event has been modified by the VTN
Priority	Event priority with zero being no priority
Event Start	The start time the event is issued by the utility server
Duration	Duration of the event displayed in standard notation of time issued by the server (ISO8601 time)
Actions	Display the details of event

TIPS:

- To locate an item in the list, type the item in the **Search** field:

- To change the number of items displayed in the list, select a different number in the **Display** drop-down list.
- To view pages of events before or after the current page, click the single arrows. To view the first or last page, click the double-arrows:

- To delete an item, either click **Delete** ( ) under **Actions**, or check one or more boxes in the first column and click **Delete Selected**.

Managing Opt Schedules

In the Automated Demand Response add-on, **Opt Schedules** describe the equipment/facility availability or unavailability to participate in an event.

Based on your contract with the utility, you may be able to use **Opt Schedules** for any event. These allow you to opt out or opt in any resources participating in profile b. For example, if a piece of equipment is off-line for maintenance or repair, you can configure an **Opt Schedule** (available or not available) which the add-on uses to automatically opt the equipment in or out of an event.

To add an Opt Schedule

To create an **Opt Schedule** allowing you to opt in or out of an event, you must first create the schedule, then select the targets and signals related to it. Do either of the following to create a schedule:

- Click **Configure** > **Configuration Wizard** > **OptIn/OptOut Wizard** and follow the steps.
- Click **Events** > **Current Events**, then click **Add Opt Schedule** and follow the instructions for the wizard.
- Click **Events** > **Current Events**, then check the selection box for the event you would like to opt out of. Then click **OptIn and OptOut of Event** (OptIn and OptOut of Event) and follow the instructions for the wizard.

Follow the instructions in the wizard to set a target and signals related to its availability.

NOTE To view later, click **Configure** > **View/Cancel Opt Schedules**.

Step		Notes
1	**Optin/Optout Information**	**OptIn-Out Name**—Schedule name, example: charging station repairs
2	**Select Availability**	Specify the event the schedule applies to and the time range that it is in effect
3	**Select Targets**	Select or add target icon and drag it to the **Target List** if you want a target to be associated with this schedule **NOTES** If the item is not listed, click **Add** (), then **Save** To delete an item from the **Target List**, click **Delete** ()
4	**Select Device Class**	Select device icons and drag them to add to the **Target List** if you want Device Class to be associated with this schedule **NOTE** To delete an item from the **Target List**, click **Delete** ()
5	**Confirmation**	Confirmation of what is sent to server

Adding Telemetry Reports

This add-on supports only telemetry reports. Check with the utility to determine which report(s) you need to set up, the Telemetry Usage report, the Telemetry Status report, or both.

NOTES:

- History reports are not supported.
- Although our add-on can request a metadata report from the VTN, the add-on will not generate a report request to the VTN based on the response from the metadata request.

To create a report and select the targets and signals related to it, do either of the following:

Click **Configure** > **Configuration Wizard** > **Reporting Wizard**.

Click **Configure** > **Manage Reports** > **Registered Report Specifier**, then click **Add Reports**.

To add a Telemetry Status report

Follow the instructions in the wizard.

Step	Notes
1 Report Information	The **Specifier ID** must be unique across your accounts.
2 Select Data Point	After selecting the **Setpoint** microblock and entering the range of the sample rate, click **Add Report Description** to view the format of the point's data in the list. **NOTE** The trend must be enabled. Add more by clicking **Add Report Description**. After summary appears in gray at the bottom, click **Next**.
3 Select Targets	Select or add target icon and drag it to the **Target List** if you want a target to be reported. **NOTES** If the item is not listed, click **Add** ( ), then **Save**. To delete an item from the **Target List**, click **Delete** ( ).
4 Confirmation	Verify information. To edit any fields, click **Previous**, then **Next** to confirm.

To add a Telemetry Usage report

Follow the instructions in the wizard.

Step	Notes
1 Report Information	The **Specifier ID** must be unique across your accounts.
2 Select Data Point	After selecting the **Setpoint** microblock and entering the range of the sample rate, click **Add Report Description** to view the format of the point's data in the list. **NOTE** The trend must be enabled. Add more by clicking **Add Report Description**. After summary appears in gray at the bottom, click **Next**.
3 Select Targets	Select or add target icon and drag it to the **Target List** if you want a target to be reported. **NOTES** If the item is not listed, click **Add** (), then **Save**. To delete an item from the **Target List**, click **Delete** ().
4 Select Device Class	Select device icons and drag them to add to the **Target List** if you want Device Class to be reported **NOTE** To delete an item from the **Target List**, click **Delete** ()
5 Confirmation	Verify information. To edit any fields, click **Previous**, then **Next** to confirm.

Managing reports

To view requested reports from server

1 To view a list of reports that have been requested from the server, do either of the following:

Click **Configure** > **Configuration Wizard** > **Reporting Wizard**.

Click **Configure** > **Manage Reports** > **Registered Reports**, then click **View Reports**.

1 Follow the instructions in the wizard.

To view updated reports sent to server

1 To view a list of reports that have been updated and sent to the server, do either of the following:

Click **Configure** > **Configuration Wizard** > **Reporting Wizard**.

