BradCommunications™
from Woodhead Industries

Direct-Link™ Industrial Ethernet Managed Switches

Hardware Reference Guide

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This document applies to the following Ethernet switch products: DRL-332, DRL-350, DRL-362, DRL-380

At Woodhead, we strive to ensure accuracy in our documentation. However, due to rapidly evolving products, software or hardware changes occasionally may not be reflected in our documents. If you notice any inaccuracies, please contact us (see Appendix C of this document).

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Hardcopies are not controlled.

Preface

Preface Sections:

- Purpose of this Guide
- Conventions

Purpose of this Guide

This manual explains how to install and maintain the Managed Switches.

Conventions

This guide uses special notation to help enhance your understanding.

Special Notation

The following special notations are used throughout this guide:

Warning

Warning messages alert the reader to situations where personal injury may result. Warnings are accompanied by the symbol shown, and precede the topic to which they refer.

Caution

Caution messages alert the reader to situations where equipment damage may result. Cautions are accompanied by the symbol shown, and precede the topic to which they refer.

Note

A note provides additional information, emphasizes a point, or gives a tip for easier operation. Notes are accompanied by the symbol shown, and follow the text to which they refer.

Contents

1
General Information

Chapter Sections:

- Overview
- Part Numbering Convention
- Operation
- Performance Specifications

1.1 Overview

This manual will help you install and maintain the Managed Switches. The main function of these switches is to:

- Enable the user to wire redundant connections between nodes
- Enable the user to manage the network by monitoring/gathering network data
- Allow for browser or telnet configuration
- Increase network performance

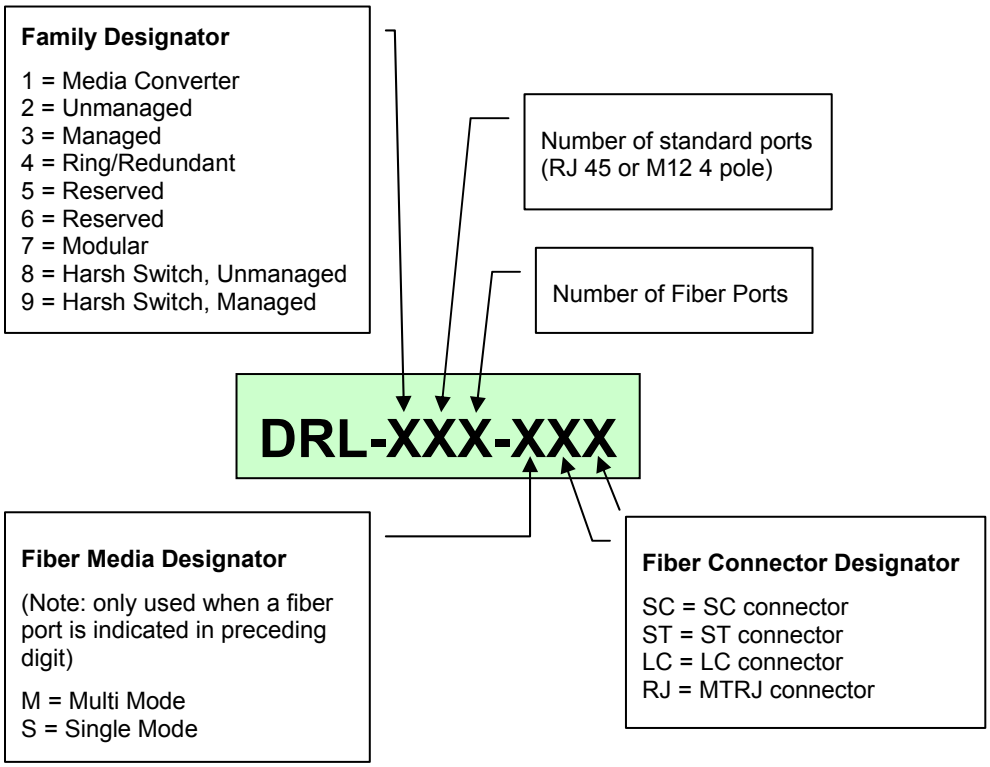
Note

For details on configuring and using any of the management functions such as SNMP, RSTP and IGMP, refer to the Software Reference Guide.

1.2 Part Numbering Convention

Each switch's name indicates the product brand, whether the switch is unmanaged or managed, the number of RJ ports, the number of fiber ports and the connector type.

Figure 1: Part Numbering Convention



1.3 Operation

Unlike an Ethernet hub, which broadcasts all messages through all ports, the Managed Switches route Ethernet messages via only the appropriate port. More importantly, unlike a regular Ethernet switch, the Managed Switch can detect and allow for ring and mesh Ethernet topologies. In other words, it prepares the network for optimal bandwidth conditions, reduces the number of collisions, and allows for redundant data path connections to reduce/eliminate downtime.

For further network reliability and performance, SNMP is also available. This protocol can extract and exchange statistical information, such as TCP, RMON and IP, helping the user to assess the network's health.

The Managed Switches can support 10BaseT (10 Mbps) or 100BaseT (100 Mbps) on their RJ45 ports. Each of these ports independently auto-senses the speed, allowing you to interface to regular or fast Ethernet devices. Certain models also have two 100BaseF (100 Mbps) fiber optic ports.

