

USER MANUAL

MODEL:

IVX-BETA Tank Level Monitoring Controller

English (Original Instructions) Updated: 03/02/21







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WARNING:

- 1. Avoid contact of chemicals with skin and eyes. If contact occurs, see MSDS sheet for further first aid measures.
- 2. Always wear appropriate PPE
- 3. Follow safety instructions of chemical manufacturer (MSDS).
- 4. Always follow plant and OSHA guidelines about the use of equipment.
- 5. Disconnect power before servicing equipment.

PROTECT THE ENVIRONMENT

Please dispose of packaging materials, old machine components, and hazardous fluids in an environmentally safe way according to local waste disposal regulations.

Always remember to recycle.

Specifications and parts are subject to change without notice.



Overview

the IVX-BETA Inventory Logix controller integrated with 4-20mA sensors to track chemical levels, predict chemical consumption and send critical email alerts when tank levels get low. Using ultrasonic or pressure sensors, they continuously monitor the level of chemicals in any size and shape of container. Data is synchronized to an on-line interface, where it can easily be viewed in custom reports at any time.

Specifications

Sensors

- Maximum number of Sensors (per Controller): 16
 - Ultrasonics
 - Pressure
 - 4-20mA rated Sensor
- Sensor Ranges:
 - *IVX-US-7*: 4 in. 7 ft. (0.1 2.1m)
 - *IVX-US-13*: 12 in. 13 ft. (0.3 4.0m)
 - IVX-PT (PP, PVDF, SS): 0 22 ft. (0 6.7m)

Networking

- Ethernet based:
 - 1883 UDP/TCP MQTT
 - 22 UDP/TCP SSH for a reverse tunnel to service unit - OR - a VPN to plant network to service unit.
 - 53 UPD/TCP DNS

NOTE: Optional CELL-POE or CELL-POE-D systems are available for Verizon cellular connection.

Terminology

- **Controller** The IVX-BETA unit. Will be used with configured Sensors to measure and record chemical volume amounts.
- Sensor Either pressure or ultrasonic (4-20mA).
 Each Sensor will be paired to a specific Container and chemical within Clean Intel for accurate reporting of all volume amounts.
- Signal Converter Connected to every IVX Sensor, the IVX-SIG converts 4-20mA signals to communicate with the IVX Controller. Also identifies the Sensor ID # via internal DIP switches for configuration purposes.
- Container Used to describe any tank, tote, or other apparatus for storing a particular chemical or liquid. Containers are linked to Sensors to accurately record volume amounts through the Controller.
- Clean Intel The online interface for configuring and viewing volume levels for all configured Containers and Sensors. Alarms and email notifications are managed and maintained using this interface as well as user management and consumption reports for all dispense activities.
- **Calibration** Configuration sequence to enable a new Sensor and/or Container. Will allow the Sensor to record accurate volume measurements and alert users of low or high quantity levels.

READ ALL INSTRUCTIONS BEFORE OPERATING EQUIPMENT



System Requirements

Electrical

- 110 VAC, 5A, Single Phase, 50-60 Hz
- NEMA 5-15 GFCI Protected Outlet
- Surge suppression recommended

Network

• Cat 5e or higher Ethernet cable connection (fieldwired sealed plug included with unit).

-OR-

 CELL-POE or CELL-POE-D modem for Verizon cellular connection with activated subscription service through Clean Logix.

Installation

- 1. Determine mounting location, with consideration of the following:
 - User accessibility
 - Distance to electrical outlet
 - Distance to Containers for Sensors
 - Accessibility to Ethernet or Cellular Signal
- 2. Attach the included mounting feet using included hardware.
- 3. Securely mount unit to wall using appropriate hardware (not included).
- 4. Plug power cord into a 115 VAC, GFCI protected receptacle.
- Connect Ethernet to plant's network or CELL-POE device, if applicable. (For CELL-POE installation see *Appendix F*)



Figure 4.1: BETA Dimensions and Installation Set-up

USER MANUAL: IVX-BETA READ ALL INSTRUCTIONS BEFORE OPERATING EQUIPMENT



Installing Sensors

To begin, identify the Container(s) to be monitored and select the appropriate Sensor(s) for pairing. The installation process may vary depending on the Sensor type. Review the following installation instructions for included Sensor types.