Click **Configure** > **Manage Reports** > **Updated Reports**, then click **View Reports**.

1 Follow the instructions in the wizard.

Troubleshooting the Automated Demand Response add-on

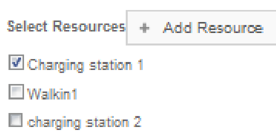
The Automated Demand Response add-on is not communicating correctly

- Verify the URL of the Automated Demand Response Server is configured properly
- Verify the correct certificates are installed

  NOTE The Automated Demand Response add-on automatically installs the root certificate of the OpenADR Certificate Authority. If the server you are integrating to needs a different certificate, manually copy it into **webroot/<system_dir>/webapp_data/openadr_2.0/private/truststore**.
- Check log files for possible errors

Resources are not attached properly

Verify that resources are "attached" to the account, not just added to the system. If they are not attached, **Delete** ( ) will appear to the left of the resource in the list. For example, charging station #1 below is attached to an account, but #2 is not.



To attach a resource: On the **Account Management** page, select the resources' checkboxes to be attached to an account and save the account.

Account is "Unregistered" after power loss

After losing power, the i-Vu® Pro server is rebooted, but now the account's status is "unregistered." After the server resumes, the Automated Demand Response add-on automatically re-registers with the utility's server. If it is unable to re-register, verify the i-Vu® Pro server is connected to the Internet.

Events did not maintain the proper state after a download

After downloading the device containing the automated demand response control programs, the logic no longer reflects the proper state of events.

Active events will not persist through downloads or power losses. To avoid this, perform maintenance operations require downloads or power disruptions at times when there are no active events.

Appendix: SSL Mutual Authentication

If the utility company requires SSL Mutual Authentication to connect to Automated Demand Response, their company's certificate is required to identify the add-on.

1 You must generate a private key and create a Certificate Signing Request (CSR).

2 Send the CSR to the utility company.

The utility company provides the public certificate (.pem file) that must be combined with several other items (keys or chain certs) and be packaged in a PKCS#12 archive file format (.pfx or .p12 file). The utility company must provide instructons for this task.

3 Enter the certificate password (see *Setting up the add-on* (page 4)).

Step 1: Generate a private key

a Determine a filename for your private key using either `.pem` or `.key` as the file extension. For example, `private_key_file.pem`. See your certificate provider for more information.

b Generate a private key for the Automated Demand Response add-on by invoking the following command.

```
openssl genrsa -out private_key_file.pem 2048
```

c Enter a password for the file.

A 2048-bit RSA key pair is generated and encrypted using the password provided. The file is saved to the current directory.

Step 2: Create a Certificate Signing Request (CSR)

The private key generated above is used to create a CSR. The utility company provides the specifications, including the CSR file extension type, such as `.csr` or `.pem`. For example, `your_domain.pem`. See your certificate provider for more information.

a Generate a CSR for the Automated Demand Response add-on by invoking the following command.

```
openssl req -new -key private_key_file.pem -out your_domain.pem
```

b The CSR file is generated at the current directory.

c Send the CSR to the utility company.

The utility company will provide you with the following based on your key and CSR:

- X.509 certificate. When you receive the certificate, verify that it uses the `.pem` file format. If it doesn't, you must convert it before proceeding. See `http://info.ssl.com/article.aspx?id=12149` for more information.
- Certificate Authority (CA) public certificate chain (intermediate certificates) that is used to establish trust with the root certificate.

WARNING Keep this private key file in a safe location.

Step 3: Preparing the certificates

Do the following to bundle all the certificates received from the utility company along with your key into PKCS#12 format.

a Place the following files in a temporary folder:

File type	for example...
Private Key	customer_pk.pem
Public Certificate from the utility company	pc_from_util.pem
CA Public Certificate chain(s) from the utility company	ca_chain_from_util.pem

a Invoke the openssl command from that folder by using the following OpenSSL command to generate the cert_bundle.pfx required in the Automated Demand Response add-on:

```
openssl pkcs12 -export -inkey customer_pk.pem -in pc_from_util.pem -certfile
ca_chain_from_util.pem -out my_cert_bundle.pfx
```

b When prompted, enter and verify your password.

NOTE You must have the cert_bundle.pfx file and the export password in order to load the certificates into the add-on.

c Copy the my_cert_bundle.pfx file to a directory on the server where i-Vu® Pro and the add-on are running:

```
C:\<Your Install
Dir>\webroot\<system>\webapp_data\openadr_2.0\private\keystore
```

d In the Automated Demand Response add-on go to **Admin** > **Sytem Config**.

e In the **Certificate Bundle File Password** field enter the certificate's password, and then click **Save Config**.

Document revision history

Important changes to this document are listed below. Minor changes such as typographical or formatting errors are not listed.

Date	Topic	Change description	Code*
2/25/20	Legalease	All rights reserved statement	A-D
10/15/19	To add an Opt Schedule	Removed incorrect graphic	AC-O-KZ-O
2/15/19	cover	updated the catalog number	

* For internal use only