Product Assessment and Evaluation Report for
Limitless™ WDRR Series NPN/PNP Conversion to Modbus/TCP

Introduction
This document constitutes Honeywell’s evaluation of the Honeywell WDRR Series product with three different Modbus™ couplers manufactured by WAGO, Beckhoff Automation, or Direct Automation. This document is the result of testing these products to determine functionality, capability, and system set-up in converting the WDRR’s NPN/PNP and NPN - Totem Pole/PNP - Totem Pole type digital outputs to a Modbus TCP/IP output.

Overview
The WDRR has 14 outputs allowing up to 14 Limitless™ switches to be connected and two outputs that provide lost RF and low battery indications for all Limitless™ switches. Up to 16 outputs from the WDRR are then connected to the WAGO, Beckhoff Automation, or Direct Automation Modbus™ coupler to thus convert the WDRR output into a Modbus/TCP output.

System Set-up

### Honeywell WDRR Series

**DUT**

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WDRR1A02A0A</td>
<td>Wireless DIN Rail Receiver</td>
</tr>
</tbody>
</table>

- 24 Vdc supply voltage
- DIP switch setting: SW1 OFF, SW2 ON
- Output and power supply cable length: 3 m [9.8 ft] max.
- RF signal strength: BEST-all five blue LEDs ON

### Honeywell WBX Series

**DUT**

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WBX1A12AAA1A</td>
<td>Wireless Hazardous Area Limit Switch</td>
</tr>
</tbody>
</table>

- DIP Switch settings: update rate set at one second

### Honeywell WLS Series

**DUT**

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WLS1A11AA1A</td>
<td>Wireless Heavy Duty Limit Switch</td>
</tr>
</tbody>
</table>

### WAGO Modbus™ Coupler

**DUTs**

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>750-352</td>
<td>Ethernet coupler with two RJ-45 ports</td>
</tr>
<tr>
<td>750-602</td>
<td>Bus feed without fuse</td>
</tr>
<tr>
<td>750-1405</td>
<td>16 DI 24 Vdc 3.0 mS</td>
</tr>
<tr>
<td>750-600</td>
<td>Bus end terminal</td>
</tr>
</tbody>
</table>

Complete WAGO specifications and instructions for DUTs can be found at wago.com.

- Modbus™ Master with custom software used along with DELL PC to log output data: Limitless™ switch cycles, low battery, and lost RF counts
- 24 Vdc supply voltage
- DIP switch setting: Set to match PLC
- Ethernet cable (2x): 1 m shield, twisted pair Cat 6

### Beckhoff Automation Modbus™ Coupler

**DUTs**

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BK9050</td>
<td>Ethernet TCP/IP “compact” bus coupler</td>
</tr>
<tr>
<td>KL1488</td>
<td>Qty (2) - 8-channel digital input terminal, NPN only</td>
</tr>
</tbody>
</table>

Complete Beckhoff Automation specifications and instructions for DUTs can be found at beckhoff.com.

- Modbus™ Master with custom software used along with DELL PC to log output data: Limitless™ switch cycles, low battery, and lost RF counts
- 24 Vdc supply voltage
- DIP switch setting: Set to match PLC
- Ethernet cable (2x): 1 m shield, twisted pair Cat 6

### Automation Direct Modbus™ Coupler

**DUTs**

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PX-TCP2</td>
<td>Modbus TCP bus coupler</td>
</tr>
<tr>
<td>PX-149</td>
<td>16-channel digital input module</td>
</tr>
<tr>
<td>PX 901</td>
<td>End module</td>
</tr>
</tbody>
</table>

Complete Automation Direct specifications and instructions for DUTs can be found at automationdirect.com.

- Modbus™ Master with custom software used along with DELL PC to log output data: Limitless™ switch cycles, low battery, and lost RF counts
- DIP switch setting: Set to match PLC
- Ethernet cable (2x): 1 m shield, twisted pair Cat 6
Figure 1. WDRR/WAGO Modbus™ Coupler

1. 24 Vdc bus coupler power
2. 120 Vac power source to Class II 24 Vdc power supply
3. Cat 6 ethernet cable to user’s Modbus™ PLC
4. IP address used in user’s PLC for Modbus™ coupler
5. Limitless™ outputs #1 thru #8 to PX149 input terminal
6. Limitless™ outputs #9 thru #14 to PX149 input terminal
7. Terminal bus power from WDRR*
8. DIP switch set for totem pole sinking output (NPN type); 1 OFF, 2 ON**
9. 24 Vdc WDRR receiver power

*Not Applicable for WAGO
**Set for totem pole sourcing output (PNP type) (WAGO only); 1 ON, 2 ON

Figure 2. WDRR/Beckoff Automation Modbus™ Coupler

1. 24 Vdc bus coupler power
2. 120 Vac power source to Class II 24 Vdc power supply
3. Cat6 ethernet cable to user’s Modbus™ PLC
4. IP address used in user’s PLC for Modbus™ coupler
5. Limitless™ outputs #1 thru #8 to PX149 input terminal
6. Limitless™ outputs #9 thru #14 to PX149 input terminal
7. Terminal bus power from WDRR*
8. DIP switch set for totem pole sinking output (NPN type); 1 OFF, 2 ON**
9. 24 Vdc WDRR receiver power

