



PT-Link II LON-3[®] Technical Guide

PT-Link II LON-3-G Code: SS9004 Version 1.0 and up
DDC Controller Code: SS9001 Version 1.0 and up



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WattMaster Form: DK-PTLNK3LON-TGD, Revision 01A
Daikin Part No.: DK-LON-TGD-01A
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1.1 Overview and System Requirements

Overview

The OE368-23-LON-3-G, PT-Link II LON-3-G, provides bi-directional communication with the DDC Controller.

***NOTE:** The PT-Link II LON device can be used to connect to only one DDC Controller. If more than one DDC Controller is present in a system, each one will require a PT-Link II LON-3 device for integration with a LON protocol network.

System Requirements

- The PT-Link II LON-3® interface is packaged and assembled as surface mount. Surface mount components are included for your convenience.
- Computer running Microsoft Windows™ operating system.
- Ethernet Crossover Cable (supplied).
- PT-Link LON software—included on the Daikin CD
- PrismD software—included on the Daikin CD

Data Sharing

The Daikin PT-Link II LON-3 Technical Guide provides the following data sharing capabilities:

- Provides values from points on the DDC Controller side of the gateway to LON® devices as if the values were originating from LON® objects.
- Allows LON® device to modify point values on the DDC Controller side of the PT-Link II LON® by using standard LON® write services.

Technical Support

Call 1-855-324-5461 (855-Daikin-1) to talk to a Daikin Technical Support Representative. Support is available Monday through Friday, 7:00 AM to 5:00 PM central standard time.

Hardware Specifications

Technical Data	
LON® Loop	TP/FT-10 (78 Kps)
Controller Loop	RS-485, 9600 Baud Rate
Network Protocol	LONWorks®
Protocol (WattMaster Loop)	HSI Open Protocol Token Passing
Power Input Voltage	24 VAC
Power Consumption	10 VA Maximum
Operating Temp	-30°F to 150°F
Operating Humidity	90% RH Non-Condensing
Weight	4.7 oz.

Table 1: PT-Link II LON-3® Interface Technical Data

2. QUICK PT-LINK SET-UP

2.1 Quick Start Guide

The following steps are a quick means to get the PT-Link II LON-3 operational for many simple installations. This quick start depends on the ability of the front end to accurately and successfully obtain the required information directly over the LON connection. If the front end cannot successfully do this, it will be necessary to manually obtain an XIF file from the PT-Link as described in the next section and then to manually commission the PT-Link II LON-3 device.

1. Familiarize yourself with the PT-Link II components (**Figure 1**).
2. Remove the Commlink jumpers on the top left corner of the DDC Controller or it will not be able to communicate with the PT-Link gateway.
3. Connect your PT-Link II LON-3 to the DDC Controller on your system (only one) and connect your PT-Link II to the LON Network (**Figure 2, page 6**). Note that nothing should
4. Power up the PT-Link II LON-3 with an appropriately sized isolated 24VAC power (Note that the DDC Controller should already be powered up and running). Do not use the same power for both the PT-Link and the DDC Controller, improper wiring of these two devices on the same power source will cause damage to both the PT-Link and the DDC Controller as they do not have isolated communications.
5. Allow at least 3 minutes for the PT-Link II LON-3 to learn internally all its information and prepare the data tables; after this point, use the learning capabilities of your front end to discovery the PT-Link device on the LON network and subsequently to discover the points provided by the PT-Link gateway.

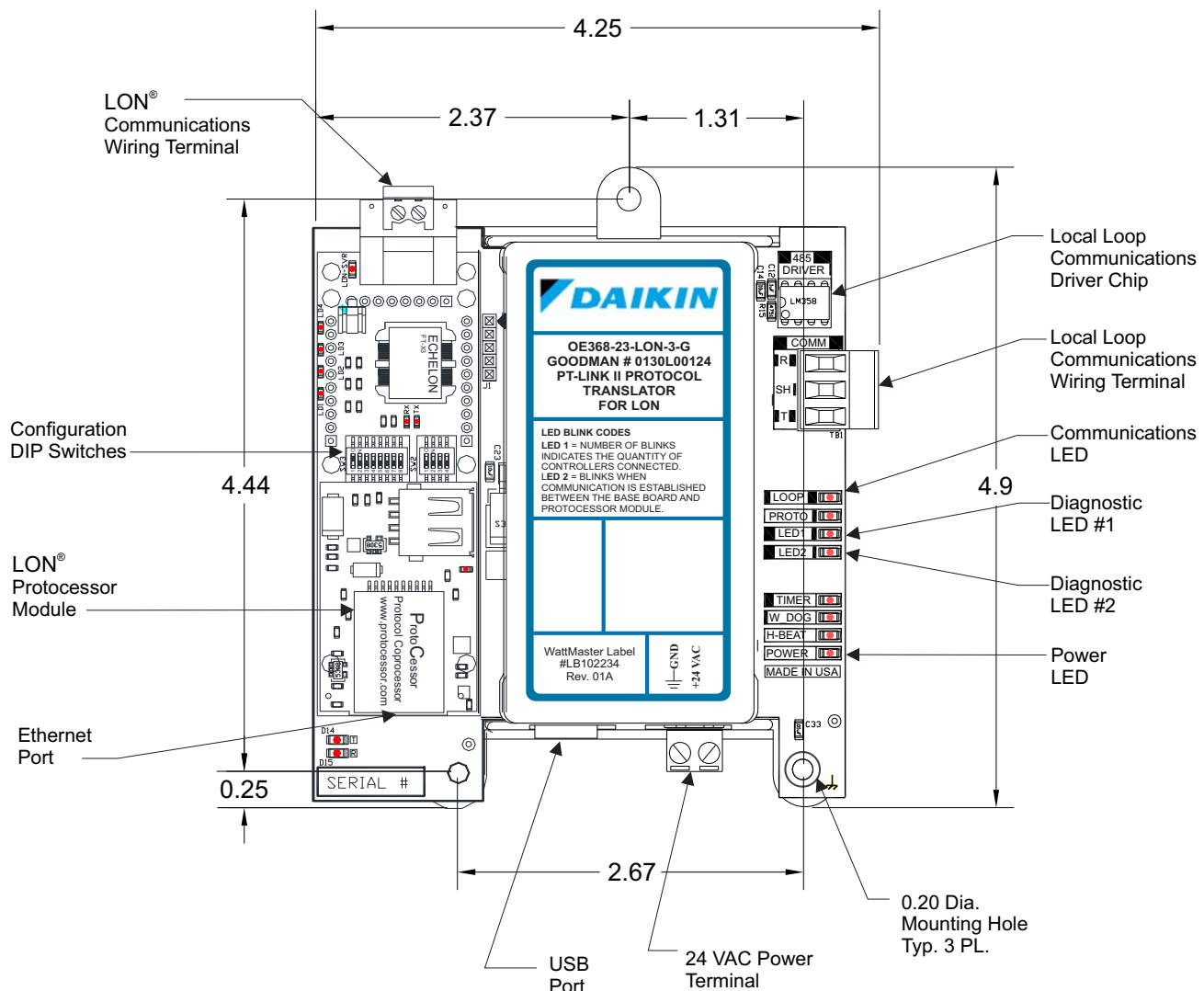


Figure 1: PT-Link II LON-3® Dimensions and Components

2. QUICK PT-LINK SET-UP

2.2 Connection and Wiring Information

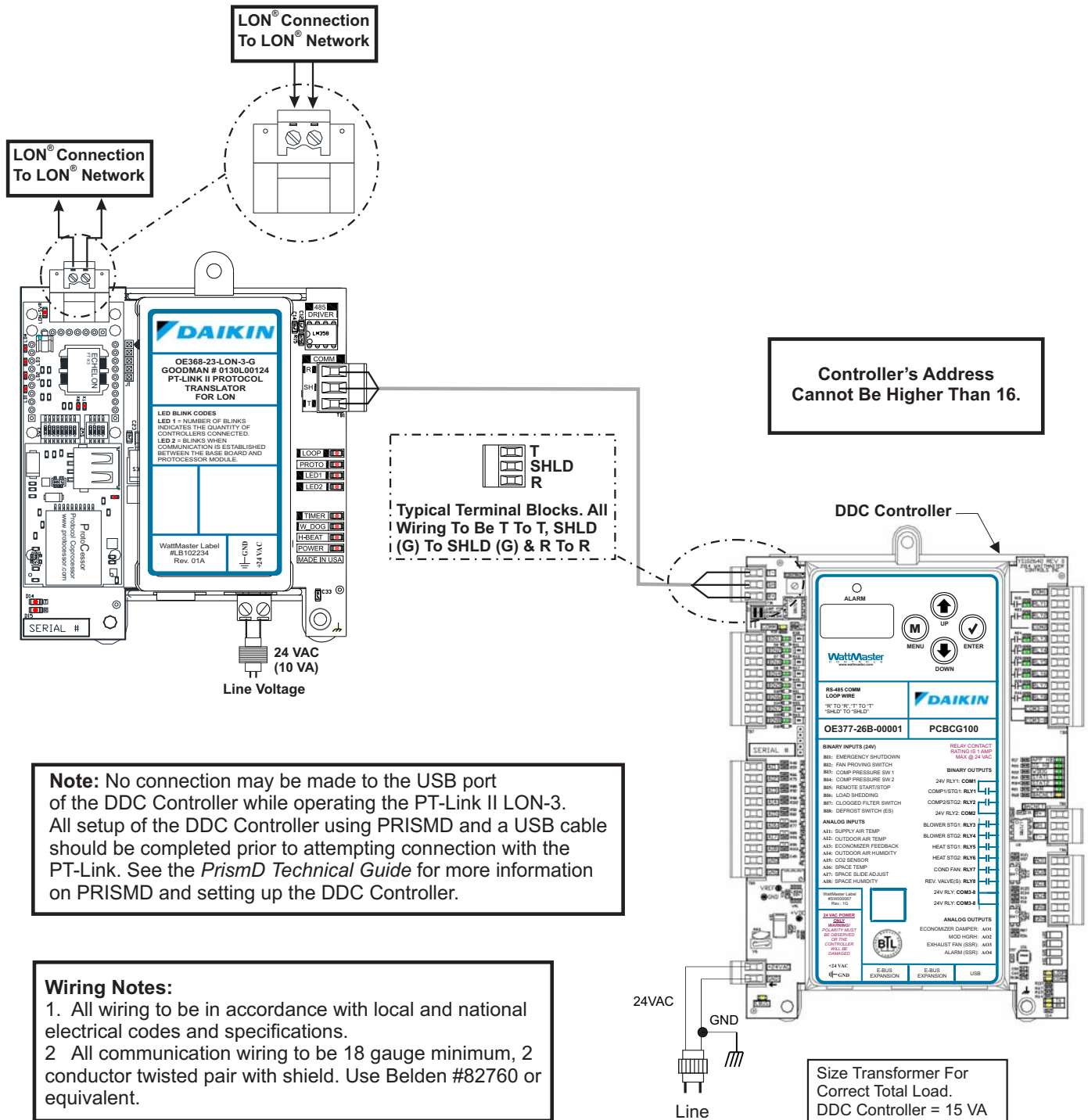


Figure 2: PT-Link II LON-3® Interface Wiring

3. PT-LINK CONFIGURATION

3.1 Obtaining the External Interface File

The External Interface File (XIF) is used in various forms by many front-end systems for off-line commissioning and situations where the front end cannot properly obtain the necessary information directly from the PT-Link. This information file is generated automatically by the PT-Link II LON-3 module on startup and is accessible through the Ethernet interface of the Fieldserver module on the PT-Link.

