EZTest
HazMon System Tester

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Revision Notes

First Release – October 18, 2012

Revision A01 – January 16, 2013

- Update to include version 1.02 firmware features

Revision A02 – March 28, 2014

- Fix main menu and configuration message

1. Overview

The **EZ**Test HazMon System Tester provides a simple method to diagnose CMC HazMon systems.

The **EZ**Test is handheld and operates off 2 AA batteries. It has an easy to read backlit LCD. A simple 4 button operator interface is provided

The **EZ**Test provides a standalone good/bad test for individual sensors. In addition, the sensor's electrical interface and real-time output can be verified. All information is presented in scaled units to simplify the test results.

In addition to testing individual sensors, the **EZ**Test can be connected to an active CMC Intrinsically Safe network. The **EZ**Test will supply a simply good/bad indication of the networks operation. Further details of the networks electrical operating condition are also provided.

The **EZ**Test can also emulate a sensor. A sensor is first attached to the **EZ**Test and after the serial number is captured the **EZ**Test is attached to the network. The keyboard can then be used to set any value for the sensor.

The mVM001 Vibration Sensor and the mTS017 Infrared Temperature Sensor are configurable. The **EZ**Test provides a simplified means of configuring these sensors.

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2. Description of Indicators

Figure 1 - Illustration of Indicators

There are five control pushbuttons:

Power	Press to turn power on or off
Select	Select the displayed function
Back	Go back one menu level or exit this function
Down	Next menu item
Up	Previous menu item

3. Operation

The **EZ**Test HazMon System Tester has an easy to use menu system. To turn on the tester, press and hold the "**POWER**" key until the display backlight illuminates. To turn the tester off, press and hold the "**POWER**" key until the display backlight goes off. The tester automatically turns off after 5 minutes except under the following conditions:

1. The tester is displaying real-time information from a sensor;
2. The tester is in "Bus Test" mode (the tester must be powered in "Bus Test" mode or it will cause the network to fault when connected).

The system will display two opening messages when power is turned on:

CMC Industrial Electronics

EZTest Ver 1.00 **Copyright 2012**

The tester may display a status message before proceeding to the main menu. The status messages are as follows:

Message	Description	Required Action
Battery Low < 25%	The battery has discharged below 25%	Check the battery level using the "Battery Gauge" function. If less than 10% replace the batteries
Program CRC Fault	The tester's program is corrupted	Return the unit to the factory for repair
Data RAM Fault	The tester failed self-test	Return the unit to the factory for repair
Calibration Fault	The calibration parameters are corrupted	Return the unit to the factory for repair

The main menu is then displayed:

Select Function **Sensor Test**

3.1 Using the Menu Control Pushbuttons

There are four menu control pushbuttons:

Select	Select the displayed function
Back	Go back one menu level or exit this function
Down	Next menu item
Up	Previous menu item

There are three menu selections from the main menu. These are selected using the "**UP**" and "**DOWN**" pushbuttons.

Sensor Test	Test an individual sensor
Bus Test	Test the CMC Intrinsically Safe network
Sensor Emulator	Emulate a sensor
Sensor Config	Configure a sensor
Battery Gauge	Check remaining battery level

Once the function is displayed, it is executed by pressing the "**SELECT**" pushbutton.

3.2 Sensor Test

The sensor test will report the health of a single sensor plugged into the modular connector on the front of the unit. In addition, the sensor test will check for any ground fault conditions between the sensor wiring and the metal case of the sensor.

********** **Caution** **********

Sensors connected to a bus converter on an active network or multiple sensors connected together cannot be tested using this function. Connect a single standalone sensor the tester's front panel connector.