1.4 Performance Specifications

The performance specifications are as follows. For complete technical specifications, including switch dimensions, refer to Appendix A.

Table 1: Performance Specifications

Ethernet Switch Type	Managed with SNMP, RSTP, IGMP, VLANs, web management and additional functionalities
Ports (models vary)	10/100BaseT(x) (Shielded RJ45), 100BaseFX (SC or ST connectors)
Required Voltage	10 - 30 VDC (see Appendix A for power consumption for each model)
Ethernet Standards	IEEE 802.3 (10BaseT), 802.3u (100BaseTX), 802.3x (Full Duplex)
Ethernet Protocols	All standard IEEE 802.3 protocols supported
Speed Per Port	RJ45: 10 Mbps/100 Mbps Fiber: 100 Mbps (full duplex)
Ethernet Isolation	1500 Volts RMS (for 1 minute)
Operating Temp.	0 to 60 °C
Humidity	5 to 95% (non-condensing)

2
LED Indicators

Chapter Sections:

- Overview
- Power LEDs
- SYS LED
- ACT / LNK LEDs
- 10 / 100 LEDs
- STS LED

2.1 Overview

The Managed Switches have communication LEDs for each port: a “SYS” (SYSTEM) output LED, a status LED and power LEDs. Refer to the sample pictures below for LED locations.