1. The FieldServer module resides at IP address 192.168.1.24. It is necessary that the PC which is to communicate with the FieldServer module be configured on the same effective IP network as the FieldServer module. Refer to **Section 6.2, page 17** for information on configuring a Windows™ computer for this network.
2. With the PC attached to the FieldServer module via Ethernet (refer to **Figure 28, page 16** for instructions), open a browser window and in the address bar *type* the address below and *press* <Enter>:
3. Use the edit menu <Select All> function or *press* <CTRL + A> to select everything in the browser window and then use the edit menu <Copy> function or *press* <CTRL + C> to copy the contents.
4. *Open* Notepad and use the edit menu <Paste> or *press* <CTRL + V> to paste the entire file information into Notepad.
5. Using the file menu, do a <Save As> and give the new file the name “fserver.xif” (without the enclosing parenthesis).
6. Use this new fserver.xif file directly with your front end or modify as necessary for your given front end and complete the off-line commissioning.

192.168.1.24/fserver.xif

The browser window will now show the entire generated XIF file starting with “File: fserver.xif....”.

4.1 Updating the PT-Link II Controller with PrismD

The PT-Link II is equipped with the ability to update its software with the use of a computer. You will need the following before you begin:

- PT-Link II in need of an update (powered up, no other connections necessary)
- Computer running Microsoft Windows™ operating system
- PrismD software from www.daikin.wattmaster.com
- Latest version of PT-Link II software and software sheet (e-mailed from Daikin technical support staff)
- USB Driver Setup.exe file from Daikin CD or downloaded from www.daikin.wattmaster.com
- USB cable

Follow these simple steps to update the PT-Link II:

1. Turn on your computer and download the latest PrismD software from www.daikin.wattmaster.com
2. Download and unzip the PT-Link II update file from the e-mail you received from Tech Support. Record the path and name of the file for later use. You will need to know where the file is located for **Step 15**. Also, print the software sheet provided for future reference. NOTE: You must unzip the file in order for Prism to recognize the hex file.
3. Run the USB Driver Setup.exe file (found on the Daikin CD or downloaded from www.daikin.wattmaster.com) so that Prism can communicate to the PT Link II. Unzip the file to the directory where you saved your PT-Link II software.
4. Plug the USB cable into the computer's and PT-Link II's USB ports.
5. A message will pop-up from the lower menu bar of Windows that reads, "Found New Hardware." Click on this message and follow the instructions that appear to install the USB drivers.
6. Open PrismD and Login with the User Name, **admin** and the Password, **admin**. If successful, "Administrator Access" will appear at the lower right of the Prism program.
7. Click on the <Job-Site> icon. The *Job-Sites Window* will appear. In the *Network Configuration Box*, select "Single Loop."

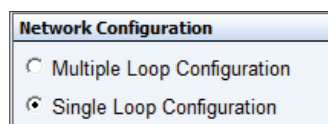


Figure 3: Network Configuration Window

8. In the *Job-Sites Window*, from the Serial Port drop down list, select the correct COM port. If you don't know the COM port number, follow the directions on **page 8**.

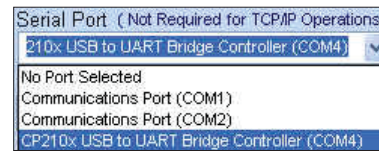


Figure 4: Serial Port Drop Down Menu

9. From PrismD's Communications tab, select "Flash Controller."

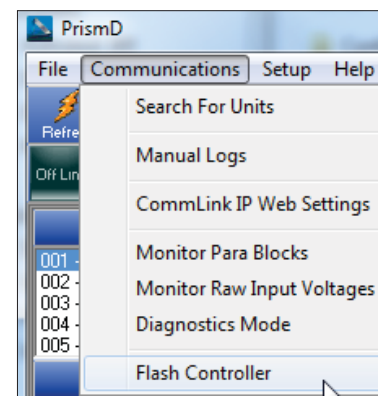


Figure 5: Communications Menu

10. The *Flash Controllers Window* will appear.

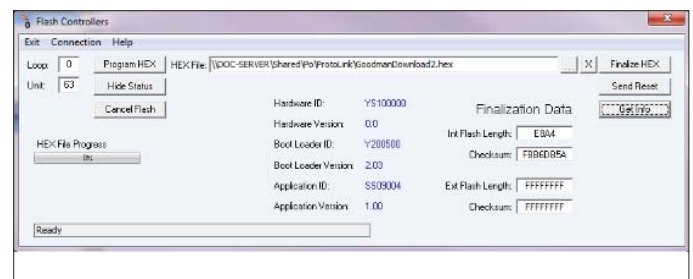


Figure 6: Flash Controllers Window

11. From the *Flash Controller Window's* Connection tab, select "Direct". Keep the *Flash Controller Window* open.



Figure 7: Direct Connection

4. UPDATING THE SOFTWARE

4.1 Updating the PT-Link II Controller

12. In the *Flash Controller Window's* Loop and Unit fields, type 0 for the Loop and 63 for the Unit, and then press <ENTER>.

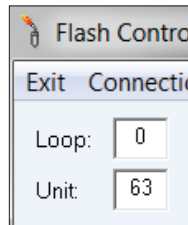


Figure 8: Loop and Unit Boxes

13. Cycle power to the PT-Link II and within 5 seconds, click the <Get Info> button in the *Flash Controller Window*. The PT-Link II information will now appear in the window under the <Get Info> button.



Figure 9: Get Info

14. The Application ID should be SS09004 and the Application Version should be a lower version than the one you will be updating to.
15. In the HEX File field, enter the path and name of the HEX file you downloaded and/or copied to your hard drive. Use the Browse button (...) to the right of the field if you need help in locating the file.



Figure 10: HEX File Field

16. Now, cycle power to the PT-Link II once again and within 5 seconds click on the <Program HEX> button (shown above). If successful, you should see the Progress Application HEX bar showing the progress percentage.

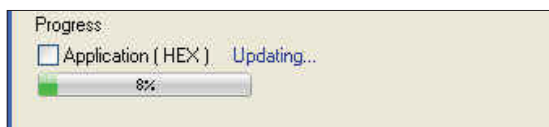


Figure 11: HEX File Updating

17. When the bar shows 100% completed, verify the PT-Link II's software is running by observing the Timer LED blinking.
18. Verify the PT-Link II's Application Version by once again cycling power to the PT-Link II and within 5 seconds clicking the <Get Info> button.
19. Verify that the Application ID still shows SS09004 and the Application Version shows the correct version number for the version just loaded.

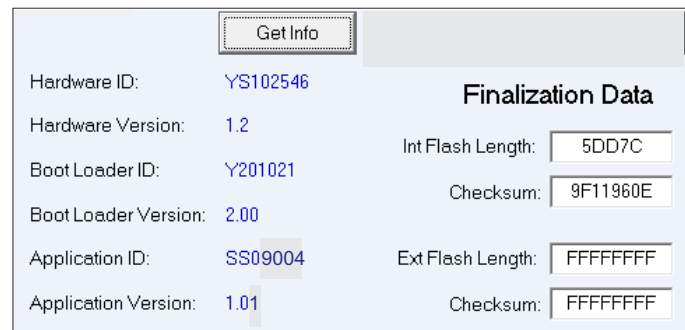


Figure 12: Application ID and Version Verification

Finding What COM Port Number the PT-Link II is Using (Windows® 7)



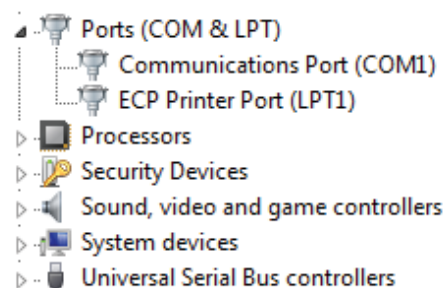
1. Left-click on <Start>, located on the bottom left of the Windows Tool Bar.

2. Select <Control Panel>.

3. Left-click on <Device Manager>.



4. Click on <Ports> to see all of the common ports.



4.2 Updating the Field Server Software

1. Install the FieldServer Toolbox. Follow instructions on **page 19**.
2. Extract and save the update file you receive from Field Server onto your PC.
3. Open your web browser, and type the IP Address of the PT-Link, which defaults to <192.168.1.24>, and press <ENTER>. The GUI will launch. Click <Diagnostic and Debugging>. The Main Screen will appear. See **Figure 13**.
- 4.) Refer to the *File Transfer Window* below (**Figure 15**). In the *General Tab*, click <Browse> and locate the file you saved in Step 1. Then click on <Submit>. When the download is complete, click on the <System Restart> button.

