

TROUBLESHOOTING



CHAPTER 5

In This Chapter...

Diagnostic LEDs	5-2
Fieldbus Errors.....	5-15
Protos X Configuration Software Troubleshooting	5-32

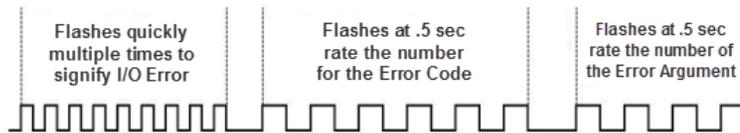
Diagnostic LEDs

All Protos X Bus Couplers have LED lights which can be used to troubleshoot errors. For instance, the I/O BUS Diagnostics LEDs will indicate the status of the bus terminals and their connections. The green LED will light up in order to indicate a fault-free operation. The red LED will blink with two different frequencies to indicate an error. The error is encoded in the blinks as follows:

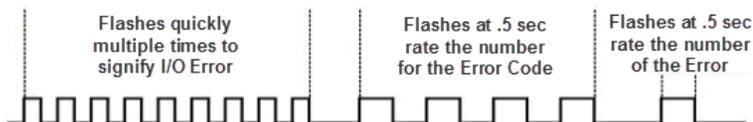
Blink Code	
Fast Blinking	Error Code Start
First Slow Sequence	Error Code
Second Slow Sequence	Error Code Argument



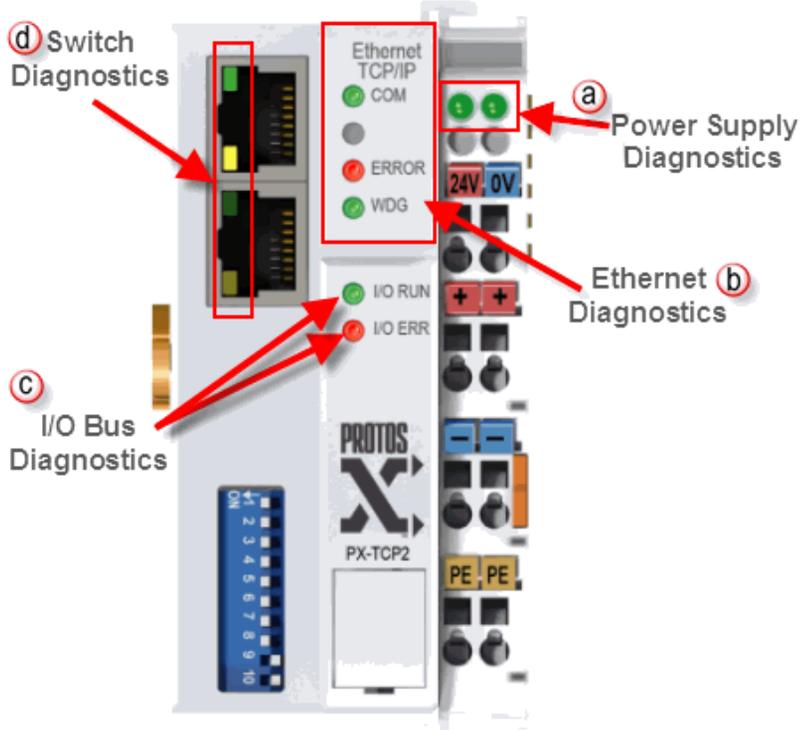
Below is an example of an I/O Error showing Error Code 6 (Bus Coupler Error) and Error Argument 4 (DIP Switch incorrect for Boot IP) from Terminal Bus Coupler PX-TCP2.



Below is an example of an I/O Error showing Error Code 4 (I/O Bus Data Error) and Error Argument 1 (Break behind bus terminal n, in this case number 1) from Terminal Bus Coupler PX-TCP2.



PX-TCP2 Diagnostics LEDs



a. Power Supply Diagnostic LEDs

PX-TCP2 Power Supply Diagnostic LEDs	
LED	Meaning
Left LED = OFF	No Bus Coupler power
Right LED = OFF	No 24VDC Terminal Bus Power

b. Ethernet Diagnostics LEDs

PX-TCP2 Ethernet Diagnostic LEDs		
LED	ON	OFF
COM	ON/Flashing = data received The LED flashes slowly if DHCP or BootP is active but the Bus Coupler has not yet received an IP Address	No data received
ERROR	The LED flashes rapidly (5 times, only when switching ON); the Bus Coupler is addressed with ARP The settings on the DIP Switch are not valid	No error
WDG	Watchdog is active (No error)	Watchdog error or no communication (start communication or reset WD error)

c. I/O Bus Diagnostics LEDs

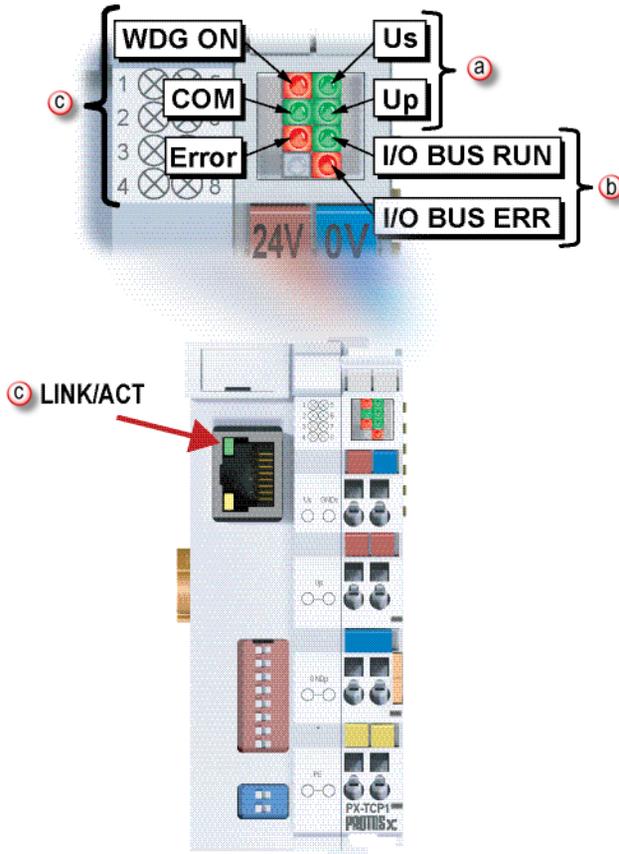
PX-TCP2 I/O Bus Diagnostic LEDs	
LED	Meaning
I/O RUN	ON or Flashing: I/O Bus Running
I/O ERR	Flashing: See error codes below

PX-TCP2 Error Codes for I/O Bus Diagnostics			
Error Code	Error Code Argument	Description	Remedy
Persistent, continuous blinking		EMC Problems	<ul style="list-style-type: none"> • Check Power Supply for over-voltage peaks • Implement EMC measures • If I/O Bus Error is present, it can be localized by a restart of the Coupler (switching it OFF and then ON again)
1 Pulse	0	EEPROM Checksum Error	• Contact ADC Returns Department at (800) 633-0405
	1	Code Buffer Overflow	• Insert fewer Bus Terminals, the programmed configuration has too many entries in the table
	2	Unknown Data type	• Contact ADC Returns Department at (800) 633-0405

PX-TCP2 Error Codes for I/O Bus Diagnostics			
Error Code	Error Code Argument	Description	Remedy
2 Pulses	0	Programmed Configuration has an incorrect entry	<ul style="list-style-type: none"> Check programmed configuration for correctness
	n(n>0)	Table comparison (Bus Terminal (n))	<ul style="list-style-type: none"> Incorrect table entry
3 Pulses	0	I/O Bus Command Error	<ul style="list-style-type: none"> No Bus Terminal inserted One of the Bus Terminals is defective; remove half of the Bus Terminals attached and check whether the error is still present with the remaining Bus Terminals. Repeat until the defective Bus Terminal is located
4 Pulses	0	I/O Bus Data Error, break behind the Bus Coupler	<ul style="list-style-type: none"> Check whether the n+1 Bus Terminal is correctly connected ; replace if necessary
	n	Break behind Bus Terminal (n)	<ul style="list-style-type: none"> Check whether the Bus End Terminal PX-901 is connected
5 Pulses	n	I/O Bus Error in register communication with Bus Terminal (n)	Exchange the n th Bus Terminal
6 Pulses	0	Error at installation	<ul style="list-style-type: none"> Exchange Bus Coupler Perform a hardware reset on the Bus Coupler (switch OFF and ON again) Change the IP Address Set 1-8 to ON or OFF, see BootIP Perform a hardware reset on the Bus Coupler (switch OFF and ON again)
	1	<ul style="list-style-type: none"> Internal Data Error DIP Switch changed after a software reset 	
	2	Other device with this IP Address in the network	
	4	DIP Switch incorrect for BootIP	
	8	Internal Data Error	
	16	Error in IP socket	
14 Pulses	n	n th Bus Terminals is no longer correct	Start the Bus Coupler again, if the Error occurs again, then exchange the Bus Terminal
15 Pulses	n	Number of Bus Terminals is no longer correct	Check the number of terminals for Bus Coupler assembly to make sure the maximum number of terminals has not been exceeded
16 Pulses	n	Length of the I/O Bus data is no longer correct	Check the amount of bytes consumed by terminals to make sure the 512 bytes Input and 512 bytes output has not been exceeded

d. Switch Diagnostics LEDs

PX-TCP2 Switch Diagnostic LEDs			
LED	ON	Flashing	OFF
LINK/ACT	Link is OK	Communication OK	No Link
10/100 Baud	100 MBaud	-	10 MBaud



a. Us/Up LEDs

PX-TCP1 Power Supply Diagnostic LEDs	
LED (Power LEDs)	Meaning
Power LED Us	OFF: No Bus Coupler 24VDC
Power LED Up	OFF: No Terminal Power Bus 24VDC

b. I/O Bus Diagnostics LEDs

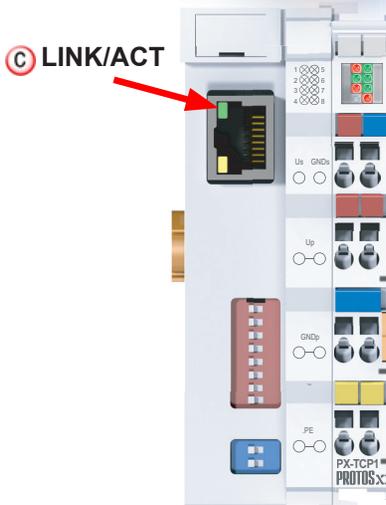
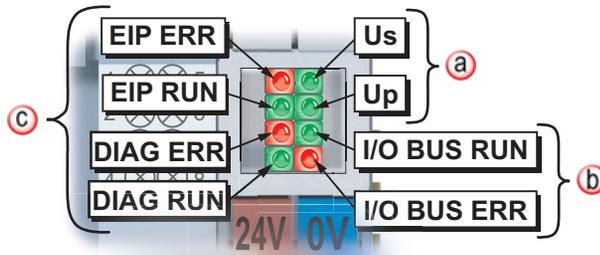
PX-TCP1 I/O Bus Diagnostic LEDs	
LED (I/O Bus)	Meaning
I/O Bus RUN	ON or Flashing: I/O Bus Running
I/O Bus ERR	Flashing: See error codes on following page