Figure 2: LEDs on DRL-332

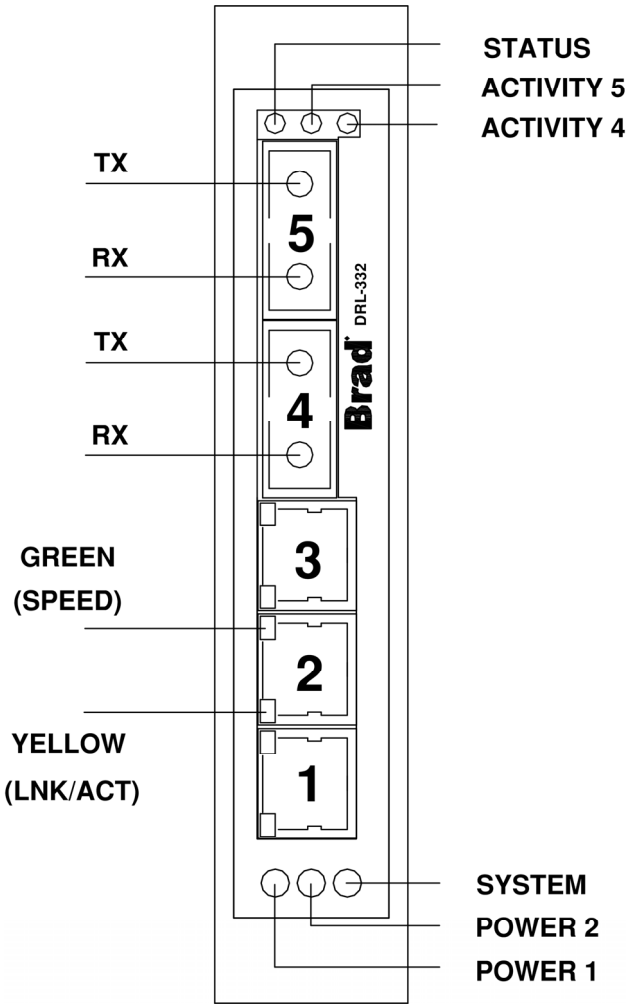


Figure 3: LEDs on DRL-350

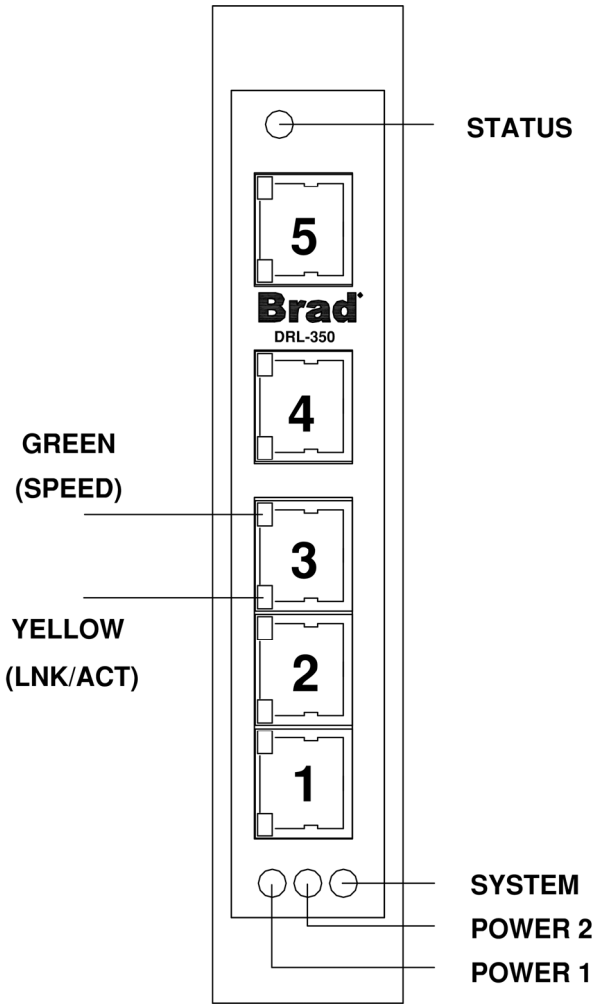


Figure 4: LEDs on DRL-362

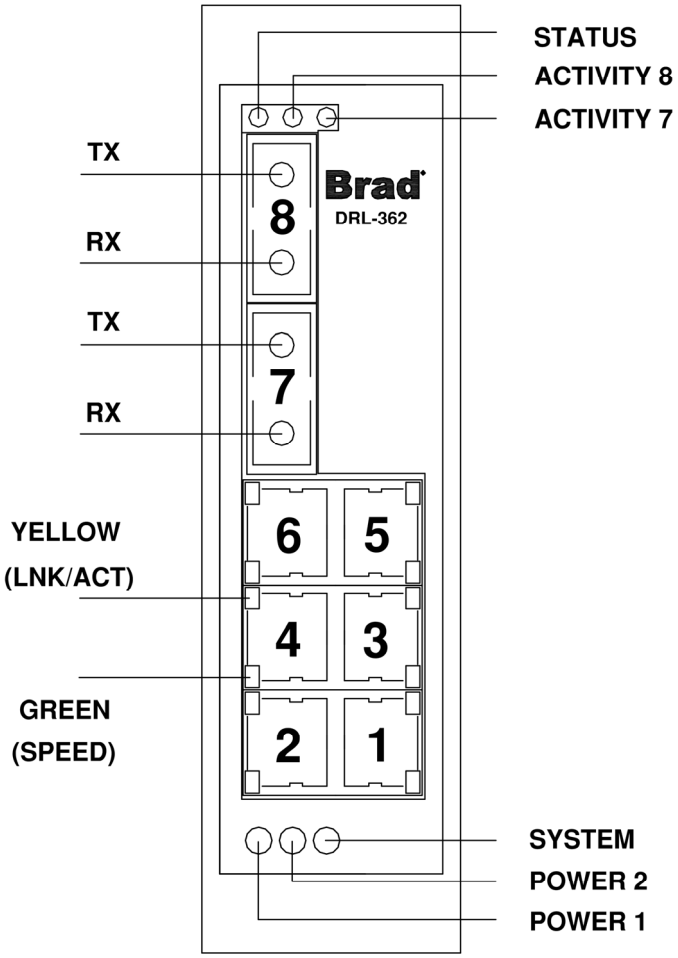
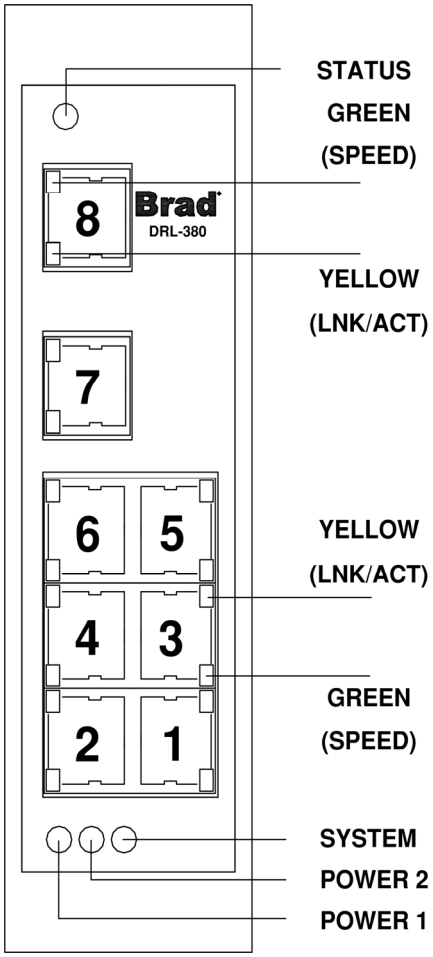


Figure 5: LEDs on DRL-380



2.2 Power LEDs

There are two Power LEDs on the Managed Switch, P1 and P2. P1 is used for primary power, and P2 is used for secondary power. Both indicate if power is being applied to the respective terminal.

2.3 SYS LED

This LED indicates the status of the power inputs. There is an output screw terminal that can be connected, as shown in Figure 9, Wiring for Managed Switch. The output voltage from the screw terminal marked 'SYS Output' is the same as the applied switch input voltage. The output is ON when both the P1 and P2 terminals have power applied to them. It's OFF if either input does not have power or the switch software is not running.

2.4 ACT / LNK LEDs

The activity (ACT) and link (LNK) functionality is combined into one LED. There is one of these LEDs per port. For switches with a fiber port, the Activity LED is located adjacent to the Power LED. On such switches, the Activity LED behaves the same as the other Activity LEDs described in the table below.

Note

The Activity LED is only available on switches that have a fiber port.

Table 2: ACT / LNK LEDs

LED State	Meaning
Off	There is not a proper Ethernet connection (link) between the port and another Ethernet device. Make sure the proper cable type is in use and that it has been plugged securely into the ports at both ends. For Ethernet wiring directions, refer to Section 5.5, Ethernet Fiber Wiring Guidelines.
On Solid (not flashing)	There is a proper Ethernet link between the port and another Ethernet device, but no communications activity is detected.
Flashing	There is a proper Ethernet link between the port and another Ethernet device, and there is communications activity.

2.5 10 / 100 LEDs

These LEDs indicate the communications speed detected on the port. There is one of these LEDs per RJ45 port.