To begin, select a Container and Sensor to be configured and record the following information:

- Sensor ID # Check DIP Switch inside cover
- Container Name
- Container Height
- Container MAX Volume
- Current Volume Amount

NOTE: Be sure the Sensor length and construction material are appropriate for the size Container and chemical they will be configured with.



Figure 5.1: Daisy-chain connection of Sensors to IVX Controller

IVX-PT Pressure Sensors

Pressure transmitters are designed to be completely submersed within the application fluid. The transmitters can either rest along the bottom of the Container or suspended at any desired level as shown in [Figure 5.2].

NOTE: The physical location of the pressure sensor will indicate the lowest level able to be measured within the tank.

Example) Mounting the transmitter 2 feet from the bottom of the tank, will result in the lowest reading of liquid being 2 feet from the bottom.



Figure 5.2: Pressure Sensor positioning at bottom and suspended at custom level



Installation

1. Select the location and position in the Container to install the Sensor.

NOTE: Avoid installing the Sensor along the bottom of the Container if materials such as sludge or debris will build up and coat/cover the transmitter as shown in [Figure 6.1].

- 2. Insert the pressure Sensor into the Container and lower into position.
- If the Container is equipped with a 2 in. NPS threaded opening the included cap assembly can be directly attached to the top of the Container.



Figure 6.2: IVX-PT-V2 Pressure Sensor Assembly, shown with Stainless Steel Transducer.

CAUTION:

Avoid installations where objects in the Container will cause the Sensor to move or swing [Figure 6.3]. If necessary, reposition the Sensor.



<u>Figure 6.1</u>: Sensor positioning in the event of sludge or debris



Figure 6.3: Mixer blade positioning complications

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IVX-US Ultrasonic Sensors

Ultrasonic Sensors are designed to be mounted at the top of a Container, above the measurable liquid. Volume measurements are generated via a high frequency ultrasonic pulse that measures the time it takes a reflected echo to return to the Sensor and calculates the target distance using the speed of sound. The value of the speed of sound, which is a function of temperature, is determined by the Sensor using its internal temperature probe.

Ultrasonic Sensors should always be mounted perpendicular to the liquid surface and installed away from any objects that could interfere with the sonic pulse waves. Consider then Sensor's position in the Container with consideration to the following:

- Do not mount at an angle
- Liquid should never enter the dead band
- Mount at least 2-3 in. away from sidewalls
- Do not mount in vacuum
- Dome Top: Avoid mounting in center
- *Cone Bottom:* Position over the deepest part of Container

Installation

- 1. Select the location and position in the Container to install the Sensor.
- 2. If the Container is equipped with a 2 in. NPS threaded opening the included cap assembly can be directly attached to the top of the Container [Figure 7.1].

NOTE: Coarse/buttress threaded caps are available upon request.



DO NOT install with vacuum

DO NOT install near sides



Figure 7.1: IVX-US-V2 Ultrasonic Sensor assembly

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IVX-US Ultrasonic Sensors (cont.)

Installation Using Stand Pipe

A standpipe may be used to dampen turbulence or separate surface foam from the point of measurement in a Container [Figure 8.1].

- 1. Select a pipe/tube with a minimum 3 in. ID made of a compatible material for the intended liquid to be measured.
- 2. Use a coupling and reducer bushing to attach the Ultrasonic Sensor to the top of the pipe
- 3. Pipe length should be measured to the lowest level a liquid could fall to.
- 4. Cut a 45 degree angle at the bottom of the pipe and drill a 1/4 in. pressure equalization hole within the dead band of the Sensor.

NOTE: Bottom of the pipe must be submerged at all times to prevent foam from entering!

<u> CAUTION:</u>

Pumps should not drive liquid past the open end, which would cause liquid in the pipe to oscillate.



