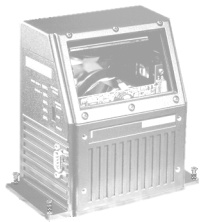
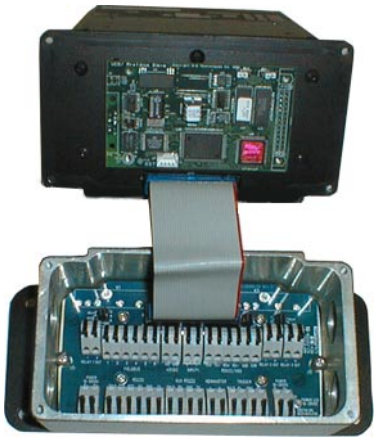
MICROSCAN®

MS-880 Network Protocol Card User's Manual

for the MS-880 Industrial Long Range Scanner





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Overview

The MS-880 Network Protocol Card is an add-on to the MS-880 Scanner/Wiring Box combination that allows users to network via DeviceNet, Profibus, and DataHighway Plus.

Network Protocol Card Kit Part Numbers

DeviceNet 98-000009-03

Profibus 98-000009-02 or 98-000009-06

DataHighway Plus 98-000009-04

About this Manual

Refer to **Chapter 1, "Quick Start,"** for installation instructions

Refer to **Chapter 2, "Network Port Configuration"** for a list of commands that can be used to setup configuration with the networked bar code scanner.

Refer to **Chapter 3, "DeviceNet,"** for setting up a DeviceNet network.

Refer to **Chapter 5, "Profibus–DP,"** for setting up a Profibus network.

Refer to **Chapter 6, "DataHighway Plus,"** for setting up a DataHighway network.

Refer to **Chapter 7, "Serial Port Emulation Mode"** for network communication for DeviceNet only.

Refer to **Chapter 8, "Bar Code Object Mode"** for general list of network data and services and attributes for Profibus and DataHighway Plus.

Refer to the **"Appendix"** for specifications including wiring and module status LEDs.

Customer Support

For detailed instructions relating to the installation and use of the MS-880 scanner and wiring box, see Microscan's ***MS-880 Industrial Long Range Scanner User's Manual***, part number 83-000880.

For more information about Microscan products, including up-to-date literature, check our web site at: ***www.microscan.com***.

For direct support, email us at ***helpdesk@microscan.com***.

Chapter

1

Quick Start

This chapter includes the overall steps in setting up and using the network protocol card.

Note: For detailed instructions relating to the installation and use of the MS-880 scanner and wiring box, see Microscan's ***MS-880 Industrial Long Range Scanner User's Manual***, part number 83-000880.

Step 1 — Install the Network Protocol Card

Important: These instructions are general. See individual network card chapters for more specific information.

1. Open wiring box to install network protocol card.

   If scanner is connected to the wiring box, remove the four mounting screws that attach the scanner to the wiring box and lift scanner away from the wiring box.

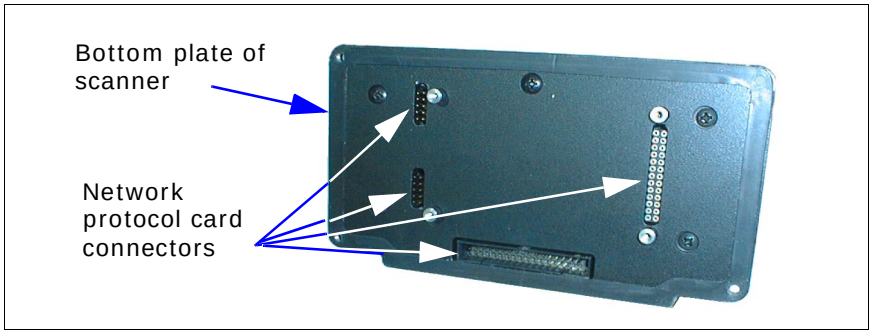


Figure 1-1 Bottom of MS-880 Scanner

2. Plug-in network protocol card.

   Insert network protocol card into the connector pins on the bottom of the scanner.

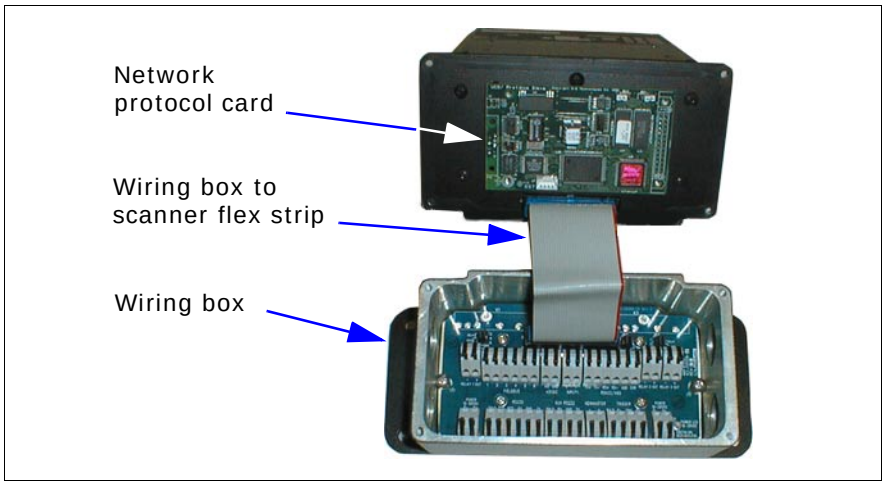


Figure 1-1 MS-880 Scanner, Wiring Box and Network Card

2. Ensure that flex strip is seated securely in scanner and wiring box.
3. Attach network card shield to the network card with the four screws included in the network card kit.
2. Make connections to the wiring box as per your scanner manual instructions.
3. Make fieldbus (network) connections as per **Table A-A-2, "Fieldbus Terminal Network Connections in Wiring Box," on page A-4**.
4. Connect the scanner to the wiring box with the 4 mounting screws (provided with the scanner) taking care not to pinch the scanner/wiring box flex strip.

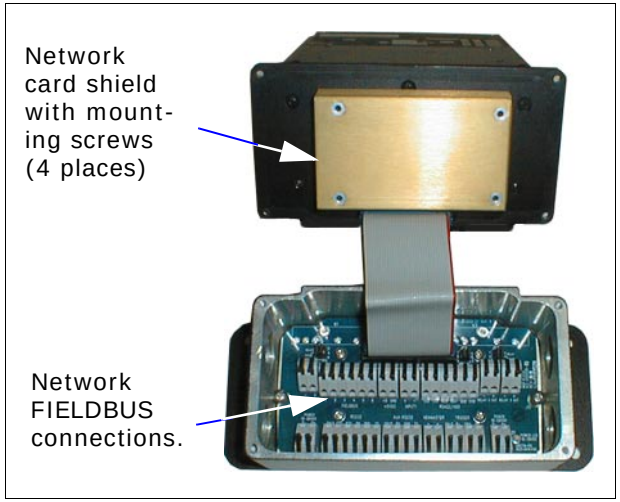


Figure 1-1 Network Shield

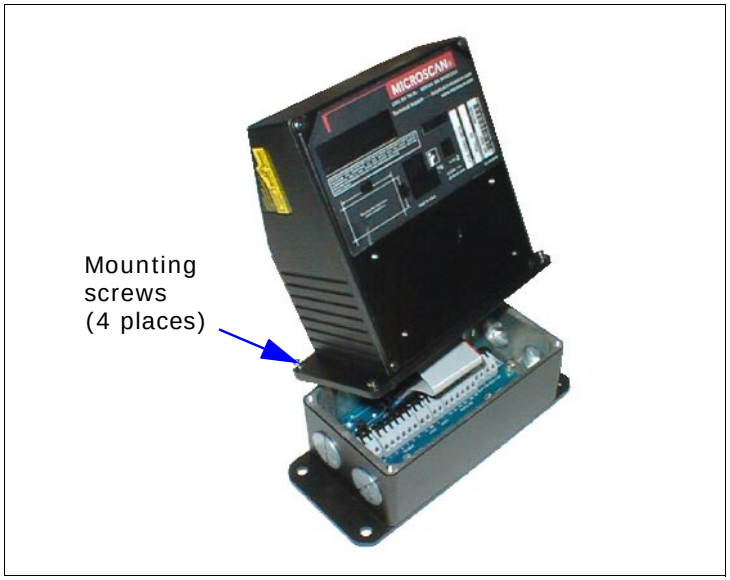


Figure 1-1 Attaching the Scanner

Step 2 — Configure the Network Port

DeviceNet, Profibus, and DataHighway Plus network protocol cards can be configured by RS-232 connection using serial commands, embedded menus, or Microscan's ESP Windows™ based program.

See **Chapter 2, "Network Port Configuration"** for details on configuration. This chapter lists the parameters for setting the scanner's network port configuration such as baud, address, etc. for communicating with the host.

See also Microscan's ***MS-880 Industrial Long Range Scanner User's Manual***, part number 83-000880 for detailed instructions relating to the installation and use of the MS-880 scanner and wiring box.

Step 3 — Specific Protocol for Data and Network Services.

Microscan's MS-880 scanner has a variety of features that allow you to control the flow of data by setting read cycle and match code conditions, I/Os, etc. In addition, a number of control service commands are available when using the protocol card.

For protocol-specific services and IDs that can be mapped to and from the MS-880,

For DeviceNet, see **Chapter 3, "DeviceNet"** and **Chapter 7, "Serial Port Emulation Mode."**

For Profibus, see **Chapter 5, "Profibus–DP."**

For DataHighway Plus, see **Chapter 6, "DataHighway Plus."**

For both Profibus and DataHighway Plus, see also **Chapter 8, "Bar Code Object Mode."**

Chapter

2

Network Port Configuration

Chapter Contents

This chapter lists the parameters for setting the scanner's network port configuration such as baud, address, etc. for communicating with the host.

You can configure the network protocol card by RS-232 connection using serial commands, embedded menus, or Microscan's ESP-MP Windows™ based program.

Note: For detailed instructions relating to the installation and use of the MS-880 bar code scanner and wiring box, see Microscan's ***MS-880 Industrial Long Range Scanner User's Manual***, part number 83-000880.

Configuration Options

The network protocol card can be configured by RS-232 connection by any of the following methods:

1. Serial command
2. Embedded menu
3. Microscan's ESP Windows™ based program

Serial Command

Function	Command Title	Format
Network Communications	Client	<**K120,***net port status*>
	Device Net	<**K121,***deviceNet baudrate,deviceNet MACID*>
	Profibus–DP	<**K122,***profibus station address*>
	DataHighway	<**K123,***DHP baudrate,DHP address*>
	Serial Port Emulation	<**K125,***length status,rx from network size,tx to network size,pad status,pad char,end justify data status,byte swap status*>

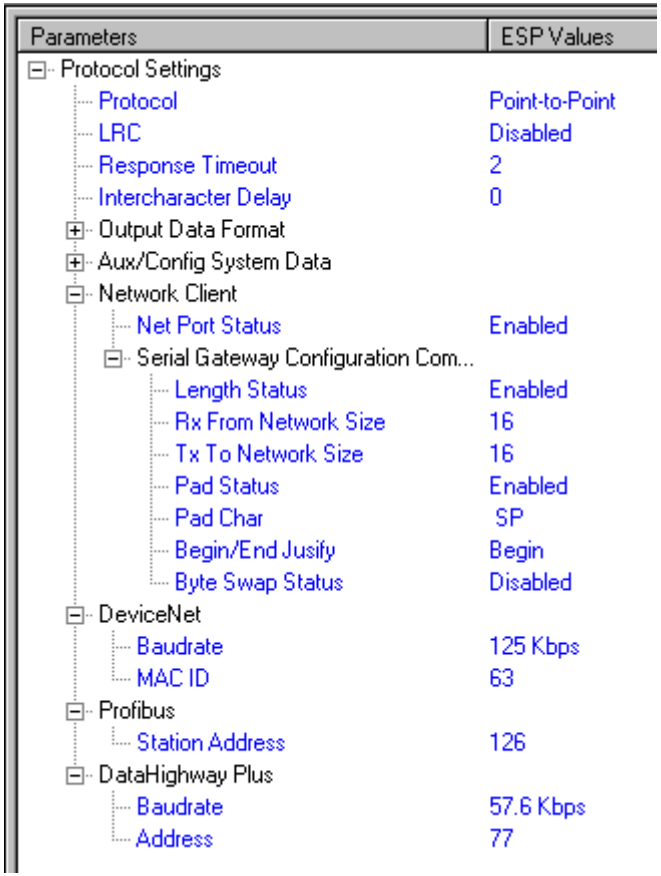
Embedded Network Menu

Select the appropriate protocol (DeviceNet, Profibus, or DataHighway) and configure. Be sure to save settings for power-on.

```
                CURRENT SETTINGS FOR NETWORK CONFIGURATION
--------------------------------------------------------------------------------
  [CLIENT SETTINGS]
NET PORT STATUS      = ENABLED
  [SERIAL GATEWAY SETTINGS]
LENGTH STATUS        = ENABLED
RX FROM NETWORK SIZE = 10
TX TO NETWORK SIZE   = 10
PAD STATUS           = ENABLED
PAD CHARACTER        = <NUL>
END JUSTIFY DATA     = DISABLED
BYTE SWAP STATUS     = ENABLED
--------------------------------------------------------------------------------
               DEVICENET       PROFIBUS        DATA HIGHWAY
NODE ADDRESS     10              1               77 (oct)
BAUD RATE        125K bps        autobaud        57.6K bps
--------------------------------------------------------------------------------
MODICON ETHERNET(MODBUS)
--------------------------------------------------------------------------------
                 ESC = MAIN MENU OR EXIT   N  = NEXT ITEM
                 M   = PREVIOUS MENU       SP = NEXT ITEM
                 B   = PREVIOUS ITEM       CR = THIS ITEM
--------------------------------------------------------------------------------
NETWORK CONFIGURATION--> CLIENT
```

Microscan's ESP Menu Command

Open the protocol menu in ESP and Select the appropriate protocol (DeviceNet, Profitbus, or DataHighway).