Note

The fiber optic port does not have a 10 / 100 LED because its speed is fixed at 100 Mbps.

Table 3: 10 / 100 LEDs

LED State	Meaning
Off	A 10 Mbps (10BaseT) connection is detected.
On	A 100 Mbps (100BaseTx) connection is detected.

2.6 STS LED

The Status LED indicates the overall health of the switch. It is normally ON solid indicating that no internal CPU or software problems are detected. It will flash when loading firmware and briefly on power up or reset. Otherwise, if it is OFF or flashing for an extended period of time then a problem is detected. In this case, please contact Woodhead Technical Support.

3
Installation

Chapter Contents:

3.1 Overview

The Managed Switches can be snapped onto a standard DIN rail (EN50022) or screwed directly to a flat panel. Refer to the photos below.

Note

Make sure you allow enough room to route your Ethernet and/or fiber optic cables.

Warning

Install the Direct-Link Industrial Ethernet Switch in accordance with local and national electrical codes.

3.2 Procedure

The Managed Switches are designed to snap tightly to a standard 35mm DIN rail. This is done by moving the tabs to an Open position, placing the switch against the rail and then moving the tabs to a Closed position. Refer to Figures 6 and 7 for views of the tabs in the Open and Closed positions.

Figure 6: Switch in Open Position

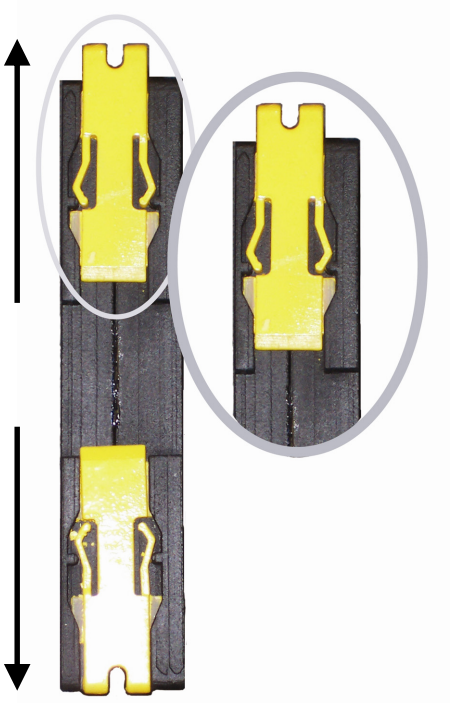
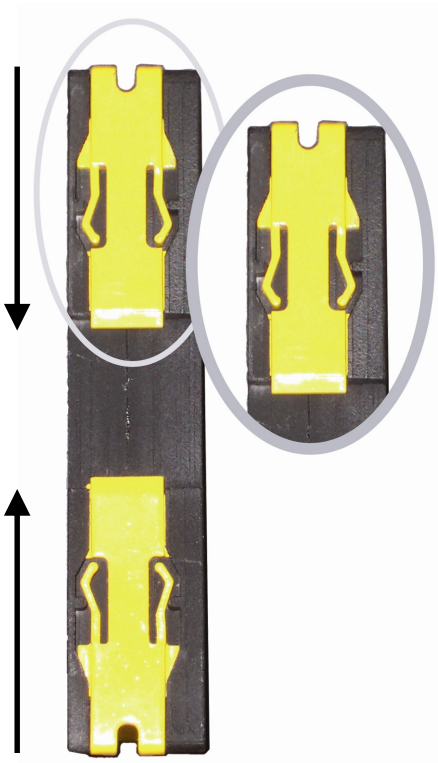


Figure 7: Switch in Closed Position



If the switch is to be mounted using the screw mount, make sure the tabs are in a Closed position (see Figure 7). A #8-32 pan head sheet metal screw is recommended for attaching the switch to the flat panel.

Figure 8: Screw Mount Position

4
Power and I/O Wiring

Chapter Contents:

4.1 Overview

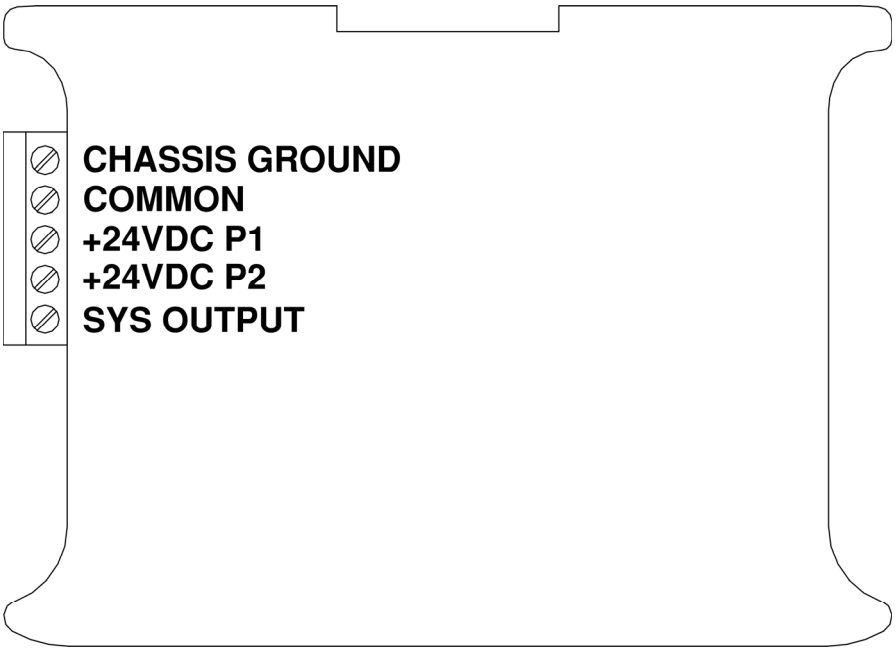
Managed Switches can be powered from the same DC source that is used to power your I/O devices. 10 to 30 VDC needs to be applied between the P1 terminal and the Common terminal. The first screw terminal should be tied to panel or chassis ground. To reduce downtime resulting from power loss, the switch can be powered redundantly with a second power supply connected to the P2 terminal and the Common terminal.