Figure 8.1: Stand Pipe installation with Ultrasonic Sensor

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IVX Signal Converter (IVX-SIG)

The IVX-SIG reads 4-20mA signals from its Sensor and communicates level readings back to the IVX Controller. Signal Converters purchased as part of a sensor assembly will arrive pre-wired and ready to connect.

Installation

- 1. Determine mounting location, with consideration of the following:
 - Visibility of status lights
 - Distance from Containers for Sensors
 - Distance from IVX Controller
- Securely mount unit to a flat surface (hardware not included) or zip-tied to a stable pipe [Figure 9.1].

Sensor ID

Signal Converters contain a DIP Switch that sets the Sensor ID #. Sensor IDs are used in identifying sensors for configuration purposes. Each Sensor connected to a single IVX controller requires a unique Sensor ID # (1-16).

NOTE: If multiple Sensors are to be used with an IVX Controller the Sensor ID# MUST be reset.

- 1. Unscrew and remove the white cover
- 2. Using the label inside the cover, set the Sensor ID# accordingly.





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Connection Architecture

1. Connect Controller and Signal Converters in a daisy-chain fashion using the orange M12 RS-485 cables. Up to 16 sensors can be connected to a single IVX Controller.

NOTE: Sensors can be installed in any order, regardless of sensor type or its ID#.

- 2. Hand tighten M12 cable connections, then tighten two more clicks using wrenches.
- 3. Connect M12 Port Cap to the final Signal Converter in the chain to seal the cable.
- 4. Activate the Termination Resistor for the final Signal Converter in the chain:
 - Open the lid on the final Signal Converter in the chain
 - Flip the single pole DIP switch (labeled **TERM**) from **1** to **ON** to activate the resistor.
- 5. If not yet identified, record the following information for each Sensor to aid in configuring the unit later:
 - Sensor ID # Check DIP Switch inside cover
 - Container Name

- Container Height
- Container MAX Volume

Container Name

Current Volume Amount



Installation Example: IVX-MINI shown with (1) Ultrasonic and (1) Pressure Sensors



Clean Intel

In order to connect and configure the Sensors to their designated Containers the IVX's web interface, Clean Intel, must be accessed.

Accessing and Login

- 1. To login, open a web browser (Google Chrome, Safari, etc.) and go to **cleanintel.com**
- 2. Login as an administrator [Figure 11.1].
- 3. When prompted, select the IVX (Inventory Logix) branch of Clean Intel [Figure 11.2].

Adding a Sensor

- 1. Using the Admin menu on the left side, open the Sensors page to view a list of connected Sensors and Containers.
 - Connected Containers and Sensors will appear in this list with their Sensor ID#
 - *icon* identifies a "linked" Sensor and Container configuration
- 2. Click the New+ button to add a new sensor:
 - *Site/Manufacturer:* Identify the plant site or manufacturer where the Sensor will be
 - Sensor Type: Ultrasonic or Pressure
 - Inventory Unit: (optional) IVX Controller
 - Channel #: Sensor ID#
 - *In Service:* Identify if this sensor is/will be active post-configuration.
- 3. When information is filled in, the **Save** button will highlight Blue and can be selected [Figure 11.3].

CleanIntel		
A Log In		
	Sign In	
	E-Mail:	
	Password.	
	Forgot your password?	Login
	Didn't receive unlock instructions?	
	© Clean-Logix 2017	

Figure 11.1: Clean Intel Login Screen (shown in Google Chrome)



Figure 11.2: Clean Intel Product Branches

CleanIntel	ALX IVX EPX
Administrator	Admin Sensors New Sensor
Overview	
Inventory Units Chemicals	Site Assign to Manufacturer?
Sites Users	Sensor Type Pressure v
Select a Site:	Inventory Unit (optional) None V
Area 51 👻	Channel # 3
Inventory Logix	In service 8
Dashboard Containers	Cancel Save

Figure 11.3: Add New Sensor Screen (complete)

READ ALL INSTRUCTIONS BEFORE OPERATING EQUIPMENT



Clean Intel (continued)

