

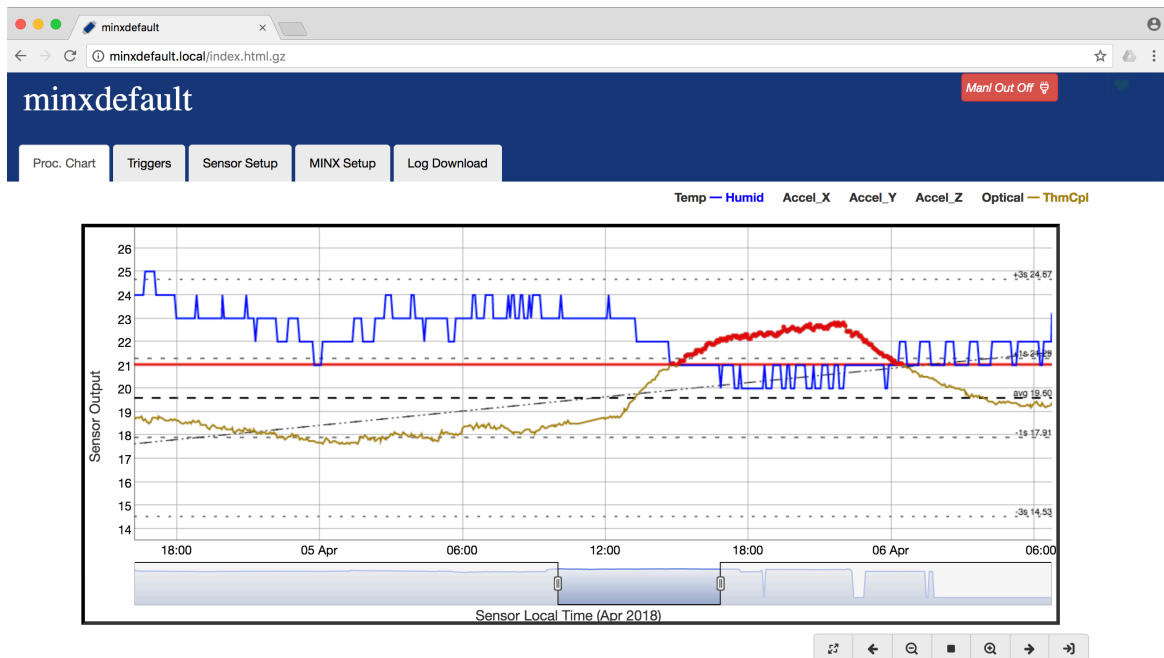
MINX0003 - User Guide

1. Introduction

MINX is designed to collect and record process data, present that data in the form of process control charts, and facilitate the monitoring of and reaction to programmed data limits through email Alerts and/or external controls. Once the MINX sensor unit is setup on the process to be monitored and attached to a local computer network, MINX will measure and record data for each of its built-in sensors. Each MINX unit is a web server and when accessed from a user's web browser, MINX produces a customizable process control chart from the collected sensor data. Through the web browser interface, MINX also enables inspection of Alert triggers, inspection of historical data, download of data and manual control of devices connected to the external output.

This guide provides detailed explanations of the MINX sensor system usage and operation. It is recommended that users first familiarize themselves with the **MINX 0003 Quick Setup Guide and Demo**, which introduces the majority of the MINX features through a guided setup procedure.

MINX is highly configurable and may be applied in countless situations, making it impossible to predict the suitability of MINX for any given application. It is the installing engineer's responsibility to determine the suitability and verify MINX's performance as adequate for the chosen purpose.



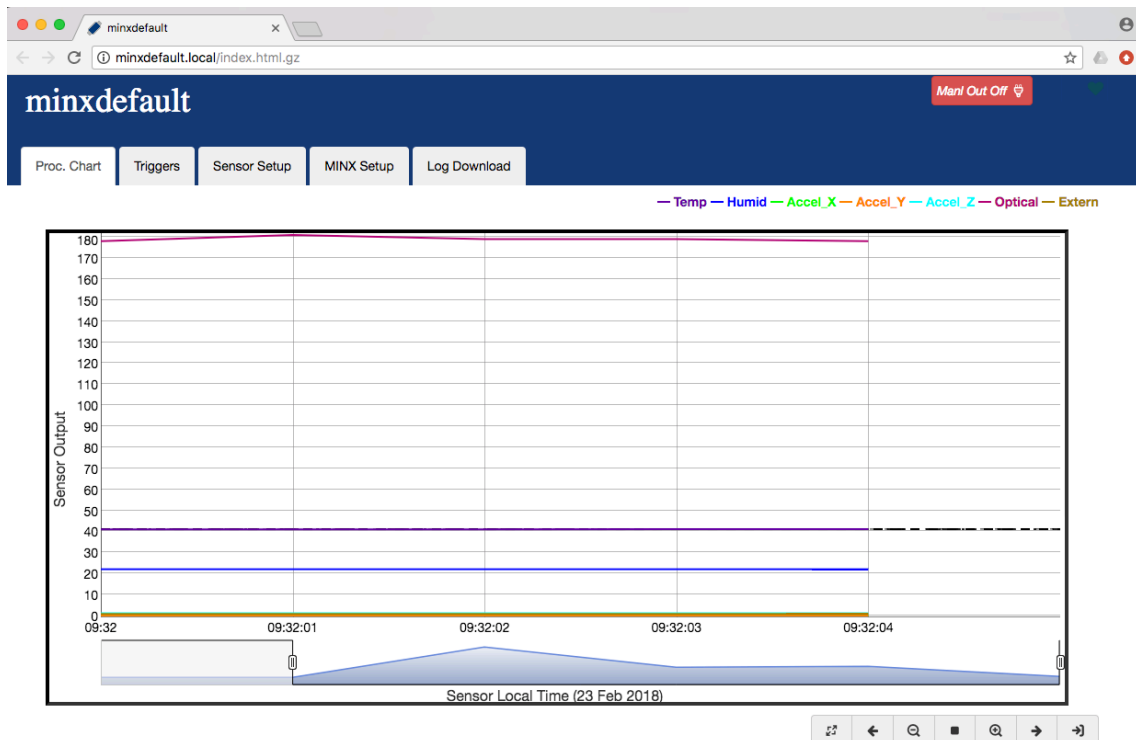
2. MINX Webpage Access

Each individual MINX unit generates and serves a dynamic webpage that allows users to control the unit and access the unit’s data. Access MINX’s webpage using a computer attached to the same local network, via any standard Web browser (ex: Chrome, Safari, Internet Explorer, etc.).

For help making physical network connection, consult Appendix’s POE section.

Each MINX unit will have been given a unique name (MINX ID) during its first setup. Navigate computer’s web browser to the MINX Web Address per the below table. If the programmed name has been lost, or if the MINX state is unknown, refer to the **MINX 0003 Network Setup Guide**. If the unit’s MINX ID is still the factory default, consult the Appendix’s General Setup section for instructions.

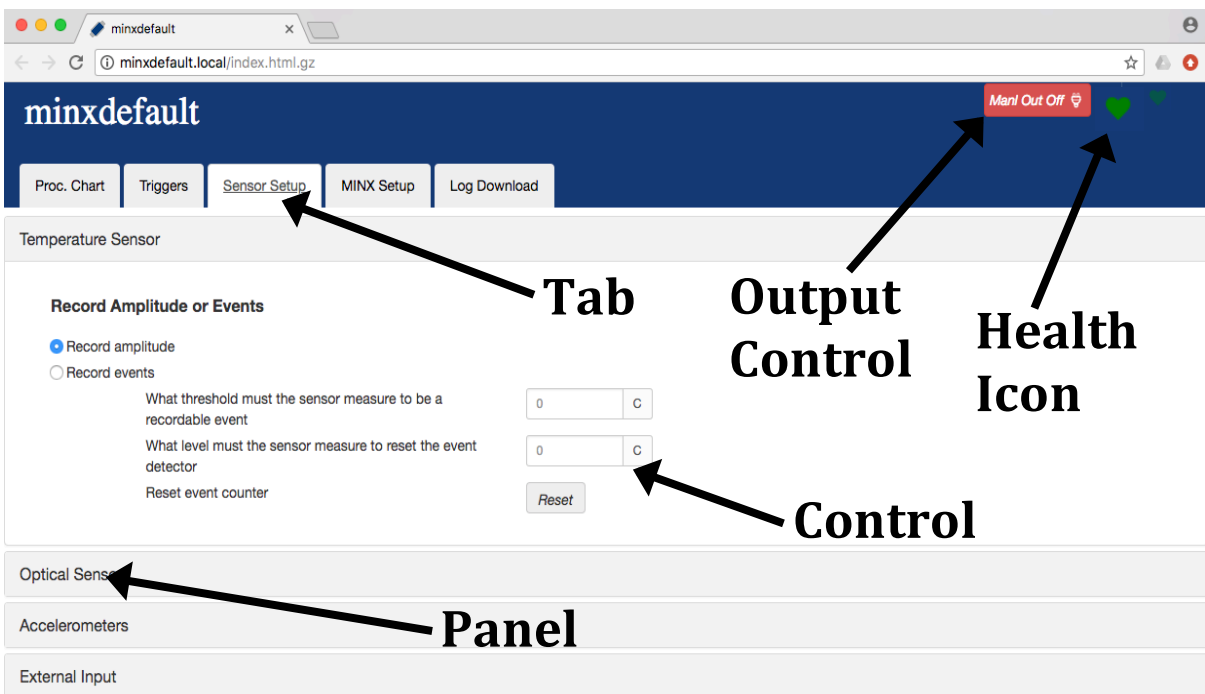
MINX State	Operating System	Web Address
Factory Default	Windows PC	http://minxdefault
	MacOS/OSX, iOS, Linux	http://minxdefault.local
After First Setup: Programmed name = ‘MINX_ID’	Windows PC	http:// + MINX_ID
	MacOS/OSX, iOS, Linux	http:// + MINX_ID + .local
	Non-mDNS platforms: Chromebook, Android OS	http:// + IP Address (see MINX 0003 Network Setup)



2.1. MINX Webpage Interface




The MINX webpage contains several navigation **Tabs**, accessed by clicking on the Tab. Some Tabs also include collapsible **Panels**, recognizable by their grey horizontal bars. Clicking on the Panel bar will hide/unhide the panels information

Each Tab and/or Panel contains various **Controls** (InputBoxes, CheckBoxes, RadioButtons, and Buttons) used to configure MINX or access its data. The following sections refer to location of webpage features and Controls by referring to the Tab and Panel that contain said item. In this document, 'click' or 'clicking' refers to use of the primary (typically the left) mouse button; use the secondary (typically the right) mouse button will use the term 'right-click' or 'right-clicking'.