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If "**Sensor Test**" is selected and no sensor is connected to the modular connector, the display will indicate:

Sensor Test

No Sensor

To test a sensor, plug the sensor into the tester. If the sensor is a temperature sensor, plug the ground fault test cable into the tester's mini-phone jack and connect the alligator clip to the sensor's metal body. If the sensor's metal body is not easily reached, connect the alligator clip to any metal part that is connected to the sensor body. ***Only temperature sensors require the ground test lead.***

When a sensor is connected to the modular jack and "**Sensor Test**" is selected, the display will first indicate:

Sensor Test
Please Wait

The following messages can be displayed:

Message	Description
Sensor Good	The sensor passed all of the tests and is operational. This test confirms the electrical interface of the sensor is working properly. Use the "**DOWN**" key to verify the sensor is providing the correct output.
Supply Volts Low	The sensor is drawing too high a current from the networks power supply.
Data Volts High	The sensor is loading the data line and the data high voltage is lower than required.
Data Volts Low	The sensor is loading the data line and the data line low voltage is higher than allowed.
Ground Fault	One of the sensor's wires is in contact with the metal case of the sensor or conducting to earth ground through moisture damage.
Red Wire Open	For temperature sensors this message indicates that the red power wire to the sensor is open
Bad Data	The tester was unable to read a valid data packet from the sensor.
No Sensor	No sensor was detected, the sensor is defective

The "**UP**" and "**DOWN**" keys can be used to display further information about the sensor's performance. If the display indicates "**Sensor Good**", use the "**DOWN"** key to verify the value being returned by the sensor. The tester displays the sensor's value in real world units for verification.

The following table describes the available display starting from the status display described above:

Key	Function	Description
Down 1	Real-time display	The sensor type and real-time value for the sensor are displayed in the units suitable for the sensor. Verify the sensor's output using this function.
Down 2	Serial number display	The sensor's serial number is displayed. The serial number should agree with the serial number printed on the sensor's label.
Up 1	Sensor Power	The sensor power voltage level is displayed. If this voltage is too low it indicates the sensor is drawing excessive power.
Up 2	Sensor Data Low	The data low voltage level on the network is displayed. If this voltage is too high, the sensor has resistance between the green data wire and the red power wire.
Up 3	Sensor Data High	The data high voltage level on the network is displayed. If this voltage is too low the sensor has resistance between the green data wire and the white common wire.
Up 4	Ground Flt Data	The ground fault leakage voltage on the network is displayed. If this voltage is too high the sensor has resistance between the metal case and the green wire.
Up 5	Ground Flt Power	The ground fault leakage voltage on the power wire is displayed. If this voltage is too high the sensor has resistance between the metal case and the red wire.
Up 6	Ground Flt Common	The ground fault leakage voltage on the common wires is displayed. If this voltage is too high the sensor has resistance between the metal case and the white or black wires.

********** **Caution** **********

Only sensors that display the "**Sensor Good**" message and that are displaying the correct reading using the real-time display should be used.

****

If a sensor is connected that does not provide a valid CMC family code, the sensor may be read, but in the real-time display will show the sensor type "**Unknown**" and the units as "**raw**". This sensor is not a valid sensor for use on a CMC network.

The following table lists the allowable tolerance set for each of the sensors permitted on the CMC network:

Model	Family Code	Ground Fault Data Maximum	Ground Fault Power Maximum	Ground Fault Common Maximum	Power Supply Minimum	Data Low Maximum	Data High Maximum
mTS01X	40	0.25	0.25	0.25	4.75	0.25	3.85
mRS001	160	0.25	0.25	0.25	4.58	0.25	3.75
mVM001	161	0.25	0.25	0.25	4.58	0.25	3.75
mCM001	162	0.25	0.25	0.25	4.61	0.25	3.75
mRH001	163	0.25	0.25	0.25	4.66	0.25	3.75
mDI001	165	0.25	0.25	0.25	4.63	0.25	3.75
mTS017	166	0.25	0.25	0.25	4.67	0.25	3.75
mTC001	177	0.25	0.25	0.25	4.47	0.25	3.85
mAM001	178	0.25	0.25	0.25	4.61	0.25	3.75
mTC002	179	0.25	0.25	0.25	4.18	0.25	3.85

3.3 Bus Test

********** Warning **********

Do not connect the tester to the network until the tester is turned on and **"Bus Test"** is selected. If the tester is not powered, it will cause the network to fault.