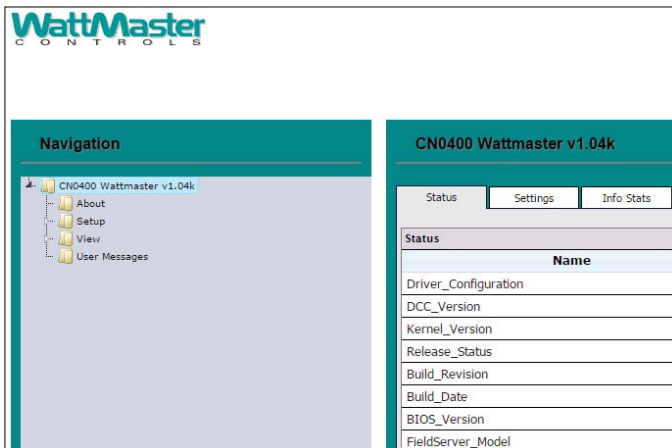


Figure 13: The FS-GUI Main Screen

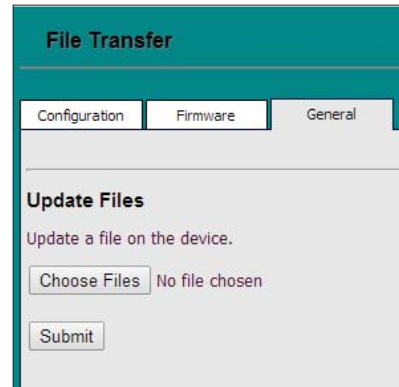


Figure 15: File Transfer - General Tab

4. In the *Navigation Window* on the left of the FS-GUI Screen, click <Setup> and then click <File Transfer>. See **Figure 14**.

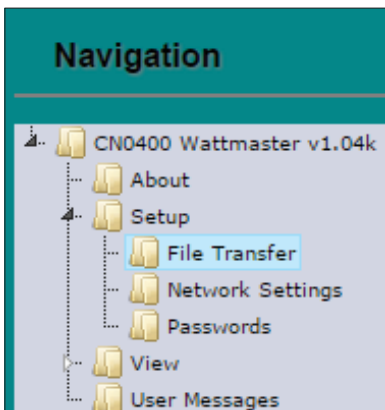


Figure 14: Navigation Window - File Transfer

5. TROUBLESHOOTING

5.1 Overview

5.1 Troubleshooting Overview

5.1.1 Check that the PT-Link is operating normally

Observe the LEDs on the PT-Link base board (refer to **Section 5.2 PT-Link Module LEDs** for more details). In normal operation, the TIMER LED should be flashing at a fast rate, the H-BEAT LED should be flashing at a slow rate, and the W-DOG and POWER LEDs should be on solid. If any of these are not operating as indicated, refer to the appropriate LED in **Section 5.2 PT-Link Module LEDs** for more details and actions, including possibly cycling power to the board.

5.1.2 Check that the DDC Controller is operating normally

Observe the LEDs on the attached DDC Controller (see **Figure 16**). In normal operation, the BACNET and COM HB LEDs should be flashing at a fast rate, the APP HB and OS HB LEDs should be flashing at a moderate rate, the W-DOG and PWR LEDs should be on solid, and the STAT 1 and STAT 2 LEDs should be off. If any of these are not operating as indicated, refer to the *DDC Controller Technical Guide* for more details and actions, including possibly cycling power to the board.

5.1.3 Check that the DDC Controller and the PT-Link are communicating

Observe the LEDs on the PT-Link base board (refer to **Section 5.2 PT-Link Module LEDs** for more details). In normal communications, LED 1 should be pulsing on and off once every 5 seconds and the LOOP LED should be somewhat dimmer but should be toggling between two distinct brightness levels. As well, on the DDC Controller, the COMM LED located adjacent to the COM connector should be flashing on and off (see **Figure 16**). If any of these LEDs are not functioning properly:

- Check that the communications cable between the DDC Controller and the PT-Link is present and that no wires have been pulled from it.
- Check that the wiring is correct, T-T, R-R and SH-SH, and that SH is the shield or drain wire from the interconnecting cable.
- Note that if the LOOP LED on the PT-Link board is varying between 4 distinct brightness levels, it indicates the PT-Link and the DDC Controller have never communicated successfully. If it is a solid single brightness, it indicates the PT-Link and the DDC Controller have successfully communicated since the last time both were powered on and now cannot communicate. This latter condition could indicate a hardware failure on one of the two boards.

5.1.4 Check that the PT-Link base board is communicating with the FieldServer module

Observe the LEDs on the PT-Link base board. In normal operation, LED 2 should be slowly flashing on and off, indicating the base board is successfully communicating with the FieldServer module. If this LED is not flashing, check the various LED operations as indicated in **Section 5.2 PT-Link Module LEDs**.

5.1.5 Check that the FieldServer module is communicating on the LON network

Refer to **Section 5.2 PT-Link Module LEDs** for the specific location and operation of the module LEDs.

5.1.6 Troubleshoot configuration and communications

If all prior checks are good and communications is still failing, follow **Section 5.3 Verifying Communications** to verify communications within the PT-Link, and if necessary, follow the directions in **Section 5.4 Viewing Diagnostic Information** to view and capture information about the internal operations of the ProtoCessor module on the PT-Link.

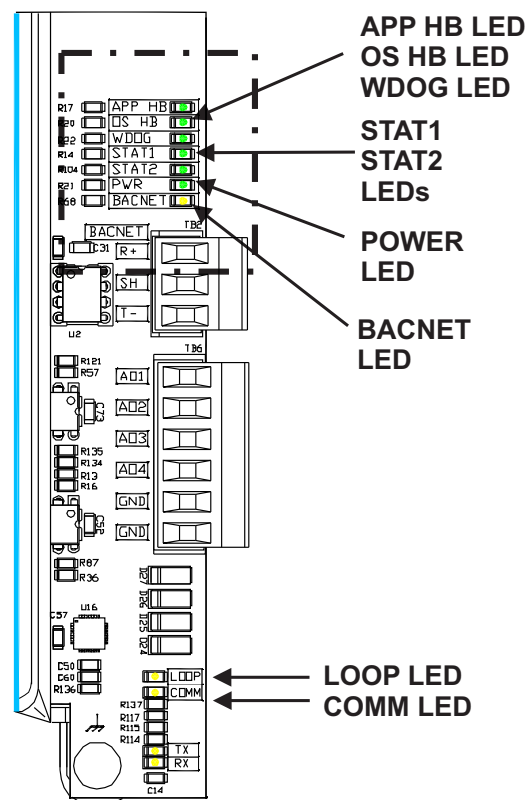


Figure 16: DDC Controller LED Locations

PT-Link II Board LEDs

The PT-Link II LON-3® is equipped with LEDs that can be used for troubleshooting. There are eight LEDs on the PT-Link board. See **Figure 17** for the locations of the LEDs on the PT-Link board. The LED descriptions and functions are listed in the following paragraphs.

POWER LED

When the PT-Link II LON-3® is powered up, the **“POWER”** LED should light up and stay on continuously. If it does not light up, check to be sure that you have 24 VAC connected to the board, that the wiring connections are tight, and that they are wired for correct polarity. The 24 VAC power must be connected so that all ground wires remain common. If after making all these checks the **“POWER”** LED still does not light up, please call 1-855-324-5461 (855-Daikin-1) to talk to a Daikin Technical Support Representative.

LOOP LED

When power is applied to the PT-Link II LON-3®, the **“LOOP”** LED will light up with 4 different levels of brightness as it tries different baud rates until it identifies the correct baud rate. When the DDC controller is connected, the LED will turn off and on in brightness. Once the connection is established, the LED will stay lit to indicate communications to the DDC controller. If the **“LOOP”** LED does not operate as indicated above, first power down the unit and then reapply power. If this does not work, please call 1-855-324-5461 (855-Daikin-1) to talk to a Daikin Technical Support Representative.

LED 1

When power is first applied, **“LED 1”** will be off temporarily and then will blink one time for each controller it is communicating with. For example, if you have 4 controllers on the loop connected to the PT-Link, **“LED 1”** will blink 4 times. If the amount of blinks does not match the number of controllers connected to the loop, it indicates there is a communications problem. The best way to find out which board is not communicating is to go to each controller and look at its **“COMM”** LED. The **“COMM”** LED should be solid and will flicker occasionally indicating communication with the PT-Link II LON-3®. If the **“COMM”** LED does not flicker, there is no communication with that controller.

LED 2

When power is first applied, **“LED 2”** will be off temporarily and then will blink slowly indicating that the PT-Link baseboard is communicating with the ProtoCessor Module. If **“LED 2”** does not blink, check that the ProtoCessor Module is installed correctly on the PT-Link baseboard and that the **“PWR”** LED is lit up on the ProtoCessor Module.

PROTO LED

When the PT-Link II is first powered up, the **“PROTO”** LED should blink rapidly and may appear to be on solid. This LED verifies communication with the board and the ProtoCessor. If the LED doesn't light up, check that the ProtoCessor is installed correctly and firmly connected to the Base Board. The **“PWR”** LED should also be lit on the ProtoCessor Module.

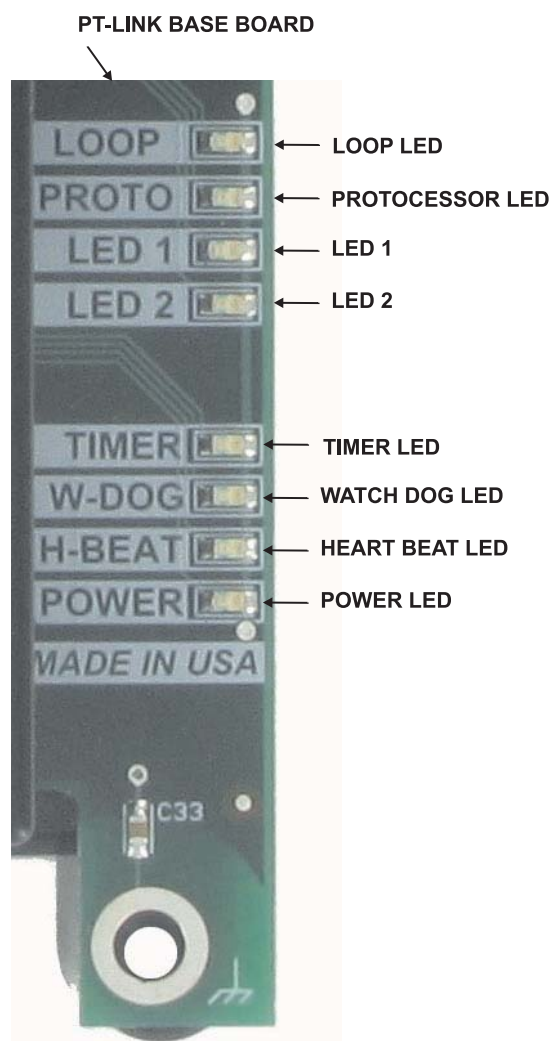


Figure 17: PT-Link II LON-3® LED Locations

TIMER LED

The **“TIMER”** LED is used for troubleshooting by WattMaster Controls Technical Support. The **“TIMER”** LED should always be blinking steadily.