Network Client

Definition:	Enables client-side (bar code scanner) network port operation.
Usage:	Allows the user to disable the network connection.
Serial Cmd:	<**K120,*net port status***>
Default:	**Enable**
Options:	0 = Enable 1 = Disable

Net Port Status must be enabled for network operation.

DeviceNet

Definition: Configures DeviceNet port operation.

DeviceNet, based on CAN (Controller Area Network) technology, is characterized by its widespread acceptance, high reliability, efficient use of network bandwidth, and availability of power on the network.

Usage: Most commonly found in assembly, welding, and material handling applications that use serial port emulation commands.

By ESP Menu

Baud Rate

Serial Cmd: <**K121,*deviceNet baudrate***,*deviceNet address*>

Default: **0**

Options:
0 = 125Kbps
1 = 250Kbps
2 = 500Kbps

Address

Serial Cmd: <**K121,***deviceNet baudrate*,***deviceNet address***>

Default: **63**

Options: 0 to 63

Profibus–DP

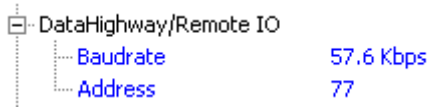
Definition:	Configures Profibus–DP network port operation.
Usage:	Profibus–DP is designed especially for communication between automation control systems and distributed I/O at the device level. Can be used with RS-485 transmission technology.
Serial Cmd:	<**K122,*profibus station address***>
Default:	**126**
Options:	1 to 126

By ESP Menu

DataHighway Plus

Definition: Configures DataHighway Plus port operation.

By ESP Menu



Baud Rate

Serial Cmd: <**K123,*DHP baudrate***,*DHP address*>

Default: **57.6 Kbps**

Options: 0 = 57.6 Kbps 1 = 115 Kbps 2 = 230 Kbps

Address

Serial Cmd: <**K123,***DHP baudrate*,***DHP address***>

Default: **77**

Options: 1 to 77 (octal)

Serial Port Emulation

Definition: **Serial Port Emulation** configures the network serial data channels.

Note: This command only applies to serial port emulation mode in DeviceNet. (See **Chapter 7, "Serial Port Emulation Mode."**)

Length Status

Definition: The user can decide if a field will be added to the transmit and receive serial data streams. When Length is enabled, a length field is added to the serial channel.

Usage: Use of **Length** is recommended.

Serial Cmd: *<**K125,length status**,rx from network size,tx to network size,pad status,pad char,end justify data status,byte swap status>*

Default: **Enable**

Options: 0 = Disable 1 = Enable

Receive from Network Size

Definition: Sets the number of serial data bytes in the stream. The actual number of data bytes in the stream is dependent upon **Length Status** plus the handshake.

Serial Cmd: *<**K125,**length status,**rx from network size**,tx to network size,pad status,pad char,end justify data status,byte swap status>*

Default: **10**

Options: 1 - 248

Rx from network size	=	248 max
+ Handshake	=	4
+ Length enabled	=	2
= Total size	=	254 max

Transmit to Network Size

Definition:	Sets the number of serial data bytes in the stream. The actual number of data bytes in the stream is dependent upon the **Length Status** plus the handshake field.
Serial Cmd:	*<**K125,**length status,rx from network size,**tx to network size**,pad status,pad char,end justify data status,byte swap status>*
Default:	**16**
Options:	1 - 248

Tx to network size	=	248 max
+ Handshake	=	4
+ Length enabled	=	2
= Total size	=	254 max

Pad Status

Definition:	**Pad Status** can be enabled to “clear” undefined bytes in the serial data stream sent to the network.
Usage:	This has no effect on the serial data received from the network.
Serial Cmd:	*<**K125,**length status,rx from network size,tx to network size,**pad status**,pad char,end justify data status,byte swap status>*
Default:	**Enabled**
Options:	0 = disabled 1 = enabled

Pad Character

Definition:	Allows the user to define the **Pad Character**.
Usage:	
Serial Cmd:	*<**K125,**length status,rx from network size,tx to network size,pad status,**pad char**,end justify data status,byte swap status>*
Default:	**Nul** (0x00)
Options:	Any ASCII char (must use on-board menu to configure '<', comma, or '>')

End Justify Data Status

Definition:	The user can decide whether the serial data sent to the network is located at the beginning or the end of the serial data stream (also referred to as “left” and “right.”) **Note**: Handshake and length fields are always located at the beginning of the serial stream. This has no effect on the serial data received from the network.
Usage:	Enable this option to end justify the data in the serial stream.
Serial Cmd:	*<**K125,**length status,rx from network size,tx to network size,pad status,pad char,**end justify data status**,byte swap status>*
Default:	**Disabled**
Options:	0 = Disabled 1 = Enabled

Byte Swap Status

Definition:	Allows the user to decide whether or not the content of the serial data stream is byte swapped. **Note:** Typically this feature is only used in network systems that require an even number of data bytes. Therefore, if the transmit or receive streams are configured for an odd size, the last byte is not swapped.
Usage:	This is useful for network hosts that map data in 16-bit little-endian format.
Serial Cmd:	*<**K125,**length status,rx from network size,tx to network size,pad status,pad char,end justify data status,**byte swap status**>*
Default:	**Disabled**
Options:	0 = Disabled 1 = Enabled

Chapter

3

DeviceNet

Chapter Contents

This chapter documents the MS-880's DeviceNet specific data and service attributes. DeviceNet operates in serial port emulation mode. See **Chapter 7, "Serial Port Emulation Mode."**

Note: For detailed instructions relating to the installation and use of the MS-880 scanner and wiring box, see Microscan's ***MS-880 Industrial Long Range Scanner User's Manual***, part number 83-000880.

Setup

1. Use one of the bar code scanner's programming interfaces (ESP, on-board menu, or serial commands over the host or configuration RS-232 ports) to configure the following:

   DeviceNet parameters (see **<K121>** command in **"DeviceNet" on page 2-5**)

   - DeviceNet address (1-63)
   - DeviceNet baud rate of the target network (125K/250K/500K bps)

   Serial port emulation parameters (see **<K125>** command **"Serial Port Emulation" on page 2-8**)

   - Data field length for input and output channels
   - Length field enable/disable
   - Pad character
   - End justify enable/disable
   - Byte swap enable/disable

   Bar code scanning parameters (see ***Microscan's MS-880 Industrial Long Range Scanner User's Manual***) for:

   - Triggering mode
   - Code types
   - Etc.

2. Add the bar code scanner's EDS file to the host's database. The EDS file can be found on the Network Protocol Manual disk. The EDS provides the following information to the host:
   - Identity of the bar code scanner,
   - Size and quantity of data connections available,
   - What connection types are available (Explicit/IO, COS/Polled/Cyclic).
   - Connection paths
3. Add the bar code scanner's device address to the master's scan list.
4. Select the report method the network will use for the connection: Change of State (COS), Polled, or Cyclic. Note that due to the symbolic connection paths used by the interface, only IO messaging is supported for accessing the serial port emulation channels.
5. Write the master system's process control algorithms to operate the serial emulation protocol. Use the format later in this chapter to map the location of individual attributes in the serial channel into the host's memory.

Table 3-1 IO Connection Options

Device Address	Connection path	Connection Size (each direction is independent)	Report Method
0 - 63	Input: 0x61 0x49	5 – 254 bytes	Polled COS Cyclic
	Output: 0x61 0x4F	5 – 254 bytes	

Refer to **Chapter 7, "Serial Port Emulation Mode"** for additional details. This information is in a separate chapter because this mode of operation operates the same regardless of what type of network interface is installed.

6. Connect the bar code scanner to the DeviceNet network using the "Fieldbus" terminals on the wiring box pcb. See **Table A-A-2, Fieldbus Terminal Network Connections in Wiring Box, on page A-4** for the pin out of the "Fieldbus" terminals.
7. Go online and test the bar code scanner.

DeviceNet Object Model/Capabilities

Specification Revision

The DeviceNet Slave firmware for the MS-880 DeviceNet port is compatible with the DeviceNet Specification:

- Volume I, Release 2.0
- Volume II, Release 2.0

General Communication Capabilities

Data Rate

- 125, 250, and 500 kbps

Predefined Master/Slave Connection Set

- Group 2 Only Server (Slave)
- Poll I/O
- Cyclic / COS I/O
- Explicit Messaging

Protocol Features

- Offline Connection Set
- Heartbeat Message
- Shutdown Message

Fragmentation

- Supports fragmented explicit messages
- Supports fragmented I/O messages

Identity Object

Object Class 0x01 (there is only one instance of this object)

Table 3-2 Object Class 0x01 — Class Attributes

Id	Description	Get	Set	Limits
1	Revision	0	0	
2	Max Instance	0	0	
3	Number of Instances	0	0	
4	Optional Attribute List	0	0	
5	Optional Service List	0	0	
6	Max ID of class attributes	0	0	
7	Max ID of instance attributes	0	0	

+ Supported 0 Not supported

Table 3-3 Object Class 0x01 — Class Services

Service		Parameter Options
Get_Attributes_All	0	
Reset	0	
Get_Attribute_Single	0	
Find_Next_Object_Instance	0	

+ Supported 0 Not supported

Table 3-4 Object Class 0x01 — Instance Attributes

Id	Description	Get	Set	Limits
1	Vendor	+	0	8
2	Device Type	+	0	12 (0x0C)
3	Product Code	+	0	316 (0x13C)
4	Revision [major, minor]	+	0	[1,1]
5	Status	+	0	
6	Serial Number	+	0	Factory Assigned
7	Product Name	+	0	“DeviceNet Slave”
8	State	0	0	
9	Configuration Consistency Value	+	0	
10	Heartbeat Interval	+	+	

+ Supported 0 Not supported

Table 3-5 Object Class 0x01 — Instance Services

Service		Parameter Options
Get_Attributes_All	0	
Reset	+	
Get_Attribute_Single	+	
Set_Attribute_Single	+	

+ Supported 0 Not supported

Message Router Object

Object Class 0x02 (there is only one instance of this object)

Table 3-6 Object Class 0x02 — Class Attributes

Id	Description	Get	Set	Limits
1	Revision	0	0	
2	Max Instance	0	0	
3	Number of Instances	0	0	
4	Optional Attribute List	0	0	
5	Optional Service List	0	0	
6	Max ID of class attributes	0	0	
7	Max ID of instance attributes	0	0	

+ Supported 0 Not supported

Table 3-7 Class Services

Service		Parameter Options
Get_Attributes_All	0	
Get_Attribute_Single	0	

+ Supported 0 Not supported

Table 3-8 Object Class 0x02 — Instance Attributes

Id	Description	Get	Set	Limits
1	Object List	0	0	
2	Maximum connections supported	0	0	
3	Number of active connections	0	0	
4	Active connections list	0	0	

+ Supported 0 Not supported

Table 3-9 Object Class 0x02 — Instance Services

Service		Parameter Options
Get_Attributes_All	0	
Get_Attribute_Single	0	

+ Supported 0 Not supported

DeviceNet Object

Object Class 0x03 (there is only one instance of this object)

Table 3-10 Object Class 0x03 — Class Attributes

Id	Description	Get	Set	Limits
1	Revision	+	0	
2	Max Instance	0	0	
3	Number of Instances	0	0	
4	Optional Attribute List	0	0	
5	Optional Service List	0	0	
6	Max ID of class attributes	0	0	
7	Max ID of instance attributes	0	0	

+ Supported 0 Not supported

Table 3-11 Class Services

Service		Parameter Options
Get_Attribute_Single	+	

+ Supported 0 Not supported

Table 3-12 Object Class 0x03 — Instance Attributes

Id	Description	Get	Set	Limits
1	MAC ID	+	0	
2	Baud Rate	+	0	
3	BOI	0	0	
4	Bus-off counter	0	0	
5	Allocation information	+	0	
6	MAC ID switch changed	0	0	
7	Baud rate switch changed	0	0	
8	MAC ID switch value	0	0	
9	Baud rate switch value	0	0	

+ Supported 0 Not supported

Table 3-13 Object Class 0x03 — Instance Services

Service		Parameter Options
Get_Attribute_Single	+	
Set_Attribute_Single*	0	
Allocate M/S connection set	+	
Release M/S connection set	+	

+ Supported 0 Not supported

Assembly Object

(No assembly objects)

Object Class 0x04

Table 3-14 Object Class 0x04 — Class Attributes

Id	Description	Get	Set	Limits
1	Revision	0	0	
2	Max Instance	0	0	
3	Number of Instances	0	0	
4	Optional Attribute List	0	0	
5	Optional Service List	0	0	
6	Max ID of class attributes	0	0	
7	Max ID of instance attributes	0	0	

\+ Supported 0 Not supported

Table 3-15 Object Class 0x04 — Class Services

Service		Parameter Options
Create	0	
Delete	0	
Get_Attribute_Single	0	

\+ Supported 0 Not supported

Table 3-16 Object Class 0x04 — Instance Attributes

Id	Description	Get	Set	Limits
1	Number of members	0	0	
2	Member List	0	0	
3	Data	0	0	