****

The "**Bus Test**" reports the health of a CMC network. Common network faults such as a partially shorted data bus or open data bus are detected. The tester also displays the number of sensors being polled by the bus converter and the serial numbers of the sensors being polled.

********** Caution **********

The tester displays the sensors that are being polled by the bus converter. This display does not indicate that those sensors are present on the network or responding to the poll request, only that they are present in the bus converters polling list. Individual sensors should be verified using the "**Sensor Test**".

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If "**Bus Test**" is selected and the tester is not connected to the network using the supplied patch cable, the display will indicate:

Bus Test
Power Volts Low

When the tester is connected to a powered network, one of the following messages will be displayed:

Message	Description
Bus Good	No errors were detected on the bus
Please Wait	Wait while information is being collected
Power Volts Low	The network DC power is below 4.00VDC
Data Volts Low	The network data line DC level is below 3.90VDC
Data Stuck Low	The network data line level is stuck in the low state
Data Stuck High	The network data line level is stuck in the high state

The "**UP**" and "**DOWN**" keys can be used to display further information about the network's performance. The following table describes the available display starting from the status display described above:

Key	Function	Description
Down 1	No. of Sensors	The number of sensors being polled by the bus converter is displayed
Down 2 -33	Serial Number Display	Displays the serial numbers of the sensors being polled by the bus converter
Up 1	Data Signal	The data line average voltage. The data line should be above 3.5VDC.
Up 2	Power Signal	The power line average voltage. The power supply should be above 4.5VDC.

The values displayed above can be used to further troubleshoot the system. If the display indicates an error, use the standard troubleshooting procedure starting at the first field interconnect box to isolate portions of the network. If the error is corrected when a branch is isolated, the problem will be in that branch. Continue to the next field interconnect box and repeat until the field interconnect box causing the error is found. The sensors in that box can then be individually tested to locate the defective sensor.

3.4 Sensor Emulator

The tester can emulate most CMC sensors. Sensors that can have multiplexed output modes such as the mTS017 and mVM001 will only be emulated as single mode devices. The mTC001 and mTC002 Thermocouple converters cannot be emulated. To emulate a sensor follow these steps:

1. Select "**Emulate Sensor**" from the main menu;
2. The display will indicate:

Connect sensor **to emulate**

3. Once connected, the display will indicate the serial number of the sensor being emulated;

166- 0-188- 58 **230- 0- 17- 52**

4. After displaying the serial number the display will indicate;

Connect tester **To bus**

5. Connect the tester to the bus using the supplied cable;
6. The display will now indicate the type of sensor being emulated and the value being sent to the host system;

mTS011
0.0 C 32.0 F

7. The "**UP**" and "**DOWN**" keys can be used to change the value. The range of values that can be emulated are dependent on the sensor. Negative values are permitted for some sensors. If the sensor cannot be emulated the display will show;

Sensor cannot
be emulated

8. The "**BACK**' key will terminate the emulation session. Disconnect the tester from the bus before ending an emulation session.

3.5 Sensor Config

The tester can configure the mTS017 Infrared Temperature Sensor and the mVM001 Vibration Sensor:

1. Select "**Sensor Config**" from the main menu;
2. The display will indicate:

Connect sensor **to configure**

3. Once connected, the display will indicate;

Wait getting **Serial number**

4. Once the serial number has been retrieved the display will momentarily indicate;

166- 0-188- 58 **230- 0- 17- 52**

5. After displaying the serial number the display will indicate;

Getting config **> > > > > > > > > > >**

6. Once the current configuration of the sensor has been read the display will show the values for the sensors configuration parameters. Use the "**UP**" and "**DOWN**" keys to select the sensor parameter;
7. To change a sensor parameter, first select the parameter using the "**UP**" and "**DOWN**" keys and then press the "**SELECT**" key. A left and right arrow will appear on the display indicating it is in change mode. Use the "**UP**" and "**DOWN**" keys to set the value and then press the "**SELECT**" key to confirm the value. The arrows will disappear when the value is confirmed;
8. To save the values to the sensor, use the "**DOWN**" key until the display indicates;

Save **Press Select**

9. Press the "**SELECT**" key to save the new values to the sensor. The display will indicate;

Saving config
> > > > > > > > > > >

10. Once the configuration has been saved the display will indicate;

Configuration
Saved

11. Press the "**BACK**" key to exit sensor configuration.

The parameters that can be configured are fully described in the Technical Manuals for the individual sensors.