PX-TCP1 Error Codes for I/O Bus Diagnostics			
Error Code	Error Code Argument	Description	Remedy
-	Flashing Continuously	EMC Problems	<ul style="list-style-type: none"> • Check Power Supply for over-voltage peaks • Implement EMC measures • If I/O Bus Error is present, it can be localized by a restart of the Coupler (switching it OFF and then ON again)
1 Pulse	0	EEPROM Checksum Error	<ul style="list-style-type: none"> • Contact ADC Returns Department at (800) 633-0405
	1	Code Buffer Overflow	<ul style="list-style-type: none"> • Insert fewer Bus Terminals, the programmed configuration has too many entries in the table
	2	Unknown Data type	<ul style="list-style-type: none"> • Contact ADC Returns Department at (800) 633-0405
2 Pulses	-	Reserve	-
3 Pulses	0	I/O Bus Command Error	<ul style="list-style-type: none"> • No Bus Terminal inserted • One of the Bus Terminals is defective; remove half of the Bus Terminals attached and check whether the error is still present with the remaining Bus Terminals. Repeat until the defective Bus Terminal is located
4 Pulses	0	I/O Bus Data Error, break behind the Bus Coupler	<ul style="list-style-type: none"> • Check whether the n+1 Bus Terminal is correctly connected ; replace if necessary
	n	Break behind Bus Terminal (n)	<ul style="list-style-type: none"> • Check whether the Bus End Terminal PX-901 is connected
5 Pulses	n	I/O Bus Error in register communication with Bus Terminal (n)	Exchange the n th Bus Terminal
6 Pulses	0	Error at installation	<ul style="list-style-type: none"> • Exchange Bus Coupler • Perform a hardware reset on the Bus Coupler (switch OFF and ON again)
	1	Internal Data Error	
	2	DIP Switch changed after a software reset	
7 Pulses	0	Cycle Time was exceeded	<p>Warning: The set cycle time was exceeded. This indication (flashing LEDs) can only be cleared by booting the Bus Coupler again</p> <p>Remedy: Increase the cycle time</p>
9 Pulses	0	Checksum Error in Flash program	<ul style="list-style-type: none"> • Transmit program to the Coupler again
	1	Incorrect or faulty library implemented	<ul style="list-style-type: none"> • Remove the faulty library
10 Pulses	n	Bus Terminal n is not consistent with the configuration that existed when the boot project was created	Check the n th Bus Terminal. The boot project must be deleted if the insertion of an n th Bus Terminal is intentional
14 Pulses	n	n th Bus Terminals has the wrong format	Start the Bus Coupler again, if the Error occurs again, then exchange the Bus Terminal
15 Pulses	n	Number of Bus Terminals is no longer correct	Check the number of terminals for Bus Coupler assembly to make sure the maximum number of terminals has not been exceeded

c. WD/COM/Error LEDs

PX-TCP1 Ethernet Diagnostic LEDs	
LED (Ethernet)	Meaning
WDG	ON: Watchdog Active (No error)
COM	ON or Flashing: communication with controller
ERROR	Flashing: DHCP or BootP active, waiting for an IP Address
RTE	ON: Hard real time is switched ON at TC. No ADS communication is possible at the same time . All TCP, UDP and ICMP telegrams (e.g., ping) will not be answered
LINK/ACT	ON: LINK available Flashing: LINK available and communicating

PX-EIP1 Diagnostics LEDs



a. Us/Up LEDs

PX-EIP1 Power Supply Diagnostic LEDs	
LED (Power LEDs)	Meaning
Power LED Us	OFF: No Bus Coupler 24VDC
Power LED Up	OFF: No Terminal Power Bus 24VDC

b. I/O Bus Diagnostics LEDs

PX-EIP1 I/O Bus Diagnostic LEDs	
LED (I/O Bus)	Meaning
I/O Bus RUN	ON or Flashing: I/O Bus Running
I/O Bus ERR	Flashing: See error codes on following page

PX-EIP1 Error Codes for I/O Bus Diagnostics			
Error Code	Error Code Argument	Description	Remedy
-	Flashing Continuously	EMC Problems	<ul style="list-style-type: none"> Check Power Supply for over-voltage peaks Implement EMC measures If I/O Bus Error is present, it can be localized by a restart of the Coupler (switching it OFF and then ON again)
1 Pulse	0	EEPROM Checksum Error	<ul style="list-style-type: none"> Contact ADC Returns Department at (800) 633-0405
	1	Code Buffer Overflow	<ul style="list-style-type: none"> Insert fewer Bus Terminals, the programmed configuration has too many entries in the table
	2	Unknown Data type	<ul style="list-style-type: none"> Contact ADC Returns Department at (800) 633-0405
2 Pulses	-	Reserved	-
3 Pulses	0	I/O Bus Command Error	<ul style="list-style-type: none"> No Bus Terminal inserted One of the Bus Terminals is defective; remove half of the Bus Terminals attached and check whether the error is still present with the remaining Bus Terminals. Repeat until the defective Bus Terminal is located
4 Pulses	0	I/O Bus Data Error, break behind the Bus Coupler	<ul style="list-style-type: none"> Check whether the n+1 Bus Terminal is correctly connected ; replace if necessary
	n	Break behind Bus Terminal (n)	<ul style="list-style-type: none"> Check whether the Bus End Terminal PX-901 is connected
5 Pulses	n	I/O Bus Error in register communication with Bus Terminal (n)	Exchange the n th Bus Terminal
6 Pulses	0	Error at installation	<ul style="list-style-type: none"> Exchange Bus Coupler Perform a hardware reset on the Bus Coupler (switch OFF and ON again)
	1	Internal Data Error	
	2	DIP Switch changed after a software reset	
7 Pulses	0	Cycle Time was exceeded	<p>Warning: The set cycle time was exceeded. This indication (flashing LEDs) can only be cleared by booting the Bus Coupler again</p> <p>Remedy: Increase the cycle time</p>
9 Pulses	0	Checksum Error in Flash program	<ul style="list-style-type: none"> Transmit program to the Coupler again
	1	Incorrect or faulty library implemented	<ul style="list-style-type: none"> Remove the faulty library
10 Pulses	n	Bus Terminal n is not consistent with the configuration that existed when the boot project was created	Check the n th Bus Terminal. The boot project must be deleted if the insertion of an n th Bus Terminal is intentional
14 Pulses	n	n th Bus Terminals has the wrong format	Start the Bus Coupler again, if the Error occurs again, then exchange the Bus Terminal
15 Pulses	n	Number of Bus Terminals is no longer correct	Check the number of terminals for Bus Coupler assembly to make sure the maximum number of terminals has not been exceeded

PX-EIP1 Diagnostics LEDs

c. I/O EtherNet Diagnostic LEDs

PX-EIP1 I/O EtherNet Diagnostic LEDs	
LED (I/O Bus)	Meaning
EIP Error	ON: See Error Codes
EIP Run	ON: EIP communication with Client. Flashing: No EIP communication with Client
DIAG Error	Flashing: See Error Codes
DIAG RUN	ON: Diagnostics running with no errors
LINK/ACT	ON: Link available Flashing: LINK available and communicating

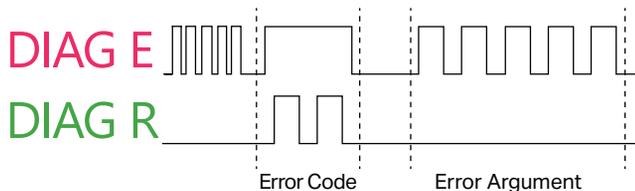
PX-TCP1 Error Codes for EIP Error		
Ethernet/IP Diagnose	EIP E (red)	EIP R (green)
IP Address OK	Off	0.5 s
No IP Address (Dip Switch 8, 9 - > On)	Off	Off
Online	Off	On
Offline PLC Stop	Off	0.1 s
TimeOut	0.5 s	Off
IP Address Conflict	On	Off

PX-EIP1 Error Codes for Diag Error (Configuration Errors)		
Configuration Diagnose	DIAG E (red) Error Argument	EIP R (green) Error Code
OK	Off	On
In Data Too Less	Flashing*	1
In Data Too Big	Flashing*	2
Out Data Too Less	Flashing*	3
Out Data Too Big	Flashing*	4
Wrong Assembly Instance	Flashing*	5
Second Master	Flashing*	6

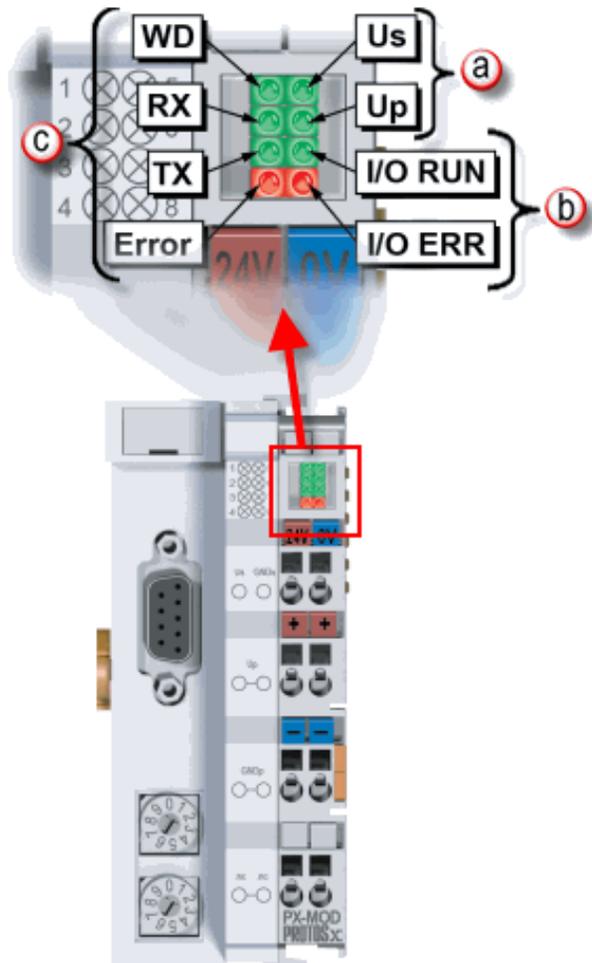
Example

Data Length in too big 5 bytes

- Start Error Code: Red LED is flashing, fast green LED Off.
- Red LED is ON, green LED shows you the Error Code flashing two times (1sec)
- Red LED OFF, green LED Off
- Red LED flashing 5 times (1sec), error argument, green LED Off