2.2. Network Connection and Health State

The MINX webpage indicates the current network connection state and health using a Health Icon displayed in the upper-right corner. A green blinking Heart icon indicates good network connection between the browser and the unit, as well as the MINX unit's status. A red blinking Exclamation icon indicates an error condition on the MINX unit. A short error message about the condition may also be displayed. A spinning, 'loading' icon indicates the webpage has lost network communication with the MINX unit and is waiting. Without network communication, data cannot be loaded to the browser and controls from the browser will not reach MINX.

Icon	Status
	Network connected, Health Good
	Network connected, Error Condition
	Network not connected

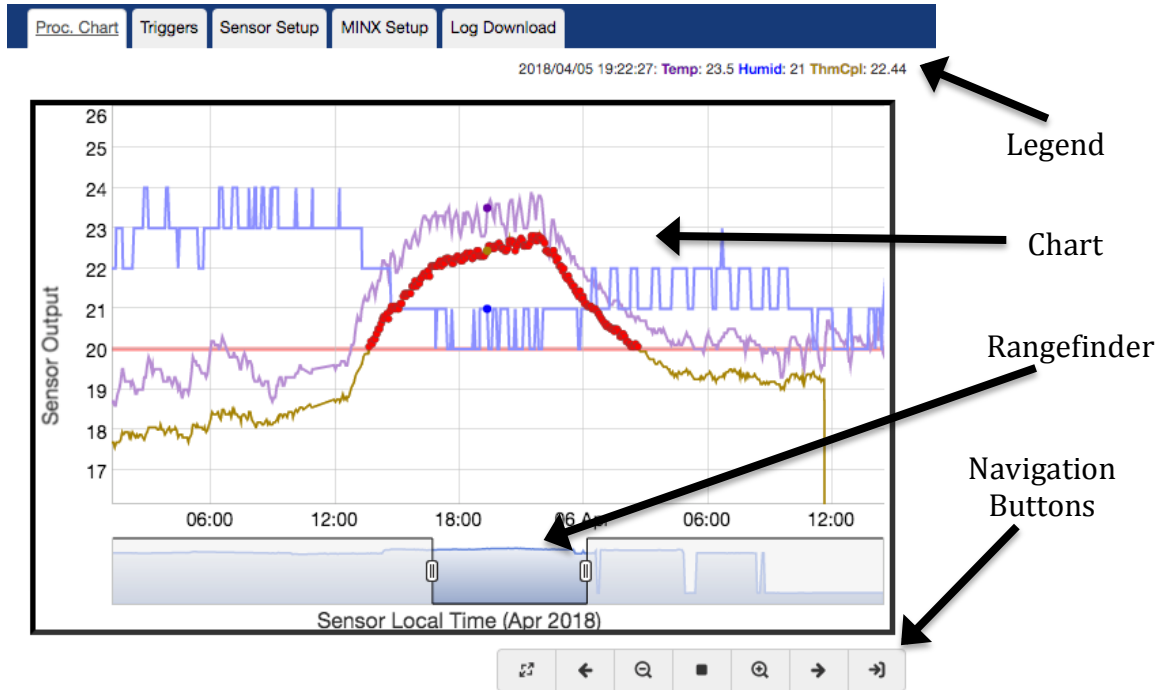
2.3. Output Control Button

MINX provides a controllable 0V to 5V output via the accessory connector. Refer to the Appendix for details. The state of the external output is always visible as indicated by the color and label of the External Output Control Button in the upper-right corner of the webpage. The user can manually switch the external output's state by clicking or touching the External Output Control Button. Additionally, the external output's state can be placed under automatic control of MINX according to programmed conditions. Refer to the Triggers section for details of the automatic control. When the output is under automatic control by trigger conditions, a user can still take immediate, manual control and switch the external output's state by clicking or touching the External Output Control Button.

External Output Button	Output Off	Output On
Manual Mode		

3. Process Control Charts

The ProcChart tab of the MINX webpage displays a process control chart using the MINX unit's collected data. On initial loading of the MINX page, the chart shows all Log data from the SD card. Oldest data is displayed on the Left and newest data on the right.



3.1. Chart Layout

The Process Chart shows one colored trace for each sensor. The horizontal axis is Time and the axis units (years, months, days, hours, etc.) will self adjust depending on the period displayed. The vertical axis is unit-less. The units for each trace are each sensor's respective amplitude units (C, %RH, g, mm, V), or "events" as programmed for that sensor. The chart Legend indicates each Traces name and color. A chart Rangefinder is located just below the horizontal axis. A series of chart Navigation Buttons are located bottom-right of the chart.

3.2. Traces

Individual traces may be hidden or shown depending on your needs. Click on the trace's name in the Legend to toggle a trace on or off.

3.3. Scrolling Live Process Data

In Scrolling mode the process chart shows some amount of historical data, while new or 'live' data accumulates on the right-most edge of the chart. As each new live sample is added to the chart, the oldest displayed sample will disappear from the left edge (e.g. the data 'scrolls' from right to left). The speed of the scrolling will depend on the range of the horizontal axis, which thereby dictates how often a new sample is added. Scrolling mode may be disabled, which will lock the chart with the currently displayed data. This is useful for inspecting historical events. Scrolling mode is enabled/disabled

with the center most Navigation Button ▶ / ■. If the ■ (stop) icon is visible, Scrolling mode is enabled. Press the ■ icon to stop scrolling. If the ▶ (play) icon is visible, scrolling is disabled. Press the ▶ icon to begin scrolling live data. **Caution:** scrolling can occur (data moving right to left) even when the process chart has been zoomed into a historical period that does not include the present time; take care to inspect the horizontal axis labels to ensure historical data is not misinterpreted as live data; If in doubt, use the Jump To Live Data Navigation Button ↗ to ensure the process chart's right edge is displaying live data.

3.4. Navigating Process Chart Data


The process chart data can be adjusted several ways so as to display specific time periods and amplitude ranges. Some features are specific to certain devices (mouse, or touch-screen).



Full Zoom: To reset both axes of the chart, click or tap the Full Zoom Navigation Button ↻. Alternatively, double-click or tap the chart background repeatedly, which will first zoom-out the vertical axis and then zoom-out the Time axis.

Time Zoom In: To zoom in on a specific time span displayed in the chart, click mouse in the chart at the desired starting time, drag horizontally to the desired ending time, and release. The Zoom-In Navigation Button 🔍 will zoom in time a set amount while maintaining the right most or latest time sample. The rangefinder can be used to zoom in by clicking mouse over a Zoom-Handle, dragging horizontally, and releasing. On touch devices, zoom in on the time axis by touching two fingers on the chart background, spreading them apart horizontally, then releasing.

Time Zoom Out: To zoom out the time axis, click the Zoom-Out Button 🔍. In certain cases the rangefinder can be used to zoom out by clicking mouse over a Zoom-Handle, dragging horizontally, and releasing. On touch devices, zoom out the time axis by touching two fingers on the chart background and pinching in a horizontal direction.

Pan Time: To pan through time, shift-left-click the mouse on the graph background, drag left or right, and then release. Alternatively, the Pan Navigation Buttons ← & → will pan by preset amounts. If range finder shows data outside the region between the Zoom-Handles data, panning can be accomplished by clicking in the range finder background between the Zoom-Handles, dragging left or right, and releasing. Panning will stop at the earliest and latest times that exist in the Log and/or current time. Panning on touch devices is accomplished by touching one finger to the chart background, and dragging left or right.

Jump To Live Time: It is possible to simultaneously zoom in the time axis and jump to the newest data using the Jump To Live Time Navigation Button . Note the Jump To Live Time Navigation Button will also enable scroll mode.

Automatic Amplitude Control: Initially the chart will automatically scale the vertical axis to encompass all available data points of any enabled traces. Automatic mode is disabled anytime the vertical axis is manually scaled. The Automatic mode can be re-enabled by right-clicking in the chart background and choosing the AutoZoom Vertical option from the context menu, double-clicking or double-tapping the chart background, using the Full Zoom Navigation Button  or the Jump To Live Time Navigation Button .

Amplitude Zoom In: To zoom in on a range of amplitude, click mouse in the chart at the desired start, drag vertically to desired stop, and release. On touch devices, touch two fingers, one vertically above the other, and spread.

Amplitude Zoom Out: To zoom out amplitude, right-click over the graph to open a context menu; then select the ZoomOut Vertical option. On touch devices, touch two fingers, one vertically above the other, and pinch. Alternatively, re-enable the Automatic mode.

Amplitude Pan Up: To pan up the amplitude scale, shift-left-click over the chart background and drag the mouse. Alternatively, right-click over the graph to open a context menu, then select the PanUp Vertical option. On touch devices, touch on finger to the chart background and drag.

Amplitude Pan Down: To pan down the amplitude scale, shift-left-click over the chart background and drag the mouse. Alternatively, right-click over the graph to open a context menu, then select the PanDown Vertical option. On touch devices, touch on finger to the chart background and drag.