3.6 Battery Gauge

The battery gauge function displays the remaining capacity of the batteries in percent.

Battery Meter
95 %

The tester uses 2 AA batteries that are located in a battery compartment in the rear of the tester. The tester will remain active even if the battery indicator drops to 0%. The sensor reading may not be accurate if the batteries are further discharged. Replace the batteries at 10% to ensure you have adequate battery power when the tester is needed.

3.7 Battery Gauge

The battery gauge function displays the remaining capacity of the batteries in percent.

Battery Meter
95 %

The tester uses 2 AA batteries that are located in a battery compartment in the rear of the tester. The tester will remain active even if the battery indicator drops to 0%. The sensor reading may not be accurate if the batteries are further discharged. Replace the batteries at 10% to ensure you have adequate battery power when the tester is needed.

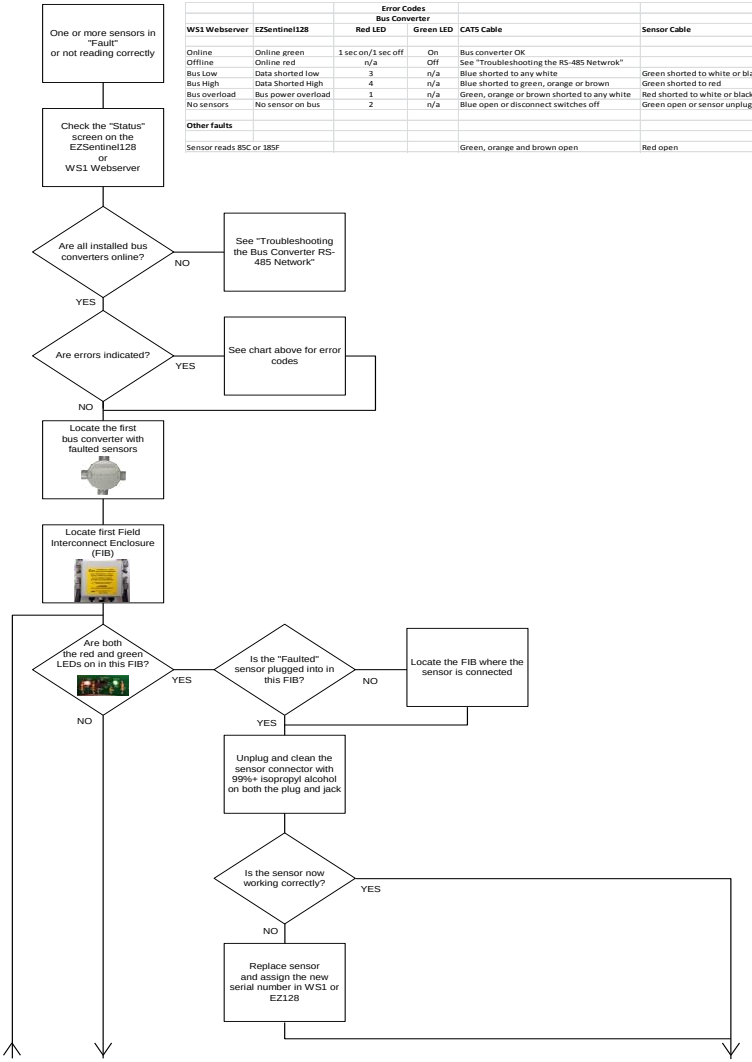
4. Troubleshooting Tips

The tester can only locate sensors that are faulted when they are connected to the tester. Sensors that are intermittent can be more difficult to locate. Here are some tips to assist you in locating problems:

1. Use the tester as soon as a fault occurs, as it is more likely the fault will be present when you connect the tester.
2. Some faults are caused when the sensor's cable becomes in contact with earth ground. This is especially possible with the temperature sensors that have metal housings. These faults can be very intermittent and are typically caused when the end of the cable is crimped against the end of the sensor tube during installation. If the cable is subject to movement from wind or other vibration sources it can wear through and short the cable to the metal tube. These faults can be located using the ground test on the sensor tester. You may have to move the conduit connection at the sensor to cause the fault.
3. In most cases, you do not need to use the tester to locate a bad sensor or wiring on the network. The basic branch isolation technique is the easiest and fastest way to locate the fault. The sensor test "**Bus Test**" can be deployed when a partially faulted sensor is disrupting the network intermittently. The "**Bus Test**" measures the signal levels on the cable system and reports if a sensor is loading the system. The traditional isolation techniques can then be used to locate the sensor that is loading the system. The sensor can then be verified using the "**Sensor Test**" function to confirm it is defective.
4. The "**Sensor Test**" function can also be used to verify sensors during the installation. It is especially useful for speed sensors where the sensors reading can be immediately compared to a handheld tachometer at the source.
5. The "**Bus Test**" function can also be used to verify that the expected serial numbers are being polled by a bus converter. Once a system is commissioned and the sensor located using the acquire function, the "**Bus Test**" function will display the sensors being polled by the bus converter. If a sensor is being polled but is not responding then the wiring to the sensor and the sensor itself should be verified.

A copy of the standard network troubleshooting guide is included with this manual. A full sized laminated version is available from our sales office on request.

5. Troubleshooting charts



		Error Codes			
		Bus Converter			
WS1 Webserver	**EZSentinel128**	**Red LED**	**Green LED**	**CAT5 Cable**	**Sensor Cable**
Online	Online green	1 sec on/1 sec off	On	Bus converter OK	
Offline	Online red	n/a	Off	See "Troubleshooting the RS-485 Netwrok"	
Bus Low	Data shorted low	3	n/a	Blue shorted to any white	Green shorted to white or black
Bus High	Data Shorted High	4	n/a	Blue shorted to green, orange or brown	Green shorted to red
Bus overload	Bus power overload	1	n/a	Green, orange or brown shorted to any white	Red shorted to white or black
No sensors	No sensor on bus	2	n/a	Blue open or disconnect switches off	Green open or sensor unplugged
Other faults					
Sensor reads 85C or 185F				Green, orange and brown open	Red open