\+ Supported 0 Not supported

Table 3-17 Instance Services

Service		Parameter Options
Delete	0	
Get_Attribute_Single	0	
Set_Attribute_Single	0	
Get_Member	0	
Insert_Member	0	
Remove_Member	0	

\+ Supported 0 Not supported
1 – Only available for Output objects

Connection Object

Object Class 0x05

The Predefined Master/Slave Connection Set is supported. However, please note the following limitations:

1. Only one IO and one Explicit connection can exist concurrently.
2. The serial port emulation channels can only be accessed with an IO connection.
3. Bit-strobe connections are not recommended

Table 3-18 IO Connection Path Options

Connection path	Connection Size (each direction is independent)	Report Method
Input: 0x61 0x49	5 – 254 bytes	Polled COS Cyclic
Output: 0x61 0x4F	5 – 254 bytes	

The connection size is configured via one of the MS-880's programming interfaces (ESP, on-board menu, or serial commands over the host or configuration RS-232 ports). See **Chapter 2, "Network Port Configuration."**

Table 3-19 Object Class 0x05 — Class Attributes

Id	Description	Get	Set	Limits
1	Revision	0	0	
2	Max Instance	0	0	
3	Number of Instances	0	0	
4	Optional Attribute List	0	0	
5	Optional Service List	0	0	
6	Max ID of class attributes	0	0	
7	Max ID of instance attributes	0	0	

+ Supported 0 Not supported

Table 3-20 Object Class 0x05 — Class Services

Service		Parameter Options
Reset	0	
Create	0	
Delete	0	
Get_Attribute_Single	0	
Find_Next_Object_Instance	0	

+ Supported 0 Not supported

Table 3-21 Object Class 0x05 — Instance Attributes

Id	Description	Get	Set	Limits
1	State	+	0	
2	Instance Type	+	0	
3	Transport class trigger	+	0	
4	Produced connection ID	+	0	
5	Consumed connection ID	+	0	
6	Initial comm. Characteristics	+	0	
7	Produced connection size	+	0	
8	Consumed connection size	+	0	
9	Expected packet rate	+	+	
12	Watchdog timeout action	+	+[1]	Settable[1] to Deferred_Delete or Auto_Delete only
13	Produced connection path length	+	0	
14	Produced connection path	+	+[2]	
15	Consumed connection path length	+	0	
16	Consumed connection path	+	+[3]	
17	Production Inhibit Time	+	+[4]	

+ Supported 0 Not supported
1 – Only settable for explicit messaging connection instances
2 – For Poll/COS/Cyclic I/O connection instances
3 – For Poll connection instances
4 – Only settable for COS/Cyclic I/O connection instances

Table 3-22 Object Class 0x05 — Instance Services

Service		Parameter Options
Reset	0	
Delete	0	
Apply_Attributes	0	
Get_Attribute_Single	+	
Set_Attribute_Single	+	

+ Supported 0 Not supported

Ack Handler Object

Object Class 0x2B

One instance of the ack handler object is created/deleted when a COS/Cyclic connection is created/deleted.

Table 3-23 Object Class 0x2B — Class Attributes

Id	Description	Get	Set	Limits
1	Revision	0	0	
2	Max Instance	0	0	
3	Number of Instances	0	0	
4	Optional Attribute List	0	0	
5	Optional Service List	0	0	
6	Max ID of class attributes	0	0	
7	Max ID of instance attributes	0	0	

+ Supported 0 Not supported

Table 3-24 Object Class 0x2B — Class Services

Service		Parameter Options
Create	0	
Delete	0	
Get_Attribute_Single	0	

+ Supported 0 Not supported

Table 3-25 Object Class 0x2B — Instance Attributes

Id	Description	Get	Set	Limits
1	Acknowledge Timer	+	+	
2	Retry Limit	+	0	
3	COS Producing Connection Inst.	+	0	
4	Ack List Size	0	0	
5	Ack List	0	0	
6	Data with Ack Path List Size	0	0	
7	Data with Ack Path List	0	0	

+ Supported 0 Not supported

Table 3-26 Object Class 0x2B — Instance Services

Service		Parameter Options
Delete	0	
Get_Attribute_Single	+	
Set_Attribute_Single	+	

+ Supported 0 Not supported

Symbolic Connection to Serial Interface

Data Connections

Table 3-27 Instance Service

Service		Parameter Options
Delete	0	
Get_Attribute_Single	+	
Set_Attribute_Single	+[1]	
Get_Member	0	
Insert_Member	0	
Remove_Member	0	

+ Supported 0 Not supported
1 – Only available for Output connections

The general format of the serial port emulation channels are as follows:

Table 3-28 Network/Reader Serial Channel Fields

Field Size	16 bits	16 bits	16 bits	8 bit char string (1-248 char)
From Net	NetNew	NetAck	Length	Serial Data
From MS-880	ReaderAck	ReaderNew	Length	[PAD] Serial Data [PAD]

Table 3-29 Definitions of Serial Channel Fields

Field name	Description
NetNew	The network signals there is a new command to the reader in the channel.
ReaderAck	The reader acknowledges new command from the network.
ReaderNew	The reader signals there is new data to the network in the channel.
NetAck	The network acknowledges new data from the reader.
Length	The run time count of new data characters in the data field. The **Length** field is enabled/disabled with the <K125> command.
PAD	The pad character is used as a delimiter to clear unused space in the data field. The pad character is enabled/disabled with the <K125> command.
Serial Data	Serial data field (1 to 248 characters). The size and alignment of the data field are configured with the <K125> command.

See also **Chapter 7, "Serial Port Emulation Mode."**

Chapter 4

Ethernet

Chapter Contents

This chapter documents the Ethernet setup and installation of the Ethernet card and com port re-director software that allows ESP communication with the host.

Note: For detailed instructions relating to the installation and use of the MS-880 scanner and wiring box, see Microscan's ***MS-880 Industrial Long Range Scanner User's Manual***, part number 83-000880.

Overview

The MS-880 handles Ethernet connectivity with the use of a com port re-director that allows Ethernet connectivity which appears to the host as a com port connection. This allows the host to run Microscan's ESP program to configure and control the MS-880 while communicating through an Ethernet network.

The total Ethernet setup is a four-part process:

1. Install the Ethernet Protocol card
2. Setup with Device Finder Program to find IP address
3. Install RealPort Driver to setup communications port re-direction.
4. Connect the MS-880 with the Ethernet Protocol card via ESP

Installing the Ethernet Card.

(See **Chapter 1, "Quick Start"** for drawings and additional install information.)

1. Plug the Ethernet card into the bottom plate of the MS-880 network protocol card connector.

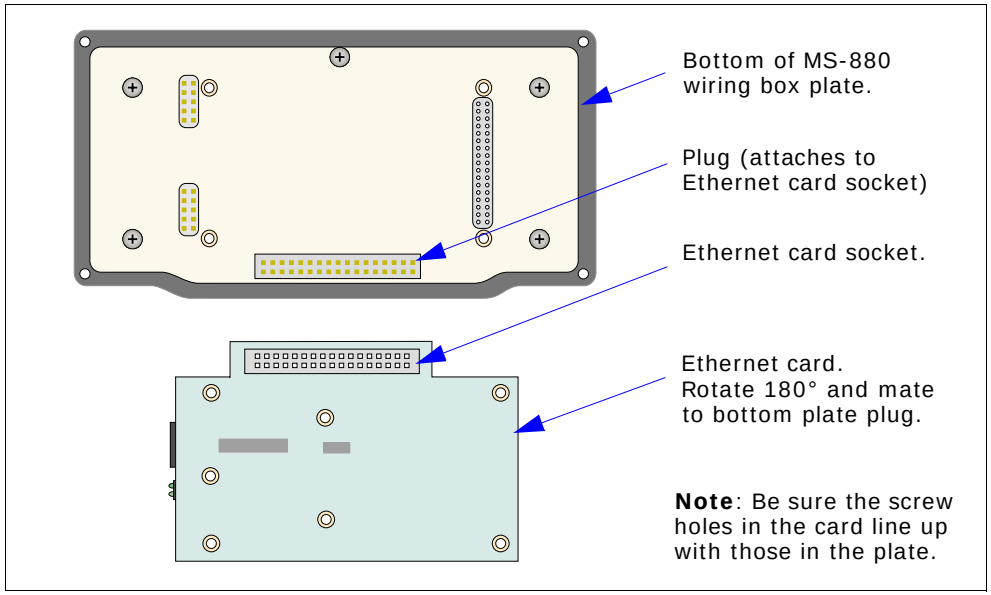


Figure 4-1 Bottom Plate and Ethernet Card (unassembled)

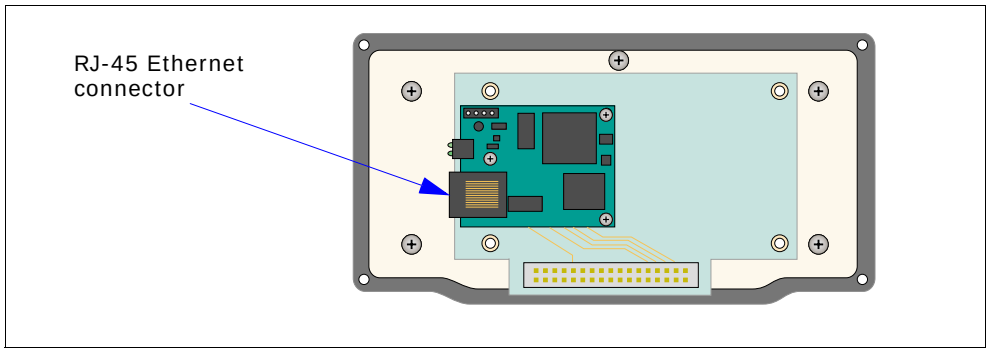


Figure 4-2 Bottom Plate with Ethernet Card Attached

2. Attach network card shield with 4 cover screws provided in kit.

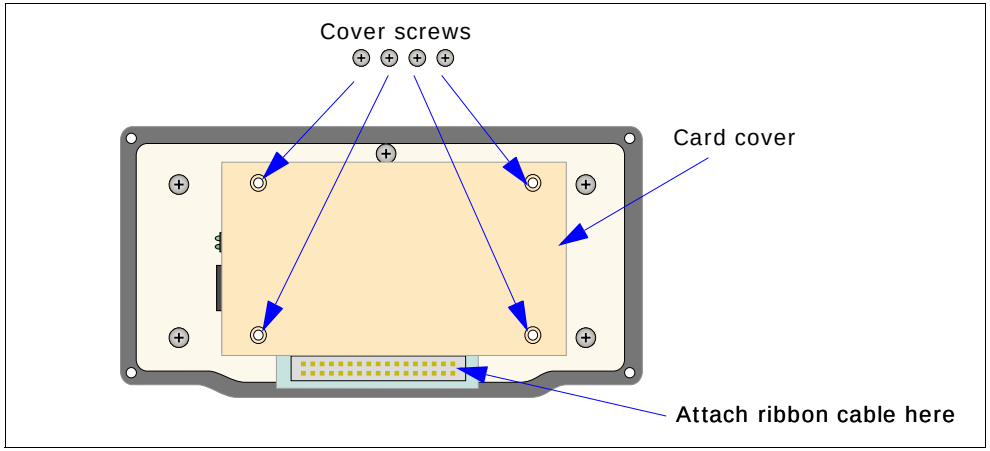


Figure 4-3 Ethernet Card (with cover)

3. Insert Ethernet RJ-45 cable through the wiring box conduit and plug into the Ethernet socket on the Ethernet card.

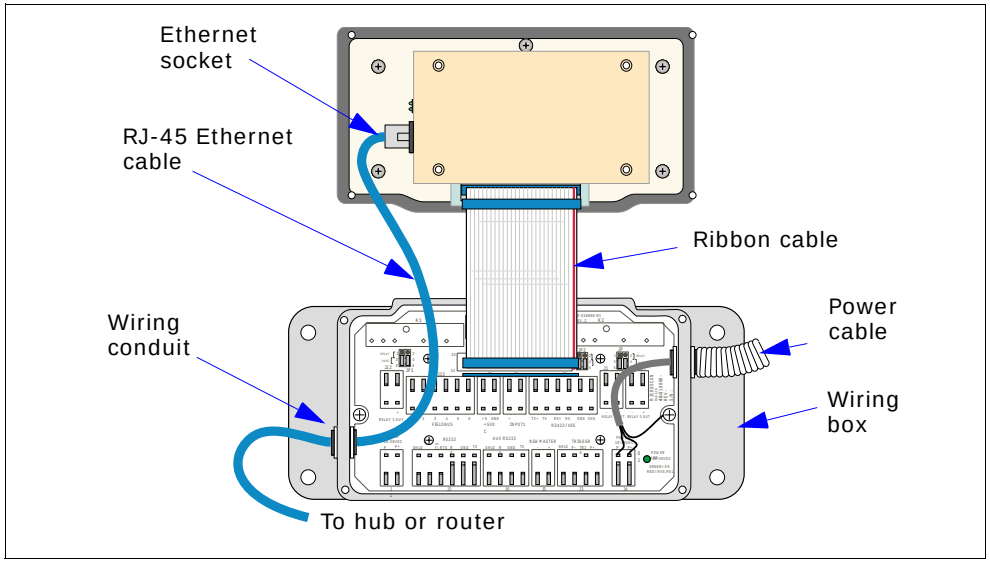


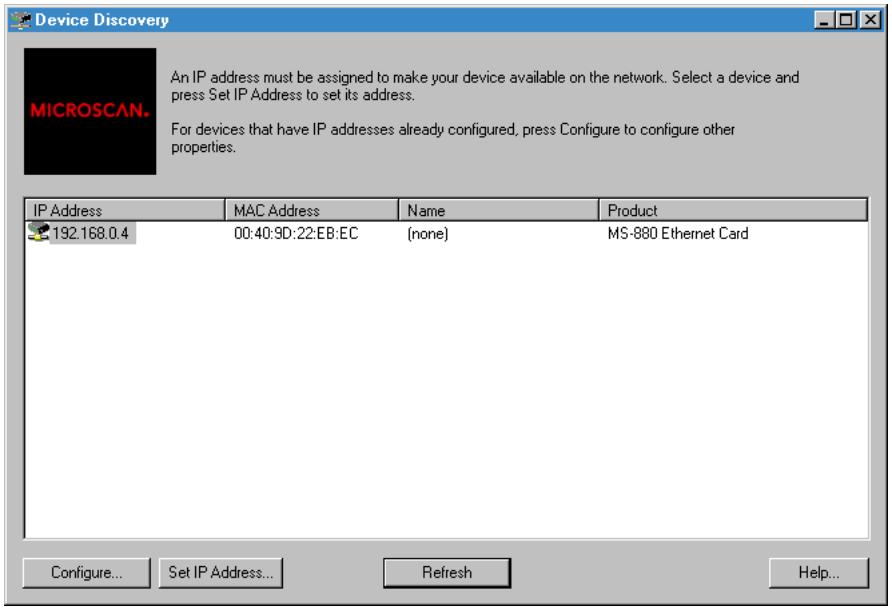
Figure 4-4 Fully Connected

4. Plug in wiring box ribbon cable into Ethernet card.
5. Plug other end of Ethernet cable into hub or router. Use un-crossed cable with hub, router, or switching box; use crossed cable if going direct to host.
6. Attach wiring box to MS-880 taking care to not to pinch or kink the ribbon and Ethernet cables.