PX-MOD Diagnostics LEDs



a. Us/Up LEDs

PX-MOD Power Supply Diagnostic LEDs	
LED (Power LEDs)	Meaning
Power LED Us	OFF: No Bus Coupler 24VDC
Power LED Up	OFF: No Terminal Power Bus 24VDC

b. I/O Bus Diagnostics LEDs

PX-MOD I/O Bus Diagnostic LEDs	
LED (I/O Bus)	Meaning
I/O RUN	ON or Flashing: I/O Bus Running
I/O ERR	Flashing: See error codes on following page

PX-MOD Error Codes for I/O Bus Diagnostics			
Error Code	Error Code Argument	Description	Remedy
Persistent, continuous blinking		EMC Problems	<ul style="list-style-type: none"> • Check Power Supply for over-voltage peaks • Implement EMC measures • If I/O Bus Error is present, it can be localized by a restart of the Coupler (switching it OFF and then ON again)
1 Pulse	0	EEPROM Checksum Error	<ul style="list-style-type: none"> • Contact ADC Returns Department at (800) 633-0405 • Insert fewer Bus Terminals, the programmed configuration has too many entries in the table • Contact ADC Returns Department at (800) 633-0405
	1	Code Buffer Overflow	
	2	Unknown Data type	
2 Pulses	0	Programmed Configuration has an incorrect entry	<ul style="list-style-type: none"> • Check programmed configuration for correctness • Incorrect table entry
	n(n>0)	Table comparison (Bus Terminal (n))	
3 Pulses	0	I/O Bus Command Error	<ul style="list-style-type: none"> • No Bus Terminal inserted • One of the Bus Terminals is defective; remove half of the Bus Terminals attached and check whether the error is still present with the remaining Bus Terminals. Repeat until the defective Bus Terminal is located
4 Pulses	0	I/O Bus Data Error, break behind the Bus Coupler	<ul style="list-style-type: none"> • Check whether the n+1 Bus Terminal is correctly connected ; replace if necessary • Check whether the Bus End Terminal PX-901 is connected
	n	Break behind Bus Terminal (n)	
5 Pulses	n	I/O Bus Error in register communication with Bus Terminal (n)	Exchange the n th Bus Terminal
14 Pulses	n	n th Bus Terminals has the wrong format	Start the Bus Coupler again, if the Error occurs again, then exchange the Bus Terminal
15 Pulses	n	Number of Bus Terminals is no longer correct	Check the number of terminals for Bus Coupler assembly to make sure the maximum number of terminals has not been exceeded
16 Pulses	n	Length of the I/O Bus data is no longer correct	Check the amount of bytes consumed by terminals to make sure the 512 bytes Input and 512 bytes output has not been exceeded

c. WD/TX/RX LEDs

PX-MOD Modbus Diagnostic LEDs	
LED (Modbus)	Meaning
<i>WD</i>	ON: Watchdog is good
<i>RX</i>	ON: data is being received
<i>TX</i>	ON: data is being transmitted
<i>Error</i>	ON: Data Error, communications with the Master Device has been lost

Bus Coupler Diagnostics Additional Notes

1. The number of pulses (n) indicates the position of the last Bus Terminal before the fault. Passive Bus Terminals, such as the power feed terminal, are not included in the count.
2. In the case of some Errors, rectification does not cause the Bus Coupler to leave the blink sequence. The Bus Coupler stays in the Stop state. The Bus Coupler can only be restarted either by switching the power supply OFF and ON again, or by a software reset.
3. Hot Swap NOT Permitted: Always remove power from the system before inserting or removing bus terminals or couplers as failure to do so could cause malfunction or damage to the terminals, couplers or other connected devices.
4. The occurrence of a fault in the course of operation does not immediately trigger the display of Error Codes by the LEDs. The Bus Coupler must be requested to diagnose the Bus Terminals. The diagnostic request is generated after switching ON.

Fieldbus Errors

The Protos X PX-TCP1, PX-TCP2, and PX-MOD Bus Couplers have built-in watchdog timer functions for end user applications. The watchdog timer functionality provides controlled output handling in the event of communication loss. When the watchdog timer is enabled by any Modbus Write message, the outputs will stay active as long as there are incoming Modbus read or write messages (If 0x1122 set to 1). Or as long as there are incoming Modbus write messages (If 0x1122 set to 0). In the event that the incoming Modbus messages are interrupted for a period longer than the watchdog timer value setting, the outputs will turn OFF. At this point, the end user must re-establish communications to the Bus Coupler and send a watchdog reset command to the device in order to re-enable the outputs. Alternately cycle power to the Bus Coupler, or use the PX-CFGSW to reboot the coupler.

The watchdog timer can be disabled under Tools> Options when connected with the PX-CFGSW. However if communication is lost, the bus terminal outputs will remain in their last state and will not update until communication is re-established.

The end user application interfaces with the watchdog timer functionality through pre-defined Modbus TCP registers. The specific registers and Modbus addresses are shown below.

Watchdog Interfacing Addresses					
Address (Hex)	Address (Dec)	Modicon Modbus Addressing	Type	Description	Notes
0x1120	4384	44385	Read/Write	Watchdog Timer Value, (ms)	Default Value = 1000 Disable Timer = 0
0x1121	4385	44386	Read/Write	Watchdog Reset Register	Reset Command: Write 0xBECF then write 0xAFFE
0x1122	4386	44387	Read/Write	Watchdog Type	Read/Write message Watchdog = 1(default) Write message Watchdog = 0
0x100C	4108	44109	Read Only	Bus Coupler Status	Bit 15 = Fieldbus Error Watchdog time elapsed
0x1020	4128	44129	Read Only	Watchdog, current time (ms)	Time elapsed since last Modbus Message after Watchdog is active

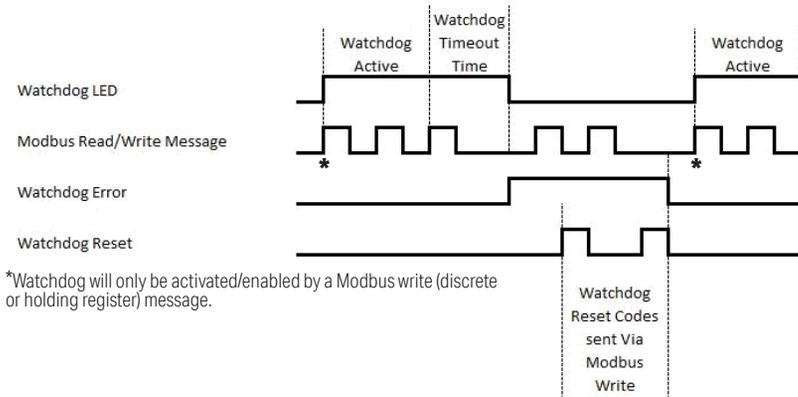
The Watchdog Timer Value is stored in the Read/Write Modbus address 0x1120 (4384 dec.) in the coupler. The value can be read at any time using a Modbus Read message. However the value can only be written to prior to the Watchdog being made active by a Modbus Write message to one of the configured output addresses and it can only be written to if the Bus Coupler is not in a watchdog fault state. If a Modbus Write message is attempted during either of these states a Modbus fault 02 Illegal Data Address will be returned from the Bus Coupler. The watchdog timer value can also be changed using the Protos X Configuration software.



NOTE: If you only have Inputs, the Watchdog settings do not matter since without an Output to write to, the Watchdog cannot be enabled.

Reset the watchdog timer and clear the error condition in order to change the watchdog timer value. Read the Bus Coupler status register (bit 15 of register 0x100C) in order to see if the Bus Coupler watchdog timer has elapsed. Bit 15 will clear after a successful Watchdog Reset Command write sequence. The Watchdog Reset Command consists of writing the value 0xBECF (48847 dec.) to address 0x1121 and then writing the value 0xAFFE (45054 dec.) to address 0x1121. See timing chart below.

During the watchdog timer elapsed state, Modbus writes to the Bus Coupler will fail with Modbus Exception Error Code 4 (SLAVE DEVICE ERROR).



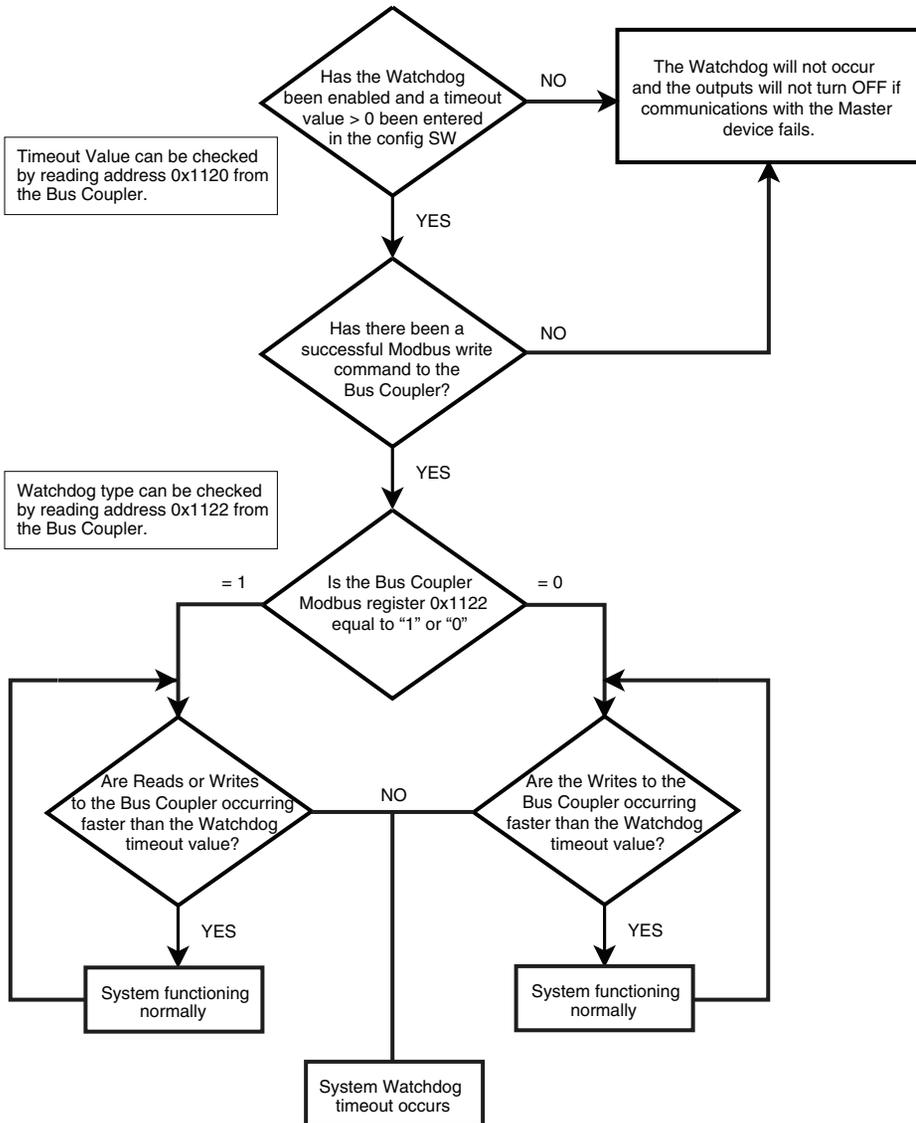
*Watchdog will only be activated/enabled by a Modbus write (discrete or holding register) message.