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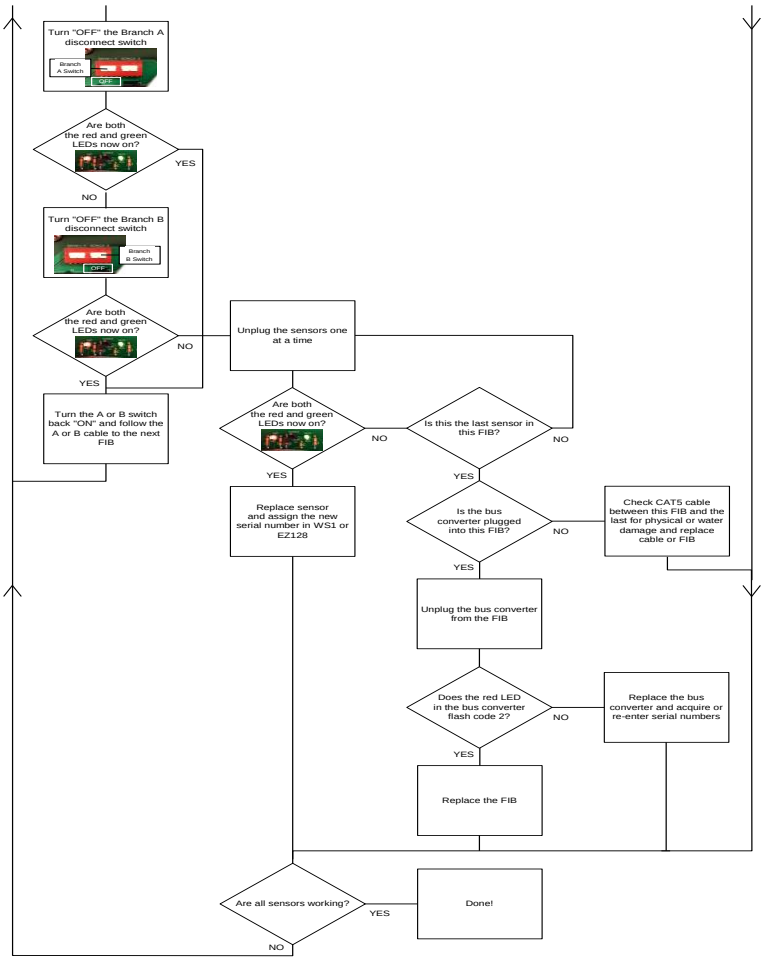
Turn "OFF" the Branch A disconnect switch
Branch A Switch
OFF
Are both the red and green LEDs now on?
YES
NO
Turn "OFF" the Branch B disconnect switch
Branch B Switch
OFF
Are both the red and green LEDs now on?
NO
YES
Unplug the sensors one at a time
Turn the A or B switch back "ON" and follow the A or B cable to the next FIB
Are both the red and green LEDs now on?
NO
YES
Is this the last sensor in this FIB?
NO
YES
Replace sensor and assign the new serial number in WS1 or EZ128
Is the bus converter plugged into this FIB?
NO
YES
Check CAT5 cable between this FIB and the last for physical or water damage and replace cable or FIB
Unplug the bus converter from the FIB
Does the red LED in the bus converter flash code 2?
NO
YES
Replace the bus converter and acquire or re-enter serial numbers
Replace the FIB
Are all sensors working?
YES
NO
Done!

FAQ's

- **What is the most common cause of "Faults"?**
  - Water ingress into the wiring or FIB's is the most common cause of "Faults".
- **Why are all the sensors on a bus converter "Faulted"?**
  - All of the sensors on a CMC Intrinsically Safe network are wired in parallel. A short circuit on one sensor can short the bus and "Fault" all of the sensors.
- **All of the sensors on a single bus converter are indicating intermittent "Faults" every once in a while?**
  - The bus may have a partial short circuit. Partial short circuits can occur after severe electrical storms or due to water ingress in the wiring. Follow the procedure in the flowchart but instead of observing the LED's, observe the voltage on the blue/white and green/white pairs. Both pairs should have 4-5VDC present, with the negative lead on the white wire and the positive lead on the colored wire.
  - You can make a test cable from an old sensor. Join the white and black wires together and measure between the white/black wires and the green (data) and red (power) wires. The test cable can be plugged into a spare jack in the FIB for testing.
  - As indicated in the flow chart, start at the first FIB after the bus converter and work outwards. If the voltages return to normal when the outbound cable(s) is disconnected using the disconnect switches, then the partial short is further down the network. If the voltages do not return to normal, disconnect the sensors one a time to locate the partial short.
- **A sensor reads +85°C or +185°F, what is wrong?**
  - The red wire in the sensor cable is open. Unplug the sensor and clean both the plug and jack with 99% Isopropyl Alcohol. Replace the sensor if the problem is not resolved.

6. Specifications

Description	Characteristic
Sensor bus	
Voltage	5 VDC
Current	5.0 mA max
Communications	CMC Intrinsically Safe Bus
Power Supply	
Battery	2 x AA
Environment	
Temperature	-20 to 50°C (-5 to 120°F)
Relative Humidity	5 to 95% non-condensing
Dimensions	
Length	140mm (5.5in)
Width	80mm (3.3in)
Depth 10°	25mm (1.0in)