   See Microscan's ***MS-880 Industrial Long Range Scanner User's Manual*** for more information on installing the wiring box.
7. Apply power.

Setup with Device Finder Program

1. Insert the **Microscan Products CD** and click on **Industrial Protocol Information Sheets and Setup Files**.
2. Under **Ethernet Protocol Card Setup Files**, click **Device Finder Setup Program** to see the following screen:



3. If the hardware is installed properly and DHCP is part of your network, the IP and MAC address will appear on the screen above.

   See **"Configuring the Ethernet Protocol Card" on page 4-10** for IP address options.
4. Write down the **IP address**. You will need it later.
5. Return to the **Industrial Protocol Information Sheets and Setup Files** screen.

Install RealPort Driver

What is RealPort

Many serial devices, including barcode scanners and sensors, don't have an Ethernet port. Even if they did, the applications that run them work on COM1 and are not designed for TCP/IP.

RealPort allows you to network enable your scanner with the Ethernet protocol card. With an Ethernet protocol card, you can easily connect your scanner to the network. The legacy application, however, may not support TCP/IP. That's where RealPort comes in.

Installed on a network-based PC, RealPort emulates a serial port. That is, the application "thinks" it is working with a real serial port, such as COM1. When the application sends data to this serial port, RealPort ships the data across the network to the Ethernet protocol card. This is also referred to as COM Port Redirection. The network is transparent to both the application and the device.

In the example that follows, Microscan's ESP (Easy Setup Program) and the MS-880 Ethernet protocol cards communicate as though they were connected with a serial cable.

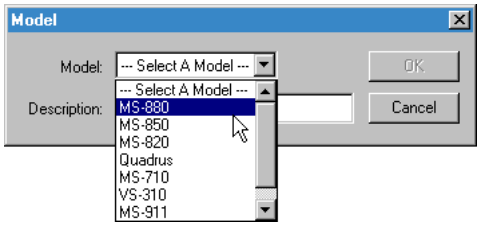
1. From the **Industrial Protocol Information Sheets and Setup Files** screen, click **Install RealPort Driver**.
2. Select the RealPort Installation driver that applies to your platform.
3. Follow the instructions to install the RealPort driver that will enable your scanner to communicate in Ethernet.

Connect Ethernet Protocol Card via ESP

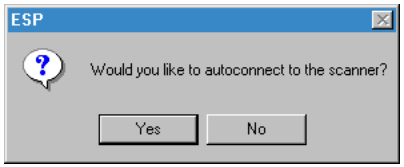
After setting up and installing your Ethernet protocol card driver, you will be able to connect from the host through the com port re-director. That is, you can use the Ethernet cable to communicate directly between your host and the MS-880.

To establish connection with the MS-880:

1. Launch the **Microscan ESP-MP** program.
2. From the **Model** popup, select the **MS-880 scanner**.



3. When the pop-up dialog asks, “Would you like to autoconnect to the scanner?” click **No**.



4. Go to the **Communication** pull-down menu and select **Serial Connection**.

This will bring up the **Serial Communication Parameters** dialog.

5. Choose the new **Com Port** connection that you created in **"Install RealPort Driver"**, for example, COM 3.
6. Make your other settings as follows:

   Baud Rate = **9600**

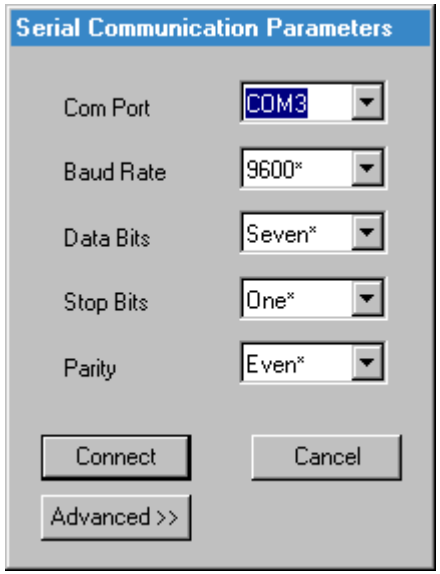
   Data Bits = **Seven**

   Stop Bits = **One**

   Parity = **Even**
7. Click **Connect**.

If everything was installed and configured correctly, you should see the green **CONNECTED** message on the bottom of the ESP screen.

You will now be able to communicate with your MS-880 scanner in a re-directed Ethernet protocol.



Configuring the Ethernet Protocol Card

Using the Device Finder program, an IP address can be located or assigned to the Ethernet protocol card by any of the following methods:

- Setup Wizard
- DHCP
- ARP-Ping
- Web Browser (changing)

Note: Before you configure your Ethernet protocol card, write down the MAC Address located on the bottom of your product.

Configuring the IP Address with the Setup Wizard

"Discovers" the device and then provides a method for assigning an IP address.

This procedure assumes the following:

- The Ethernet protocol card is connected to the network and powered-on
- The **Microscan Product Tools** CD will be used on a system running Microsoft Windows operating system.
- The Ethernet protocol card's MAC address is recorded for later use in assigning an IP address.

Procedure

1. Insert the **Microscan Product Tools** CD in the CD drive.
2. If the CD does not start automatically, double-click **My Computer > CD ROM Drive > setup.exe**.
3. The wizard will automatically pop up. Click **Next**.
   The application finds and lists all of the Ethernet protocol cards on your network.
4. Locate your Ethernet protocol card by its MAC address.
5. Select the Ethernet protocol card and then choose **Next**.
6. Follow the wizard to configure your Ethernet protocol card.

Configuring the IP Address with DHCP

The Ethernet protocol card's default configuration is as a DHCP client.

This procedure assumes the following:

- That the Ethernet protocol card is configured as a DHCP client. Since this is the default configuration, this will be the case unless the configuration has been changed.
- That the Ethernet protocol card is not powered-on.

Procedure

1. Set up a permanent entry for the Ethernet protocol card on a DHCP server.
2. Connect the Ethernet protocol card to the network and power it on. The IP address configured in step 1 is assigned automatically.

Configuring an IP Address with ARP-Ping

Enables IP address assignment by updating the ARP tables on a PC with the Ethernet protocol card's MAC address and then pinging the The Ethernet protocol card.

This procedure assumes the following:

- That the Ethernet protocol card is connected to the network and powered-on
- That you have access to a PC on the same LAN as the Ethernet protocol card
- No DHCP server is running
- No IP address has been configured

Procedure

1. Manually update the PC's ARP (Address Resolution Protocol) table using the Ethernet protocol card's MAC address (on the bottom of the unit) and the IP address you want assigned to the Ethernet protocol card.

   Here is how this is done on a system running under Microsoft Windows OS:

   a) Access the command line.

   b) Issue the following command:

   arp -s *ip-address mac-address*

   Example: arp -s 192.168.2.2 00-40-9D-00-00-00
2. Ping the Ethernet protocol card using the IP address just assigned.

   Example: **ping** 192.168.2.2

The ping will probably time out before there is a response from the Ethernet protocol card. Wait a few seconds and then ping the Ethernet protocol card again. The Ethernet protocol card will respond indicating that the IP address has been configured.

Changing an IP Address from a Web Browser

This method works only for changing the IP address of an Ethernet protocol card that has already been assigned one.

This procedure assumes that the Ethernet protocol card already has an IP address and you simply want to change it.

Procedure

1. Open a web browser and enter the Ethernet protocol card's current IP address in the URL address bar.
2. When the Ethernet protocol card prompts you to log on, specify the following:
   - The user name is **root.**
   - The default password is **dbps**.
3. Click **Network** to access the **Network Configuration** page.
4. Enter an IP address (and other network-related parameters) and then click **Apply** to save the configuration.

Testing the IP Address Configuration

Use this procedure to test your IP address configuration.

This procedure assumes that you have configured the Ethernet protocol card with an IP address.

Procedure

1. Access the command line of a PC or other networked device.
2. Issue the following command:

   ping *ip-address*

   where *ip-address* is the address you assigned to the Ethernet protocol card.

   Example:

   ping 192.168.2.2

   A reply should be returned.

Advanced Configuration Functions

Configuring the Ethernet protocol card for Incoming Connections

This section describes how to configure the device server for incoming connections providing TCP or UDP socket service for a serial device connected to the serial port. In this type of configuration, another network device initiates the communications. The device server simply waits for incoming traffic and then passes data to the serial device connected to its port.

RFC 2217 Support

Ethernet protocol cards support RFC 2217, an extension of the Telnet protocol used to access serial devices over the network. RFC 2217 implementations enable applications to set the parameters of remote serial ports (baud rate, flow control, etc.), detect line signal changes, as well as receive and transmit data. The configuration information provided in this section applies to device servers functioning as RFC 2217 servers. If you have altered the Ethernet protocol card, restore the factory default settings. No additional configuration is required.

About TCP and UDP Port Numbers

The Ethernet protocol card uses the TCP and UDP port numbering conventions described in the following table:

For this connection type...	Use this Port
Telnet to the serial port	2001 (TCP only)
Raw connection to the serial port	2101(TCP and UDP)

You must ensure that the application or device that initiates communication with the device server uses these ports. If they cannot be configured to use these ports, you can change what is known as the “base socket” on the device server, which allows you to use different port numbers to designate a Telnet or raw connection to the serial port.

Changing the Base Socket: Procedure

1. Access the configuration by opening a web browser and entering the device server’s IP address in the URL window.
2. Log on to the device server as the root user (User Name **root**). The default root password is **dbps**.
3. From the main menu, choose **Network**.
4. Use the base socket field to change the base socket. Specify a multiple of 100 between 1000 and 50000. Telnet connections will use the base socket value plus

one. Raw connections will use the base socket value plus 101 (one-hundred one). The following table illustrates how this works:

If the base socket is...	Then Telnet uses...	Then Raw uses...
3000	3001	3101
4100	4101	4201
8000	8001	8101

5. Click **Apply**.

Configuring the Ethernet protocol card as a Server: Procedure

1. Access the configuration by opening a web browser and entering the device server's IP address in the URL window.
2. Log on to the device server as the root user (User Name **root**). The default root password is **dbps**.
3. From the main menu, choose **Serial Port**.

   Note: If the Ethernet protocol card has been altered from the factory settings, restore the factory default settings.
4. Select **Restore Factory Serial Port Settings** and click **Restore**.
5. Select **Basic Serial Port Settings** and configure the Ethernet protocol card to match the settings of the attached MS-880. (If using RFC 2217 protocol, do not modify the port settings from the defaults.)
6. Click **Apply**.
7. Select TCP Client / TCP Server Settings and record the TCP port numbers listed under the TCP Server header. The TCP port number is needed to configure the application or device that accesses the Ethernet protocol card's serial port from the network.

Autoconnecting to a Network Host (TCP Clients)

This section describes how to configure the device server to initiate an automatic connection (autoconnect) to a host on the network. The device server initiates TCP connections to applications running on servers or serial devices connected to server serial ports (sometimes called TCP socket service). There are three conditions which use this configuration:

- DCD signal goes high
- Data arrives
- Always

Procedure

1. Access the configuration by opening a web browser and entering the device server's IP address in the URL window.
2. Log on to the device server as the root user (User Name **root**). The default root password is **dbps**.

   If the Ethernet protocol card has been altered from the factory settings, restore the factory default settings.
3. Click **Serial Port Settings**.
4. Select **Restore Factory Serial Port Settings** and click **Restore**.
5. Configure the **Basic Serial Port Settings** to match the settings of the MS-880.
6. Click **Apply** to save the configuration.
7. Select **TCP Client / TCP Server Settings** and check the **Automatically establish TCP connections** box.
8. Select the **Connect** option that describes when the TCP connection will be initiated.
9. Enter the IP address or DNS name of the destination server in the **Connect To** box.
10. Select a Service to use for the connection: **Raw**, **Rlogin**, or **Telnet**.
11. Specify the destination TCP Port Number.