*Not Applicable for WAGO
**Set for totem pole sourcing output (PNP type) (WAGO only); 1 ON, 2 ON
Figure 3. WDRR/Automation Direct Modbus™ Coupler

1. 24 Vdc bus coupler power
2. 120 V ac power source to Class II 24 Vdc power supply
3. Cat6 ethernet cable to user’s Modbus™ PLC
4. IP address used in user’s PLC for Modbus™ coupler
5. Limitless™ outputs #1 thru #8 to PX149 input terminal
6. Limitless™ outputs #9 thru #14 to PX149 input terminal
7. Terminal bus power from WDRR*
8. DIP switch set for totem pole sinking output (NPN type); 1 OFF, 2 ON**
9. 24 Vdc WDRR receiver power

*Not Applicable for WAGO
**Set for totem pole sourcing output (PNP type) (WAGO only); 1 ON, 2 ON
Figure 4. WAGO: 750-352 Ethernet Fieldbus Coupler  
(See Figure 1)

Fieldbus  
Connection  
RJ-45

X1

User's Modbus™ master module

Power supply

+  -

24 Vdc power source

Figure 5. WAGO: 750-602 Supply Module  
(See Figure 1)

Bus feed without fuse

Honeywell WDRR output power

3

Figure 6. WAGO: 750-1405 16-channel Digital Input Module  
(See Figure 1)

Honeywell: WDRR1A02A0A  
Outputs

Output 1  Input 1  Input 2  Output 2
Output 3  Input 3  Input 4  Output 4
Output 5  Input 5  Input 6  Output 6
Output 7  Input 7  Input 8  Output 8
Output 9  Input 9  Input 10  Output 10
Output 11  Input 11  Input 12  Output 12
Output 13  Input 13  Input 14  Output 14
Output 15  Input 15  Input 16  Output

Low Batterv

Lost RF

Honeywell: WDRR1A02A0A  
Outputs

750-1405  Inputs
Figure 7. Beckhoff Automation: BK9050 Ethernet TCP/IP Coupler
(See Figure 2)

Bus Coupler
Power

24 Vdc 0 Vdc

+          +

-          -

24 Vdc power source

Figure 8. Beckhoff Automation: KL1488 (Qty2) 8 Channel Digital Input Terminals
(See Figure 2)

Honeywell: WDRR1A02A0A Outputs

Output 1 Input 1
Output 3 Input 3
Output 5 Input 5
Output 7 Input 7

Honeywell: KL1488 Inputs

Input 1 Input 2
Input 3 Input 4
Input 5 Input 6
Input 7 Input 8

Honeywell: WDRR1A02A0A Outputs

Output 9 Input 1
Output 10 Input 3
Output 13 Input 5
Output 14 Input 7

Output Low Battery
Output Lost RF

Honeywell: WDRR1A02A0A Outputs

Output 11
Output 12
Output 13
Output 14

Honeywell: WDRR1A02A0A Outputs

Output Low Battery
Output Lost RF

User’s Modbus™ master module

X900

Cat 6 cable

Bus Coupler Power

24 Vdc 0 Vdc

+          +

-          -

24 Vdc power source

Fieldbus Connection RJ-45
Figure 9. Automation Direct: PX-TCP2 Ethernet Coupler
(See Figure 3)

![Diagram showing the PX-TCP2 Ethernet Coupler with labels for bus coupler power, fieldbus connection RJ-45, and terminal bus power.]

Figure 10. Automation Direct: PX-149 16pt 24Vdc Discrete Input Terminal
(See Figure 3)

![Diagram showing the PX-149 16pt 24Vdc Discrete Input Terminal with labels for user's Modbus™ master module, and connections for output and input terminals.]

Legend:
- 24 Vdc power source
- + and - terminals for bus power and fieldbus connection
- Port 1 connected to Cat 6 cable
- User's Modbus™ master module
- Cat 6 cable
- PX-149 Inputs and Outputs
- Honeywell: WDRR1A02A0A Outputs
- Low Battery
- Lost RF
Test Conditions and Pass Criteria

ENDURANCE TESTING: 14 Limitless™ WBX Switches

- WBX update rate set at 1 second
- 10 CPM, 10 K min. operations, 25 °C [77 °F] room temperature, simultaneous actuation
- WBX cycles, low battery and lost RF counts monitored
- PASS criteria: 99.9 % count detection; low battery and lost RF counts: zero

RESULT: PASS

ENDURANCE TESTING: 14 Limitless™ WLS Switches

- WLS update rate set at 30 seconds
- 5 CPM, 10 K min. operations, 25 °C [77 °F] room temperature, simultaneous actuation
- WLS cycles, low battery & lost RF counts monitored
- PASS criteria: 99.9 % count detection; low battery and lost RF counts: zero

RESULT: PASS
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