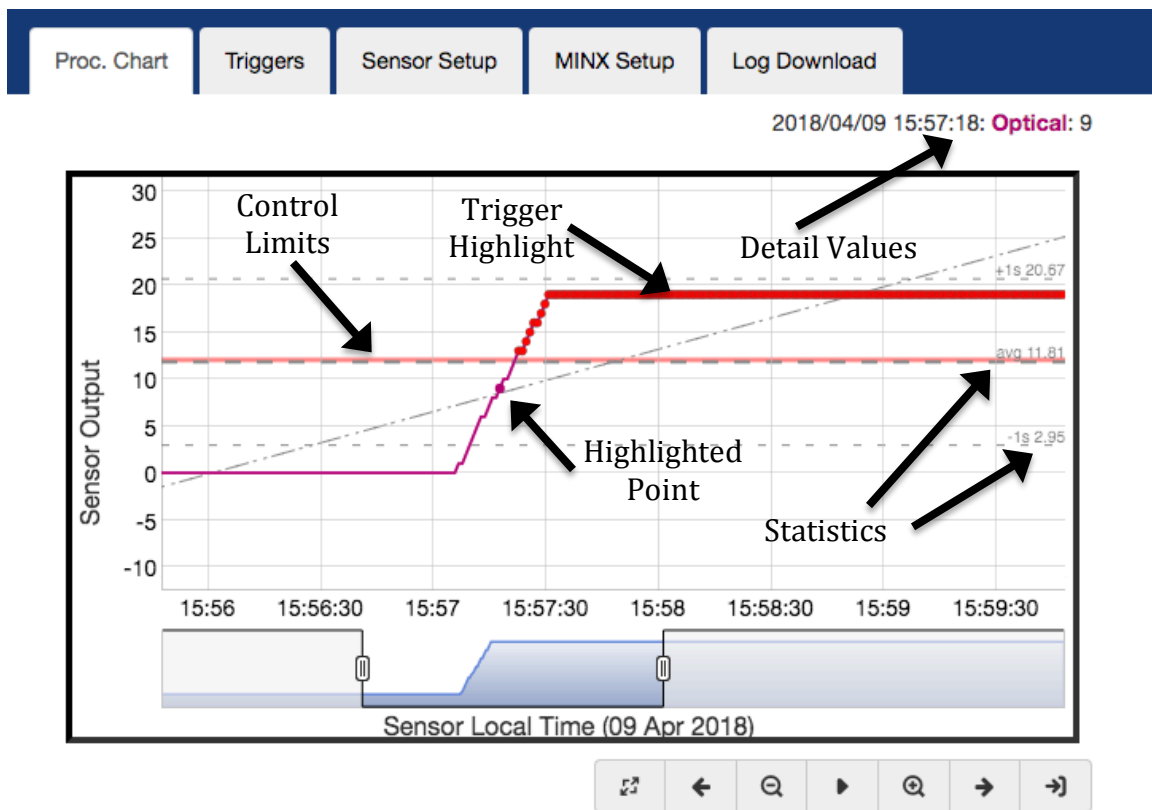
Once the vertical axis pan/zoom has been manually changed, the vertical axis range will no longer change automatically; this may result in NO trace data being displayed if no values fall in the chosen vertical axis range. If this condition occurs re-enable the Automatic mode.

3.5. Data Point Inspection, Statistics, Control Limits

The detail values of any displayed time point can be inspected by moving the mouse into the chart area, and hovering the cursor over the specific time point. For each enabled trace, a highlighted dot appears on the trace at the time point, and the Legend will be amended with the corresponding Time and Amplitude values. It may be desirable to disable Scrolling mode during data point inspection.

Statistics can be generated and displayed for any trace (Trend Line, Average, +/-1 Sigma, +/-3 Sigma). To enable statistics for a given trace, hover mouse over trace of interest and click on the highlighted dot. To disable a trace with statistics enabled, hover mouse over trace and click on highlighted dot. Only one trace can display Statistics at a time.

When triggers are enabled (and assuming the trigger trace is enabled for display), Control Limit lines are displayed at the programmed high and/or low levels. Any data points on the trigger trace that meet the trigger criteria, are displayed with a red highlight.



3.6. Printing Control Charts

Scale the window's width to height ratio to match the paper orientation. While the Control Chart is displayed and showing the time and amplitude ranges of interest, activate the browser's Print command. Adjusting the window's size and/or zoom level (Ctrl-+ / Ctrl--; ⌘-+ / ⌘--), may affect the printed chart size for some browsers.

4. Triggers

The Trigger tab of the MINX webpage is used to control how MINX reacts to certain programmed conditions. MINX can be programmed to detect particular ranges of data values for any of the MINX sensors. When the programmed range is detected, MINX will record the event to a log file. Additionally MINX can cause one or more alert emails and texts to be sent. Lastly, MINX can change the state of its external output, which may for example control another device or machine.

From the Trigger Settings Panel, user may select which sensor will be used for trigger detection. Next, user may set a high and/or low limit, by entering the desired limit in the respective box and checking the CheckBox. If both high and low limits are set, and additional option is presented allowing for detection of sensor values either between or outside the limits.

When the selected sensor produces a data value equal to or exceeding the programmed limits, a 'Trigger' event has occurred. The trigger event details will be stored to the trigger log on the SD card (MINX unit ID, time/date, sensor name, sensor value).

Proc. Chart	Triggers	Sensor Setup	MINX Setup	Log Downloa
Trigger History				
Trigger Settings				
Select which sensor can create a Trigger:				
Trigger Select		Optical		
Define characteristics of your Trigger:				
<input checked="" type="checkbox"/>	High Limit:	1000	evts	
<input type="checkbox"/>	Low Limit:	0	evts	
Control what happens in the event of a Trigger:				
<input checked="" type="checkbox"/>	Alert Email			
	Custom Alert Message	1000 bottle limit reached		
<input type="checkbox"/>	Triggered External Output			
<input type="radio"/>	Once set, output stays set until Latch Clear button is pressed			
<input checked="" type="radio"/>	Output only stays set as long as the trigger event state lasts			
Second Trigger when above condition remains for period:				
<input checked="" type="checkbox"/>	2nd Log/Alert After Period:	00:01:00	h:m:s	
	Custom Alert Message	>1000 bottles w/o reset		

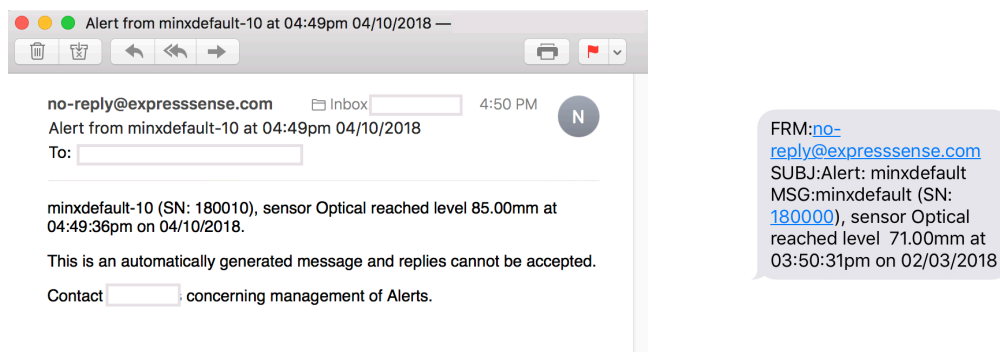
4.1. Email/Text Alerts

MINX can be programmed to transmit trigger event details to the ExpressSense Alert Server, which will in turn send alert emails or texts according to the settings in the user's ExpressSense Alert Server Account.

To enable alerts, check the Alert Email CheckBox. A custom message may be added to the alert message by entering a string in the Custom Alert Message box.

To enable secondary or delayed alerts, check the 2nd Alert After Period checkbox and enter a delay time in the input box. If the programmed trigger condition occurs and remains for the entire duration of the delay period, MINX will generate log messages and alerts at that delayed time. A custom message may be added to the alert message by entering a string in the Custom Alert Message box. This feature is useful to detect certain conditions such as a door being open too long, or some machine condition not being serviced in an acceptable time period.

See the Appendix for details about setting up MINX to communicate with the ExpressSense Alert Server.



4.2. Triggered External Output & Output Controls








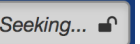


MINX's external output, located on the Accessory Connector, can either be controlled manually, or MINX can automatically change the external output state in response to trigger events. Automatic control of the external output is enabled by checking the Trigger External Output CheckBox, whereas manual control mode is active when the CheckBox is cleared. When the external output is under automatic control, two modes are available, No Latch mode and Latched mode. The 'latch' is analogous to a latch on a swinging gate. No Latch mode can be described as a garden gate without a latch, and therefore the gate can be freely moved from open to closed and back. Latch mode can be represented by a gate with a latch, in which case the gate can freely swing from open to closed, but once closed the latch locks the gate in the closed position.

For MINX, the automatic external output control operations are:

- In No Latch Mode, the output turns ON when the sensor matches the trigger condition and turns off when the sensor no longer matches the trigger condition.
- In Latched Mode, the output turns ON when the sensor matches the trigger condition, and stays ON until a user manually resets the latch (by clicking/touching the Latch Control Button). When the latch is reset, the output will turn OFF if the sensor no longer matches the trigger condition; conversely if sensor still matches the trigger condition, the output will remain ON and the Latch will immediately return to the Latched state.

An example application of Latch mode would be a MINX unit whose external output controls the power to a machine via a 120V relay, while the MINX is programmed to trigger on excessive vibration level emanating from that same machine. When MINX detects the excess vibration, the external output will turn ON, which shuts off power to the machine, at which time the excessive vibration stops. However, as the Latch has been 'set', the external output remains on and therefore power to the machine remains off. An operator may then service the machine and correct the condition leading to the vibration, after which the operator restores power to the machine by clearing the Latch (clicking the Latched Button).

MINX indicates the status of the external output and the output control mode by the appearance of the Output Control Buttons located in the upper right corner of the webpage. The appearance of the Output Control Buttons for the manual and two automatic modes are show below:

External Output Button	Output Off	Output On
Manual Mode		
Automatic, No Latch Mode	 	 
Automatic, Latched Mode	 	 

When the external output is under manual control, clicking on the External Output Control Button switches the external output state from On to Off, or Off to On. Likewise, when the external output is under automatic control, clicking on the External Output Control Button switches the external output state and simultaneously switches to Manual Control mode as the user has purposefully indicated that an output state opposite of the current trigger condition is desired.

4.3. Trigger History

Each time a trigger condition becomes true, the event time and sensor data are recorded to a Trigger History Log file on the SD card. This log file is visible on the Triggers Tab on the Trigger History Panel.

Double clicking on an item in the trigger history list will cause a jump to the process control chart, centered on the time of the event. Note it may be necessary to hide other traces or change the time or amplitude scales to see the event of interest.

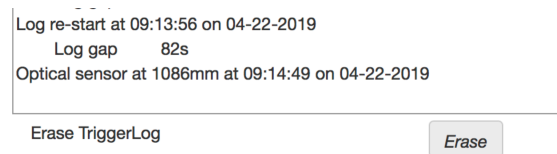
The Trigger History Log file can be erased by pressing the Erase Button on the Trigger History Panel, located just under the Trigger History textbox. Alternatively, the file may be deleted from the SD card using a computer.



Double clicking on a log message event will cause the displayed Tab to immediately switch to the process chart and the charted time will automatically center itself around that even's time.

The log file may be erased using the Erase button provided.