The Watchdog type determines how you want the Watchdog fault to work. If there is a "1" in this register a Modbus Write message will initiate the Watchdog timer and the Watchdog will become active. In this mode, any read or write message will keep the Watchdog active as long as they happen before the Watchdog timeout value has been exceeded. If there is a "0" in this register a Modbus Write message will initiate the Watchdog timer and another Modbus Write must be performed before the Watchdog timeout value has been exceeded to keep the coupler from having a Watchdog Fault.

To monitor the current time elapsed in the Watchdog timer a Modbus Read message can be used to get the value in Modbus register 0x1020 (4128 dec.). This value will show how much time has elapsed since a Modbus message has reset the Watchdog Timer last. If this time reaches or exceeds the value in the Watchdog Timer Value a Watchdog Fault will occur.

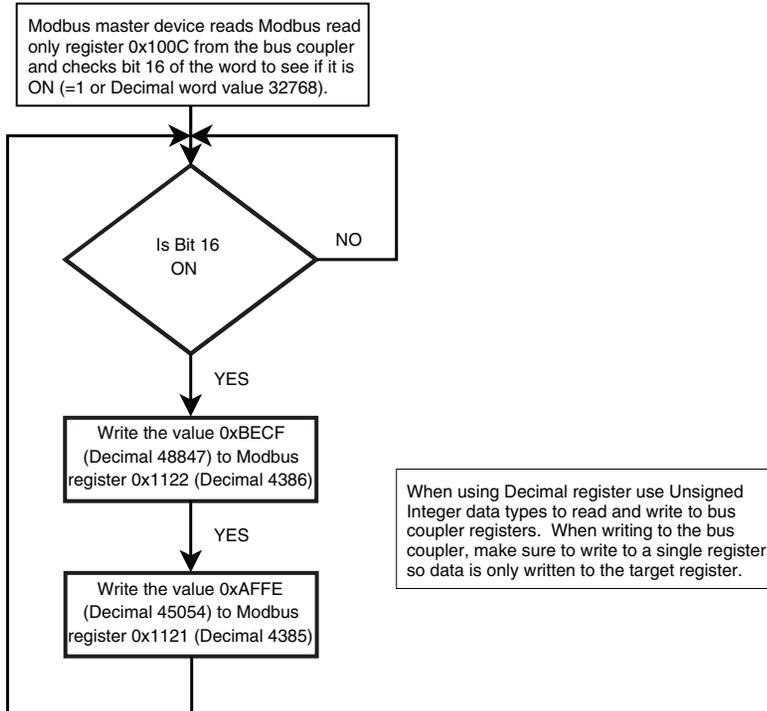
The PX-MOD will not allow Modbus Read or Write messages to the I/O data if the bus coupler is in the Watchdog timeout condition. The PX-TCP1 and PX-TCP2 will allow Modbus Reads of inputs, but Modbus Writes to Outputs will fail if the bus coupler is in the Watchdog timeout condition.

Watchdog Enable/Activate



When the Watchdog occurs the PX-MOD will not allow Modbus Reads or Writes to Inputs or Outputs. When a Watchdog occurs, the PX-TCP1 and PX-TCP2 bus couplers will still allow Modbus Reads from Inputs to work, but all Modbus Writes to Outputs will fail. Bus coupler registers can continue to be read from or written to with all bus coupler models.

Resetting Watchdog Errors



Resetting Watchdog Errors, continued

DirectLOGIC PLC Ladder Example

THIS INFORMATION PROVIDED BY AUTOMATIONDIRECT.COM TECHNICAL SUPPORT IS PROVIDED "AS IS" WITHOUT A GUARANTEE OF ANY KIND. These documents are provided by our technical support department to assist others. We do not guarantee that the data is suitable for your particular application, nor do we assume any responsibility for them in your application.

This Project shows how to use the status register of the Protos X bus coupler to detect when a Modbus Watchdog error has occurred and how to programatically reset it from ladder logic. In this project the Protos X Assembly consists of the following hardware:

- 1) PX-TCP2 Modbus TCP Bus Coupler
- 2) PX-412 2 Channel Analog Output Terminal
- 3) PX-272-1 2 Channel Solid State Relay Terminal
- 4) PX-144 4 Channel Digital Input Terminal
- 5) PX-332-K 2 Channel Thermocouple Type K Module
- 6) PX-901 Bus End Terminal

Your hardware does not have to match this, but you should use appropriate Modbus addresses and function codes for your hardware configuration.

1 _____ (NOP)

Network #1 uses the Hx-ECOM100 in Slot 1. This would be the only slot in 05, first slot in 06, and second slot in 205/405 models. It will use the range of V-memory from V400 - V502 as the working status, workspace and buffer. These locations must not be used anywhere else.

Make sure Dipswitch 7 is turned ON in the ECOM100.

The Modbus converter spreadsheet from ADC Tech Support site will be extremely useful to convert Modbus addresses into the octal-based addressing required in the instructions.

NOTE: NetEdit 3 MUST be used to setup the ECOM100 "Peer-to-Peer Config" table in the ECOM100. This is what determines if the communications are ModbusTCP or ECOM.

2

ECOM100 Config	
ECOM100 #	IB-710
Slot	K1
Status	V400
Workspace	V401
Msg Buffer (65 WORDs)	V402 - V502

On the first PLC scan, set the Comm Success & Comm Error count registers to 0.

Also SETS C106, which is the enable logic to the ECXX boxes.



Resetting Watchdog Errors - DirectLOGIC PLC Ladder Example, continued

Once the ECRX and ECWX IBoxes are enabled, the ECOM100 IBox will automatically sequence them, no manual control of the port busy bits is required.

This example uses C106 with a SET on First Scan, it could be changed to whatever logic the user desires such as SP1.

4 (NOP)

The ECRX will read from Slave ID "1", and will target address V10014 which is the Modbus equivalent address 44109 (Holding Register). This is the Status word of the Bus Coupler.

It will get 2 bytes (1 register) and place the data in V2000. This data will be in decimal format. The DataView window at left has V2000 set for Decimal format.

Note that Workspace V location must be unique.

5

ECOM100 RX Network Read	
ECRX	IB-740
ECOM100 #	K1
Workspace	V503
Slave ID	K1
From Slave Element (Src)	V10014
Number Of Bytes	K2
To Master Element (Dest)	V2000
Success	C100
Error	C101

Bit #15 of register V2000 will be monitored to see when a watchdog fault has occurred. If Bit 15 is true it will initiate two ECWX Modbus write instructions which will send reset codes to V10441 (Modbus address 404386). The first write instruction sends a Hex code of 0xBECF.

6

C106 WD Fail Bit 15 B2000.15

ECOM100 WX Network Write	
ECWX	IB-741
ECOM100 #	K1
Workspace	V510
Slave ID	K1
From Master Element (Src)	V2501
Number Of Bytes	K2
To Slave Element (Dest)	V10441
Success	C106
Error	C107

The second ECWX Modbus write instruction will be initiated upon the completion of the first ECWX and only if the watchdog fail bit is set. The second Modbus write instruction will send a Hex value of 0xAFFE to V10441 (Modbus address 404386)

7

C106 WD Fail Bit 15 B2000.15 C110

ECOM100 WX Network Write	
ECWX	IB-741
ECOM100 #	K1
Workspace	V511
Slave ID	K1
From Master Element (Src)	V2502
Number Of Bytes	K2
To Slave Element (Dest)	V10441
Success	C110
Error	C111

Resetting Watchdog Errors - DirectLOGIC PLC Ladder Example, continued

The ECWX will write to Slave ID "1", and will target address V4010 which is the Modbus equivalent of 42057 third Holding Register.

It will write 2 bytes (1 registers) from the PLC addresses V2500. This address will be displayed as decimal in dataview, but it will represent the binary value of the bits of the word. If the value is "1" then bit "1" will be true, if the value is "2" bit "2" will be true, if the value is "3" then bits "1" and "2" will be true. Any decimal value that have bits "1" or "2" will turn on the outputs of the terminal.

Note that Workspace location must be unique.



ECOM100 WX Network Write	
ECWX	IB-741
ECOM100 #	K1
Workspace	V504
Slave ID	K1
From Master Element (Src)	V2500
Number Of Bytes	K2
To Slave Element (Dest)	V4010
Success	C102
Error	C103

The ECRX will read from Slave ID "1", and will target address TA5 (V2005) which is the Modbus equivalent address 40006 (Holding Register).

It will get 2 bytes (1 registers) and place the data in V2001. This data will be in decimal format. The DataView window at left has V2001 (CH1 Temp) set for Decimal format. Since the value is coming from a temperature module and the data is in Celcius format it needs to be converted to Fahrenheit. So it must be changed to the Real format to display decimal places. To do this we load V2001 into the accumulator, perform a Binary to Real conversion and then output the converted value to V2002 - V2003. We then use a Math Real instruction to run the Celcius to Fahrenheit conversin formula on the data and put it into V2004 - V2005.