WATCH DOG LED

The **“W-DOG”** LED is used for troubleshooting by WattMaster Controls Technical Support. The **“W-DOG”** LED should always be on solid.

HEARTBEAT LED

The **“H-BEAT”** LED blinks to show the PT-Link II board software is running. If the LED doesn't light up, and all other checks have been made, please call 1-855-324-5461 (855-Daikin-1) to talk to a Daikin Technical Support Representative.

5. TROUBLESHOOTING

5.2 Troubleshooting LEDs

PT-Link Module LEDs

Refer to **Figure 18** for LED locations.

PWR LED

When the PT-Link II is first powered up, the “**PWR**” green LED should light up and stay on continuously. If the LED doesn’t light up, check that the ProtoCessor is installed correctly and firmly connected to the Base Board.

LON LED

Once the unit is powered up, the “**LON**” LED will blink continuously until the PT-Link II has been commissioned. Once commissioned, the “**LON**” LED will remain off.

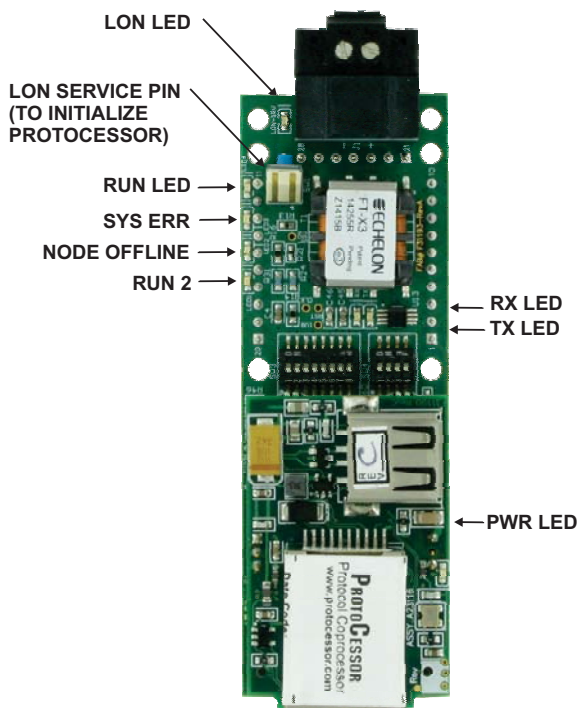


Figure 18: PT-Link II LON-3® LED Locations

RX & TX LEDs

During normal operation, the “**RX**” LED will flash when a message is received on the field port of the ProtoCessor and the “**TX**” LED will flash when a message is sent on the field port of the ProtoCessor. The “**TX**” and “**RX**” LEDs work together to indicate that communication is being established with the desired protocol network. If both LEDs are blinking, then communication is working properly. If not, check the protocol network wiring and the baud rate in the configuration file.

RUN LED

Upon powerup, the “**RUN**” LED should light up and stay solid for 15 seconds. It should then blink steadily, signifying normal operation. The ProtoCessor will be able to access RUINET once this LED starts flashing.

RUN2 LED

The “**RUN2**” LED should blink steadily after power up, signifying normal operation. The ProtoCessor will be able to access RUINET once this LED starts flashing.

SYS ERR LED

The “**SYS ERR**” LED will go on solid 15 seconds after power up and then shut off. A steady red light will indicate there is a system error on the ProtoCessor. If this occurs, immediately report the related “system error” shown in the error screen of the Remote User Interface to FieldServer Technologies for evaluation.

NODE OFFLINE LED

The “**NODE OFFLINE**” amber LED will go on solid 15 seconds after power up and then shut off. A steady amber light indicates the ProtoCessor is not communicating with a device that it is polling.

NOTE: If all of these tests are made and the controller still doesn’t operate, please call 1-855-324-5461 (855-Daikin-1) to talk to a Daikin Technical Support Representative.

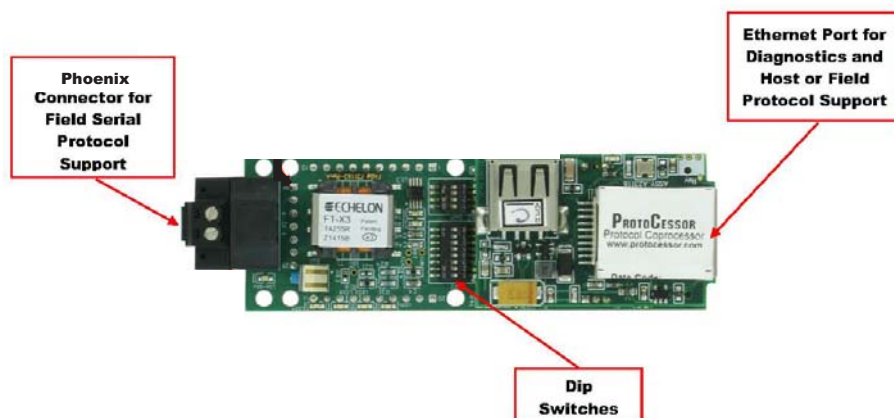


Figure 19: PT-Link II LON-3® Components

5.3 Verifying Communications & Viewing Diagnostic Information

5.3 Verifying Communications

1. Refer to **page 19** for instructions on installing the FieldServer Toolbox and accessing the FieldServer Graphical User Interface (FS-GUI).
2. In the *Navigation Window* on the left of the *FS-GUI Main Screen*, click <View> and then click <Data Arrays>. See **Figure 20**.

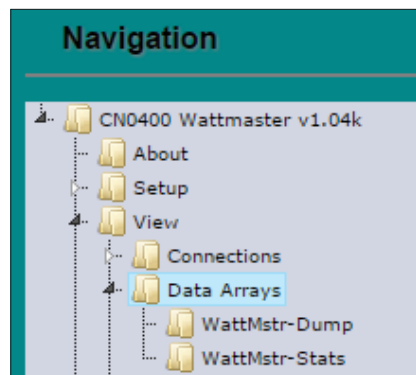


Figure 20: Navigation Window - View Data Arrays

3. Click on the Controller name. In this case, it is DA_C160_I0, a DDC Controller. The Controller's Data Array Table will display. See **Figure 20**.

Data Array						
Offset	0	1	2	3	4	5
0	1.100000	106.000000	41.000000	1.000000	1.000000	-255.000000
10	0.000000	0.000000	0.000000	0.000000	0.000000	74.000000
20	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
30	0.000000	1.000000	1.000000	0.000000	0.000000	0.000000
40	0.000000	1.000000	0.000000	0.000000	0.000000	1.000000
50	0.000000	0.000000	0.000000	1.000000	3.000000	0.000000
60	1.000000	5.000000	3.000000	3.000000	1.000000	2.000000
70	74.000000	68.000000	1.000000	5.000000	5.000000	0.000000
80	60.000000	55.000000	120.000000	5.000000	5.000000	170.000000
90	20.000000	50.000000	70.000000	30.000000	65.000000	50.000000
100	900.000000	0.000000	0.000000	0.000000	0.000000	0.000000

Figure 21: DDC Data Array Table

4. You can verify communications by verifying data within the fields. For example, the first field displays the current version, in this case 1.10.

5.4 Viewing Diagnostic Information

1. Type the IP address of the PT-Link into your web browser or use the FieldServer Toolbox to connect to the PT-Link
2. Click on <Diagnostics and Debugging> then click on <View>, and then click on <Connections>. See **Figure 22**.
3. If there are any errors showing in the *Connections Window*, please refer to the next section **Diagnostic Capture**.

Connections						
Overview						
Connections						
Index	Name	Tx Msg	Rx Msg	Tx Char	Rx Char	Errors
0	R2 - PCP-WMST	12,139,181	12,139,180	95,964,580	93,009,282	0
1	R1 - BACnet_MSTP	1	0	14	0	0

Figure 22: Connections Window

5. TROUBLESHOOTING

5.5 FieldServer Diagnostic Utilities

5.5 Diagnostic Capture Procedures

1. Once the Diagnostic Capture is complete, email it to mail@wattmaster.com with the subject line "PT-Link LON Diagnostic Capture". The Diagnostic Capture will allow us to rapidly diagnose the problem.
2. Ensure that FieldServer Toolbox is Loaded on the PC that is currently being used, or download FieldServer-Toolbox.zip at <http://sierramonitor.com/customer-care/resource-center>
3. Extract the executable file and complete the installation.
4. Disable any wireless Ethernet adapters on the PC/Laptop. See **Figure 23**.
5. Disable firewall and virus protection software if possible.
6. Connect a standard Cat 5 Ethernet cable between the PC and ProtoNode.
7. Double-click on the FS Toolbox Utility. Refer to **Figure 28, page 15** for Toolbox components.
8. Click on the diagnose icon  of the desired device. See **Figure 24**.
9. Select Full Diagnostic. See **Figure 25**.