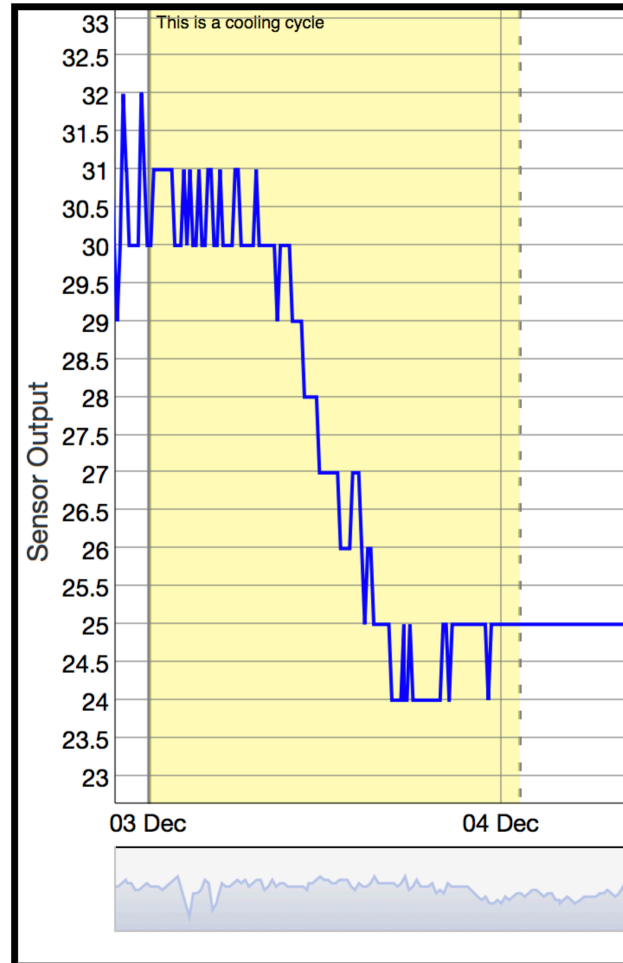
In addition to Trigger events, MINX also logs power up time and calculates the gap in the log data. This is useful to ensure data integrity.



5. Annotations

MINX process charts can be annotated with custom user notes that highlight a particular period of time that encompasses some data event. This feature is the digital equivalent of writing a note on a paper chart.

Annotations are created by the following process: 1) pan and zoom the process chart so that the entire time period of interest is displayed; 2) right-click the mouse over the process chart background to access the context menu and choose the Add Annotation option from the drop down menu; 3) Move the mouse over the chart to the start time of the period; 4) Left-Click & Hold the mouse, then drag over the chart background to the end time of the period, and release the mouse; 5) In the pop-up box that appears, enter the custom annotation note and hit enter.



A yellow background region will appear from the start time to the end time, whenever the chosen period is displayed on the chart. The custom message appears in the upper left of the highlighted period.

An annotation may be deleted by right-clicking over the graph background to access the context menu, then choosing Delete Annotation, followed by left-clicking the mouse while hovering over the highlighted region of the annotation to be deleted.

Annotations are recorded on the SD card in file *annotations.txt*.

6. Setup Protection (Locking/Un-locking)

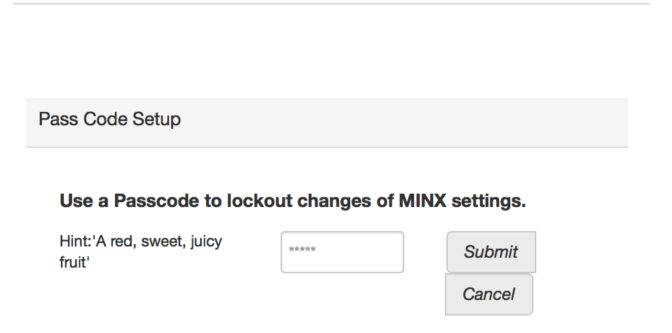
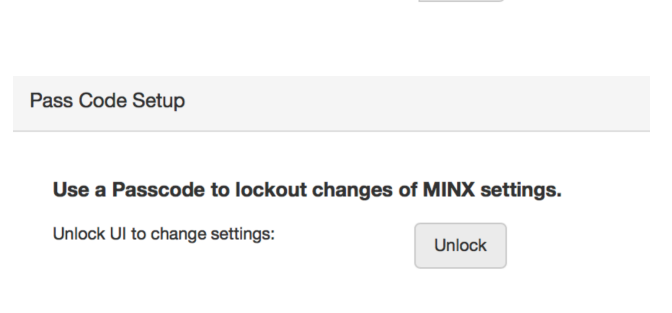
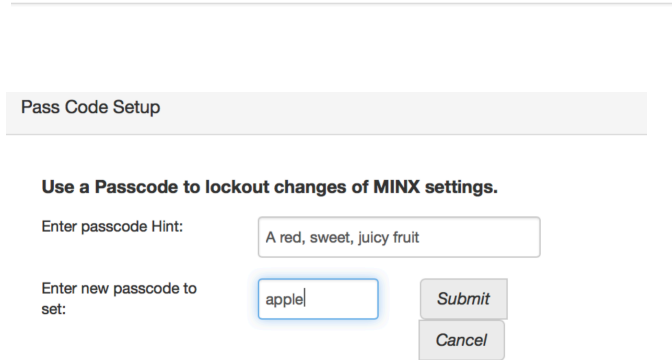
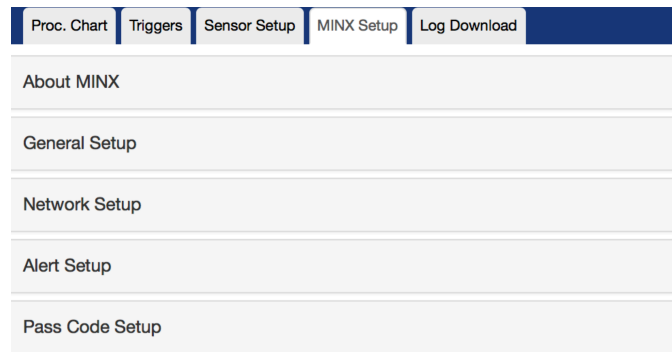
To protect a MINX unit's setup, the web-interface can be 'locked'. When locked, no changes can be made to the MINX sensor settings, trigger settings, etc. However, all web pages can still be viewed, data downloaded, and the process graph can be manipulated. Users may still create Annotations, but annotations cannot be deleted when MINX is locked.

Setup protection feature is accessed on the MINX Setup Tab, under the Pass Code Setup Panel.

To lock the MINX unit: Left-clicking the Set button will display an Input box for a Hint and a Passcode. Enter a memorable Passcode and an appropriate Hint, then left-click the Submit button.

To un-lock the MINX unit: Access the Pass Code Setup Panel, then left-click the Unlock button. Next, enter the chose passcode.

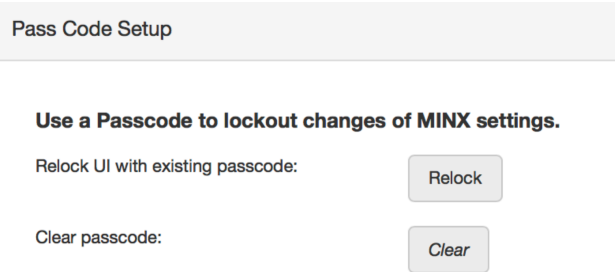
Once unlocked, changes to the MINX setup can be made.



The MINX unit can be easily 'relocked' by left-clicking the Relock button.

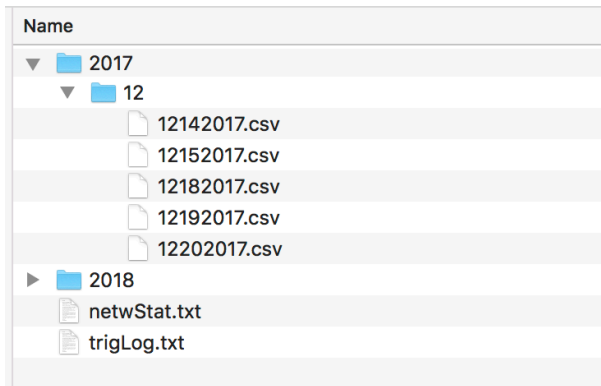
Alternately, the passcode may be completely removed by left-clicking the Clear button.

If the passcode is forgotten, the MINX unit can be factory-reset. See Factory Reset under section Health LED/Control Button section.



7. Log files & SD Card

MINX records sensor data once per second to a daily log file on the SD card. Daily log files are named with the day, month, and year. This data is arranged into directories of 4 digit years and 2 digit months (ex: /2018/12/12142017.csv). The daily log files are in CSV (Comma Separated Value) format. Log files may be copied/moved to a computer and imported into most spreadsheet programs.



The recorded sensor data is either in the native units of that sensor (C for temperature, %RH for humidity, g for accelerometers, mm for optical distance, V for analog input) or in *events*, as determined by the settings indicated and controlled with the webpage. In order to support

programmatic analysis of the CSV data and ease combining of the CSV data within spreadsheet programs, no header information is included. The column order of CSV data is always: Time, Temperature, Humidity, Accel_X, Accel_Y, Accel_Z, Optical, External, where External may be either external thermocouple data or external Analog data as the user has selected in the webpage. Likewise the user will have determined each sensor's units (native or events) via the webpage.

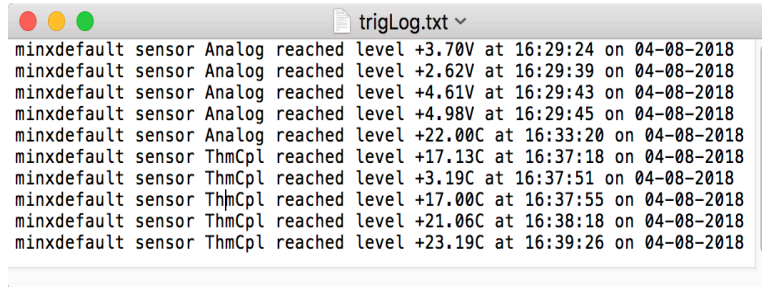
Take care when changing MINX sensor setup to remember that previously recorded log files may have different units. To prevent confusion, it may be desirable to copy and remove old log files from the SD card at the start of a new measurement series that involves a different MINX configuration.