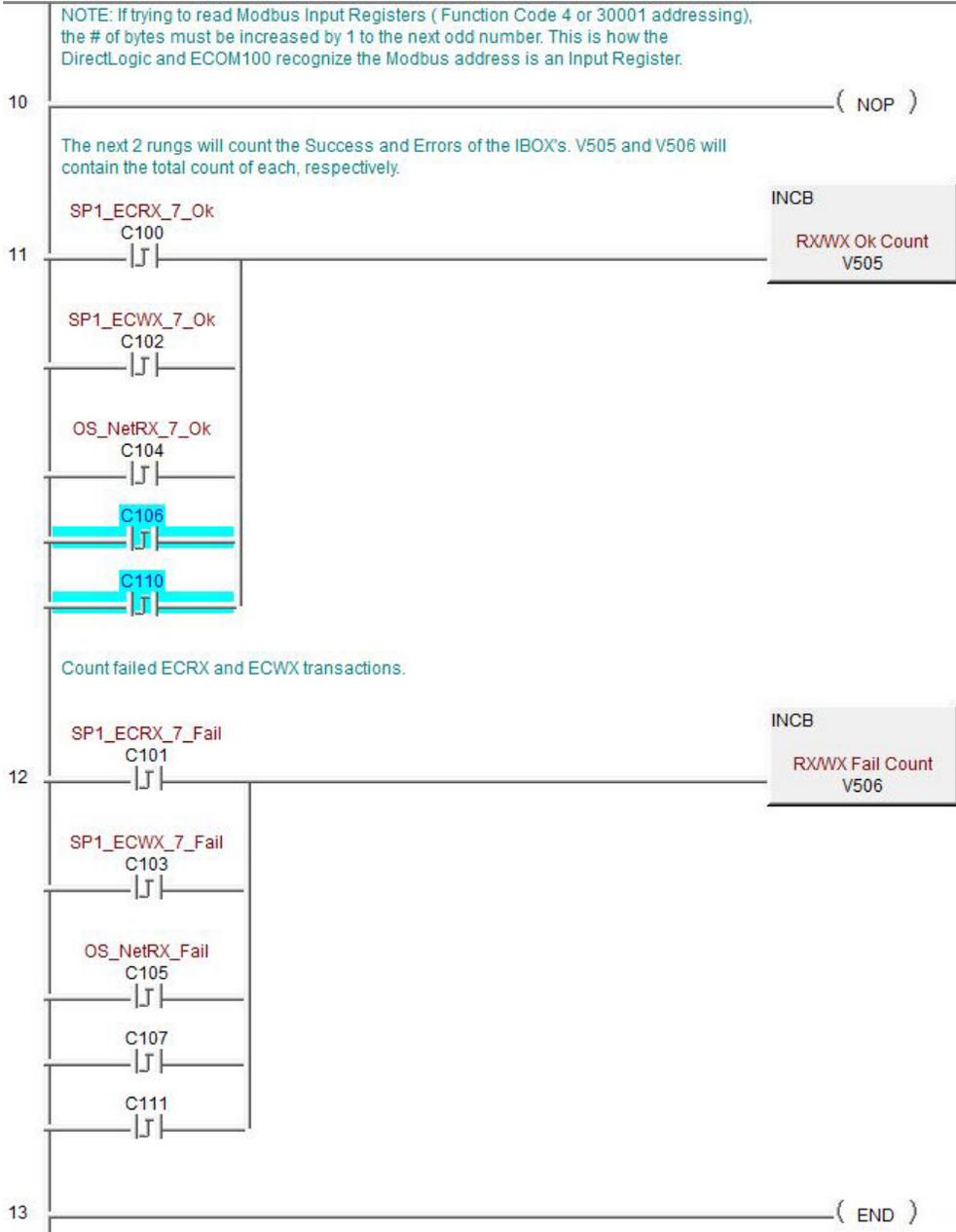
Note that Workspace V location must be unique.



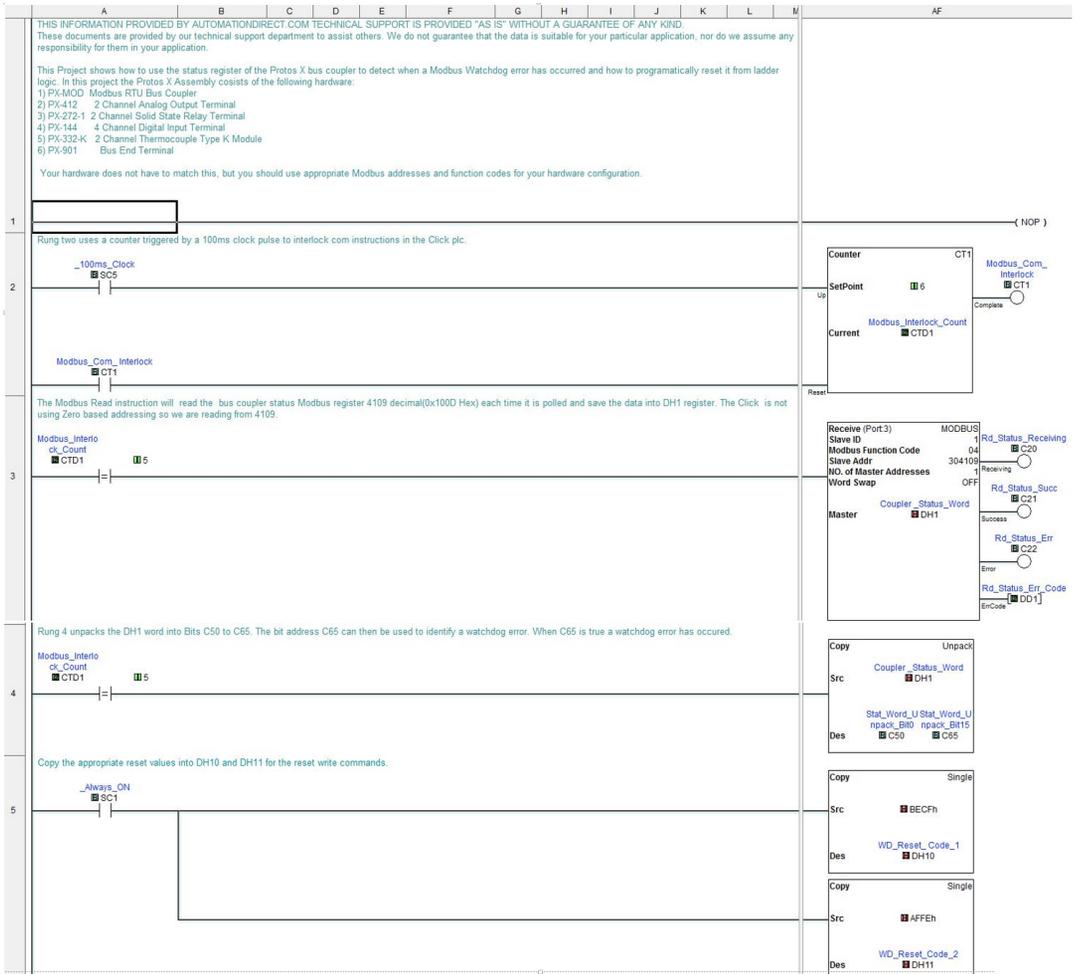
ECOM100 RX Network Read	
ECRX	IB-740
ECOM100 #	K1
Workspace	V507
Slave ID	K1
From Slave Element (Src)	TA5
Number Of Bytes	K2
To Master Element (Dest)	V2001
Success	C104
Error	C105

LD	
	CH1 Temp V2001
BTOR	
OUTD	V2002
	Math - Real
MATHR	IB-541
Result	70.34
Expression	$((R9 / R5) * V2002 * R0.1) + R32$

Resetting Watchdog Errors - DirectLOGIC PLC Ladder Example, continued



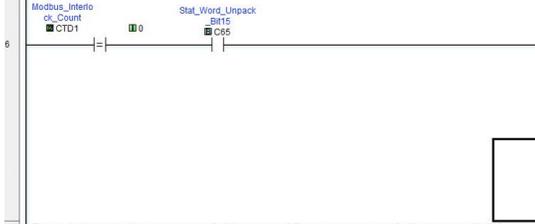
Resetting Watchdog Errors, continued - CLICK Ladder Example



Chapter 5: Troubleshooting

Resetting Watchdog Errors, continued - CLICK Ladder Example, continued

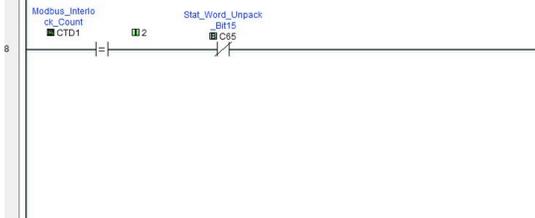
In Rung 5 if C65 (bit 15 of the bus coupler status word) is true and the counter value = 0 then the Click will initiate two Modbus write commands. The first instruction will write a value of 48847 decimal(0xBECF Hex) to Modbus register 404386 decimal(0x1122 Hex). The Click is not using Zero based addressing so we are reading from 404386. Be sure you know what your master device uses. Also make sure you only write to a single register so you do not over write other registers. Also make sure you use Unsigned Integer 16 bit data types in your logic for decimal values.



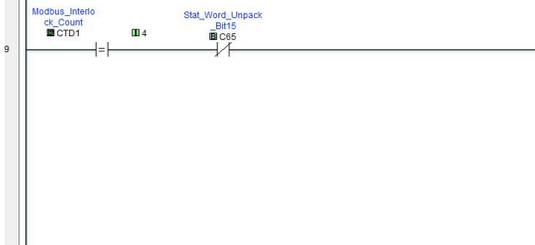
The second instruction in rung 6 triggered off of the success of Send instruction in rung 5 will write a value of 46554 decimal(0xAFFE Hex) to Modbus register 404386 decimal(0x1122 Hex). This will reset the watchdog error. The Click is not using Zero based addressing so we are reading from 404386. Be sure you know what your master device uses. Also make sure you only write to a single register so you do not over write other registers. Also make sure you use Unsigned Integer 16 bit data types in your logic for decimal values.



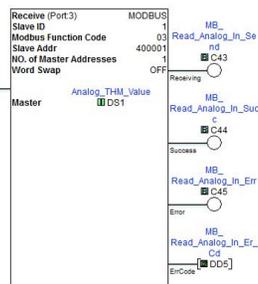
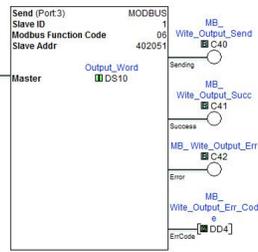
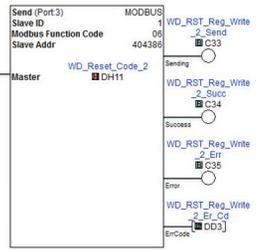
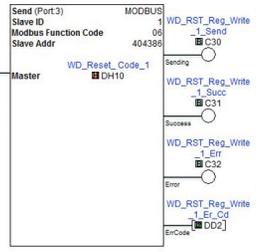
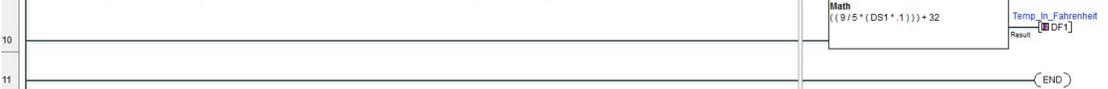
This rung can be used to check Modbus communication to the Protos X bus coupler. In Rung 7 we are writing to the word of a discrete output module that resides on the Protos X bus coupler. If you have a bus coupler with different I/O you will have to identify the Modbus addresses and use a different address than is used in this instruction. By enabling the "Modbus_Writes" contact and changing the value in the "DS10" you can manipulate the physical outputs. For the watchdog function of the bus controller to become active a modbus write command must be made to the bus coupler. After the modbus write message makes the watchdog active, and both the MWX and MRX are stopped the watchdog would fail and all outputs would be turned off. In this project however, the MRX for the status read will keep the watchdog active. To simulate a watchdog fail you can unplug the RS485 cable from the bus controller until the WD LED goes off on the PX-MOD.