The switches also have a SYS output that can be tied to a PLC input or other device to indicate when there is a power loss. When ON, this output will source the same voltage that is applied to the switches' power terminals. For wiring details, see Figure 9, below.

Note

For the SYS Output to used effectively, both P1 and P2 must be powered. For a full description of the SYS Output, refer to Section 2.3, SYS LED.

Figure 9: Wiring for Managed Switch



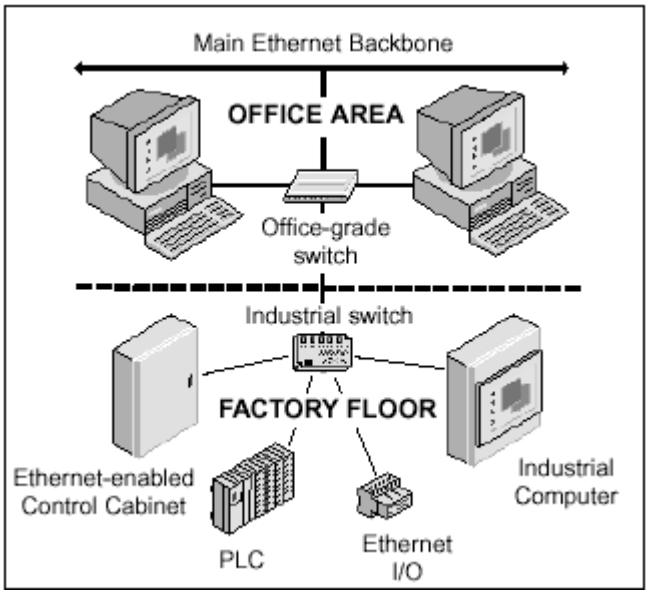
5
Communication Ports Wiring

Chapter Contents:

5.1 Overview

The Managed Switches provide connections to standard Ethernet devices, such as PLCs, Ethernet I/O and industrial computers. Two types of communication ports may be found on the switches: Ethernet ports (RJ45 or fiber) or a management port (serial).

Figure 10: Managed Switch Connections



5.2 RJ45 Ethernet Wiring

Use data-quality (not voice-quality) twisted pair cable rated category 5 (or better), with standard RJ45 connectors. For best performance, use shielded cable. Straight through or crossover RJ45 cable can be used, regardless of the device the switch is to be connected to, as all the Managed Switches are capable of auto-mdi/mdix-crossover detection.

The RJ45 Ethernet port connector bodies on these products are metallic and are connected to the Chassis GND terminal. Therefore, shielded cables may be used to provide further protection. To prevent ground loops, the cable shield should be tied to the metal connector body at one end of the cable only. For increased reliability, electrical isolation is also provided on the Ethernet ports.

Note

The two tables below are for reference only, as either cable wiring will work.

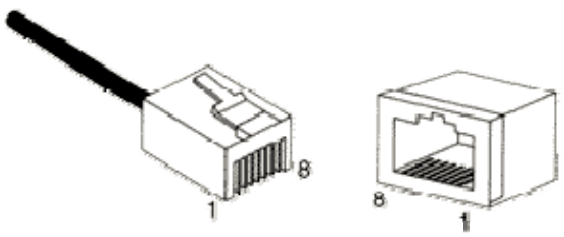
Table 4: Straight-thru Cable Wiring

Pin 1	Pin 1
Pin 2	Pin 2
Pin 3	Pin 3
Pin 6	Pin 6

Table 5: Cross-over Cable Wiring

Pin 1	Pin 3
Pin 2	Pin 6
Pin 3	Pin 1
Pin 6	Pin 2

Figure 11: Ethernet Plug & Connector Pin Positions



5.3 Ethernet Connector Pin-outs

Table 6: Ethernet Connector Pinouts

Pin #	MDI-X Port	MDI Port (typical for uplink)	Auto-MDI / MDI-X	Ethernet Device Port
1	TX+	RX+	TX/RX+	RX+
2	TX-	RX-	TX/RX-	RX-
3	RX+	TX+	RX/TX+	TX+
6	RX-	TX-	RX/TX-	TX-

5.4 RJ45 Cable Distance

The maximum cable length for 10/100BaseT is typically 100 meters (328 ft.).