	A	B	C	D	E	F	G	H
1	1523354774	25.9	20	0.02	-0.02	1.02	28	0.2
2	1523354775	25.9	20	0.02	-0.02	1.02	28	0.2
3	1523354776	25.9	20	0.02	-0.02	1.02	28	0.2
4	1523354777	25.9	20	0.02	-0.02	1.02	28	0.2
5	1523354778	25.9	20	0.02	-0.03	1.02	28	0.2
6	1523354779	25.9	20	0.02	-0.03	1.02	28	0.2
7	1523354780	25.9	20	0.02	-0.03	1.02	28	0.2
8	1523354781	25.9	20	0.02	-0.03	1.02	28	0.2
9	1523354782	25.9	20	0.02	-0.03	1.02	28	0.2
10	1523354783	25.9	20	0.02	-0.02	1.02	28	0.2
11	1523354784	25.9	20	0.02	-0.02	1.02	28	0.2
12	1523354785	25.9	20	0.02	-0.03	1.02	28	0.2
13	1523354786	25.9	20	0.02	-0.03	1.02	28	0.2
14	1523354787	25.9	20	0.02	-0.03	1.02	28	0.2

Note the log file format of the log files as written by MINX is critical to MINX reading the log files for display as process control charts. Alteration of log file contents will likely prevent MINX from successfully reading the log file as most spreadsheet programs insert extra spaces or other characters that may not be visible to a human operator. It is recommended that log files be copied from the SD card to a computer prior to opening them with a spreadsheet program. Log files that are no longer of interest for display as process control charts may be removed from the SD card, however it is not recommend leaving gaps in the data (e.g. also remove all files older than the data to be excluded).

MINX log files consume ~5Mb per day. If the SD card becomes full, copy log files to computer if desired, and then delete log files from the SD card to create space.

MINX records all Trigger events to the SD card in file named *trigLog.txt*. This file is an ASCII text format and can be read by any text reader program. It is recommended to