In this rung we are reading the temp value of a PX-332-K thermocouple terminal. When the Modbus interlock count is = 4 and the C65 watchdog error is false the Click will execute a MRX command to get the value from the bus coupler. The Modbus read command can be used to keep the watchdog active once it has been initiated by the Modbus write instruction. After the Modbus write message makes the watchdog active, and both the MWX and MRX are stopped the watchdog would fail and all outputs would be turned off. In this project however, the MRX for the status read will keep the watchdog active. To simulate a watchdog fail you can unplug the RS485 cable from the bus controller until the WD LED goes off on the PX-MOD.

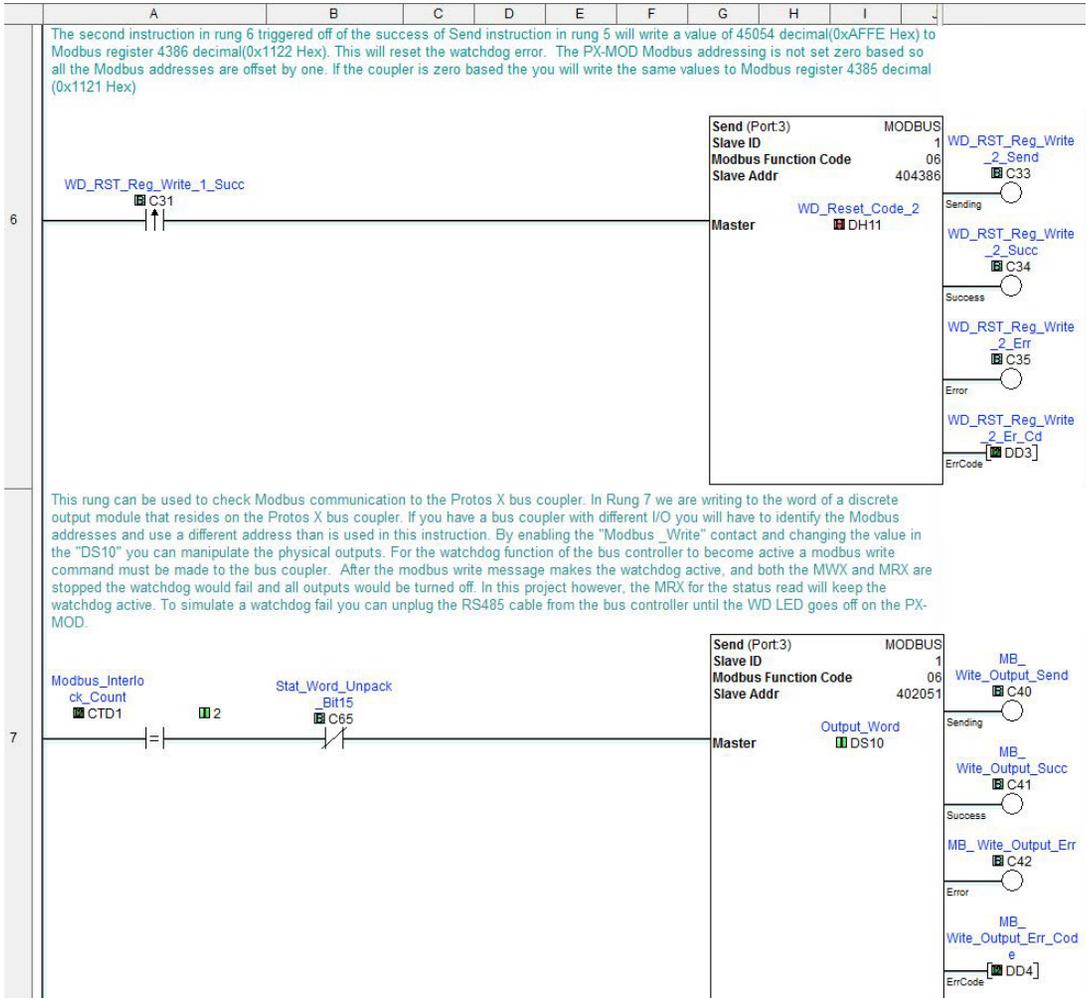


The Protos X temperature terminals only read in Celcius. In the MATH instruction below there is an example for converting from Celcius to Fahrenheit.

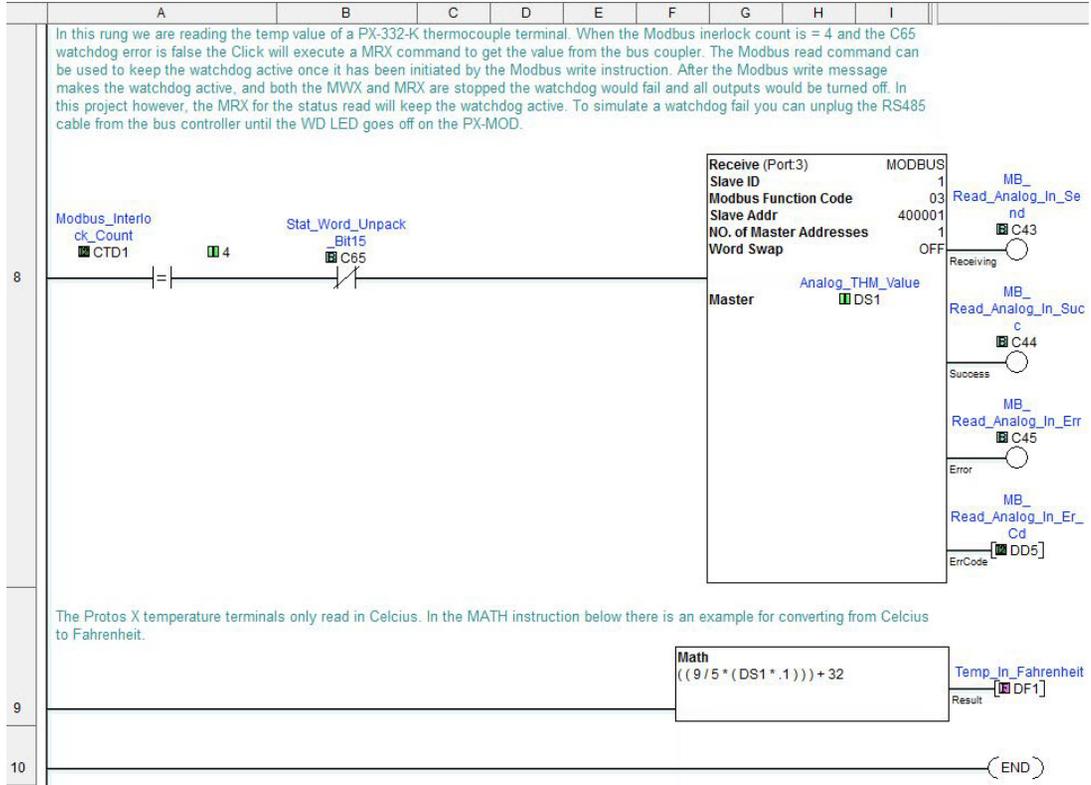


(END)

Resetting Watchdog Errors, continued - CLICK Ladder Example, continued



Resetting Watchdog Errors, continued - CLICK Ladder Example



Resetting Watchdog Errors, continued - Do-more Ladder Example

THIS INFORMATION PROVIDED BY AUTOMATIONDIRECT.COM TECHNICAL SUPPORT IS PROVIDED "AS IS" WITHOUT A GUARANTEE OF ANY KIND. These documents are provided by our technical support department to assist others. We do not guarantee that the data is suitable for your particular application, nor do we assume any responsibility for them in your application.

This Project shows how to use the status register of the Protos X bus coupler to detect when a Modbus Watchdog error has occurred and how to programatically reset it from ladder logic. In this project the Protos X Assembly consists of the following hardware:

- 1) PX-TCP2 Modbus TCP Bus Coupler
- 2) PX-412 2 Channel Analog Output Terminal
- 3) PX-272-1 2 Channel Solid State Relay Terminal
- 4) PX-144 4 Channel Digital Input Terminal
- 5) PX-332-K 2 Channel Thermocouple Type K Module
- 6) PX-901 Bus End Terminal

Your hardware does not have to match this, but you should use appropriate Modbus addresses and function codes for your hardware configuration.

1 (NOP)

The Modbus Read instruction will continually read the bus coupler status Modbus register 4109 decimal(0x100D Hex) and save the data into V2000 register. Bit # 15 of word V2000 will represent the watchdog error. If this bit is true a watchdog error has occurred. The PX-TCP2 Modbus addressing is not set to zero based so all the Modbus addresses are offset by one. If the coupler is set zero based and your controller supports it then you will read from Modbus register 4108 decimal(0x100C Hex).

2

MRX	Modbus Network Read
Device	@IntModTCPClient
IP Address	10.1.32.16
TCP Port Number	502
Unit ID	255
Function Code	3 - Read Holding Registers
	Modbus Address 4... + offset value entered below
From Modbus Offset Address	4109
Number of Modbus Registers	1
To Do-more Memory Address	V2000
Continuous at Interval	0.100s
On Success, Set bit	C1
On Error, Set bit	C2