The Port number depends on the conventions used on the remote server or device. The following table provides common TCP port number conventions:

Connection Type	Common TCP Port
Telnet	23
Rlogin	513
Reverse Telnet to the port of an Ethernet protocol card	2001
Raw connection to the port of an Ethernet protocol card	2101

12. Click **Apply** to save the configuration.

Autoconnecting to a Network Host (UDP)

This section describes how to configure the device server to initiate an automatic connection (autoconnect) to one or more hosts on the network. The device server initiates UDP communications to applications running on servers or serial devices connected to server serial ports (sometimes called UDP socket service).

This configuration provides multicasting capability. That is, multiple devices can be identified as destinations for a single communication.

Autoconnecting to Network Hosts: Procedure

1. Access the configuration by opening a web browser and entering the device server's IP address in the URL window.
2. Log on to the device server as the root user (User Name **root**). The default root password is **dbps**.

   If the Ethernet protocol card has been altered from the factory settings, restore the factory default settings.
3. From the main menu, choose **Serial Port**.
4. Select Restore Factory Serial Port Settings and click **Restore**.
5. Select Basic Serial Port Settings and configure the Ethernet protocol card to match the settings of the MS-880.
6. Click **Apply** to save the configuration.
7. Click UDP Client / UDP Server Settings and enter the following for each of the UDP destinations:
   - a description of the destination
   - the destination IP address
   - the destination UDP port
8. Click **Add**.
9. Select the options that define when data is sent.
10. Click **Apply** to save the configuration.

Configuring a Network Serial Bridge

A serial bridge is a network connection between two serial devices, each of which uses a serial server. The serial devices “think” they are communicating with each other across a serial cable using serial communication techniques. There is no need to reconfigure the server or the serial device. Neither is aware of the intervening network.

The following figure illustrates this configuration.

Configuring a Serial Bridge: Procedure

1. Access the configuration by opening a web browser and entering the device server’s IP address in the URL window.
2. Log on to the device as the root user (User Name **root**).
3. The default root password is **dbps**.

   Note: If the Ethernet protocol card has been altered from the factory settings, restore the factory default settings.
4. From the **Main** menu, choose **Serial Port**.
5. Select **Restore Factory Serial Port Settings** and click **Restore**.
6. Configure the **Basic Serial Port Settings** to match the settings of the MS-880.
7. Click **Apply** to save the configuration.
8. Select **TCP Client / TCP Server Settings** and check the **Automatically Establish TCP Connections** box.
9. Select **Connect > Bridge/Tunnel** (bi-directional).
10. In the **Connect To** box, type the IP address or DNS name of the other Ethernet protocol card.
11. In the **TCP Port Number** box, type the appropriate TCP port number for the destination serial port.

    NOTE: The default value is 2101 for RAW and 2001 for ASCII.
12. Click **Apply** to save the configuration.
13. Follow the same steps to configure the other Ethernet protocol card of the bridge, specifying the IP address of the first Ethernet protocol card in the ‘Connect to’ box.

Administration

Changing the Root Password

For security reasons, we recommend that you change the root password immediately. This procedure shows you how.

Prerequisite

This procedure assumes that you are the root user and that you know the current root password.

Procedure

1. Open a web browser and enter the device server's IP address in the URL window.
2. When the prompts you to log in, enter the following:
   - User Name is **root**
   - The root default password is **dbps**
3. Choose **Administrator Password**.
4. Fill in the **New Password** and **Confirm Password** fields.
5. Click **Apply** to save the password.
6. Log on using new password (you will receive notification password is changed).

Restoring the Configuration to Factory Defaults

The two procedures in this section restore the configuration to defaults. The first procedure resets the configuration from a web browser which will clear all current settings except the IP address settings and administrator password. This is the best way to reset the configuration because you can also back up the settings (which provides a means for restoring it after you have worked through configuration issues). See **"Backup/Restore the Configuration" on page 4-20** for more information.

The second procedure resets the configuration using the reset button on the Ethernet protocol card. Use this method if you cannot access the device from a web browser.

Note: Restoring the The Ethernet protocol card to its factory default settings will clear all current settings except the IP address settings and the administrator password.

Resetting the Configuration from a Browser

1. Open a web browser and enter the Ethernet protocol card's IP address in the URL window.
2. When the Ethernet protocol card prompts you to log on, enter the following:
   - User Name is **root**
   - The root default password is **dbps**
3. Choose **Factory Default Settings** from the main menu.
4. Click **Restore**.

Backup/Restore the Configuration

This procedure shows you how to backup or restore the configuration to a server and to download a configuration from a server to a file or TFTP.

Prerequisite

If you intend to use TFTP, ensure that the TFTP program is running on a server before you begin this procedure.

Procedure

1. Open a web browser and enter the device server's IP address in the URL window.
2. When the device server prompts you to log in, enter the following:
   - User Name is **root**
   - The root default password is **dbps**
3. Choose **Backup/Restore** from the main menu.
4. Choose the appropriate option (**Backup** or **Restore**) and select your file.

Viewing Port or Network Statistics and Settings

Use this procedure to view port or network statistics and configuration settings.

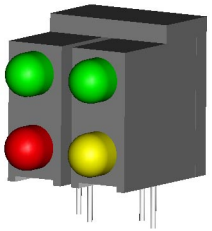
Procedure

1. Open a web browser and enter the device server's IP address in the URL window.
2. When the device server prompts you to log in, enter the following:
   - User Name is **root**
   - The root default password is **dbps**
3. Click **System Information** from the main menu.
4. Click **Details** for more information.

Note: Use your browser's Refresh option to update the statistics.

Interpreting LED Information

The Ethernet protocol card's LEDs provide information on port activity, diagnostics, and Ethernet activity.



LED	Color	Function	Interpretation
Top left	Green	Indicates serial port activity	Off means that the serial channel is idle. Blinking indicates an active connection.
Top right	Green	Network link status	Off means that no link has been detected. On means that a link has been detected.
Bottom left	Red	Diagnostics	Blinking 1-1-1 means starting the operating system. Blinking 1-5-1 means configuration has been returned to factory defaults. Steady blinking means the device is seeking an IP address from a DHCP server. **Note:** If other blinking patterns appear on this LED, call Microscan Technical Support.
Bottom right	Yellow	Reserved	NA

Chapter

5

Profibus–DP

Chapter Contents

This chapter documents the Profibus–DP specific interface to the bar code scanner's data and service attributes listed in **Chapter 8, "Bar Code Object Mode."**

Note: For detailed instructions relating to the installation and use of the MS-880 scanner and wiring box, see Microscan's ***MS-880 Industrial Long Range Scanner User's Manual***, part number 83-000880.

Summary of Data and Services

Table 5-1 Summary of the Data and Services Available

Attribute Name	Description	Operation	Page Ref.
Read Cycle Attributes	These include bar codes and other data that is generated when a read cycle occurs.	Uses a two-way handshake method called Read Cycle Attribute Handshake (abbreviated as “RAH”) to guarantee coherent delivery to the host.	page 8-3
Discrete I/O	Not supported.		page 8-12 page 8-16
Diagnostics	Not supported.		page 8-17
Control Services and Acknowledgement Signals	Not supported.		page 8-19
General Status and Configuration Status	Not supported.		page 8-23 page 8-25
Serial Data From/To Network	These provide nearly the same control over the bar code scanner as the RS-232/422 serial communication ports. The host can use these attributes to send serial data to and receive data from the scanner. Serial data can also be used to send commands to the MS-880 and to receive responses to these commands. **Note**: These attributes do not allow the MS-880 to be used as a serial gateway device.	Uses a two-way handshake method called Serial Data to Network Handshake (abbreviated as “STNH”) and Serial Data from Network Handshake (abbreviated as “SFNH”) to guarantee coherent delivery to the host.	page 8-28[a]

a. Refer to the ***MS-880 Industrial Long Range Scanner User's Manual***, part number 83-000880.

Card versions

Because some Profibus masters do not support the full 244 byte message length and because some systems only have limited memory resources, Microscan supports two versions of the MS-880 Profibus cards.

Multisymbol Card

This card with part number 98-000009-02 is used in conjunction with GSD file 310401xx.gsd and supports the following features:

- Up to 6 symbols can be read and transmitted per read cycle
- Occupies 120 byte input space and 104 byte output space on the master
- 64 bytes maximum total length of data read
- 16 bytes maximum command length
- 96 bytes maximum command response length

Single Symbol Card

This card with part number 98-000009-06 is used in conjunction with GSD file 3104012xx.gsd and supports the following features:

- Only a single symbol can be read per read cycle
- Occupies 40 byte input space and 22 byte output space on the master
- 32 bytes maximum total length of data read
- 16 bytes maximum command length
- Command response data not supported

GSD Files

A Profibus GSD file contains a structured description of the I/O space and network capabilities of a Profibus device. A different GSD file is used for each type of device. For the MS-880, one GSD file is available for each of the two Profibus network cards: 310401xx.gsd for 98-000009-02 and 310402xx.gsd for 98-000009-06. Note that the “xx” stands for the revision number of the file. For example, the full name of the file can be 31040210.gsd for version 1.0.

Setup

1. Use one of the bar code scanner's programming interfaces (ESP, on-board menu, or serial commands over the host or configuration RS-232 ports) to set its Profibus address (1-126).
2. Add the GSD file for the Profibus card installed on the MS-880 to the master's database. The GSD file can be found on the Network Protocol Manual disk. The GSD provides the following information to the host:

   •Identity of the bar code scanner,

   •Size of input and output data.

   Refer to the manuals provided with the master system for more information on how to add a GSD file to the device database.
3. Add the bar code scanner's Profibus address to the list of Profibus devices on the master system for more information on how to add a GSD file to the device database. Refer to the manuals provided with the master system for more information on how to add a device to the Profibus network.
4. Use the I/O List table later in this chapter to map the location of individual attributes into the master's memory.
5. Write the master system's process control algorithms to operate the bar code scanner's data and service attributes. Refer to Chapter **Chapter 8, "Bar Code Object Mode"** for details. This information is in a separate chapter because the data and services available in the scanner operate the same regardless of what type of network interface is installed.
6. Connect the bar code scanner to the Profibus-DP network using the Fieldbus terminals on the wiring box PCB. Refer to **"Wiring Connections" on page A-4** for more information on connecting the MS-880 to a Profibus network.
7. Go online and test the bar code scanner.

Protocol Support

MS-880 Profibus Slave operation provides a connection to Profibus–DP or FDL layer 2 networks. The main features are:

- Capacitively isolated interface
- All baud rates from 9600 bps to 12M bps with auto baud rate detect.
- Compatible with DIN 19 245, parts 1 and 3.
- Profibus–DP and FDL layer 2 protocol.

I/O Tables

Table 5-2 Profibus-DP I/O List for card 98-000002-02

Slot	Format	Qty bytes	Description[a]	Data flow	Offset (bytes)	Hand-shake
From MS-880 to master						
0	WORD	2	Read cycle Attribute Handshake (RAH) request	Input	[00]	RAH
1	WORD	2	Serial To Network Handshake (STNH) Request	Input	[02]	STNH
2	WORD	2	Serial From Network Handshake (SFNH) Response	Input	[04]	SFNH
3	WORD[6]	12	Barcode offsets[6]	Input	[06..16]	RAH
4	WORD[6]	12	Barcode lengths[6]	Input	[18-28]	RAH
5	WORD[4]	8	Read cycle results[4]	Input	[30-36]	RAH
			Read cycle result code a)		[30]	
			Number of symbols in read cycle		[32]	
			Number of outputs in read cycle		[34]	
			Number of no reads in read cycle		[36]	
6	BYTE[16]	16	Bar Code Buffer #1	Input	[38-53]	RAH
7	BYTE[16]	16	Bar Code Buffer #2	Input	[54-69]	RAH
8	BYTE[16]	16	Bar Code Buffer #3	Input	[70-85]	RAH
9	BYTE[16]	16	Bar Code Buffer #4	Input	[86-101]	RAH
10	WORD	2	Serial To Network Length	Output	[00]	STNH
11	BYTE[16]	16	Serial To Network Data	Output	[02-17]	STNH
	Total	**120**				
From master to MS-880						
12	WORD	2	Read cycle Attribute Handshake (RAH) Response	Output	[18]	RAH
13	WORD	2	Serial To Network Handshake (STNH) Response	Output	[20]	STNH
14	WORD	2	Serial From Network Handshake (SFNH) Request	Output	[22]	SFNH
15	WORD	2	Serial From Network Length	Output	[24]	SFNH
16	BYTE[16]	16	Serial From Network Data #1	Output	[26-41]	SFNH
17	BYTE[16]	16	Serial From Network Data #2	Output	[42-57]	SFNH
18	BYTE[16]	16	Serial From Network Data #3	Output	[58-73]	SFNH
19	BYTE[16]	16	Serial From Network Data #4	Output	[74-89]	SFNH
20	BYTE[16]	16	Serial From Network Data #5	Output	[90-105]	SFNH
21	BYTE[16]	16	Serial From Network Data #6	Output	[106-121]	SFNH
	Total	**104**				

a. Refer to **table 5-4** for a description of the read cycle result bits.