Adding a Container

- 1. Using the Inventory Logix menu, open the Container page to view a list of connected Sensors and Containers.
- 2. Click the **New+** button to add a new Container and fill out the following [Figure 12.1]:
 - *Name:* Identifier for reporting purposes
 - Volume Label: Unit of measure
 - *Max Volume:* How much chemical can the container hold when full?
 - Expected Daily Consumption: (optional) for projected ordering purposes
 - *Height:* (optional) how tall is the container? Aids in Ultrasonic Calibrations.
 - *Chemical:* (optional) Identify the Chemical in the container.
 - Location: (optional) Where is the container?
 - Inventory Sensor: (optional) Select the Sensor to be linked with this Container.
- 3. When all required information is filled in, the **Save** button will highlight Blue and can be selected.
- 4. After being linked with a Sensor, additional options will appear on the Containers page as shown in [Figure 12.2]:
 - *Calibrations:* Inputted data for volume measurement
 - *Alarms:* For creating and subscribing to notifications (low volume, reorder date, etc.)
 - *Levels:* Detailed overview page for live readings and level/consumption history

Pr Clean Logix	ALX [IVX] EPX
Administrator	Area 51 Containers New Container
Overview Sensors Inventory Units Chemicals	Name
Sites Users	Volume Label
Select a Site: Area 51 -	Anax voume Expected Daily Consumption (sectiona)
Inventory Logix	Height (setionar)
Dashboard Containers	Chemical (sporar)
Subscriptions	Location (spionar)
	Invertiny Sensor (patrona) None v
	Cancel Som



LX <u>IVX</u> EPX	
Calibrations 🖗 Alarms 🌲 Levels 👁	
Name	
Caustic 1	
Volume Label	
gallons	$\overline{\mathbf{v}}$
Max Volume	
5250	
Expected Daily Consumption (optional)	

Figure 12.2: Added Container/Sensor Links

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Clean Intel - Calibrations

Before a Sensor can begin reporting volume measurements it must be calibrated. The combination of <u>two Calibration points</u> will allow the IVX Controller to accurately measure any volume amount of its Container. Depending on Sensor type the Calibration process may differ.

To begin, access the Calibrations page for the Sensor/ Container to be calibrated:

- 1. Log in to Clean Intel and open the **Containers** tab.
- 2. Select the Sensor/Container configuration.
- 3. Select Add Calibration Point+, the following will need to be identified for each sensor:
 - Sensor Reading: The raw 4-20mA reading from the sensor
 - Volume: Amount at specified Sensor Reading

Calibrating Pressure Sensors

Pressure sensor mA readings correlate with the volume amount in a container. The *greater* the volume, the *greater* the raw mA reading will be.

Calibration Point 1: Zero

- 1. Suspend the sensor in mid-air and record the raw mA reading (should be around 4.0 mA)
- 2. This will identify the container as EMPTY
- 3. Add the recorded mA **Sensor Reading** and enter its **Volume** as 0
- 4. Click Save to add the 1st Calibration

Calibration Point 2: Current Volume

- 1. Re-install sensor in container (page 6)
- 2. Add the raw mA reading of the sensor and enter the CURRENT volume in the container
- 3. Click Save to add the 2nd Calibration

BarLogix	Calibration	S		
Enter exactly 2 calibration points. The maximum volume of the container.	e calibrations should differ i	n volume by at least	half of the	
Sensor Reading (mA)	Volume (G)	Created		
5.1	100	08/09/17	Û	
New Calibration				
Sensor Reading:				
Sensor Reading: 4 Volume: 0				





Figure 13.2: Calibration Table for Pressure Volume readings. Greater Volume = Greater mA Reading

READ ALL INSTRUCTIONS BEFORE OPERATING EQUIPMENT

VOLUME

75%

25%

20



Calibrating Ultrasonic Sensors

Ultrasonic sensors mA readings correlate with the volume amount in a container based on the distance of the sensor's ultrasonic beam reflection. The *lesser* the volume, the *greater* the raw reading will be. Two options are available to calibrate an Ultrasonic Sensor:

NOTE: A tape measure will be necessary to measure the height of the container and liquid.