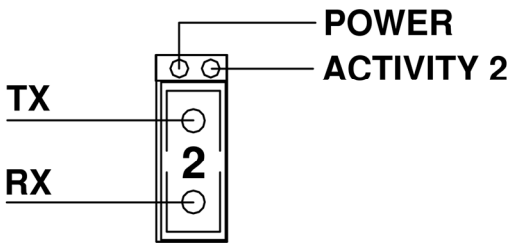
5.5 Ethernet Fiber Wiring Guidelines

The Managed Switches have one multi-mode or single-mode port. The multi-mode port supports a maximum segment length of 2 km each. The single-mode port supports a maximum segment length of 15 km.

Each fiber optic port on the switch is comprised of a pair of SC or ST-style connectors. For each fiber port, there is a transmit (TX) and receive (RX) signal. When making your fiber optic connections, make sure that the transmit (TX) port of the switch connects to the receive (RX) port of the other device, and the receive (RX) port of the switch connects to the transmit (TX) port of the other device. See Figure 12 below.

Use standard fiber optic wiring techniques to make your connections. The corresponding ACT/LNK LED will be ON solid when you have made a proper connection.

Figure 12: 100BaseT Fiber Ports (SC Style)



5.6 Duplex Operation

The RJ45 ports will auto-sense for Full or Half duplex operation, while the fiber ports are configured for full duplex operation.

Note

Fiber devices with half duplex settings should still communicate with the switch. If they don't, contact Woodhead Technical Support.

5.7 Verifying Connectivity

After all Ethernet and/or fiber connections have been made, check the LEDs corresponding to the ports that each of the devices are connected to. Ensure that for each port that is in use, the LED is on or blinking. If a port LED is off, check for connectivity problems between that port and the network device connected to it. In addition, the LED color should indicate the speed your device is connected at (for more details, refer to Chapter 2, LED Indicators).

5.8 Serial Port Wiring

An RJ45 female connector is used to configure the switch's networking and management options. Use a DB9F to RJ45F adapter along with a RJ45 male to RJ45 male straight-thru-wired patch cable to connect the RS232 port of the Managed Switch (RJ45 female) to a com port (DB9 male)on your PC.

Woodhead offers a pre-wired converter under part number DRL-002.

Figure 13: DB9 to RJ45F Adapter (DRL-002)

A typical DB9F to RJ45F adapter should be wired as follows:

Table 7: DB9F to RJ45F Wiring

DB9F		RJ45F	
Signal Name	**Pin #**	**Pin #**	**Signal Name**
DTR out	4	1	RI/DSR in
N/C	n/c	2	DCD in
DSR in	6	3	DTR out
GND	5	4	GND
TXD out	3	5	RXD in
RXD in	2	6	TXD out
RTS out	7	7	CTS in
CTS in	8	8	RTS out

6
Switch Features

Chapter Contents:

6.1 Switch Features

Here's a brief explanation of the features found in the Direct-Link Industrial Ethernet Switches.

10BaseT and 100BaseTx Auto-Detection

Standard Ethernet (10BaseT) has a maximum speed of 10 Mbps. Fast Ethernet (100BaseTx) has a maximum speed of 100 Mbps. The RJ45 ports on the switches automatically select the appropriate speed.

100BaseFX (Multi-mode and Single-mode) Fiber Optic Port

The fiber optic port found on some models is classified as 100BaseFX and supports 100 Mbps operation only. Both multi-mode and single-mode models are available. Multi-mode fiber has a large core diameter relative to a wavelength of light, and is typically 62.5 microns. Light injected into the fiber travels through many different paths, causing multiple modes to occur at the receiving end. This dispersion of light limits the distance for multi-mode to about 2km. Single-mode fiber has a thin core diameter of typically 10 microns, which eliminates multi-mode dispersion and allows distances of more than 15km.

2K MAC Addresses with Automatic Learning, Aging and Migration

Each Ethernet device inserts its unique "MAC" address into each message it sends out. The port on the switch used for a given MAC address is automatically learned when a frame is received from that address. Once an address is learned, the switch will route messages to the appropriate port only, instead of broadcasting messages out all ports like a hub. A timestamp is also placed in memory when a new address is learned. This timestamp is used with the aging feature, which will remove unused MAC addresses from the table after 300 seconds. If a device moves, the associated port on the switch will be changed (migrated) as needed. Up to 2,048 MAC addresses can be stored and monitored at any time on the DRL-332, DRL-350 DRL-362 and DRL-380.

Auto-Crossover (Auto-mdi/mdi-x)

The RJ45 ports will automatically detect the cable type (straight-thru vs. cross-wired) and re-configure themselves accordingly.

Auto-Sensing or Auto-Negotiating Speed

The RJ45 ports will auto-negotiate with the connected device to determine the optimal speed (10 Mbps vs. 100 Mbps).

Automatic Power Saving

If there is no cable on a port, most of the circuitry for that port is disabled to save power.

Backoff Operation

The switches will drop a packet after 16 collisions.

Back Pressure for Half-Duplex

The switches will apply "back pressure" when necessary with half-duplex operation. This will reduce congestion on busy networks.

Buffering

SRAM is used for buffering the messages. The DRL-332, DRL-350 DRL-362 and DRL-380 have 1 MB of SRAM for buffering.

Unmanaged Operation

The switches require no supervisory processor to operate properly.

Flow Control

The switches automatically support flow control frames on both the transmit and receive sides.

Forwarding

The switches support store and forward mode. They forward messages with known addresses out the appropriate port only. Messages with unknown addresses, broadcast messages, and multicast messages get forwarded out all ports, except the source port. The switches will not forward error packets, 802.3x pause frames, or "local" packets.