Figure 23: Ethernet Port Location



Figure 25: Full Diagnostic

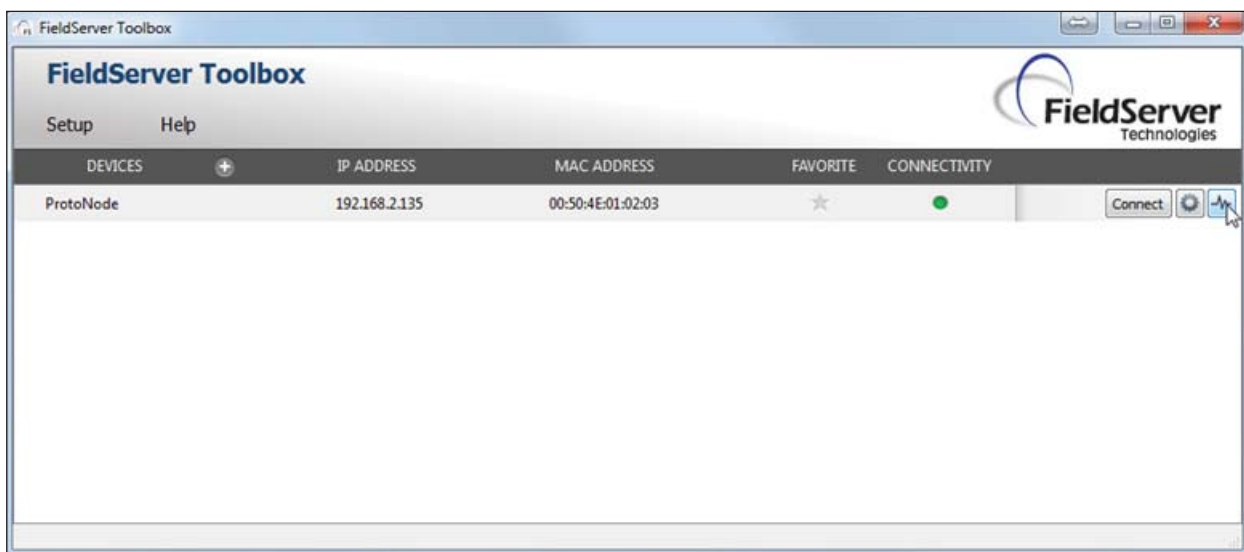


Figure 24: FieldServer Toolbox - Diagnostic Icon

10. If desired, the default capture period can be changed. See **Figure 26**.

11. Click on <Start Diagnostic>. **Figure 26**.



Figure 26: Set Capture Period and Start Diagnostic

12. Wait for the Capture period to finish. The *Diagnostic Test Complete Window* will appear. **Figure 27**.

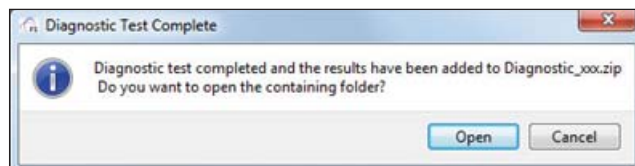
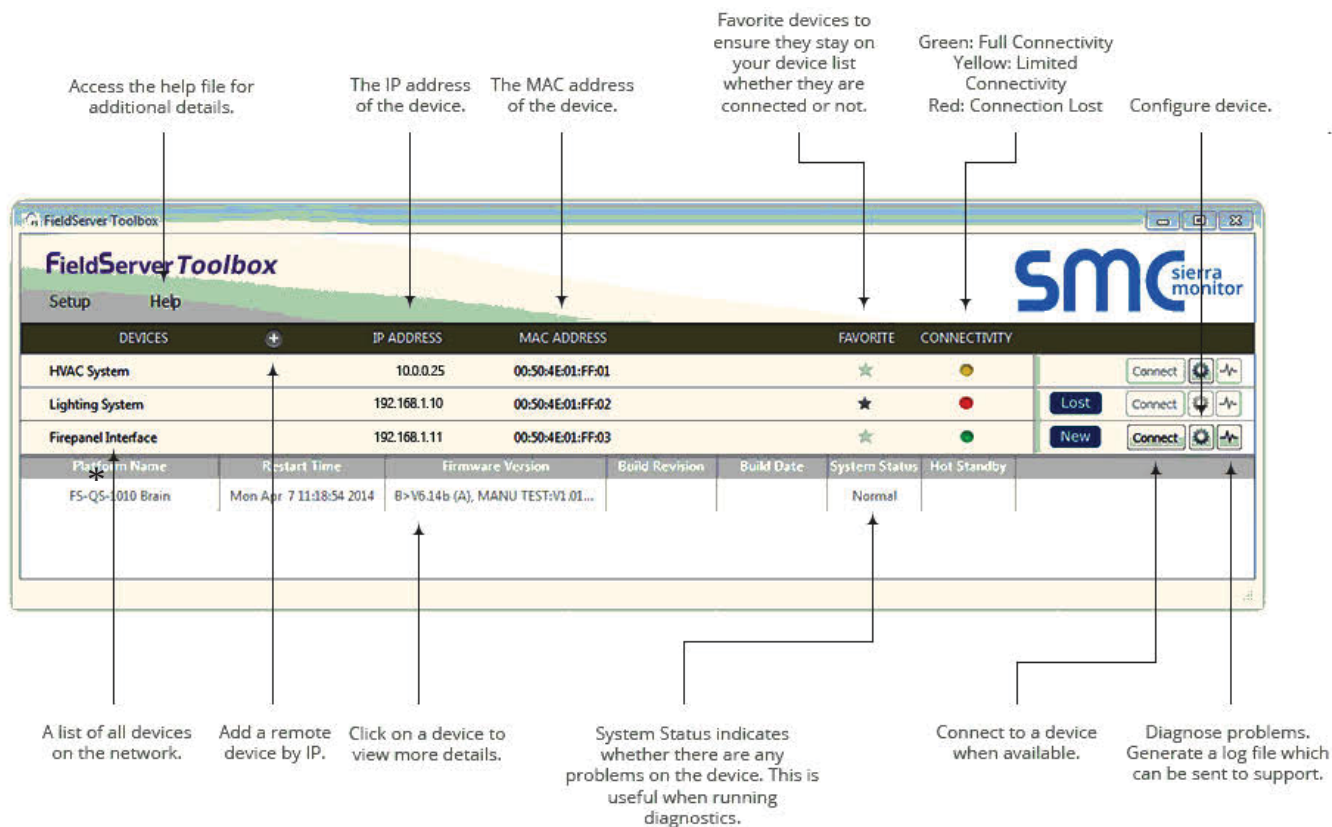


Figure 27: Diagnostic Test Complete Window

13. Once the Diagnostic test is complete, a .zip file will be saved on the PC.
14. Click <Open> in the *Diagnostic Test Complete Window* to launch explorer and have it point directly at the correct folder.
15. Send the Diagnostic zip file to mail@wattmaster.com with the subject line "PT-Link LON Diagnostic Capture".



* **Note:** Blue: Limited connectivity. You might have an older software version on the FieldServer processor. You would need to run the RUINET setup instead of using the FS-GUI interface.

Figure 28: FieldServer Toolbox Components

6. IP ADDRESS CONFIGURATION

6.1 PT-Link II Ethernet Connection

6.1 PT-Link II Hardware Connection

Additional setup of the PT-Link requires connection of the PT-Link to a computer. It is recommended (and required for some steps) that the FieldServer Toolbox (provided on the CD) be utilized with this connection. Follow these instructions to connect the PT-Link II to your PC via Ethernet:

1. Using the supplied Ethernet crossover cable or similar cable, connect the Ethernet port of the ProtoCessor on the PT-Link to the Ethernet port of your computer.
2. Power up the PT-Link by plugging in the power cable. The PT-Link may take up to three minutes to power up completely.
3. Once the PT-Link is powered up, you should notice that the green RUN LED on the ProtoCessor Board is blinking continuously. See **Figure 17, page 12** for a diagram showing the location of the ProtoCessor RUN LED.

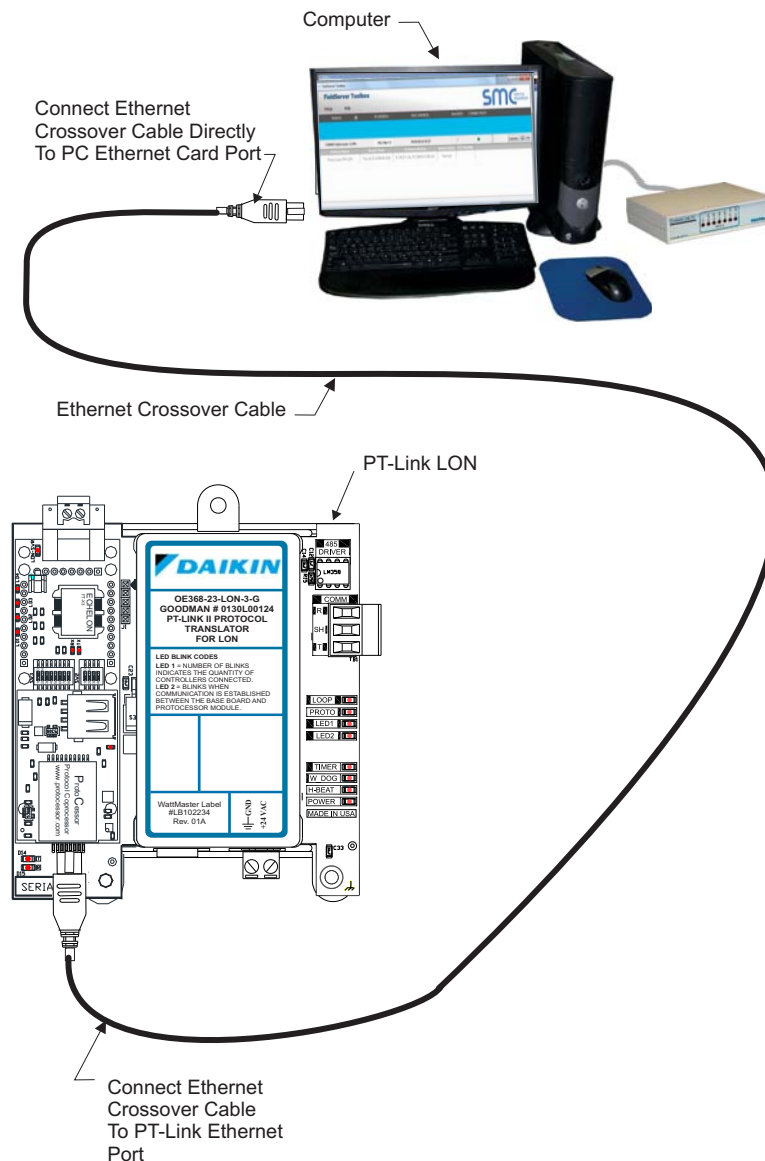


Figure 29: Connecting With Crossover Cable

6.2 Computer IP Address Set-up for Windows XP, Vista, 7, 8 & 10

PT-Link to PC communications requires that the PC be setup on the same default network as the PT-Link. The network the PT-Link is operating on can be change while in the PT-Link setup, but initially it is required that the PC be configured to the default network of the PT-Link. Follow the steps in the appropriate subsection to set your IP address to match the PT-Link default network.

NOTE: Consult your IT Specialist to ensure that your Firewall and anti-virus software are turned off before proceeding.