OPTION 1: Formula Calculation

US-7 (4 in. - 7 ft.):

US-13 (12 in. - 13 ft.):

 $mA = (0.2 \times D_n) + 3.2$

mA = (0.111 x D_n) + 2.666

NOTE: Formula values are based

Using the following formulas, the mA readings of a sensor can be calculated using container and liquid volume measurements. The following distances can be used to identify mA readings:

- **D**₁ = Distance from sensor to full capacity
- **D**₂ = Distance from sensor to current level
- D₃ = Distance from sensor to bottom of container (empty)



OPTION 2: Current Volume Raw Readings

The current volume and raw mA readings of the sensor can be inputted as a Calibration:

- 1. Add the raw mA reading of the installed sensor and enter the CURRENT volume of the container
- 2. Click **Save** to add the 2nd Calibration

NOTE: Raw readings for Ultrasonics will be lower than Pressure at the same volume due to sensor type and mA output.

NOTE: Ultrasonic formulas can be used for both calibration points for any volume level.

Figure 14.1: Calibration Table for Ultrasonic Distance readings

Lower Volume = Greater mA Reading

CALIBRATION POINT (Dn)

CALIBRATION POINT (Dn)

in inches.



Controller is Not Powered On

<u>Cause</u>

<u>Solution</u>

The Controller is not receiving power

- Ensure unit is plugged into 110 VAC outlet that is receiving power.
- Check and confirm the power cord is not damaged and is connected.

<u>Cause</u>

<u>Solution</u>

- A fuse has been blown
- Find and replace it (a spare fuse is included with controllers, it can be found inside the unit.)

Controller is Not Communicating With Sensor

<u>Cause</u>

The Sensor has not been configured properly or at all

Verify DIP Switches are not duplicated in the chain, reset if necessary.
 Login to Clean Intel and verify the Sensor has been configured and linked to the container.

<u>Cause</u>

There is an issue with the Cable

Solution

Solution

- Verify power and signal status lights on IVX-SIG Signal Converters
- Check the orange M12 Cable for any damaged or disconnected areas.
- Ensure all connection points are linked and tightened.
- Verify there are not damaged wires or instable connections by unscrewing the Cable connection points, checking the wires/plugs inside each port, and reconnecting them back together.

IVX-SIG Signal Converter "Power" Light is not Illuminated

Cause

<u>Solution</u>

There is an issue with the Cable

- Check the orange M12 Cable for any damaged or disconnected areas.
- Ensure all connection points are linked and tightened.
- Verify there are not damaged wires or instable connections by unscrewing the Cable connection points, checking the wires/plugs inside each port, and reconnecting them back together.



Sensor Readings Not Reporting to Clean Intel

<u>Cause</u>

Low connection signal

<u>Solution</u>

- Verify the network connection on the IVX and in the facility
- Power down and reboot the following (depending on set-up and equipment):
 - Facility's internet modem for Ethernet connection
 - CELL-POE or CELL-POE-D unit for cellular connection

<u>Cause</u>

The network connection attempting to be used is unable to be paired with the IVX

Solution

• Try a different configuration or contact Clean Logix for network subscription support.

<u>Cause</u>

Solution

- Data has not been transmitted yet.
- Wait data is transmitted to Clean Intel every 10-15 minutes.

Sensor Reading is Inaccurate

<u>Cause</u>

Something is interfering with reading the physical aspects of the Container.

Solution

- Pressure Sensors: verify it is not clogged or coated in substance that may be preventing it from obtaining readings.
- Ultrasonic Sensors: verify there is not an object or feature of the container interfering with the sonic beam reflection.
- Clean the Sensor.

<u>Cause</u>

One or both of the sensor's calibrations are inaccurate

- <u>Solution</u>
- Recalibrate.



Maintenance

Notes:

- Check for corrosion on cable connection points.
- Check Ultrasonic Sensors for coating or condensation accumulation to maintain accurate readings.
- Check Pressure Sensors for sludge, debris or other clogs to maintain accurate readings.
- Verify Calibration settings and recalibrate if necessary.
- Check Network connection to verify stable connection to Ethernet or Cellular services, depending on equipment.
- Verify report emails are being sent to specified personnel.
- Verify Alarms have been set-up and are subscribed to.