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minxdefault sensor Analog reached level +3.70V at 16:29:24 on 04-08-2018
minxdefault sensor Analog reached level +2.62V at 16:29:39 on 04-08-2018
minxdefault sensor Analog reached level +4.61V at 16:29:43 on 04-08-2018
minxdefault sensor Analog reached level +4.98V at 16:29:45 on 04-08-2018
minxdefault sensor Analog reached level +22.00C at 16:33:20 on 04-08-2018
minxdefault sensor ThmCpl reached level +17.13C at 16:37:18 on 04-08-2018
minxdefault sensor ThmCpl reached level +3.19C at 16:37:51 on 04-08-2018
minxdefault sensor ThmCpl reached level +17.00C at 16:37:55 on 04-08-2018
minxdefault sensor ThmCpl reached level +21.06C at 16:38:18 on 04-08-2018
minxdefault sensor ThmCpl reached level +23.19C at 16:39:26 on 04-08-2018

```

periodically erase this file to prevent it growing too large.

Any Fat32 formatted SD card may be used with MINX. Prior to removing the SD card from MINX, the logging function must be **stopped** by pressing the Control Button on the MINX unit (Refer to the Health Icon/Control Button Section). The SD card may be read in any standard computer using an appropriate SD card interface. Any file(s) may be copied to a computer. Any file(s) may be deleted from the SD card. If the SD card becomes full, copy year/month directories to computer and delete them from the SD card. Re-inserting an SD card to MINX restarts the logging function automatically.

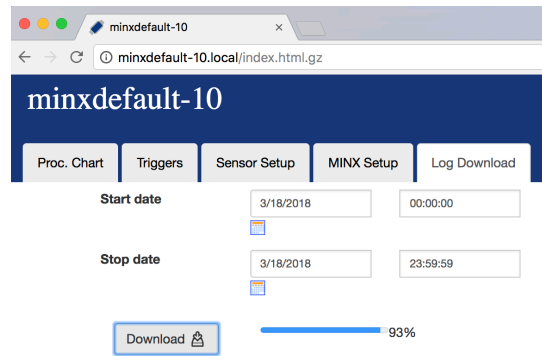
Note that though the MINX webpage continues to operate when the SD card is removed, the data displayed in the process control chart only exists within the browser and cannot be saved. Any displayed data will be lost at the next webpage reload.

The SD card also contains file *netwStat.txt*. This file is written 3 seconds after first power up or 3 seconds after a SD card is inserted to MINX. In the even of network connection issues, this file may be used for recovering MINX unit name and other network information. Consult the ***MINX 0003 Network Setup*** for details.

The SD card also contains file *annotations.txt*. All annotations created are recorded here. This fail may be deleted to remove all annotations. Do not alter the *annotations.txt* file manually. Individual annotations can be removed via the process chart interface. See the Annotations section for more information.

8. Log File Download

Direct Download of small data sets via the MINX web page can be performed from the Download Tab. MINX will read the SD Log files and generate a composite log file that will be sent to the Browser's download function as a file named minx-data.csv. The Start and Stop Time and Date are pre-entered according to the presently displayed process control chart. Alternatively, the Time and Date can be entered in the corresponding InputBoxes. Pressing the Download Button will begin the download process. A progress bar indicates the status of the download. A download of 24 hours of data takes approximately 2 minutes on a typical network. For large data sets, remove the SD card from MINX and transfer to computer via an SD card reader.



Downloaded CSV data includes headers to identify current MINX configuration of sensor units. Note however that even when downloading older data, the included header labels always reflect the *current* MINX sensor configuration.

	A	B	C	D	E	F	G	H
1	Time (S)	Temp (C)	Humid (%RH)	Accel_X (g)	Accel_Y (g)	Accel_Z (g)	Optical (mm)	ThmCpl (C)
2	1522495988	14.5	40	0.148	-1.06	-0.08	34	0.4
3	1522495988	14.5	40	0.148	-1.06	-0.08	34	0.4
4	1522495989	14.5	40	0.136	-1.1	-0.12	82	0.4
5	1522495989	14.5	40	0.136	-1.1	-0.12	82	0.4
6	1522495990	14.6	40	0.148	-1.092	-0.172	69	0.4
7	1522495990	14.6	40	0.148	-1.092	-0.172	69	0.4
8	1522495991	14.6	40	0.128	-1.064	-0.064	66	0.4
9	1522495992	14.6	40	0.144	-1.08	-0.124	70	0.4
10	1522495992	14.6	40	0.144	-1.08	-0.124	70	0.4
11	1522495993	14.6	40	0.14	-1.044	-0.136	63	0.39
12	1522495993	14.6	40	0.14	-1.044	-0.136	63	0.39
13	1522495994	14.6	40	0.136	-1.064	0.084	60	0.39

9. Health LED / Control Button

MINX includes an LED illuminated Button located on top of the unit.

9.1. Health LED

The LED illuminated Button blinks to indicate MINX health. The LED blinks any time power is applied. The pattern of blinking indicates the MINX health/status. In normal operation, when MINX is error free and recording data to the SD card, the LED will blink in a rapid, random pattern (e.g. activity light). In an error condition, MINX will hold the LED off for ~3 seconds, followed by a number of shorts blinks, the number of which indicate the error type.

Pattern	Status	Notes
Rapid, random Blink (Activity)	Good status, Logging	
1 Blink/3secs	Logging disabled	Control Button was pressed; Remove and then reinsert SD card
2 Blinks/3secs	Incompatible SD card	Delete MINX update files to use this SD card for logging
3 Blinks/3secs	SD card failed mount	Remove and then reinsert SD card; Reformat SD card
4 Blinks/3secs	SD card full	Erase log files to free space
5 Blinks/3secs	Log file read/write fail	Remove and then reinsert SD card; Delete current day's log file to resume operation
6 Blinks/3secs	Sensor Failure	See error message on web page
7 Blinks/3secs	Internal HW Failure	Power cycle MINX; Contact factory if error persists
Solid Off	Internal HW Failure	Power cycle MINX; Contact factory if error persists
Solid On	Internal HW Failure	Power cycle MINX; Contact factory if error persists
Fast Blink (3/sec)	FW Erased State	MINX FW update failed, Consult Installation Guide

9.2. Control Button

Press the MINX control Button using a pointed object (ex: ballpoint pen).

Log Stop: Prior to ejecting the SD card, stop the logging function by pressing and releasing the MINX control Button one time.

Power Reset: Reset MINX (equivalent to cycling power) by pressing and holding the MINX control Button for ~15seconds. The LED will change to OFF when the Button is initially pressed, then the LED will blink after ~3-5seconds. Continue to hold the Button until the LED changes to OFF, and then release the Button after the entire 15second period has elapsed.

Factory Reset: MINX can be reset to factory settings, if for example the programmed passcode is lost. Note this will not alter and data on the SD card, other than the *netwStat.txt* file. Press and hold the MINX Control Button; the LED will turn OFF and after ~3-5seconds, the LED will begin to rapidly blink ON-OFF; immediately release the MINX control button. After, ~3-5 seconds the LED again blinks rapidly ON-OFF; press-and-release the MINX control button; the LED turns OFF. Each time the LED begins to blink ON-OFF; press-and-release the MINX control button. Repeat this process 5times. MINX will reset all the web-interface settings, including the unit name. To access the MINX unit it will be necessary to re-direct browsers to 'http://minxdefault' or 'http://minxdefault.local'. See the General Setup section of the Appendix for more information.

10. Sensors, Setup and Applications

10.1. Ambient Temperature Sensor

MINX's built in temperature sensor is intended to measure temperature of the ambient environment surrounding the unit. Air temperature is sensed through MINX's case. MINX's case must be allowed to heat or cool to the level of the surrounding air temperature to accurately measure that temperature. MINX expects cooling by natural convection; blowing air will cause errors in the sensing of the ambient temperature. For best accuracy, mount minx to a vertical surface (ex: an interior wall), with MINX in a horizontal orientation, at least 6" from any horizontal surface.

Due to MINX thermal mass, the maximum cooling/heating rate that MINX can measure is $\sim 2\text{C}/\text{minute}$. Heating/cooling rates that exceed this limit may not be measured accurately during temperature transitions. Do not place MINX in direct sunlight. For accurate measurement of ambient temperature, do NOT place MINX near heat/cold sources.

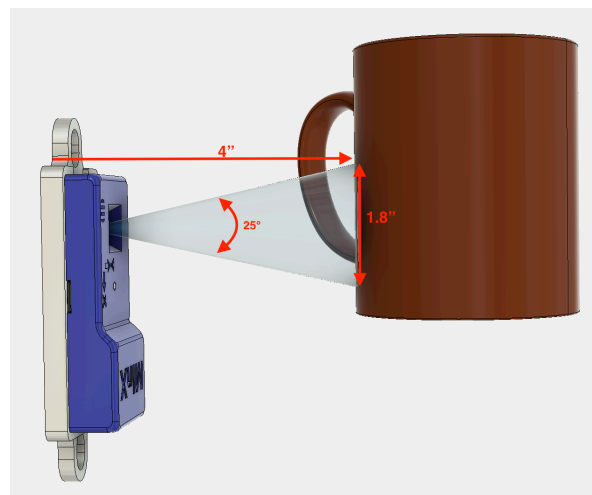
For maximum accuracy measuring air temperature, and anytime fast changes to air temperature need to be measured, use the external thermocouple via the accessory connector.

10.2. Humidity Sensor

MINX's built in humidity sensor measures the humidity level of the ambient air. Ambient air enters MINX through the vented opening on the top of the MINX case. Do not block this vent, as this will prohibit accurate measurement.

10.3. Optical Sensor

The optical sensor works in the infrared frequency region and is generally not affected by color of the item to be measured. The optical sensor will not work well in the presence of direct sunlight, or when aimed near heat sources such as incandescent lights. The optical sensor has a cone angle of 25 degrees and this must be considered when determining the distance between MINX and the target to be measured, as well as the spatial distance between separate targets. For example, if MINX is placed 4" from the target to be measured, the cone's diameter will be 1.8".



To accurately count individual items at a distance of 4", the items would need to be spaced approximately 1.8" apart. If multiple objects are present in the light cone simultaneously, MINX may not distinguish them and erroneous distance measurements may result. If multiple objects are present in the light cone and at different distances, erroneous measurements may result, and an Optical Sensor Error message may result. If the target object's diameter is too small for the cone diameter, too little energy will be reflected back to the sensor erroneous measurements may result, and an Optical Sensor Error message may result.



A plastic window that features an anti-scratch coating covers the optical sensor. The window may be cleaned using VERY gentle pressure and a cotton swab dipped in IPA. Push any particles to the edges of the window and away from the center two "eyes" of the optical sensor (particles not over the eyes will not affect the performance).

10.4. Accelerometers

MINX's built in 3-axis accelerometers can measure ranges +/-2g to +/-16g. Choose the desired range on the Sensor Settings Tab and the Accelerometer Panel. The relative direction of '+' and '-' acceleration are indicated on the MINX case with embossed 'X' and 'Y' labeled arrows, wherein the arrows point in the '+' direction for the respective axis. For the 'Z' axis, the '+' acceleration direction is away from MINX back plate, and pointing out through the top of the case.

In addition to sensing typical dynamic acceleration due to vibration or shock, the accelerometers are also sensitive static acceleration (e.g. earth's gravity) and can therefore be used to determine the unit's orientation. 3D orientation can be accomplished by post analysis of the three accelerometer's readings.

Using the event counting feature, and having pre-determined useful peak acceleration limits, the MINX can count various mechanical actions such as the number of times a stamp strikes die. When detecting peak acceleration for counting, it is desirable to eliminate the static offset due to the 1G of earth's gravity. The 1G due to earth's gravity can be eliminated by mounting MINX in the desired location for acceleration event counting, and then pressing the 'Compensation' Reset button found on the Sensor Settings Tab and the Accelerometer Panel.