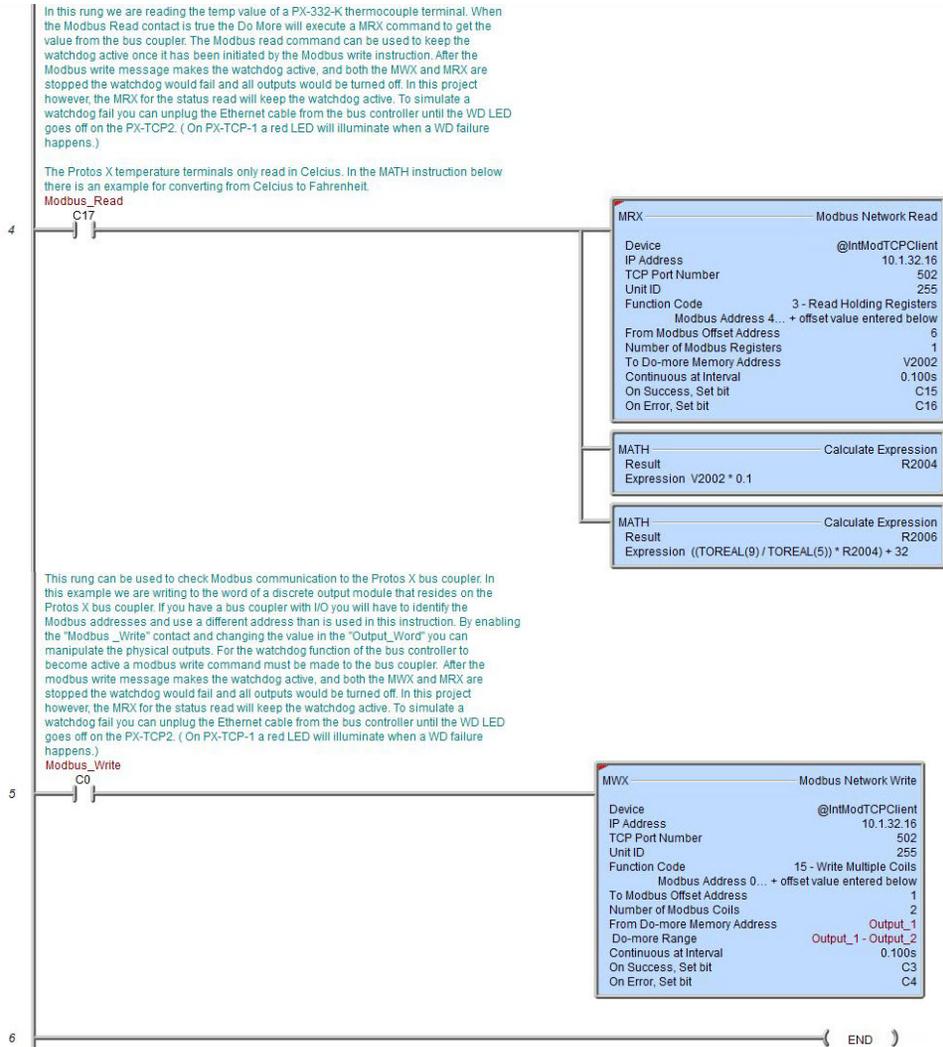
In this logic if V2000:15 (bit 15 of the bus coupler status word) is true then the Do More will initiate two Modbus write commands. The first instruction will write a value of 48847 decimal(0xBECF Hex) to Modbus register 4386 decimal(0x1122 Hex). The second instruction will write a value of 45054 decimal(0xAFFE Hex) to Modbus register 4386 decimal(0x1122 Hex). This will reset the watchdog error. The PX-TCP2 Modbus addressing is not set zero based so all the Modbus addresses are offset by one. If the coupler is zero based the you will write the same values to Modbus register 4385 decimal (0x1121 Hex)

3

MWX	Modbus Network Write
Device	@IntModTCPClient
IP Address	10.1.32.16
TCP Port Number	502
Unit ID	255
Function Code	6 - Write Single Register
	Modbus Address 4... + offset value entered below
To Modbus Offset Address	4386
Constant	0xBECF
On Success, Set bit	C5
On Error, Set bit	C6

MWX	Modbus Network Write
Device	@IntModTCPClient
IP Address	10.1.32.16
TCP Port Number	502
Unit ID	255
Function Code	6 - Write Single Register
	Modbus Address 4... + offset value entered below
To Modbus Offset Address	4386
Constant	0xAFFE
On Success, Set bit	C7
On Error, Set bit	C8

Resetting Watchdog Errors, continued - Do-more Ladder Example, continued



Resetting Watchdog Errors - P3000 Ladder Example

1 2 3 4 5 6 7 8 9 10 11

THIS INFORMATION PROVIDED BY AUTOMATIONDIRECT.COM TECHNICAL SUPPORT IS PROVIDED "AS IS" WITHOUT A GUARANTEE OF ANY KIND.
 These documents are provided by our technical support department to assist others. We do not guarantee that the data is suitable for your particular application, nor do we assume any responsibility for them in your application.

This Project shows how to use the status register of the Protos X bus coupler to detect when a Modbus Watchdog error has occurred and how to programmatically reset it from ladder logic. In this project the Protos X Assembly consists of the following hardware:

- 1) PX-TCP2 Modbus TCP Bus Coupler
- 2) PX-412 2 Channel Analog Output Terminal
- 3) PX-272-1 2 Channel Solid State Relay Terminal
- 4) PX-144 4 Channel Digital Input Terminal
- 5) PX-332-K 2 Channel Thermocouple Type K Module
- 6) PX-901 Bus End Terminal

Your hardware does not have to match this, but you should use appropriate Modbus addresses and function codes for your hardware configuration.

1  (NOP)

The Modbus Read instruction will continually read the bus coupler status Modbus register 4109 decimal(0x100D Hex and unpack the data into bits. Bit # 15 will represent the watchdog error. If this bit is true a watchdog error has occurred. The PX-TCP2 Modbus addressing is not set to zero based so all the Modbus addresses are offset by one. If the coupler is set to zero based and the controller messaging it supports zero based then you will read from Modbus register 4108 decimal(0x100C Hex).

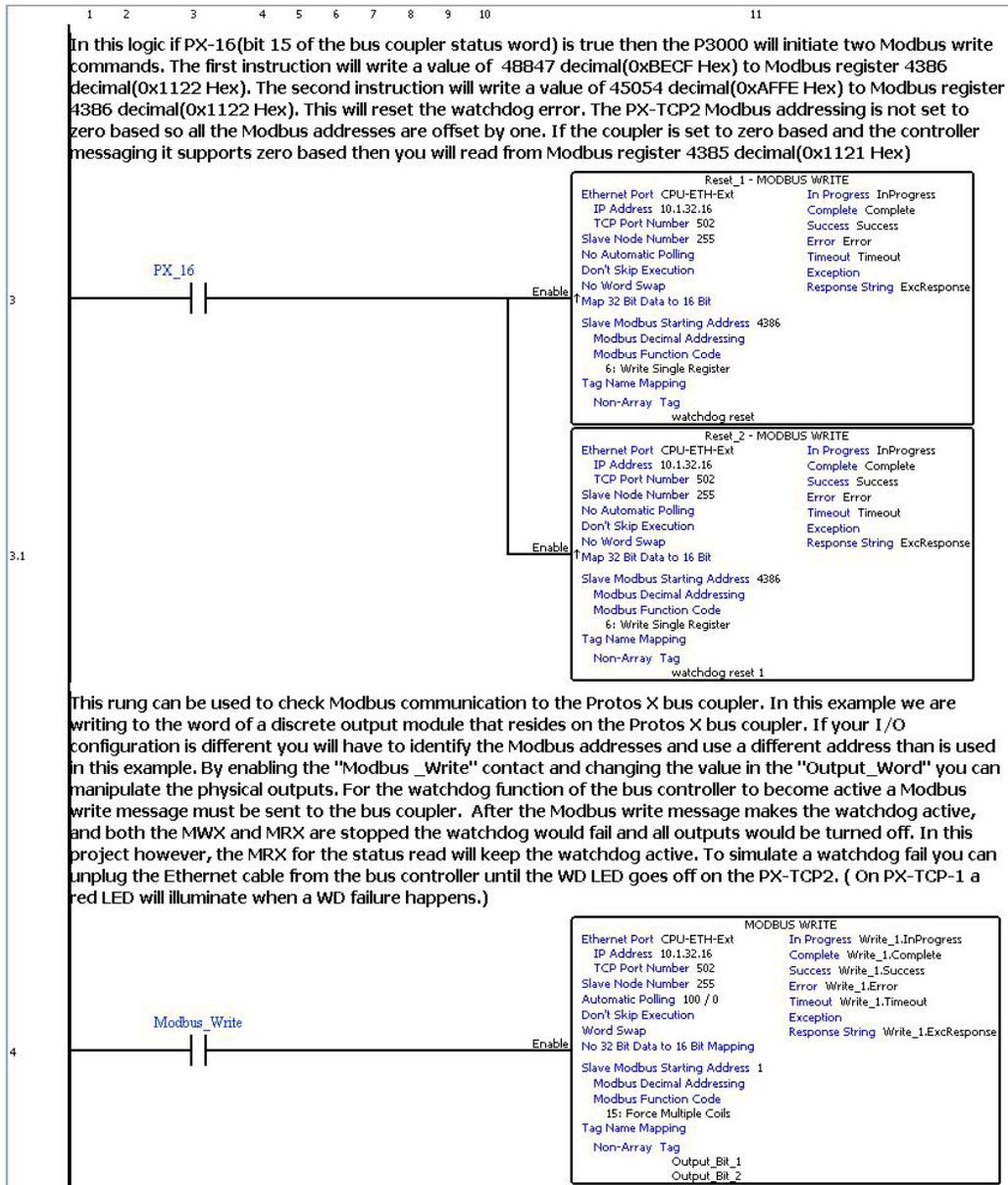
PX-TCP2 Status Register

MODBUS READ	
Ethernet Port	CPU-ETH-Ext
IP Address	10.1.32.16
TCP Port Number	502
Slave Node Number	255
Automatic Polling	500 / 0
Don't Skip Execution	
Word Swap	
No 32 Bit to 16 Bit Mapping	
Slave Modbus Starting Address	4109
Modbus Decimal Addressing	
Modbus Function Code	3: Read Holding Registers
Tag Name Mapping	
Non-Array Tag	PX_TCP2_Satus
In Progress	Read_1.InProgress
Complete	Read_1.Complete
Success	Read_1.Success
Error	Read_1.Error
Timeout	Read_1.Timeout
Exception	
Response String	Read_1.ExcResponse

Un pack bits from PX-TCP-2 Status Register

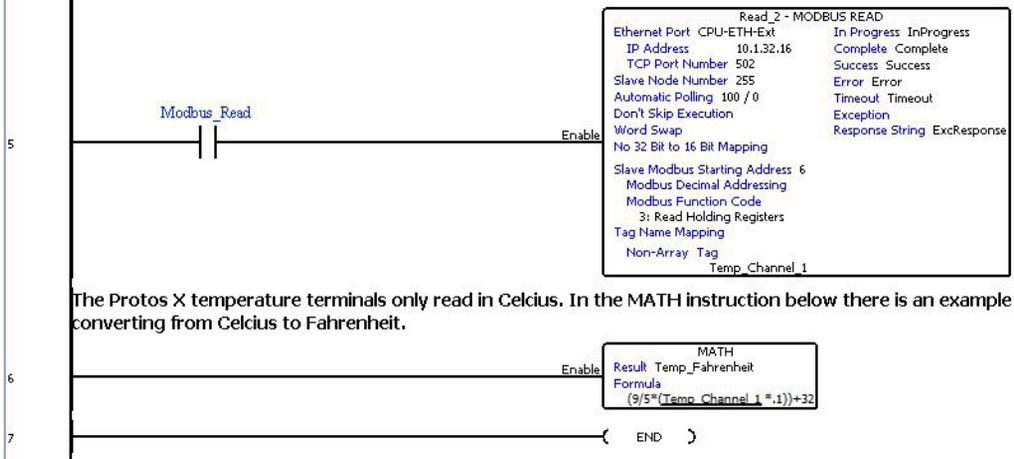
UNPACK BITS			
Input	PX_TCP2_Satus	BR Number	Output
		1	PX_1
		2	PX_2
		3	PX_3
		4	PX_4
		5	PX_5
		6	PX_6
		7	PX_7
		8	PX_8
		9	PX_9
		10	PX_10
		11	PX_11
		12	PX_12
		13	PX_13
		14	PX_14
		15	PX_15
		16	PX_16

Resetting Watchdog Errors - P3000 Ladder Example, continued



Resetting Watchdog Errors - P3000 Ladder Example, continued

In this rung we are reading the temp value of a PX-332-K thermocouple terminal. When the Modbus Read contact is true the P3000 will execute a MRX command to get the value from the bus coupler. The Modbus read command can be used to keep the watchdog active once it has been initiated by the Modbus write instruction. After the Modbus write message makes the watchdog active, and both the MWX and MRX are stopped the watchdog would fail and all outputs would be turned off. In this project however, the MRX for the status read will keep the watchdog active. To simulate a watchdog fail you can unplug the ethernet cable from the bus controller until the WD LED goes off on the PX-TCP2. (On PX-TCP-1 a red LED will illuminate when a WD failure happens.)