Full/half-Duplex Operation

The switches'RJ45 ports support both full and half duplex flow control. The fiber optic port supports full duplex only.

Illegal Frames

Illegal frames, as defined by IEEE 802.3, will be dropped. This includes short frames, long frames and FCS error frames.

IEEE 802.3 Compliant

The switches abide to the IEEE 802.3 standard for 10BaseT, 100BaseTX, and 100BaseFX Ethernet communications.

Late Collision

If a packet experiences collisions after 512 bit times of transmission, it will be dropped.

Latency

The typical latency of a message is 5 microseconds or faster. The latency is the time it takes a message to be routed internally to a switch from one port to another.

Plug and Play

This means that most of the switches' functions or features are automatic and that no optional parameters need to be set. Just plug in your Ethernet cables, apply power, and the unit will immediately begin to operate.

Protocol Independent

The switches simultaneously support all popular Ethernet protocols and networks, such as TCP/IP, the Internet (IP), UD and NetBEUI that run over standard Ethernet (IEEE 802.3).

A

Technical Specifications

Appendix Contents:

- Technical Specifications

A.1 Technical Specifications

The hardware technical specifications for the Managed Switches are as follows. Refer to the Software Reference Guide for complete software specifications.

Table 8: Copper RJ45 Ports: (10/100BaseT or 10/100)

10/100/BaseT ports	Shielded RJ45
Protocols supported	All standard IEEE 802.3
Ethernet compliancy	IEEE 802.3, 802.3u, 802.3x, 802.3z, 802.1p and more
Auto-crossover	Yes, allows you to use straight or cross wired cables
Auto-sensing operation	Full and half duplex
Auto-negotiating	10BaseT and 100BaseT
Auto-polarity	Yes, on the TD and RD pair
Flow control	Automatic
Ethernet isolation	1500 VRMS 1 minute
Plug and play	Yes
Cable requirements	Twisted pair (Cat. 5 or better) (shielded recommended)
Max. cable distance	100 meters

Table 9: SC or ST Fiber Ports: (100BaseF multi-mode or single-mode)

100BaseF ports	2
Fiber port mode	Multi-mode (mm) or Single-mode (sm)
Fiber port connector	Duplex SC or ST
Optimal fiber cable	62.5/125 µm for mm; 9/125 µm for sm
Center wavelength	1300 nm
TX output power	Contact your switch vendor
RX input sensitivity	Contact your switch vendor
Max. distance (full duplex)	4 km with mm; 20 km with sm
Half and full duplex	Software Configurable
Ethernet compliance	100BaseF

Table 10: General Specifications:

Ethernet switch type	Managed with 5 or 8 Ethernet ports	
Latency for 10 Mbps ports	16 us + frame time (typical)	Varies on load and settings
Latency for 100 Mbps ports	5 us + frame time (typical)	
Full or half duplex operation	Configurable	
"OK" Output	ON if P1 and P2 have power and switch software is running	
Voltage	Same as switch input voltage	
Maximum current output	0.5 Amp	
Management serial port	RS232 (TXD, RXD and GND), 9600, 8, N, 1 fixed	
Mounting	DIN rail or direct panel mounting	
Power input	Redundant Input Terminals	
Input power (typical - all ports active at 100 Mbps) (10 W maximum)	3.60 W (DRL-350), 5.52 (DRL-332), 4.32 W (DRL-380), 6.32 W (DRL-362)	
Input voltage (all models)	10-30 VDC (continuous)	
Ethernet isolation	1500 VRMS 1 minute	
Environmental		
Operating temperature range	0 to +60 °C	
Storage temperature range	-40 to +85 °C	
Humidity (non-condensing)	5 to 95% RH	
Vibration	IEC68-2-6	
Electrical safety	EN61010-1	
EMI emissions	FCC part 15, ICES-003, EN55011	
EMC immunity	EN61326	
Packaging	IP30 protection	
Dimensions	See Figures 14, 15 and 16 for details.	