Computer IP Address Set-up for Windows XP

1. Click <start>; then click <Control Panel>.
2. Double-click on the **Network Connections** icon. The *Network Connections Window* will appear (**Figure 30**).

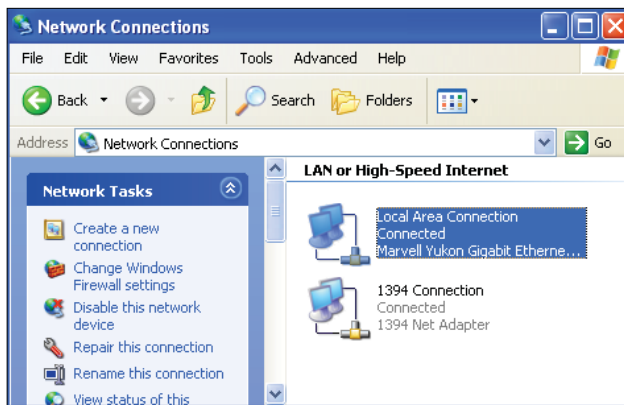


Figure 30: Network Connections Window

NOTE: If any wireless connections are listed, disable them by *right-clicking* the connection and *selecting* <Disable>.

3. In the *Network Connections Window*, double-click the **Local Area Connections** entry. The *Local Area Connection Status Window* will appear (**Figure 31**).

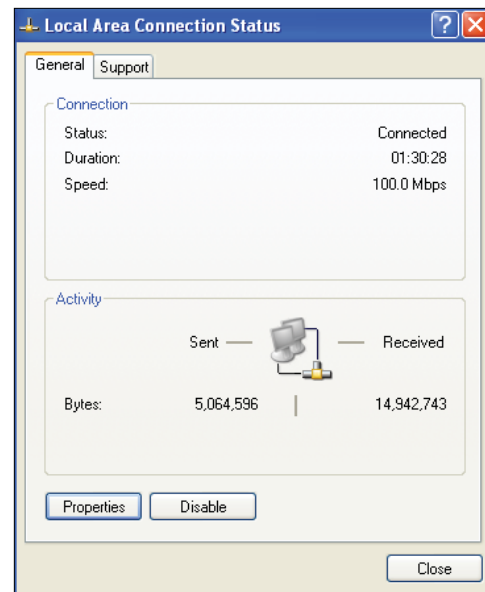


Figure 31: Local Area Connection Status Window

4. As shown in **Figure 32**, click <Properties> in the lower left of the window. The *Local Area Connection Properties Window* will appear.

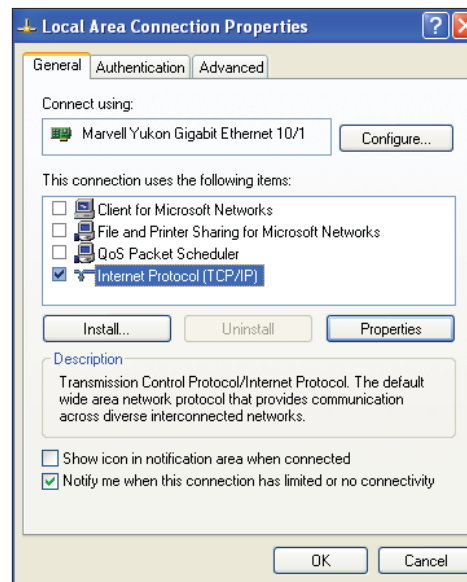


Figure 32: Local Area Connection Properties Window

5. As shown in **Figure 6**, in the Connection Items list box, be sure the **Internet Protocol (TCP/IP)** is checked. Select the **Internet Protocol (TCP/IP)** item to highlight it and then click <Properties>. The *Internet Protocol Properties Window* will appear.

6. IP ADDRESS CONFIGURATION

6.2 IP Address Configuration

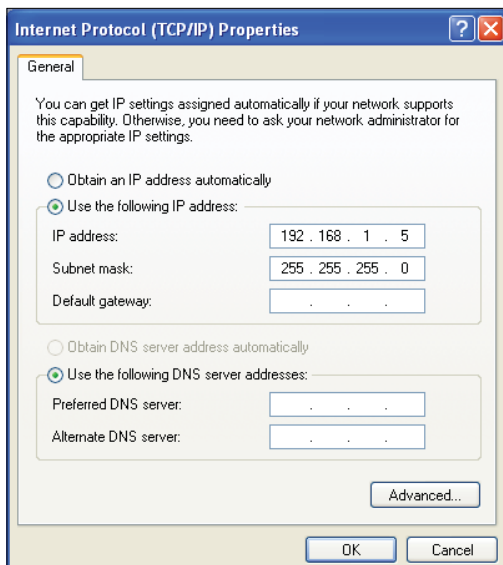


Figure 33: Internet Protocol Properties Window

6. Select the radio button in front of **Use the following IP address (Figure 33)** and write down the current defaults so that you can re-enter them when you finish configuring the PT-Link II and then type in the following information:
 - a. IP address 192.168.1.5
 - b. Subnet mask 255.255.255.0
 - c. Default Gateway is blank
7. Click <OK> until all of the above network configuration windows are closed. You may have to *reboot* the computer before the new values are valid.

Computer IP Address Set-up for Windows Vista, 7, 8 & 10

1. Click <start>; then click <Control Panel> (Vista & Windows 7). Click <start>; then right-click for <All apps>. Click <All apps> and then click <Control Panel> (Windows 8).
2. Click on the **Network and Internet** icon.
3. Click **Network and Sharing Center**.
4. From the shaded box in the left side of the window, select **Manage Network Connections** (Vista) or **Change adapter settings** (Windows 7).
5. Right-click on the **Local Area Connection** icon and select <Properties> for the drop down window.
6. Choose **Internet Protocol Version 4 (TCP/IPv4)** by highlighting it and then click <Properties>. The *Internet Protocol Properties Window* will appear (**Figure 7**).
7. Select the radio button in front of **Use the following IP address (Figure 33)** and write down the current defaults so that you can re-enter them when you finish configuring the PT-Link II and then type in the following information:
 - a. IP address 192.168.1.5
 - b. Subnet mask 255.255.255.0
 - c. Default Gateway is blank
8. Click <OK> until all of the above network configuration windows are closed. You may have to *reboot* the computer before the new values are valid.

7.1 Installing the FieldServer Toolbox

The PT-Link is configured using a Graphic User Interface (GUI) which is a password protected web browser-based interface that uses a combination of technologies and devices to provide a platform from which you can gather and process information. The GUI allows you to do the following:

- Check the status and diagnostics of the PT-Link, such as network settings, connection information, node information, map descriptors, and error messages
- Monitor the PT-Link's internal data and parameters
- Change or update the PT-Link's internal data and parameters
- Restart the PT-Link

The following items are needed to be able to run the GUI:

- PC Requirements—a computer with a web browser that connects over the Ethernet on port 80*
*NOTE: Computer and network firewalls must be opened for Port 80 to allow the GUI to function.
- Software Requirements—Mozilla Firefox 13.0 and up, Microsoft Internet Explorer 8 & 9**, Google Chrome 19.0 and up, Opera 11 and up, or Safari 4.1 and up **NOTE: Internet Explorer 8 does have some limitations in terms of graphical features. Some effects such as rounded corners and semi-opaque backgrounds are not supported. So, although technical functionality is operational, the looks might be slightly different

1. Refer to **Figure 29, page 16** for instructions on how to connect your PT-Link to your computer using an ethernet connection.
2. Locate the FieldServer Toolbox on Sierra Monitor's Customer Care site - <http://www.sierramonitor.com/customer-care/resource-center?filters=software-downloads>
3. Click on the *FieldServer Toolbox* to download it to your computer.
4. Unzip the file and install it onto your machine (you may use the default location on the C drive or another location.)

NOTE: Information on the Field Server interface can be found here: <http://www.sierramonitor.com/assets/blteb-3bef03a4864a1c/start-up-guide-fieldserver-toolbox-user-interface.pdf>

5. Once launched, the FieldServer Toolbox will automatically discover the attached PT-Link (this operation may take a minute). If the connected device does not display, review the section "IP Address Configuration" to make certain your PC is on the default network as required to communicate with the PT-Link. See **Figure 34**.

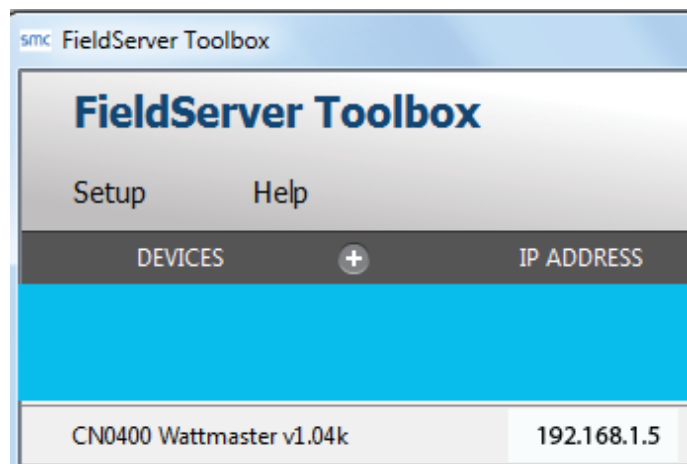


Figure 34: FieldServer Toolbox

6. To the right of the device entry are button options for "Connect", "Configure" and "Diagnose", all tools provided by the Toolbox. Click on the LON connection <Connect> button. See **Figure 35**.



Figure 35: Connect Button

8. PARAMETER TABLES

DDC LON Parameters

NOTE: Analog Outputs and Binary Outputs are read-only. Only Analog Inputs are read/writeable. You cannot write directly to Sensor Inputs.

NOTE: When a new setpoint is received from LON, it is maintained and used in temporary memory until the unit goes unoccupied. It is then stored in permanent memory and will become the new default setpoint even if power is cycled. Therefore, if power is cycled prior to the unit going unoccupied, the setpoint will not have been stored in permanent memory.