10.5. External Sensors

MINX’s accessory connector port allows MINX to sense, log, and trigger on either an external thermocouple, or a discrete 0V to 5V, ground referenced signal. Select the desired sensor type under the Sensor Setup tab, on the External Input panel

10.5.1. External Thermocouple

Any standard thermocouple (K,J,N,R,S,T,E,B types) may be connected to MINX’s accessory connector. Refer to Appendix for connection details. A thermocouple makes a differential measurement of the temperature between the thermocouple tip and the point where the thermocouple wires attach to the accessory connector. MINX turns this differential measurement into an absolute temperature by referencing the measured differential temperature to MINX’s case temperature, which under normal circumstances matches the temperature of the accessory connector. MINX case temperature is factory calibrated and will provide the specified accuracy over the full operating temperature range.

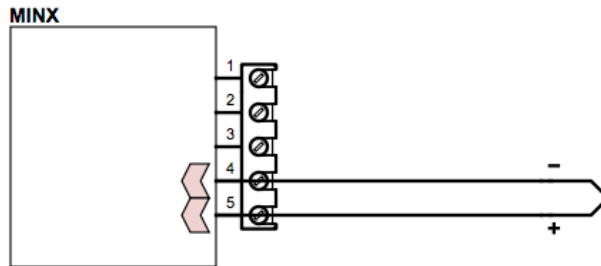
Placing MINX and the accessory connector in an unstable temperature environment or near a heat/cold source (including handling MINX and/or the accessory connector), will create a temperature differential between MINX case and the accessory connector, which will contribute an error term to the thermocouple measurement. For the same reason, to attain the specified accuracy, it is necessary to wait for the temperature of MINX and the

The screenshot shows the 'Sensor Setup' tab in the MINX interface. Under 'External Input 1', the 'Select External Input 1 Type' section has 'Thermocouple' selected with a radio button. A dropdown menu next to it is set to 'Analog'. Below this, the 'Thermocouple Options' section includes a 'Thermocouple Type' dropdown set to 'K'. The '2 Point Calibration' section has two rows: 'MINX(Raw) Temp' and 'Known(Ref.) Temp', each with 'Point1' and 'Point2' input fields. The values for Point1 and Point2 are both set to 0 and 100, respectively.

accessory connector to stabilize following power-up, experiencing a large temperature shift, and/or inserting the accessory connector into MINX.

The thermocouples quality determines the accuracy of the differential temperature measurement. This error will be in addition to any inherent error in the MINX unit. Typical thermocouples are +/-2.2 °C accurate, while “Special Limits of Error” type

thermocouples may be +/-1 °C accurate. To account for possible gain and offset errors present in certain thermocouples, MINX provides facilities to applying a two-point calibration curve to the measured differential temperature of the thermocouple. Two-point calibration requires heating or cooling the installed thermocouple to two distinct and known (or reference) temperature points and capturing the temperature measured by MINX. The *known* and *MINX* temperatures for each point are then programmed into the MINX via the webpage (Sensor Setup Tab, External Input Panel, select Thermocouple). Numerous references and articles explain how to perform two-point calibration. The same facility can also be used to apply one-point (offset only) calibration.



MINX is supplied with one “Special Limits of Error” type thermocouple. Additional or alternative thermocouples can be purchased from any electronics vendor. Use caution when connecting thermocouples to ensure correct polarity.

10.5.2. Discrete Input

Discrete input options include analog 0-5V signals or digital 0-5V pulse signals.

Choose the desired discrete sensor type from the drop-down menu next to the Discrete Input checkbox.

Proc. Chart	Triggers	Sensor Setup	MINX Setup	Log Download
Temperature Sensor				
Optical Sensor				
Accelerometers				
External Input 1				

Select External Input 1 Type

- Discrete Input
- Thermocouple

✓ Analog

Pulse

PulsFrq

Analog Input 1 Options

Connected Sensor Name:

Units Of Connected Sensor:

Analog Sensor Mapping:

Input Value:

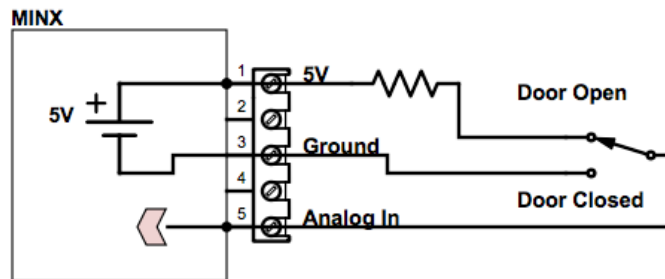
Upper point:

Sensor Value:

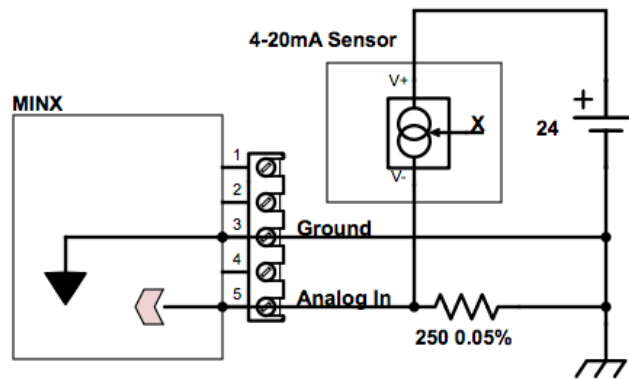
10.5.2.1. Analog Signals

By selecting Analog as the External sensor type, any low frequency analog signal in the range of 0V to 5V can be measured using MINX's accessory connector and the AnalogIn input. Refer to Appendix for connection details. MINX will perform an analog to digital conversion operation on the applied analog signal.

Numerous sensors are available that provide a 0V to 5V signal (fluid level sensor, pressure sensors, voltage and current sensors, open/close switches, load cells, etc.). MINX's 5V DC output can be used to power such external sensors if so required.



Current loop sensors with 0-20mA (includes 4-20mA) outputs can be sensed using a 250 Ohm, 0.1% or better shunt resistor.



The connected sensor can be 'named' by entering a string in the Connected Sensor Name input box, and this string will appear in the process chart legend. For example 'Condy' is short for a conductivity sensor. This name, Condy, will appear in the process chart legend.

The units of the connected analog sensor can be entered into the Units input box. These units will appear in the process chart legend. For example, conductivity measurements are typically in uS/cm.

External Input 1

Select External Input 1 Type

Discrete Input Thermocouple

Analog Input 1 Options

Connected Sensor Name:

Units Of Connected Sensor:

Analog Sensor Mapping:

<p>Input Value</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%; text-align: center;">0</td> <td style="width: 20%; text-align: center;">V</td> </tr> </table>	0	V	<p>Upper point</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%; text-align: center;">5</td> <td style="width: 20%; text-align: center;">V</td> </tr> </table>	5	V
0	V				
5	V				
<p>Sensor Value</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%; text-align: center;">0</td> <td style="width: 20%; text-align: center;">us/cm</td> </tr> </table>	0	us/cm	<p>Lower point</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%; text-align: center;">100</td> <td style="width: 20%; text-align: center;">us/cm</td> </tr> </table>	100	us/cm
0	us/cm				
100	us/cm				

The measured value of the connected analog sensor can be translated from the volts value input to MINX, to the actual sensor values. The appropriate values for the connected sensor can be found on the sensor's data sheet or by contacting the sensor maker. For example, a conductivity sensor may have a 0-20mA output that corresponds to a 0 to 100 uS/cm fluid measurement. If the 0-20mA signal is converted to a 0-5V signal with a precision 250Ohm resistor, then 0Volts input corresponds to a sensor measurement of 0us/cm and 5V input corresponds to 100us/cm. Entering these vales into the Input and Sensor Value input boxes, will result in MINX measuring this sensor in values of 0 to 100uS/cm, and it is these values that will appear in the process chart and the SD card data files.

Settings for a basic analog voltage would be: Volts, V, 0V=0V, 5V=5V

10.5.2.2. Pulse Signals

By selecting Pulse as the External sensor type, 0V to 5V digital pulses can be measured using MINX's accessory connector and the AnalogIn input. Refer to Appendix for connection details. MINX will perform threshold detection of the analog input to find pulse edges.

The connected sensor can be 'named' by entering a string in the Connected Sensor Name input box, and this string will appear in the process chart legend. For example 'Pump1', for a volume measurement from a pump. This name, Pump1, will appear in the process chart legend.

The units of the connected analog sensor can be entered into the Units input box. These units will appear in the process chart legend. For example, total pumped fluid volume is measured in cubic-centimeters, 'cc's.

The pulse calibration is set according to the data from the sensor manufacturer. In this example, the flow sensor produces 50pulses for each cc delivered. This is equivalent to 0.02cc per pulse. As pulses are detected, MINX is accumulating the total equivalent volume pumped. The process chart will therefore begin a 0ccs and the value will increase by 0.02cc each time a pulse is detected. This value will increment indefinitely, unless a Reset level is programmed by entering a maximum value in the At_what_count_should_the_event_counter_roll_over input box. When this value is detected, the next pulse will result in a volume of 0. The total accumulated volume can be reset to 0 at anytime using the Reset button

MINX can be programmed to detect pulses by looking for voltage transitions past a particular voltage between 0V and 5V. For example, a 0 to 5V pulse may use a detection level of 2.5V, whereas a 0-3V digital pulse may prefer a 1.5V detection threshold. Input hysteresis is set by programming an appropriate pulse detector reset level. This setting is used to combat noise on the signal from the sensor, and should be set sufficiently far from the detector value to prevent any signal noise from causing double counting.

External Input 1

Select External Input 1 Type

Discrete Input Pulse

Thermocouple

Pulse Accumulator Options

Connected Sensor Name:

Units Of Connected Sensor:

Pulse Calibration:

Define Pulse Event

What threshold must the sensor measure to be a recordable event

What level must the sensor measure to reset the event detector

At what count should the event counter roll over

Reset event counter

10.5.2.3. Pulse Frequency Signals

By selecting Pulse Frequency (Pulse Frq) as the External sensor type, 0V to 5V digital pulses can be measured using MINX's accessory connector and the AnalogIn input. Refer to Appendix for connection details. MINX will perform threshold detection of the analog input to find pulse edges and then calculate the number of pulses per minute (event/m).

The connected sensor can be 'named' by entering a string in the Connected Sensor Name input box, and this string will appear in the process chart legend. For example 'Pump1', for a volume measurement from a pump. This name, Pump1, will appear in the process chart legend.

External Input 1

Select External Input 1 Type

Discrete Input PulsFrq ▾

Thermocouple

Pulse Frequency Options

Connected Sensor Name:

Units Of Connected Sensor:

Pulse Calibration:

Define Pulse Event

What threshold must the sensor measure to be a recordable event

What level must the sensor measure to reset the event detector

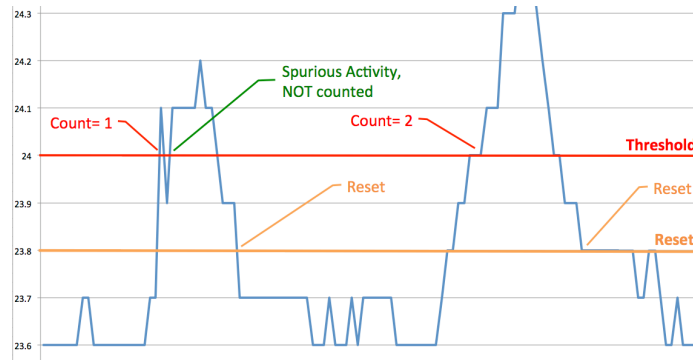
The units of the connected analog sensor can be entered into the Units input box. These units will appear in the process chart legend, amended by '/m'. For example, if pumped fluid volume is measured in gallons ('gal'), the process chart would display 'gal/m' (e.g. gym, gallons per minute).

The pulse calibration is set according to the data from the sensor manufacturer. In this example, the flow sensor measures 0.00036984 gallons per pulse. As pulses are detected, MINX is accumulating the total equivalent volume pumped per minute as a running average. The process chart will display the current average of the pump's gal/m.