Figure 14: Managed Switch, Side View

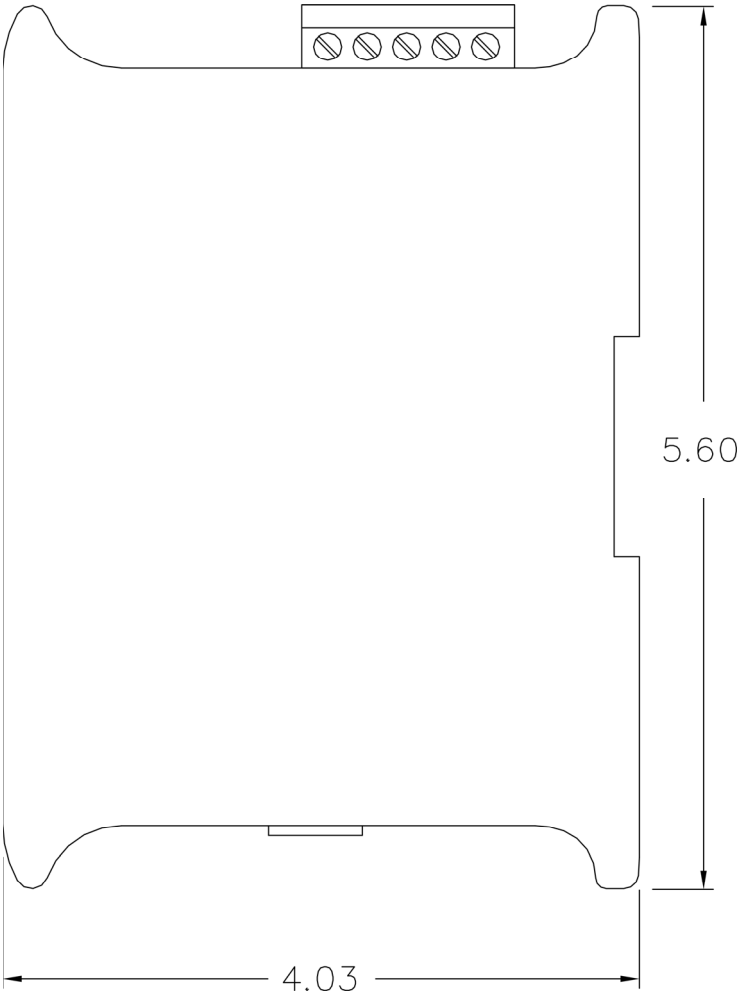


Figure 15: Managed Switch, Front View (DRL-362 & DRL-380)

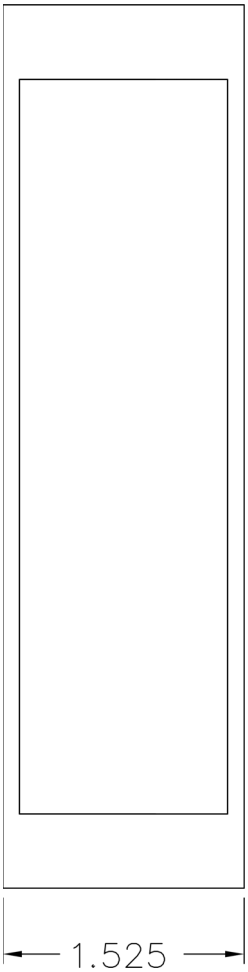
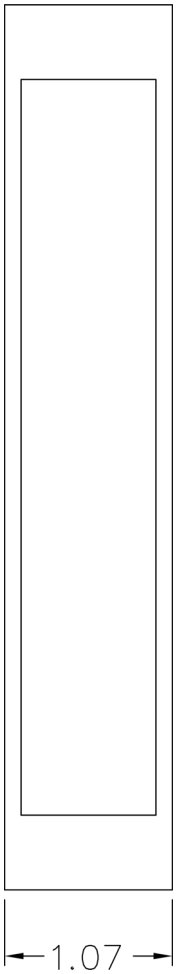


Figure 16: Managed Switch, Front View (DRL-332 & DRL-350)



B

Standards and Safety

Appendix Sections:

- Standards and Safety

B.1 Standards and Safety

The applicable standards and certifications are:


European Directives


US Emissions


ML File: E205563

B.1.1 CE Statement

Electrical safety - EN61010-1 (IEC61010)
EMI emissions - FCC part 15, ICES 003, EN55011; Class A
EMC immunity – EN61326

B.1.2 FCC Statement

This equipment complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Note

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Warning

Changes or modifications not expressly approved by Woodhead Industries could void the user's authority to operate the equipment.

B.1.3 UL Statement

ML File: E205563

B.1.4 General Warnings

Caution

This equipment is neither designed for, nor intended for operation in installations where it is subject to hazardous voltages and hazardous currents.

Note

To maintain compliance with the limits and requirements of the EMC Directive, it is required to use quality interfacing cables and connectors when connecting to this device.

Note

The supply voltage for this equipment must be delivered as Separated Extra Low Voltage (SELV).

C

Warranty and Support

Appendix Sections:

- Warranty
- Technical Support

C.1 Warranty

For warranty information pertaining to the switch, refer to http://www.mysst.com/warranty.asp.

C.2 Technical Support

Please ensure that you have the following information readily available before calling for technical support:

- Switch type and serial number
- Details of the problem you are experiencing: switch type and version, target network, and circumstances that may have caused the problem

C.2.1 Getting Help

Technical support is available during regular business hours by telephone, fax or email from any Woodhead Software & Electronics office, or from http://www.woodhead.com. Documentation and software updates are also available on the Web site.

North America

Canada:
Tel: 1-519-725-5136
Fax: 1-519-725-1515
Email: SupportNA@woodhead.com

Europe

France:
Tel: 33-(0)2-32-96-04-22
Fax: 33-(0)2-32-96-04-21
Email: SupportEU@woodhead.com

Germany:
Tel: 49-711-782-374-22
Fax: 49-711-782-374-11
Email: SupportEU@woodhead.com

Italy:
Tel: 39-010-595-4052
Fax: 39-010-595-6925
Email: SupportEU@woodhead.com

Other countries:
Tel: 33-(0)2-32-96-04-23
Fax: 33-(0)2-32-96-04-21
Email: SupportEU@woodhead.com

Asia-Pacific

Japan:
Tel: 81-3-5791-4621
Fax: 81-3-5791-4688
Email: SupportAP@woodhead.com

Singapore:
Tel: 65-6261-6533
Fax: 65-6261-3588
Email: SupportAP@woodhead.com

China:
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