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Appendix A - Parts Callout (IVX-BETA)



Part No.	Description
F1075	SCREW SELF TAP 10-16 X 12 TRUSS HD
F1186	SCREW #8-18 X 1/2 HI-LO SS
M1331	BACK PANEL ALX-CELL
M1727	DECAL IVX-MINI CLEAN LOGIX
P1111	END STOP TERMINAL BLOCK
P1122	POWER SUPPLY 24VDC 60W
P1147	CORD GRIP 1/2 NPT X .170450 BLK
P1148	CORD GRIP NUT 1/2 NPS NYL
P1169	DIN RAIL 35mm X 175mm LONG 0.175
P1181	ENCLOSURE FIBOX AR1086CHSSL
P1184	CORD GRIP 1/2 NPT X .095260 BLK
P1278	TERMINAL QUICK CONNECT 18-22 AWG .110" TO .125" X .020" TAB
P1282	CAN CABLE 5 Meter (16.48ft)
P1288	POWER CORD 18-3 SO 5-15P
P1432	USB DUST CAP ASSY
P1433	FUSE HOLDER 250V 10A PANEL MOUNT

Part No.	Description
P1489	FUSE 250VAC 5A 5X20
P1523	SCREW #4-24 X 5/16" HI-LO PHILLIPS PAN ZN
P1555	CABLE TIE HOLDER
P1640	POE INJECTOR WITH LED INDICATOR
P1668	TERMINAL RJ45 FIELD WIRED CIRCULAR SEALED
P1669	RECEPTACLE RJ45 PANEL MOUNT CIRCULAR SEALED w/ 0.25m CABLE
P1673	TERMINAL BLOCK 4-POS 2 CONDUCTOR FLANGE MOUNT
P1722	POWER SUPPLY 5V 10 WATT DIN RAIL
P1723	CIRCUIT BOARD RDS REPORTING MODULE
P1724	ENCLOSURE DIN RAIL MOUNT RDS REPORTING MODULE
P1725	CABLE USB MALE A TO MICRO B 3 FT.
P1754	MICRO SD CARD 32GB
P1761	USB TO RS485 ADAPTER

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Appendix C - IVX-PT-V2 Pressure Sensor Parts Callout



READ ALL INSTRUCTIONS BEFORE OPERATING EQUIPMENT



Appendix A - Parts Callout (IVX-US-V2 Ultrasonic Sensor)



Part No.	Description
M1743	SENSOR SWIVEL NUT
M1865	DECAL IVX SENSOR PREP TAG
M1866	DRUM PLUG WITH CENTER MACHINED OUT
P1871	ULTRASONIC SENSOR, 4" - 7' DEPTH
P1872	ULTRASONIC SENSOR, 12" - 13' DEPTH

READ ALL INSTRUCTIONS BEFORE OPERATING EQUIPMENT



Appendix A - Parts Callout (IVX-SIG 4-20mA Signal Converter)



Part No.	Description
F1134	SCREW HI-LO 8-18 X 3/8 SS
F1224	SCREW SELF TAP #12 X 3/4 316SS
M1142	ALX-PC COVER SCREW
M1144	ALX-PC COVER
M1814	PCB 4-20MA TO RS485 CONVERTER V2
M1863	DECAL, IVX-SENSOR 4-20mA SIGNAL CONVERTER
M1868	MOUNTING PLATE, ALX-PC BASE
M1870	ALX-PC BASE REV100 (MACHINED)
P1282	CAN CABLE 5 Meter (16.48ft)
P1366	CORD GRIP 3/8 NPT X .105315 BLK
P1430	CORD GRIP NUT 3/8" NPT NYLON
P1855	VENT, PLUG .375 NPT BLK

READ ALL INSTRUCTIONS BEFORE OPERATING EQUIPMENT



Appendix B - Wiring Diagram (IVX-BETA)