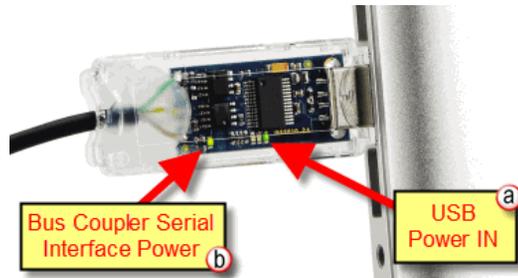
The Protos X temperature terminals only read in Celcius. In the MATH instruction below there is an example for converting from Celcius to Fahrenheit.

Protos X Configuration Software Troubleshooting

If the Protos X configuration software has been started, a connect has been attempted, and the dialog box displaying the hardware configuration does not display, use the troubleshooting steps below.

Confirm Power Supply to USB Device

Make sure the PX-USB-232 serial cable green LEDs are illuminated as shown below.

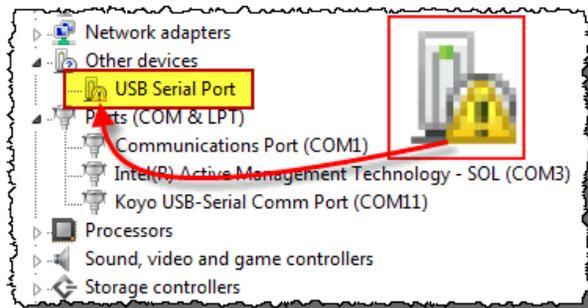


- The USB Power IN LED should be green if the USB device is in a good USB port being powered by the PC.
- The Bus Coupler Serial Interface Power LED should be green if the Bus Coupler is powered up and the connection is good.

Verify the PX-USB-232 Driver Installation

Ensure that the PX-USB-232 USB Driver was installed properly. To verify the installation follow these steps:

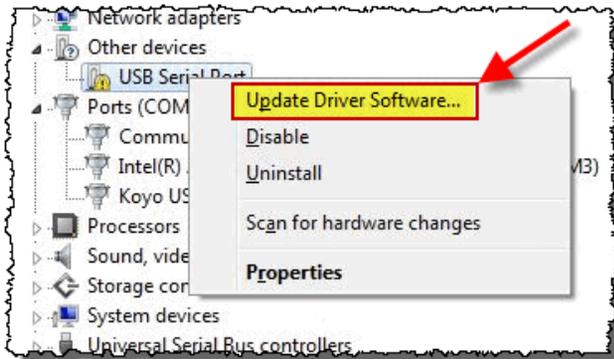
- Go to the Device Manager on your PC and verify the USB Device is in the list under Ports. If there are multiple devices listed and if not sure which one is the device, unplug the PX-USB-232 and see if any of the listed devices go away. If so, plug the PX-USB-232 device back in and verify it shows up under the Ports list.
- If the driver does not show up under the Ports list look elsewhere in the Device Manager. If the driver for this device did not install correctly it will usually show up under Other Devices or Universal Serial Bus Controllers with an exclamation point beside it as shown below.



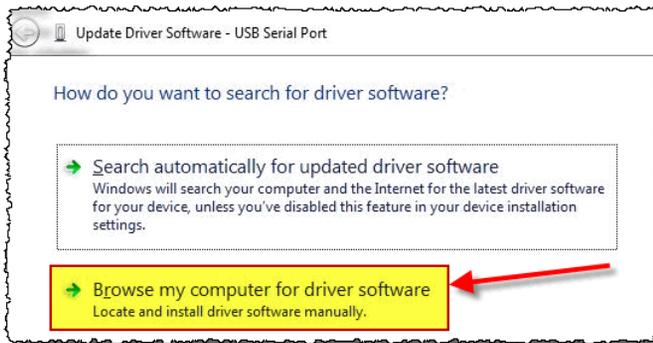
3. If the driver shows up in the Device Manager with the exclamation symbol, or anywhere other than the Ports level, you have two options. You can uninstall and reinstall the software, making sure any antivirus software is disabled and the UAC on your PC is set to “Never Notify” (Win 7 and 8), or you must manually update the driver for the USB device.

To update the USB driver:

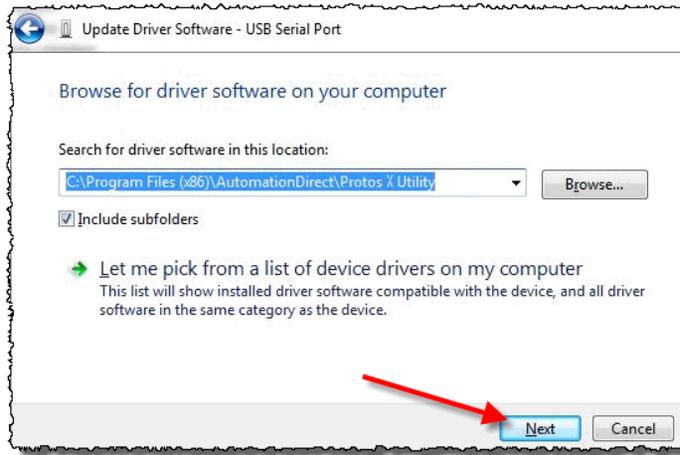
- a. Go to Device Manager and find the device as explained in the preceding steps.
- b. Select and Right Click on the device. This will open the drop down menu shown below.



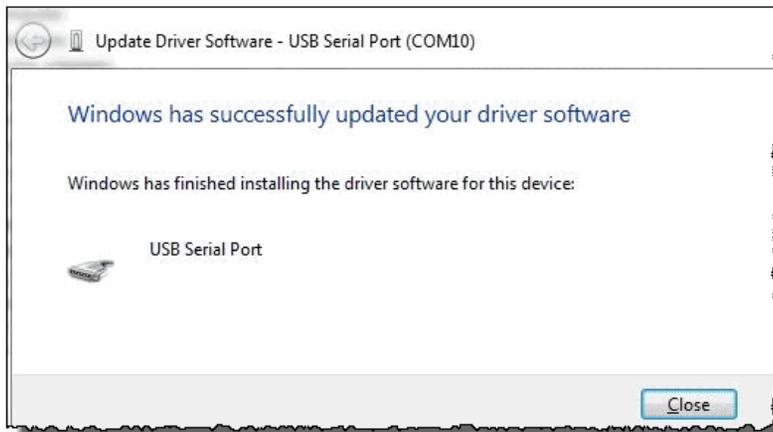
- c. From the drop down menu, select “Update Driver Software”. A window will open with the choices shown below.



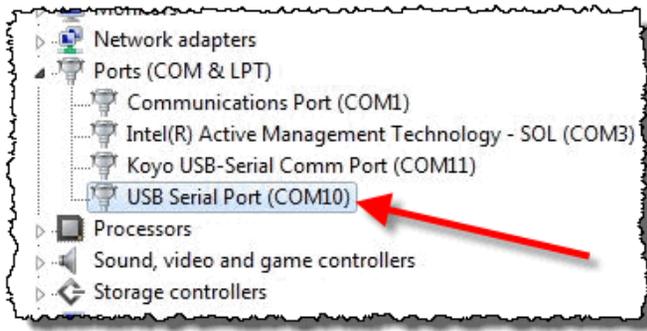
- d. From this window, click on “Browse my computer for driver software”. This will open a window where you can select the location of the Driver software.



- e. Use the Browse box to go to the location shown on the graphic above: C:\Program Files (x86)\AutomationDirect\Protos X Utility or the directory where the software was installed to.
- f. Click on “Next” and the driver should install. Once installation is complete the following dialog will display:



4. If the Driver Update was successful, go back to your Device Manger in the Control Panel and check that the device is properly installed. The device should be under the Ports section as shown on the following page (COM number might be different).



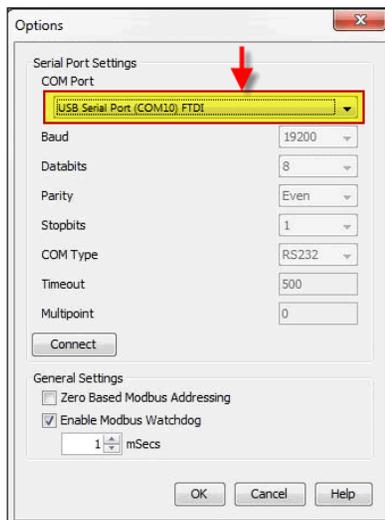
Cannot Connect After Verifying Previous Steps

If you still cannot connect, the dialog box shown below should display.



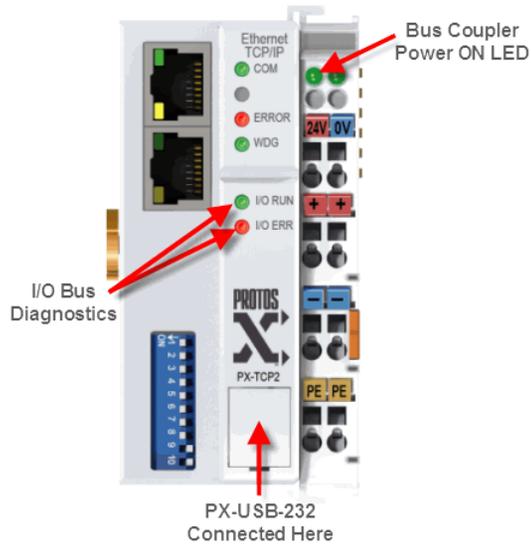
In this case try the following steps:

1. Click on "OK" to close the error window and confirm that the COM Port matches the one identified in the Device Manager. For example, in the graphic on Step 4 above, COM10 is displayed. Go to the Options window (see below), and verify the selected COM Port matches the COM Port (COM10) shown in the Device Manager.



Chapter 5: Troubleshooting

2. If the connection still fails, make sure the PX-USB-232 serial cable is connected to the Protos X Bus Coupler and the power to the Coupler is ON.



3. On the Bus Coupler the green I/O Run LED should be blinking quickly and the red I/O Error LED should NOT be flashing. If the red LED is flashing, verify that the Bus End Terminal is in place.