Table 5-3 Profibus-DP I/O List for card 98-000002-06

Slot	Format	Qty bytes	Description[a]	Data flow	Offset (bytes)	Hand-shake
From MS-880 to master						
0	WORD	2	Read cycle Attribute Handshake (RAH) request	Input	[00]	RAH
1	WORD	2	Serial From Network Handshake (SFNH) Response	Input	[02]	SFNH
2	WORD	2	Read cycle result code a)	Input	[04]	RAH
3	WORD	2	Barcode length	Input	[06]	RAH
4	BYTE[16]	16	Bar Code Buffer #1	Input	[08-23]	RAH
5	BYTE[16]	16	Bar Code Buffer #2	Input	[24-39]	RAH
	Total	**40**				
From master to MS-880						
6	WORD	2	Read cycle Attribute Handshake (RAH) Response	Output	[00]	RAH
7	WORD	2	Serial From Network Handshake (SFNH) Request	Output	[02]	SFNH
8	WORD	2	Serial From Network Length	Output	[04]	SFNH
9	BYTE[16]	16	Serial From Network Data #1	Output	[06-21]	SFNH
	Total	**22**				

a. Refer to **table 5-4** for a description of the read cycle result bits.

Table 5-4 Description of the read cycle result code bits

Read cycle result code low byte[a]			**Read cycle result code high byte**		
Bit	**Value**	**Set to "1" on:**	**Bit**	**Value**	**Set to "1" on:**
D_7	Reserved		D_7 (D_{15})	Reserved	
D_6	Reserved		D_6 (D_{14})	Reserved	
D_5	Reserved		D_5 (D_{13})	Reserved	
D_4	Reserved		D_4 (D_{12})	Reserved	
D_3	Not all output	One or more symbols read but not output	D_3 (D_{11})	Reserved	
D_2	Noread	At least one no read occurred in the current read cycle	D_2 (D_{10})	Output lost	A new read cycle occurred before the RAH handshake was updated by the master
D_1	Mis-match	A mismatch occurred in the current read cycle	D_1 (D_9)	To many decodes	One or more symbols have been read but can not be output because there are no more length/offset slots
D_0	Match/ Good	All symbols have been read/matched in the current read cycle	D_0 (D_8)	Buffer overflow	Barcode data too big for Profibus buffer

a. Refer to **Chapter 8, "Bar Code Object Mode"** for additional information.

Importing MS-880 I/O Modules

The MS-880 Profibus card will appear on the bus master as a modular slave, with either 22 modules (98-000009-02) or 10 modules (98-000009-06). Most systems will allow any combination of these modules to be imported, in any order. However, the MS-880 will only work when all modules are imported and placed into the I/O space in the same order in which they appear in the GSD file. The **Universal Module** that appears at the top of the I/O list on some systems, is not to be used.

Noread Messages

If noread messages are enabled on the MS-880, they will also be output in the **Bar-code Buffer** fields.

Because no barcode lengths are available for noread messages, they can only be located in the barcode buffer by parsing the buffer.

Because the number of noreads in a read cycle is output in the **Number of noreads in read cycle field**, there is no need to process the noread messages to detect and handle a noread situation.

Because the network port of the MS-880 will only be updated when data is available, noread messages must be enabled at all times to ensure that the network port will be updated at the end of every read cycle.

Serial to Network Data

The serial to network data buffer is mainly used to receive responses to commands sent to the MS-880. Because the serial to network data buffer is limited to only 16 bytes, typically the responses will not fit into this buffer. If this is the case, the MS-880 will break the response into several messages of 16 bytes each. These messages are placed into the serial to network buffer one by one. Each partial message must be acknowledged with the STNH handshake counter before the next is placed in the buffer.

Byte Swapping

On some systems, e.g. the S7-300 series from Siemens, word (16 bit) values will appear in memory with the high and low byte swapped. The software on such systems will have to ensure that word values, such as the handshake counters, are swapped before using them.

Chapter

6

DataHighway Plus

Chapter Contents

This chapter documents the DataHighway Plus specific interface to the bar code scanner's data and service attributes listed in **Chapter 8, "Bar Code Object Mode."**

Note: For detailed instructions relating to the installation and use of the MS-880 scanner and wiring box, see Microscan's ***MS-880 Industrial Long Range Scanner User's Manual***, part number 83-000880.

Summary of Data and Services

Table 6-1 Summary of the Data and Services Available

Attribute Name	Description	Operation	Page Ref.
Read Cycle Attributes	These include bar codes and other data that is generated when a read cycle occurs.	Uses a two-way handshake method called Read Cycle Attribute Handshake (abbreviated as “RAH”) to guarantee coherent delivery to the host.	page 8-3
Discrete Inputs and Outputs	This includes the status of the discrete IO and provides host control over the programmable operation assigned to the inputs.	Bit-mapped handshake. Each Discrete Input has a host-controlled override and a status bit. When the host activates an input, the corresponding status bit acknowledges the request.	page 8-12 page 8-16
Diagnostics	These indicate the bar code scanner’s temperature, service time, laser current, and other maintenance-related items.	Read only status indicators. No handshake required.	page 8-17
Control Services and Acknowledgement Signals	This controls the operation of the counters, read rate, laser, and scan motor, plus acknowledgement of non-diagnostic warnings like reset and serial communication errors.	Bit mapped handshake. Each Control Service has a corresponding Acknowledgment Signal. When a service is requested, the acknowledgement signal changes state to signify that the service was performed.	page 8-19
General Status and Configuration Status	These provides miscellaneous information on what the bar code scanner is doing, and configuration information that impacts the operation of the network port.	Read only status indicators. No handshake required.	page 8-23 page 8-25
Serial Data	These provide nearly the same control over the bar code scanner as the RS-232/422 serial comm ports. The host can use these attributes to send serial data to and from the scanner. Note that this is not a “serial gateway”. The scanner only sends serial data to the host when it receives a serial command that requires a serial response. In other words, the scanner does not send a copy of the serial data that is sent out the RS-232/422 ports to the network port.	Uses a two-way handshake method called Serial Data to Network Handshake (abbreviated as “STNH”) and Serial Data from Network Handshake (abbreviated as “SFNH”) to guarantee coherent delivery to the host.	page 8-28

Setup

1. Use one of the bar code scanner's programming interfaces (ESP, on-board menu, or serial commands over the host or configuration RS-232 ports) to set its DataHighway Plus address (1-77 octal) and the baud rate (57.6K/115K/230K bps) of the target network. See **"DataHighway Plus" on page 2-7** for configuration information. Add the bar code scanner's device address to the master's scan list.
2. For each bar code scanner in the scan list, determine which data interface files are required for the application. Refer to the data file list later in this chapter.
3. Map the location of individual attributes into the host's memory. Refer to the data file list later in this chapter. Note that the bar code scanner is a peer device on DataHighway Plus networks. From the network host's (PLC) perspective, the bar code scanner's data files are located in the scanner. Therefore it is the host's responsibility to read and write the data files to and from the bar code scanner.
4. Write the master system's process control algorithms to operate the bar code scanner's data and service attributes. Refer to **Chapter 8, "Bar Code Object Mode"** for details. This information is in a separate chapter because the data and services available in the scanner operate the same regardless of what type of network interface is installed.
5. Connect the bar code scanner to the DataHighway Plus network. (See **"Data Highway Plus Module Status LEDs (see page A-6)" on page A-8**.) If your bar code scanner's network interface has a 3 pin terminal strip (Phoenix type), then this is where the network connection must be made. If the network interface does not have 3 pin terminal strip, then the network connection is made to the Fieldbus terminals on the wiring box pcb.
6. Go online and test the bar code scanner.

Table 6-2 DataHighway Plus

File Type, Number File access: (r/w) = read/ write (ro) = read only File Name	nn. = 16 bit element address	**Attributes** Assume all attribute elements are read only unless otherwise marked with (r/w).	**Qty**	**Data Type**	**Ref.**
O0 (r/w) Discrete IO Override	00	Discrete Inputs (r/w): Bit 0 = Trigger Bit 1 = New Master Bit 2 = Programmable Input 1	1	Word	
	01	Discrete Outputs (r/w): Bit 0 = Output 1 Bit 1 = Output 2 Bit 2 = Output 3	1	Word	
I1 (ro) Discrete IO Status	00	Discrete Inputs Logical Status: Bit 0 = Trigger Bit 1 = New Master Bit 2 = Programmable Input 1 Discrete Inputs Physical Status: Bit 8 = Trigger Bit 9 = New Master Bit 10 = Programmable Input 1	1	Word	
	01	Discrete Output Logical Status: Bit 0 = Output 1 Bit 1 = Output 2 Bit 2 = Output 3 Discrete Output Physical Status: Bit 8 = Output 1 Bit 9 = Output 2 Bit 10 = Output 3	1	Word	
B2 (ro) Diagnostics	00 01 02 03 04 05 06 07 08 09 10 11–12 13 14	Time Since Reset Number of Power Ups Number of Warm Resets Last Reset Cause Operating Temperature Temperature Status Laser Current Status Lifetime Status Novram Status Operational/Comm Configuration Status Data Output Configuration Status General Status Control Status Acknowledge Control Status (r/w)	1 1 1 1 1 1 1 1 1 1 1 2 1 1	UINT2 UINT2 UINT2 Word UINT2 Word Word Word Word Word Word Word Word Word	

Table 6-2 DataHighway Plus

File Type, Number File access: (r/w) = read/ write (ro) = read only File Name	nn. = 16 bit element address	**Attributes** Assume all attribute elements are read only unless otherwise marked with (r/w).	**Qty**	**Data Type**	**Ref.**
B3 (ro) Read Cycle Binary Attributes	00 01–12	Read Cycle Result Code Bar Code Result Codes 1-12	1 12	Word Word	
N4 (ro) Version Identity	00 01 02–07 08–13	Format ID Major Rev (LSB), Minor Rev (MSB) Boot Code Part number (12 chars, byte swapped) Application Code period, number (12 chars, byte swapped)	2 2 12 12	UINT1 UINT1 CHAR CHAR	
N5 (ro) Serial To Network	00 01 02 03–127	Handshake Request To Net Handshake Response From Net (r/w) Length Data (250 chars, byte swapped)	1 1 1 250	UINT2 UINT2 UINT2 CHAR	
N6 (ro) Serial From Network	00 01 02 03–127	Handshake Request From Net (r/w) Handshake Response To Net Length Data (250 chars, byte swapped)	1 1 1 125	UINT2 UINT2 UINT2 UINT2	
N7 (r/w) Read Cycle Integer Attributes	00 01 02–13 14–25 26 27 28 29 30 31 32 33–532	Handshake Request To Net Handshake Response From Net (r/w) Bar Code Offsets 1–12 Bar Code Lengths 1–12 Bar Code Total Count Bar Code Output Count Bar Code Noread Count Historical Read Cycle Counter Trigger Historical Read Cycle Counter Match/Good Historical Read Cycle Counter Mismatch Historical Read Cycle Counter Noread Bar Code Buffer (1000 chars, byte swapped)	1 1 12 12 1 1 1 1 1 1 1 500	UINT2 UINT2 UINT2 UINT2 UINT2 UINT2 UINT2 UINT2 UINT2 UINT2 UINT2 UINT2	

Firmware Specification

Network Commands

The DataHighway Plus module supports the following PLC-5 commands:

Table 6-3 PLC-5 Commands

Command	Function	Description
0Fh	00h	Word Range Write[a]
0Fh	01h	Word Range Read[a]
0Fh	26h	Word Read / Modify / Write[a]
0Fh	67h	Typed Write
0Fh	68h	Typed Read

a. These commands cannot be used with Floating Point files

These commands accept both Logical ASCII and Logical Binary addressing. The list of file types supported with these commands is given in section 3.1.3.

Termination

Network termination consists of an 82 ohm resistor connected between the blue and clear conductor wires at opposite ends of the network trunk or daisy chain. Some older equipment requires 150 ohm resistors for proper operation; users must consult their Allen-Bradley product documentation to determine when these resistors are required.

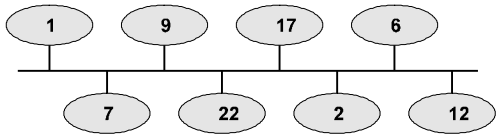
Note: The network is limited to a maximum of 16 stations when 150 ohm termination resistors are used.

Physical Network

Topology

DataHighway Plus networks can be cabled in Trunk Line – Drop Line or Daisy Chain topology.

Trunk Line – Drop Line Topology



When connecting nodes in a Trunk Line – Drop Line topology, follow these rules:

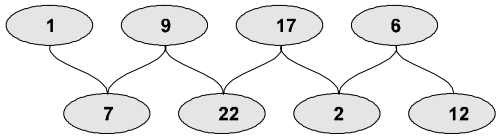
- opposite ends of the trunk-line must be terminated
- drop lines must be between 10 feet (3m) and 100 feet (30m) in length
- drop lines connect to the trunk with Allen-Bradley station connectors (A-B part number 1770-SC)
- the trunk length should not exceed:

  10000 feet (3050m) at 57.6K baud

  5000 feet (1525m) at 115.2K baud

  2500 feet (760m) at 230.4K baud

Daisy Chain Topology



When connecting nodes in a Daisy Chain topology, follow these rules:

- nodes at opposite ends of the network must be terminated
- the total length of the network should not exceed:

  10000 feet (3050m) at 57.6K baud

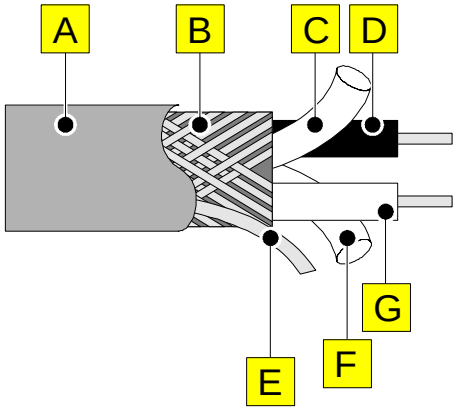
  5000 feet (1525m) at 115.2K baud

  2500 feet (760m) at 230.4K baud

Media Type

DataHighway Plus uses Belden 9463 or compatible shielded twin axial cable, commonly referred to as “Blue Hose”.