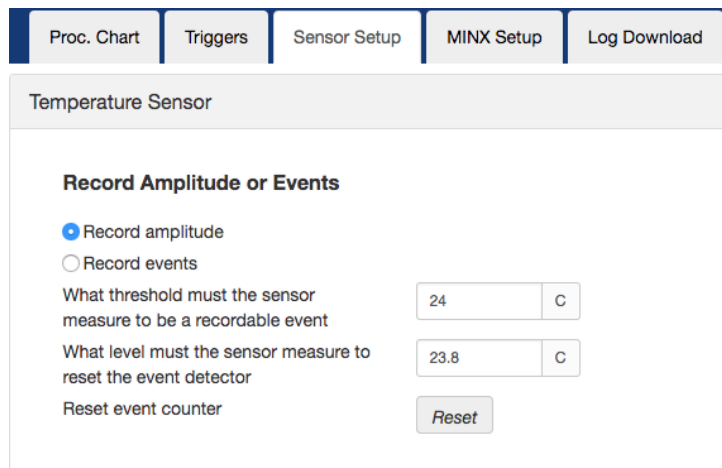
MINX can be programmed to detect pulses by looking for voltage transitions past a particular voltage between 0V and 5V. For example, a 0 to 5V pulse may use a detection level of 2.5V, whereas a 0-3V digital pulse may prefer a 1.5V detection threshold. Input hysteresis is set by programming an appropriate pulse detector reset level. This setting is used to combat noise on the signal from the sensor, and should be set sufficiently far from the detector value to prevent any signal noise from causing double counting.

10.6. Event Counting

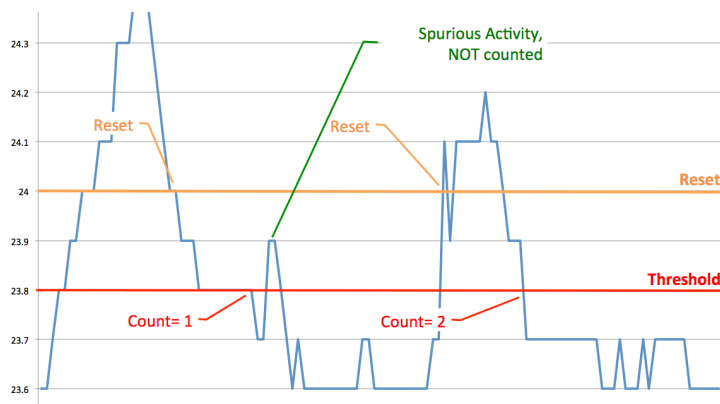
MINX offers the ability to count *events* that occur on the Temperature sensor, Accelerometers, Optical sensor, External Thermocouple sensor, or External sensor. An *event* is defined as the particular sensor output reaching a programmed **Threshold**. In order to prevent spurious counts, the system will not allow another *event*, until the sensor output has reached a programmed **Reset** level. This is illustrated in the figure.



On the MINX webpage, under the SensorSetup Tab, on the respective sensor’s Panel, there is a Record Amplitude/Record Events RadioButton, Threshold and Reset level InputBoxes, and a Reset Button. Enter the desired Threshold and Reset levels in the respective InputBoxes. Press the Reset Button to initialize the count to 0. Enable event counting by selecting the Record Events RadioButton.



If the Threshold level is **above** the Reset level, then the count will increment each time the sensor level has been less than the Reset threshold, followed by being greater than the Threshold level. In the opposite case, if the Threshold level is **below** the Reset level, then the count will increment each time the sensor level has been greater than the Reset threshold, followed by being less than the Threshold level.



11. External Outputs

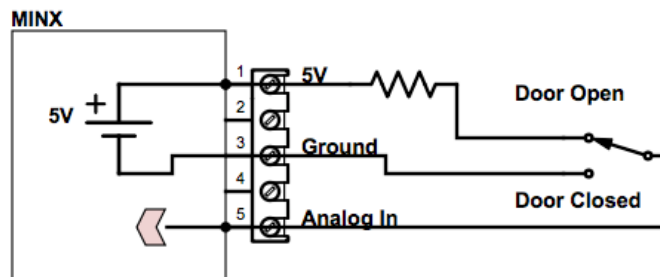
MINX's accessory connector provides two current protected outputs:

- 5V DC Supply
- 0-5V External Output

Refer to **MINX 0003 Specification** and Appendix for details. Exceeding the maximum current total for the combined 5V DC and External Outputs will result in a voltage less than 5V.

11.1.1. 5V DC Supply

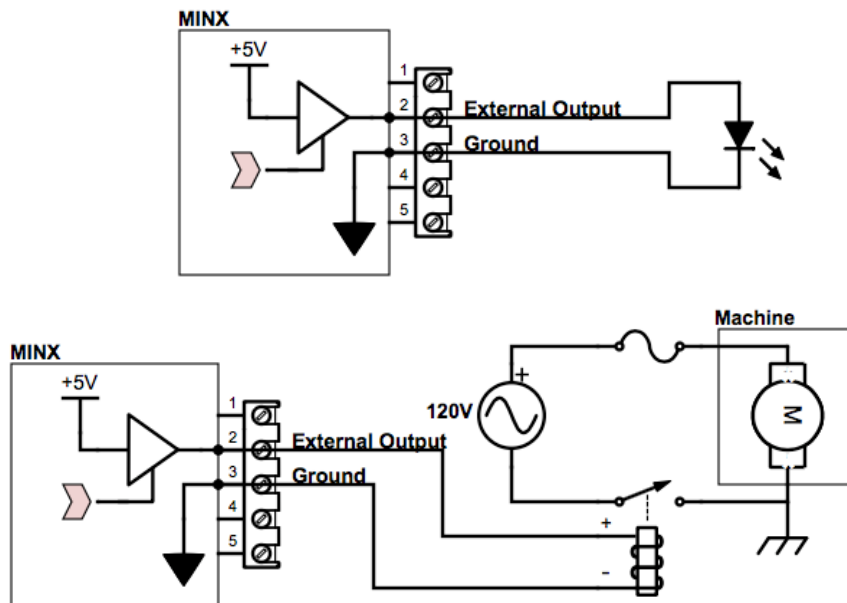
MINX's 5V DC Supply is available anytime the unit is powered. This supply can be used to power certain low voltage sensors, signal conditioners, or otherwise be used in simple circuits for creating suitable inputs to the MINX external Analog input.



11.1.2. 0V-5V External Output

MINX's External Output may be used to manually or automatically control other circuits or equipment. Control of 120V equipment may be accomplished through the use of a suitable relay. Always use appropriate backup and/or redundant monitoring systems commiserate with the importance and value of the process being monitored. **NEVER** use MINX to control equipment where either the operation or failure to operate could result in harm to people, damages, or loss of property. Refer to Section 4.2 for information on the control of the external output.

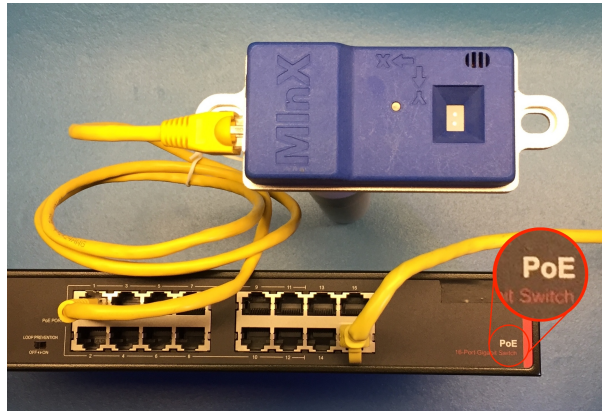
The polarity of the External Output can be controlled; see the General Setup information in the Appendix.



APPENDIX:

POE (Power Over Ethernet) Network Connection

Minx derives power from its POE network connection. This feature eliminates the need to run 120V electricity and an Ethernet connection to MINX. MINX may be attached directly to any 802.3 compliant POE source equipment such as a router or switch, using standard Cat5 or better Ethernet cable (up to 100m).



Alternatively, MINX may be attached to a non-POE router, switch, or computer using the included POE injector. The POE injector will add the necessary POE voltage onto any standard Ethernet cable; simply connect the Injector's "LAN" port to the router, switch, or computer and the Injector's "POE" port to MINX's Ethernet connector, then plug the Injector into a 120V circuit.



MINX is factory configured for use with a local area network that offers DHCP (Dynamic Host Configuration Protocol). On DHCP networks, the DHCP server provides each device with appropriate network settings (ex IP Address). For non-DHCP networks, direct computer-to-MINX configurations, consult the **MINX 0003 Network Setup Guide**.

General Setup

On the MINX Setup Tab, under the General Setup Panel, enter a unique name for this MINX unit in the MINX ID InputBox. This unique name will thereafter be used for navigating browsers to the unit on the network (Note every MINX on the local network **MUST** have a unique name). After entering the new name, be sure to re-direct the current browser session to the MINX webpage address using the new MINX_ID. Create a bookmark within the browser for easy navigation. If the unique name is forgotten, consult the ***MINX 0003 Network Setup Guide***.

Programmed name = 'MINX_ID'	Windows PC	http:// + MINX_ID
	MacOS/OSX, iOS, Linux	http:// + MINX_ID + .local

Refer to the below Time Keeping section for information on times and time zone controls.

The polarity of the External Output can be controlled using the External Output Polarity RadioButton. When Standard Mode is selected, the Output is 0V when the trigger condition is NOT present and 5V when present. In Inverted mode, the Output is 5V when the trigger condition is NOT present and 0V when present.

Time Keeping

MINX includes a real-time clock that will keep time over a range of temperatures and other conditions. If so enabled, MINX will check and update its time with Internet Time Servers at every power-up and periodically during normal operation. This feature can be controlled from the MINX Setup tab, General Setup Panel, using the Use Internet Time CheckBox. If Use Internet Time is disabled, the User will need to manually set the local time using the LocalTime@Sensor InputBox located on the MINX Setup tab, General Setup Panel.

At initial installation, from the MINX Setup tab, General Setup Panel, the User must:

- Set time zone where the MINX unit is located by selecting the correct time zone from the TimeZone@Sensor menu
- Enable or disable Daylight Savings Time using the CheckBox

Note that for systems where Daylight Saving Time is enabled, at the Spring transition, there will be a one-hour gap in the logged data, and at the Fall transition, there will be duplicate time stamp entries for a one-hour period. Conversely, for systems with DST disabled, the logged time periods will be off by one hour from the actual local time.

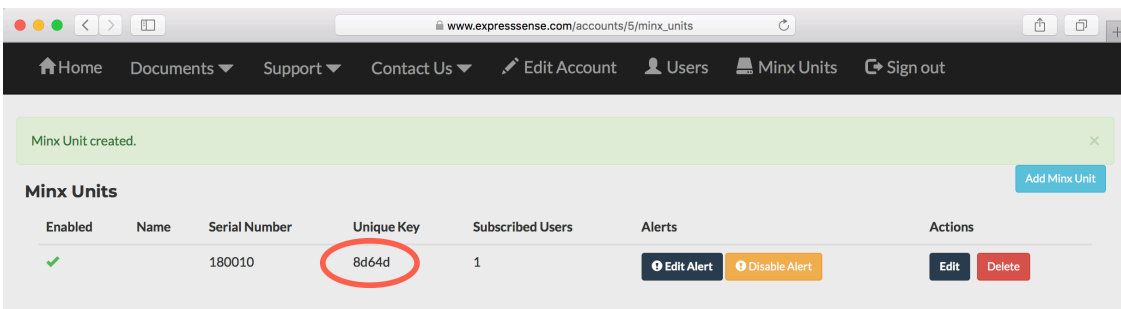
Network Setup

Refer to the ***MINX 0003 Network Setup Guide*** for details on using the contents to the Network Setup Panel.

Alerts Setup

Email/text alerts can be generated by MINX units in conjunction with the ExpressSense Alert Server. The ExpressSense Alert Server is cloud server that will receive communication from a MINX unit and translate it to emails as programmed by the unit owner.

To utilize this feature, it is necessary to create an account at www.ExpressSense.com: under the Alert Manager menu, choose SignUp link from the Sign In screen. After activating the account or logging in an existing account at www.ExpressSense.com Alert Manager, select the **MINX Units** menu screen and select the **Add MINX Unit** Button, then enter the serial number located on the side of the physical MINX unit. The ExpressSense Alert Server will issue a **Unique Key**, as listed next to the unit's serial number on the **MINX Units** menu screen. Note the value of the unique key for use in the next step



Returning to the MINX unit's generated webpage, navigate to the MINX Setup Tab, and the Alert Setup Panel. Then enter the value of the unit's **Unique Key** into the Alert Identity Key InputBox. This Serial Number and Key combination, ensures only the true owner can generate and receive alerts from a MINX unit.



Once these steps are completed, a test email can be generated by hitting the Send Test Alert Button. The MINX unit's communication status will be displayed in the Alert Status MessageBox. In the event of a communications failure, ensure the local area network allows http access to outside Internet addresses, and double check the serial number and Key information on the ExpressSense Alert Server.

Additional recipients can receive alerts from the MINX unit. First, from the unit owner's ExpressSense Alert Server account, invite additional users to create an ExpressSense Alert Server account by selecting Invite New User Button from the Users menu. Second, from the unit owner's ExpressSense Alert Server account, under the MINX Units menu, choose Edit Alerts for the desired unit, and Enable the CheckBox next to the new recipients name.

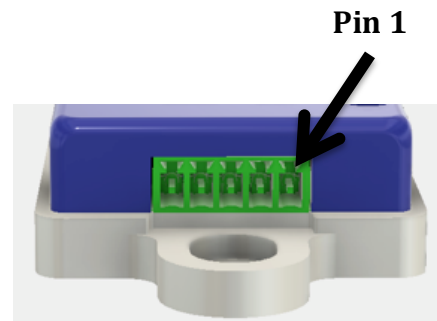
To prevent excessive email traffic, the minimum time between email alerts, can be configured from one minute an up. Enter the minimum time between emails, into the InputBox.

Accessory Connector

Accessories can be attached to MINX using an Amphenol connector PN 20020008-D051B01LF. This connector mates to the Accessory Connector on MINX and includes screw terminals for easy build up. Refer to the following pin out when creating external connections.

Pin	Description	V	A
1	5V DC Supply	5V	200mA* total
2	External Output	0-5V	
3	Ground Return	0V	
4	TC-	-	
5	TC+ / Analog Input	0-5V	

*Combined current draw not to exceed 200mA



Mounting

MINX may be mounted in any manner necessary to sense the desired the process attribute. For front mounting, MINX mounting plate provides slotted holes that will accept 1/4"-20 or cap screws (low-profile cap screws required for use with Accessory connector, McMaster-Carr 92220A186 or 93070A147). For rear mounting, MINX mounting plate provides tapped 1/4"-20 mounting holes.

For accurate acceleration/shock measurement, secure MINX tightly to machine or structure. Failure to securely mount MINX will allow MINX to move in directions and at accelerations other than the item to be measured and can lead to missed peaks, missed events, extraneous data, etc.

For accurate temperature measurement of ambient air, MINX must be allowed to cool by simple convection of the air to be measured (Do not place MINX near/cool sources, nor allow air to blow on MINX). For best results when measuring ambient air temperature, mount MINX horizontally to an interior wall or other feature. Take care to account for differences in temperature near floor or ceiling.

For Optical measurements, locate MINX such that the optical sensor window points at the object to be measured, noting that the optical IR laser exists MINX perpendicular to the MINX mounting plate. Due to the cone angle of the laser, the mounting distance from the object to be measured must account for the object's diameter and object-to-object spacing (see detail discussion in the User Guide). Do not mount MINX such that the optical sensor will be pointed at infrared energy sources such as sunlight or incandescent bulbs. The MINX optical sensor uses a class 1, eye-safe laser, however it is not recommended that the optical sensor be mounted such that the laser would be constantly shine into an operator's eyes.