SNVTs for the DDC Controller				
Binary Output SNVTs are SNVT_lev_disc				
all other SNVTs are SNVT_count_inc_f				
Parameter	Name	Object	Description	Limits
Application Software Version	AppVer	Analog Output	Current version of the software in the unit.	
Controller ID#	CtrlID#	Analog Output	Controller Identification Number.	
Power Up Counts	PwrUpCnt	Analog Output	Number of times the board has been reset due to power loss.	
Schedule Mode	SchdMode	Analog Output	Current Occupied/Unoccupied Status.	See Schedule Mode Bits on page 26.
HVAC Mode	HVAC-Mode	Analog Output	Current operational status.	See HVAC Mode Bits on page 26.
Space Temperature	SpcTp	Analog Output	Current value of the Space Temperature Sensor.	
Slide Adjust	SlideAdj	Analog Output	Amount of Current Sensor Slide Offset	
Indoor Air Humidity	InRh	Analog Output	Current value of the Indoor Humidity Sensor.	
Supply Air Temperature	SaTp	Analog Output	Current value of the Supply Air Temperature Sensor.	
Outside Air Temperature	OaTp	Analog Output	Current value of the Outdoor Temperature Sensor.	
Outside Air Humidity	OaRh	Analog Output	Current value of the Outdoor Humidity Sensor.	

SNVTs for the DDC Controller				
Binary Output SNVTs are SNVT_lev_disc				
all other SNVTs are SNVT_count_inc_f				
Parameter	Name	Object	Description	Limits
Outside Air Dewpoint Temperature	OaDp	Analog Output	Current Calculated Outdoor Air Dewpoint Temperature.	
Outside Air Wetbulb Temperature	OaWb	Analog Output	Current calculated Outdoor Wetbulb Temperature.	
Title 24 Economizer Feedback	EcoFb	Analog Output	Current Feedback position from Economizer Actuator.	
Economizer Position	EcoPos	Analog Output	Current position signal to the Economizer Actuator.	
Calculated Space Cooling Setpoint	CaSpClSp	Analog Output	Current Space Cooling Setpoint calculated from the Cooling Setpoint, Slide Adjust Value, Unoccupied Setbacks, and Load Shed Status.	
Calculated Space Heating Setpoint	CaSpHtSp	Analog Output	Current Space Heating Setpoint calculated from the Heating Setpoint, Slide Adjust Value, Unoccupied Setbacks, and Load Shed Status.	
Outdoor Enthalpy	OaEnth	Analog Output	Current calculated Outdoor Air Enthalpy.	
Indoor CO ₂	InCO2	Analog Output	Current Indoor CO ₂ Level.	
Low Speed Blower Relay	LoSpdRly	Binary Output	Current status of the Low Speed Blower Relay.	0 = Off 1 = On
High Speed Blower Relay	HiSpdRly	Binary Output	Current status of the High Speed Blower Relay.	0 = Off 1 = On
Compressor 1 Relay	Cmp1Rly	Binary Output	Current status of Compressor 1 Relay on the DDC Main Board.	0 = Off 1 = On
Compressor 2 Relay	Cmp2Rly	Binary Output	Current status of Compressor 2 Relay on the DDC Main Board.	0 = Off 1 = On
Heat 1 Relay	Ht1Rly	Binary Output	Current status of Heat 1 Relay on the DDC Main Board.	0 = Off 1 = On

8. PARAMETER TABLES

DDC LON Parameters

SNVTs for the DDC Controller				
Binary Output SNVTs are SNVT_lev_disc				
all other SNVTs are SNVT_count_inc_f				
Parameter	Name	Object	Description	Limits
Heat 2 Relay	Ht2Rly	Binary Output	Current status of Heat 2 Relay on the DDC Main Board.	0 = Off 1 = On
Reversing Valve Relay	RvVlvRly	Binary Output	Current status of Reversing Valve Relay on the DDC Main Board.	0 = Off 1 = On
Condenser Fan Relay	CondRly	Binary Output	Current status of Condenser Fan Relay on the DDC Main Board.	0 = Off 1 = On
Exhaust Fan Enable Output	ExFanRly	Binary Output	Current status of Exhaust Fan Enable output voltage on the DDC Main Board.	0 = Off 1 = On
Alarm Output	AlmRly	Binary Output	Current status of Alarm output voltage on the DDC Main Board.	0 = Off 1 = On
Load Shed Status	LdShdSts	Binary Output	Status that indicates Load Shedding is active.	0 = Off 1 = On
Defrost Mode Status	DefSts	Binary Output	Status that indicates Defrost Mode is enabled.	0 = Off 1 = On
Cooling Enable Status	CmpEnSts	Binary Output	Status that indicates Cooling is enabled based on the Outdoor Temperature.	0 = Off 1 = On
Heating Enable Status	HtEnSts	Binary Output	Status that indicates Heating is enabled based on the Outdoor Temperature.	0 = Off 1 = On
Heat Pump Heat Enable Status	HpEnSts	Binary Output	Status that indicates Heat Pump Heat is enabled based on the Outdoor Temperature.	0 = Off 1 = On
Economizer Enable Status	EcoEnSts	Binary Output	Status that indicates Economizer is enabled based on the Economizer Enable Setpoint.	0 = Off 1 = On
Fan Proof of Flow Alarm	PoFAlm	Binary Output	Alarm that indicates an Airflow failure.	0 = Off 1 = On
Dirty Filter Alarm	FltrAlm	Binary Output	Alarm that indicates a dirty filter condition.	0 = Off 1 = On

SNVTs for the DDC Controller				
Binary Output SNVTs are SNVT_lev_disc				
all other SNVTs are SNVT_count_inc_f				
Parameter	Name	Object	Description	Limits
Emergency Shutdown Alarm	EShdnAlm	Binary Output	Alarm that indicates that Emergency Shutdown has been activated. Will shut the unit down.	0 = Off 1 = On
Pressure Switch 1 Alarm	Prs1Alm	Binary Output	Alarm that indicates Pressure Switch 1 is open. Compressor 1 will shut down.	0 = Off 1 = On
Pressure Switch 2 Alarm	Prs2Alm	Binary Output	Alarm that indicates Pressure Switch 2 is open. Compressor 2 will shut down.	0 = Off 1 = On
High Supply Air Temp Alarm	HiSatAlm	Binary Output	The Supply Air has risen above the Hi SAT Cutoff Setpoint. Heating stages begin to deactivate and the fan continues to run.	0 = Off 1 = On
Low Supply Air Temp Alarm	LoSatAlm	Binary Output	The Supply Air has fallen below the Low SAT Cutoff Setpoint. The unit will shut off including the Fan.	0 = Off 1 = On
Mechanical Cooling Alarm	MchClAlm	Binary Output	Cooling Outputs are energized but the Supply Air Temperature has not changed a user-adjustable amount in a user-adjustable time period.	0 = Off 1 = On
Mechanical Heating Alarm	MchHtAlm	Binary Output	Heating Outputs are energized but the Supply Air Temperature has not changed a user-adjustable amount in a user-adjustable time period.	0 = Off 1 = On
Space Temperature Alarm	SpcTpAlm	Binary Output	The Space Temperature has gone outside of the user-adjustable range for a user-adjustable amount of time.	0 = Off 1 = On

8. PARAMETER TABLES

DDC LON Parameters

SNVTs for the DDC Controller					
Binary Output SNVTs are SNVT_lev_disc					
all other SNVTs are SNVT_count_inc_f					
Parameter	Name	Object	Description	Limits	
Space Sensor Missing Alarm	SpSnsAlm	Binary Output	A Space Sensor is not detected.	0 = Off 1 = On	
Supply Air Sensor Missing Alarm	SaSnsAlm	Binary Output	A Supply Air Sensor is not detected.	0 = Off 1 = On	
Outdoor Air Sensor Missing Alarm	OaSnsAlm	Binary Output	An Outdoor Air Sensor is not detected.	0 = Off 1 = On	
Econo Not Economizing Alarm	Eco1Alm	Binary Output	Economizer is enabled but not following the desired Economizer position commanded.	0 = Off 1 = On	
Econo Economizing Alarm	Eco2Alm	Binary Output	Economizer is not be using for free cooling, but the feedback signal indicates a position more open than the minimum.	0 = Off 1 = On	
Econo Not Modulating Alarm	Eco3Alm	Binary Output	Economizer is being used for free cooling, but not within 10% of the desired position within 150 seconds.	0 = Off 1 = On	
Econo Excess Outdoor Air Alarm	Eco4Alm	Binary Output	Economizer feedback is lost or Economizer is not following commanded position.	0 = Off 1 = On	
Temp Scaled in Celsius	Celsius	Analog Input	Temperature Scale is in Celsius	0	1
Number of Heat Stages	HtStgCnt	Analog Input	Number of Heat Stages that are configured	0	2
Economizer Enable Source	EcoEnSrc	Analog Input	The economizer enable source: 0 = None, 1 = Drybulb, 2 = Dewpoint, 3 = Wetbulb	0	3
Economizer Configuration	EcoCfg	Analog Input	The economizer configuration: 0 = None, 1 = Standard, 2 = IAQ	0	2
Digital Space Sensor Installed	DigSpSns	Analog Input	An E-BUS Digital Room Sensor is configured and installed	0	1

SNVTs for the DDC Controller					
Binary Output SNVTs are SNVT_lev_disc					
all other SNVTs are SNVT_count_inc_f					
Parameter	Name	Object	Description	Limits	
Fan Auto Mode Configuration	FnAuto	Analog Input	Fan configuration 0 = Continuous Fan, 1 = Fan Cycles	0	1
Defrost Interval	DefInt	Analog Input	This is the amount of time between Defrost Cycles if the Defrost Switch is closed in the Heat Pump Heating Mode.	1	3
Compressor Stage Up Delay	CmpStgUp	Analog Input	This is the amount of time between compressors when the demand is high enough to run more than one stage of Cooling. It is also the time between the Economizer and the first compressor.	1	10
Compressor Stage Down Delay	CmpStgDn	Analog Input	This is the amount of time between compressors when the unit is staging down due to the Supply Air Temperature being met.	1	10
Compressor Minimum Run Time	CmpMnRun	Analog Input	Minimum time a Compressor must run before it can stage off.	1	10
Compressor Minimum Off Time	CmpMnOff	Analog Input	The minimum time a Compressor must be off before it can stage back on.	1	10
Heat Stage Up Delay	HtStgUp	Analog Input	This is the amount of time between Gas and Electric Heat stages when the demand is high enough to run more than one stage of Heating.	1	10
Heat Stage Down Delay	HtStgDn	Analog Input	This is the amount of time between Gas and Electric Heat stages when the unit is staging down due to the Supply Air Temperature being met.	1	10