Feature	Description
A	Outer Jacket
B	Shields, braid over foil
C	Filler Cord
D	Blue conductor wire
E	Drain Wire
F	Filler cord
G	Clear conductor wire



Refer to the ***Approved Vendor List for DH, DH+, DH-485 and Remote I/O Cables*** (Allen-Bradley Publication ICCG-2.2) for a complete list of DataHighway Plus cable vendors.

Note: The recommended convention is to connect the clear conductor wire to Line 1 terminals and the blue conductor wire to Line 2 terminals. Some installation sites may have an opposite local convention.

Connectors

DataHighway Plus uses 3 pole Phoenix Combicon connectors, MSTB 2,5/3-ST-5,08 or equivalent. The pin-out of these connectors is not standardized and varies with the type of equipment connected. Be sure to verify the pin-out of the connector at each piece of equipment attached to the network. The pin-out for the DataHighway Plus module is illustrated in section 4.3.2 of this manual.

Signaling

DataHighway Plus uses a subset of the HDLC/SDLC low-level frame synchronous protocol. A Manchester encoder converts between the DC referenced signals of the communications controller and the AC signals required for network transmission. The AC signals are differentially transmitted to increase noise immunity and transformer coupled to provide ground isolation between nodes. The transmitted signal level is 8-12 volts peak-to-peak with the receiver sensitive to zero crossings in signals as low as 200 mV peak-to-peak to allow for attenuation due to cable length.

Termination

Network termination consists of an 82 Ω resistor connected between the blue and clear conductor wires at opposite ends of the network trunk or daisy chain. Some older Allen-Bradley equipment requires 150 Ω resistors for proper operation; users must consult their product documentation to determination when these resistors are required.

Note: The network is limited to a maximum of 16 stations when 150 Ω termination resistors are used.

Logical Network

Node Addressing

Each node on a DataHighway Plus network is assigned a station number by the end user. These addresses are expressed in octal and range from 00 to 77. Station address 00 is not recommended; some communication errors are undetectable by DataHighway Plus' CRC hardware in combination with this address.

Media Access Method / Protocol

DataHighway Plus stations communicate in a peer-to-peer fashion; any station may send a message to any other station.

A token passing method is used to arbitrate access to the bus. A station holding the token is permitted to transmit one or more messages, which the receiver acknowledges (or in the case of errors, negatively acknowledges) immediately. If the acknowledgement is garbled or timed out, the transmitting station retries up to a maximum of three times. Negatively acknowledged messages are not retried. The token is held for a maximum of 38ms, after which it is passed to the next highest numbered successor. A proprietary solicitation scheme is used to detect nodes entering and leaving the network.

Receiving stations send a reply when they possess the token. For read commands, the reply contains the requested data; for write commands, the reply simply indicates that data has been written. If the command fails for any reason (invalid address, and so on), the reply contains a status field to indicate the reason for command failure. Unsuccessfully transmitted messages (negatively acknowledged, garbled acknowledgements or acknowledge time outs) are also flagged with appropriate status codes.

Masters and Slaves

When the terms *master* and *slave* are applied to a DataHighway Plus network, master indicates the station that originates a command request; slave indicates the station that responds to the request.

Data Addressing

The data address format varies depending on the type of slave addressed. A list of addressing schemes can be found in the ***DF1 Protocol and Command Set Reference Manual*** (Allen-Bradley Publication 1770-6.5.16). The address ranges supported by the DataHighway Plus module are listed in section 3.1.2 of this manual.

Troubleshooting

This section presents basic troubleshooting information for DataHighway Plus networks.

Cable System Test

The network cabling can be tested with the following procedure:

Warning: All control systems should be stopped and all nodes disconnected from the network while performing this test. Failure to comply with this warning could result in equipment damage or personal injury.

The steps of this test must be performed in the sequence presented.

1. Connect the shield to the blue and clear conductor wires (short them out) at one end of the network cable or trunk line.
   - For a daisy chain network, continuity should be measurable at the opposite end of the network between any two conductors.
   - For a trunk line – drop line network, continuity should be measurable between any two conductors at each drop and at the opposite end of the network.
2. Remove the shorts between the shield, blue and clear conductor wires.
3. Measure the resistance between the blue and clear conductor wires at each node:
   - If > 59 ohms, there could be a break in one of the signal wires or missing terminating resistor(s).
   - If < 38 ohms, look for a short between the network wires or extra terminating resistor(s).

Diagnostic Indicators

Some DataHighway Plus products include a diagnostic LED or front panel display to indicate the status of the communications link. There is no standard for such diagnostic indications; you must consult individual product documentation to determine what, if any, diagnostic readouts are available.

The DataHighway Plus module's Network Status LED is documented in section 4.3.3.

Diagnostic Counters

Every DataHighway Plus node contains a set of diagnostic counters that can be retrieved by any station capable of formatting diagnostic commands. The number and type of counters returned vary with the station type and are documented in the ***DF1 Protocol and Command Set Reference Manual*** (Allen-Bradley Publication 1770-6.5.16).

The diagnostic counters maintained by the DataHighway Plus module are listed in section 3.1.5.

Note: A PC-based network interface card and software are typically required to access diagnostic counters.

Diagnostic Commands

The DataHighway Plus module supports the following diagnostic commands:

Command	Function	Name / Description
06h	00h	Echo (data loop back)
06h	01h	Read diagnostic counters The implementation of these counters is documented in section 3.1.5
06h	03h	Diagnostic status The reply format for this command is documented in section 3.1.4
06h	07h	Reset diagnostic counters

Basic Command Set

The basic command set is used to map PLC specific functions across the network. Since the DataHighway Plus module is designed to enable an I/O product, it does not emulate PLC functionality and does not support the basic command set.

Remote Status Code (STS)

The DataHighway Plus module returns the following codes in the STS field of command responses. Errors indicated by this field are not reported to the client.

Value	Description
00h	Success – no error
10h	Illegal command or format
20h	Host has a problem and will not communicate
30h	Remote node host is missing, disconnected, or shut down
40h	Host could not complete function due to hardware fault
50h	Address problem or memory protect rungs
60h	Function disallowed due to command protection selection
70h	Processor is in program mode
80h	Compatibility mode file missing or communication problem
90h	Remote node cannot buffer command
A0h	Buffer pool exhausted
B0h	Remote node problem due to download
C0h	Cannot execute command due to active IPBs
D0h	Not used
E0h	Not used
F0h	Error code in the EXT STS byte

Supported File Types

The DataHighway Plus module supports the following file types:

File	Description
O	Output file (file 0), elements are 16-bit words Offset contained in Logical ASCII Addressing is interpreted as octal
I	Input file (file 1), elements are 16-bit words Offset contained in Logical ASCII Addressing is interpreted as octal
B	Binary file, elements are 16-bit words Offset contained in Logical ASCII Addressing is interpreted as decimal
N	Integer file, elements are 16-bit words Offset contained in Logical ASCII Addressing is interpreted as decimal

Each file may contain a maximum of 1000 elements (words or dwords). The first element always begins at file offset zero.

Extended Status Byte (EXT STS)

The extended status byte is present in responses when the remote STS code is F0h.

Value	Description
00h	Not used
01h	A field has an illegal value
02h	Less levels specified in address than minimum for any address
03h	More levels specified in address than system supports
04h	Symbol not found
05h	Symbol is of improper format
06h	Address doesn't point to something usable
07h	File is wrong size
08h	Cannot complete request, situation has changed since the start of the command
09h	Data or file is too large
0Ah	Transaction size plus word address is too large
0Bh	Access denied, improper privilege
0Ch	Condition cannot be generated, resource is not available
0Dh	Condition already exists, resource is already available
0Eh	Command cannot be executed
0Fh	Histogram overflow
10h	No access
11h	Illegal data type
12h	Invalid parameter or invalid data
13h	Address reference exists to deleted area
14h	Command execution failure for unknown reason; possible PLC-3 histogram overflow
15h	Data conversion error
16h	Scanner not able to communicate with 1771 rack adapter
17h	Type mismatch
18h	1771 module response was not valid
19h	Duplicated symbol
1Ah	File is not open, another node owns it
1Bh	Another node is the program owner
1Eh	Data table element protection violation
1Fh	Temporary internal problem
22h	Remote rack fault
23h	Timeout
24h	Unknown error

Diagnostic Status Response

The *diagnostic status* command response contains the following data:

Byte	Contents	Description
1	Mode / Status	00h
2	Interface Type	FEh
3	Interface Type Extension	1Bh
4-6	Reserved	-
7, 8	Diagnostic Counter Offset	Use in *read diagnostic counters* command
9-10	Reserved	-
11-18	Station Name	ASCII characters “MS-880” [1]

Diagnostic Counters

The *read diagnostic counters* command returns the following counter bytes:

Byte	Counter
0	ACK received with bad CRC
1	ACK timeout
2	Transmit retries exhausted
3	NAK - illegal protocol
4	NAK - bad LSAP received
5	NAK - no memory received
6	Received ACK/NAK too short
7	Received ACK/NAK too long
8	Unrecognized ACK/NAK response
9	Token pass timeout
10	Token pass retries exhausted
11	Token claim sequence entered
12	Token claimed
13	Bad CRC in received frame
14	NAK - illegal protocol sent
15	NAK - bad LSAP sent
16	NAK - no memory sent
17	Received frame too small
18	Received frame too long
19	Received a duplicate frame
20	Received frame aborted
21, 22	Messages successfully sent[1]
23, 24	Messages successfully received[1]

25, 26	Commands successfully sent[1]
27, 28	Replies successfully received[1]
29, 30	Commands successfully received[1]
31, 32	Replies successfully sent[1]
33	Reply could not be sent
34	Number of active stations
35-67	Padded with 00h

1 These 16-bit counters appear LSB first

Node Addressing

Each node on a DataHighway Plus network is assigned a station number by the end user. These addresses are expressed in octal and range from 01 to 77. Station address 00 is not allowed for the bar code scanner because some communication errors are undetectable by

DataHighway Plus CRC hardware in combination with this address.

Hardware Specification

Overview

The DataHighway Plus module connects client bar code scanners to DataHighway Plus networks. The main features are:

- Isolated DataHighway Plus interface
- DataHighway Plus compatible 3-pin screw terminal bus connector
- Compatible with proprietary DataHighway Plus electrical interface
- Supports standard DataHighway Plus baud rates of 57.6K, 115.2K and 230.4K

Identification

The DataHighway Plus module printed circuit board is labeled “DHP/RIO” on the primary side.

Network

Cable: “Blue Hose” shielded twin axial cable, Belden 9463 or compatible

Isolation: Type tested at 1000VAC RMS for 1 second

Protocol: DataHighway Plus

Data Rate: 57.6, 115.2 or 230.4K baud

Environmental

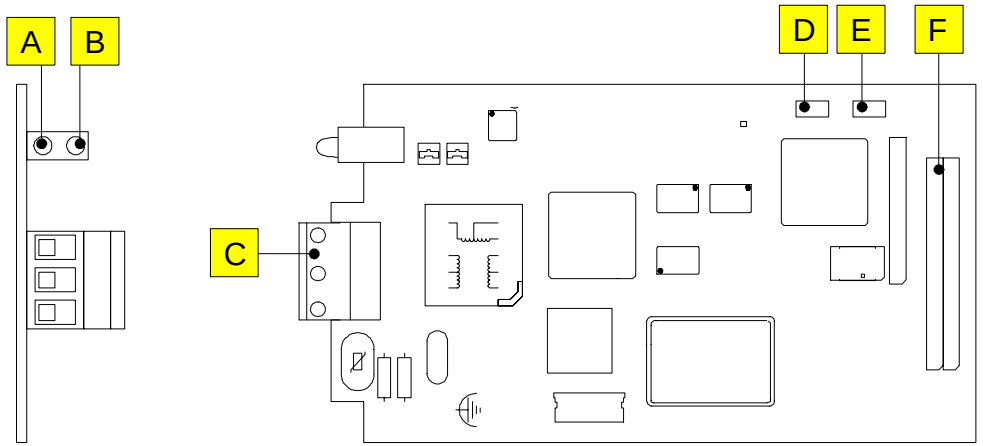
Storage Temperature: –50 °C to 75 °C

Operating Temperature: 0 °C to 50 °C

Operating Humidity: Up to 90% non-condensing

Reference

The main features of the DataHighway Plus module are listed in the following diagram.



Feature	Description
A	Network Status LED[a]
B	Module Status LED
C	Network connector
D	BA1 Jumper
E	BA2 Jumper
F	Client Bus Connector

a. Indications on the Network Status LED are only valid when the Module Status LED is solid green.

Chapter

7

Serial Port Emulation Mode

Chapter Contents

Serial port emulation functions like a serial gateway and provides the host with a “networked” connection to the MS-880's serial communication processor, without using the host RS-232 port. All of the MS-880's serial communication ports retain their independent functionality. The data rate is not limited by the host port's baud rate because with serial port emulation the MS-880 connects to the network protocol card through an independent parallel data bus.

At this time, Serial Port Emulation only supports DeviceNet. See **Chapter 3, “DeviceNet.”**

The network communicates with the MS-880 via Microscan's serial communication protocol documented in Microscan’s ***MS-880 Industrial Long Range Scanner User’s Manual***, part number 83-000880.

To facilitate serial port emulation, two items have been added to the Microscan serial protocol:

1. A two-way handshake for both the receive and transmit channels.
2. A 16-bit length field that defines the length of the serial data.