8. PARAMETER TABLES

DDC LON Parameters

SNVTs for the DDC Controller					
Binary Output SNVTs are SNVT_lev_disc					
all other SNVTs are SNVT_count_inc_f					
Parameter	Name	Object	Description	Limits	
Heat Minimum Run Time	HtMinRun	Analog Input	The minimum time a Heat stage must run before it can stage off.	1	10
Heat Minimum Off Time	HtMinOff	Analog Input	The minimum time a Heat stage must be off before it can stage back on.	1	10
Aux Heat Delay	AuxHtDly	Analog Input	The delay period before Auxiliary Heating Stages can be activated once Compressor Heating Stages have been activated.	1	60
Vent Mode Minimum Time	VntMinTm	Analog Input	If the controller switches between Heat and Cool mode, this is minimum amount of time the controller must remain in Vent mode before switching.	1	60
Fan Starting Delay	FnStrt	Analog Input	To prevent multiple units operating on the same schedule from starting their fans at the same time, enter a different starting delay (in seconds) for each unit to stagger the load effects on building power consumption. -1 = 5 seconds multiplied by controller address.	-1	600
Occupied Cooling Setpoint	OcpClSp	Analog Input	This is the customer's desired Cooling Setpoint for the space. The controller will create a "Calculated Space Cooling Setpoint" from this "Base" Cooling Setpoint as described for that status point.	40	90

SNVTs for the DDC Controller					
Binary Output SNVTs are SNVT_lev_disc					
all other SNVTs are SNVT_count_inc_f					
Parameter	Name	Object	Description	Limits	
Occupied Heating Setpoint	OcpHtSp	Analog Input	This is the customer's desired Heating Setpoint for the Space. The controller will create a "Calculated Space Heating Setpoint" from this "Base" Heating Setpoint as described for that status point.	40	90
Space Setpoint Deadband	SpcDb	Analog Input	This value is added to and subtracted from the space setpoints to determine when the unit will enter and leave the Cooling and Heating modes.	0	5
Unoccupied Cooling Offset	UncClOff	Analog Input	During the Unoccupied Mode of Operation, this Setpoint offsets the Occupied Cooling Setpoint up by this user-adjustable amount.	0	30
Unoccupied Heating Offset	UncHtOff	Analog Input	During the Unoccupied Mode of Operation, this Setpoint offsets the Occupied Heating Setpoint down by this user-adjustable amount.	0	30
Space Slide Adjust Offset	SldAdOff	Analog Input	Enter an offset to adjust the Space Cooling and Heating Setpoints.	0	3
Aux Heat Offset	AuxHtOff	Analog Input	The Aux Heat stages on if the Space Temperature is below the setpoint by this offset amount.	0	30
Load Shed Offset	LdShdOff	Analog Input	If the Load Shedding contact activates, the Heat/Cool Setpoints are separated or offset by this amount.	0	10

8. PARAMETER TABLES

DDC LON Parameters

SNVTs for the DDC Controller					
Binary Output SNVTs are SNVT_lev_disc					
all other SNVTs are SNVT_count_inc_f					
Parameter	Name	Object	Description	Limits	
Push Button Override Duration	PbOvr	Analog Input	The Push-Button Override Duration Setpoint allows you to adjust the amount of time the Override will remain in effect when the Override Button is pressed.	0	8
Space Temp Alarm Offset	SpcAlOff	Analog Input	If the Space Temperature is this value above the Cooling Setpoint or below the Heating Setpoint for the Alarm Delay period, this Space Temperature Alarm will occur.	1	30
Space Temp Alarm Time Delay	SpcAlDly	Analog Input	This is the amount of time the Space Temperature must remain outside the alarm limits before a space temperature alarm will be generated.	1	300
Supply Air Cooling Setpoint	SaClSp	Analog Input	Supply Air Cooling Setpoint.	35	90
Supply Air Heating Setpoint	SaHtSp	Analog Input	Supply Air Heating Setpoint.	35	150
Supply Air Cool Stage Off Deadband	SaClStDb	Analog Input	In Cooling Mode, if the Supply Air Temperature drops below the Supply Air Cooling Setpoint minus the deadband, a Cooling Stage will be deactivated after its Minimum Run Time.	1	30
Supply Air Heat Stage Off Deadband	SaHtStDb	Analog Input	In Heating Mode, if the Supply Air Temperature rises above the Supply Air Heating Setpoint plus the deadband, a Heating Stage will be deactivated after its Minimum Run Time.	1	30

SNVTs for the DDC Controller					
Binary Output SNVTs are SNVT_lev_disc					
all other SNVTs are SNVT_count_inc_f					
Parameter	Name	Object	Description	Limits	
High Supply Air Alarm Setpoint	HiSaAlSp	Analog Input	Heating will be disabled if the Supply Air Temperature rises above this value. See sequence for more details.	35	170
Low Supply Air Alarm Setpoint	LoSaAlSp	Analog Input	Cooling will be disabled if the Supply Air Temperature falls below this value. See sequence for more details.	32	90
Supply Air Hi/Low Alarm Time Delay	SaAlmDly	Analog Input	This is the amount of time the Supply Air Temperature must remain outside the alarm limits before a space temperature alarm will be generated.	0	120
Mechanical Cool Alarm Offset	MchClOff	Analog Input	If the Supply Air Temperature remains this far from setpoint for the Mechanical Alarm Time Delay, this alarm will occur.	0	30
Mechanical Heat Alarm Offset	MchHtOff	Analog Input	If the Supply Air Temperature remains this far from setpoint for the Mechanical Alarm Time Delay, this alarm will occur.	0	30
Mechanical Alarm Time Delay	MchAmDly	Analog Input	This setpoint adjusts the amount of time the unit has to change the Supply Air Temperature a user-adjustable amount after a stage of Heating or Cooling is energized.	0	120
OA Compressor Enable Setpoint	OaCpEnSp	Analog Input	Cooling will be enabled if the outdoor air temperature is above this setpoint.	0	90

8. PARAMETER TABLES

DDC LON Parameters

SNVTs for the DDC Controller					
Binary Output SNVTs are SNVT_lev_disc					
all other SNVTs are SNVT_count_inc_f					
Parameter	Name	Object	Description	Limits	
OA Heat Enable Setpoint	OaHtEnSp	Analog Input	Heating will be enabled if the outdoor air temperature is below this setpoint.	35	90
OA Heat Pump Enable Setpoint	OaHPEnSp	Analog Input	Heat Pump Compressor(s) will be enabled if the outdoor air temperature is above this setpoint.	0	90
OA Economizer Enable Setpoint	OaEcEnSp	Analog Input	If the Economizer Drybulb Enable Source is below this value, the Economizer is enabled for Cooling operation.	35	90
OA WB/DP Enable Setpoint	OaWb-DpSp	Analog Input	The economizer is enabled if the outdoor dewpoint or wetbulb temperature falls below this setpoint.	0	90
OA Enthalpy Enable Setpoint	OaEnthSp	Analog Input	If the Outdoor Air Enthalpy is below this value, the Economizer is enabled for Cooling operation.	12	90
Economizer Minimum Position	EcoMnPos	Analog Input	The minimum position of the Outdoor Air damper in the Occupied Mode. This can be reset upwards based on indoor CO ₂ levels.	0	100
Economizer Min at High CO ₂	EcoMnCo2	Analog Input	This is the minimum carbon dioxide level that resets the Economizer Minimum Position to the High CO ₂ Minimum setting.	0	100

SNVTs for the DDC Controller					
Binary Output SNVTs are SNVT_lev_disc					
all other SNVTs are SNVT_count_inc_f					
Parameter	Name	Object	Description	Limits	
High CO ₂ Level Setpoint	HiCo2Sp	Analog Input	This is the CO ₂ level at which the Economizer Min Damper Position will be reset to the Economizer Max Position in High CO ₂ . In between the Min and Max CO ₂ levels the Economizer Min Damper Position will be proportionally reset between the configured Min Damper Position and the Max Position in High CO ₂ .	0	2000
Low CO ₂ Level Setpoint	LoCo2Sp	Analog Input	This is the threshold CO ₂ level at which the Economizer Min Damper Position Setpoint will begin to be reset higher.	0	2000
Write Space Temperature Value	WrSpTp	Analog Input	If the controller is configured for this operation, the user can write a Space Sensor value.	-40	100
Write Outdoor Air Temperature Value	WrOaTp	Analog Input	If the controller is configured for this operation, the user can write an Outdoor Sensor value.	-40	120
Write Outdoor Humidity Value	WrOaRh	Analog Input	If the controller is configured for this operation, the user can write an Outdoor Humidity Sensor value.	0	100
Write Indoor Humidity Value	WrInRh	Analog Input	Reserved for future use. Not available at this time.	0	100
Write Carbon Dioxide Value	WrCo2	Analog Input	If the controller is configured for this operation, the user can write a CO ₂ Sensor value.	0	2000

8. PARAMETER TABLES

6.1 DDC LON Parameters

SNVTs for the DDC Controller					
Binary Output SNVTs are SNVT_lev_disc					
all other SNVTs are SNVT_count_inc_f					
Parameter	Name	Object	Description	Limits	
Write Force Occupy Command	WrFrcOcp	Analog Input	0 = Auto, 1 = Occupied	0	1
Write Load Shed Enable Command	WrLdShd	Analog Input	0 = No Load Shedding, 1 = Load Shedding	0	1
Write Econo Position	WrEcoPos	Analog Input	User-writeable Economizer Position.	0	100

6.1.1 DDC PT-Link II LON®

Property Identifier:

The PT-Link II LON® Link amends the following property identity to the LON® property identifier.

LONPropertyIdentifier :

```
DDCScheduleModeStatusBits ::= ENUMERATED {  
    Unoccupied                      (0)  
    Occupied                       (1),  
    Push-Button Override           (2),  
    Holiday Unoccupied             (3),  
    Holiday Occupied               (4),  
    Forced Occupied                 (5),  
    Forced Unoccupied              (6),  
    Remote Occupied                 (7),  
}
```

```
DDCHVACModeStatusBits ::= ENUMERATED {  
    Off                            (0),  
    Vent Mode                      (1),  
    Cooling Mode                   (2),  
    Heating Mode                   (3),  
}
```




WattMaster Form: DK-PTLNK3LON-TGD, Revision 01A
Daikin Part No.: DK-LON-TGD-01A
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June 2016

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