Serial Port Emulation Channels

The general format of the serial port emulation channels is as follows:

Table 7-1 Network/Reader Serial Channel Fields

Field Size	16 bits	16 bits	16 bits	8 bit char string (1-248 char)
From Net	NetNew	NetAck	Length	Serial Data
From MS-880	ReaderAck	ReaderNew	Length	[PAD] Serial Data [PAD]

Tables **7-2** and **7-3** show the resulting formatting for the various combinations of **Length**, **End Justify** and **Pad** options. Table **7-4** defines the terms.

Table 7-2 From MS-880 to Network Serial Channel Format Options (default in bold)

Length	End Justify	Pad	Format
Enable	**Disable**	**Enable**	[NetNew–16 bits][NetAck–16 bits][Length–16 bits][1-248 char][Pad]
Enable	Disable	Disable	[NetNew–16 bits][NetAck–16 bits][Length–16 bits][1-248 char ….]
Enable	Enable	Enable	[NetNew–16 bits][NetAck–16 bits][Length–16 bits][Pad][1-248 char]
Enable	Enable	Disable	[NetNew–16 bits][NetAck–16 bits][Length–16 bits][…. 1-248 char]
Disable	Disable	Enable	[NetNew–16 bits][NetAck–16 bits][1-248 char][Pad]
Disable	Disable	Disable	Do not use.
Disable	Enable	Enable	[NetNew–16 bits][NetAck–16 bits][Pad][1-248 char]
Disable	Enable	Disable	Do not use

Table 7-3 From Network to MS-880 Serial Channel Format Options (default in bold)

Length	Format
Enable	[ReaderNew–16 bits][ReaderAck–16 bits][Length–16 bits][1-248 char]
Disable	[ReaderNew–16 bits][ReaderAck–16 bits][1-248 char ….]

Table 7-4 Definitions of Serial Channel Fields

Field name	Description
NetNew	The network signals there is a new command to the reader in the channel.
ReaderAck	The reader acknowledges new command from the network.
ReaderNew	The reader signals there is new data to the network in the channel.
NetAck	The network acknowledges new data from the reader.
Length	The run time count of new data characters in the data field. The **Length** field is enabled/disabled with the <K125> command.
PAD	The pad character is used as a delimiter to clear unused space in the data field. The pad character is enabled/disabled with the <K125> command.
End Justify	If **Disabled**, serial data will be placed at the beginning of the data field. If **Justify** is **Enabled**, serial data will be placed at the end of the data field. The **Justify** field is enabled/disabled with the <K125> command.
Serial Data	Serial data field (1 to 248 characters). The size and alignment of the data field are configured with the <K125> command.

Network Transmit/Receive Procedure

The following shows sequence of events between sender and receiver in the serial channels:

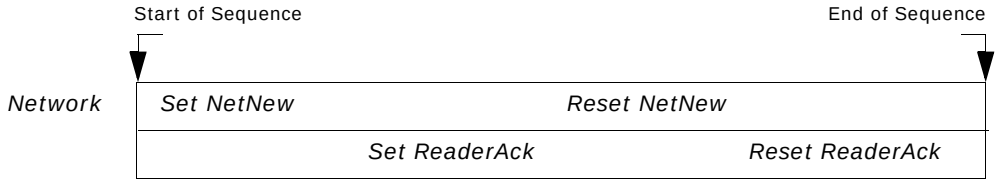


Figure 7-1 Network to Reader Sequence

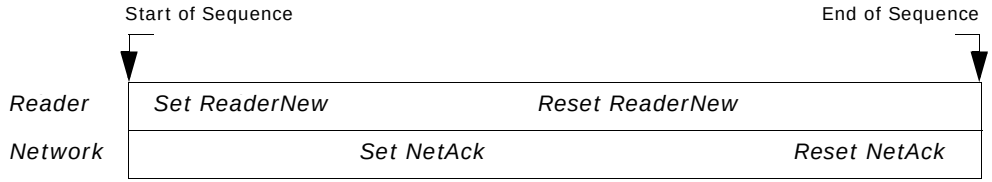


Figure 7-2 Reader to Network Sequence

In both figures above, “Set” means change the specified channel field to 1 and “Reset” means change the specified field to 0.

The following table is an example of the network sending a serial trigger to a reader:

Table 7-5 Network to Reader Serial States

	NetNew	ReaderAck	Length	Data
Start of Sequence	0	0	-	-
Set NetNew	1	0	3	<^]>
Set ReaderAck	1	1	-	-
Reset NetNew	0	1	-	-
Reset ReaderAck	0	0	-	-
End of Sequence	0	0	-	-

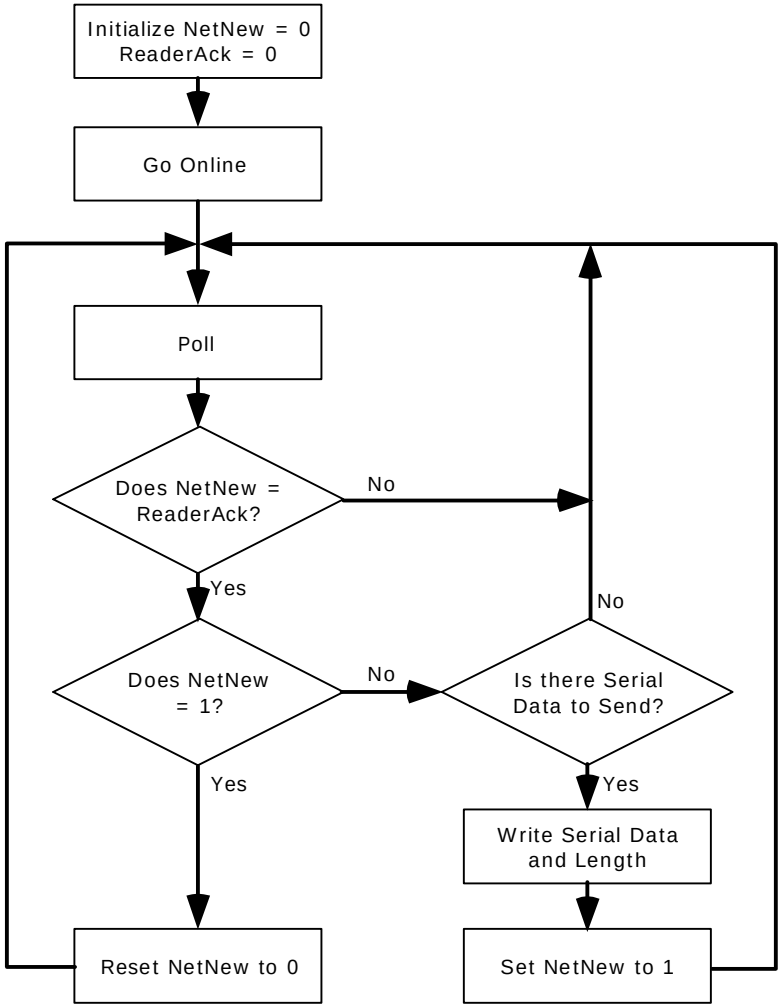
The following is an example of the network receiving serial data from a reader:

Table 7-6 Reader to Network Serial States

	ReaderNew	NetAck	Length	Data
Start of Sequence	0	0	-	-
Set ReaderNew	1	0	10	ABC12345XY
Set NetAck	1	1	-	-
Reset ReaderNew	0	1	-	-
Reset NetAck	0	0	-	-
End of Sequence	0	0	-	-

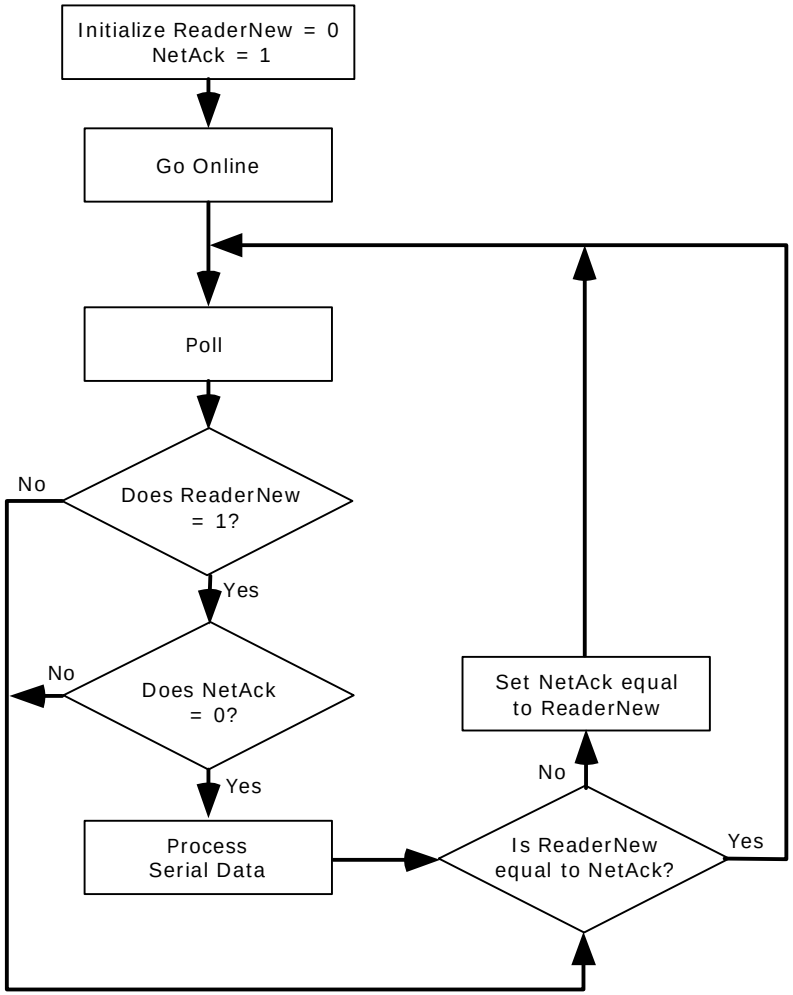
Transmitting Data to the Reader

To understand the following flow chart, refer to **Table 7-5, Network to Reader Serial States, on page 7-3** for an example of the serial transmission protocol.



Receiving Data from the Reader

To understand the following flow chart, refer to **Table 7-6, Reader to Network Serial States, on page 7-3** for an example of the serial transmission protocol.



Special Notes On Serial Port Emulation

Handshake

The handshake method used for serial port emulation is different than the handshake used in **Chapter 8, "Bar Code Object Mode"** mode of operation. The serial port emulation handshake method uses two states (0 and 1) of the **NetNew/ReaderNew** and **ReaderAck/NetAck** fields in a four-step process to signal the presence of new data, acknowledge the data, and reset the handshake to idle.

No Aux Port Interaction

The reader's host port operation as related to the reader's auxiliary port in **Transparent**, **Full**- and **Half**-**Duplex** modes is not emulated over the network. That is, no data is exchanged between the network port and the reader's aux port.

Preamble/Postamble

To move data through the network port that might exceed the size of the serial data attributes, host preamble and postamble characters are often employed for read cycle and diagnostic data. For example, the network can use these to determine when a new batch of data begins and ends over several handshake transactions.

Note the following issues:

1. Preamble and postamble characters are not sent to the network when responding to serial commands from the network.
2. Preamble and postamble characters are not required from the network.
3. It is possible under certain conditions for the host network to receive preamble and postamble characters separately from read cycle and diagnostic message. If **Preamble** and **Postamble** are enabled in the reader's host port, the network could receive the preamble, data, and the postamble in separate handshake transactions.

Data Length Field

If the network writes the length field in the reader's serial receive buffer with a value that is larger than the data field, the reader will process the entire serial data field for commands as if the maximum number of data characters had been received. However, the comm buffer overflow flag will be set in the reader's system status byte, which can be read with the status command <?>.

Serial Command Response Timing

If a read cycle is in progress and a serial command is received from the network requiring serial response (including the status commands <?> and <?1>), the reader's response will be delayed until the end of a read cycle.

Ignored commands

The following commands when received from the network will be ignored and a command error flag set in the system status byte:

Menu **<D>**, autocal **<@>**, code download **<d>**.

Chapter

8

Bar Code Object Mode

Chapter Contents

The data and services described in this chapter are available only for Profibus and Data-Highway Plus and operate the same on the both networks.

For network-specific mapping for **Profibus**, see **Chapter 5, "Profibus–DP."**

For network-specific mapping for **DataHighway Plus**, see **Chapter 6, "DataHighway Plus."**

Note: For detailed instructions relating to the installation and use of the MS-880 bar code scanner and wiring box, see Microscan's ***MS-880 Industrial Long Range Scanner User's Manual***, part number 83-000880.

Summary of Data and Services

Table 8-1 Summary of the Data and Services Available

Attribute Name	Description	Operation	Page Ref.
Read Cycle Attributes	These include bar codes and other data that is generated when a read cycle occurs.	Uses a two-way handshake method called Read Cycle Attribute Handshake (abbreviated as “RAH”) to guarantee coherent delivery to the host.	page 8-3
Discrete Inputs and Outputs	This includes the status of the discrete IO and provides host control over the programmable operation assigned to the inputs.	Bit-mapped handshake. Each Discrete Input has a host-controlled override and a status bit. When the host activates an input, the corresponding status bit acknowledges the request.	page 8-12 page 8-16
Diagnostics	These indicate the bar code scanner’s temperature, service time, laser current, and other maintenance-related items.	Read only status indicators. No handshake required.	page 8-17
Control Services and Acknowledgement Signals	This controls the operation of the counters, read rate, laser, and scan motor, plus acknowledgement of non-diagnostic warnings like reset and serial communication errors.	Bit mapped handshake. Each Control Service has a corresponding Acknowledgment Signal. When a service is requested, the acknowledgement signal changes state to signify that the service was performed.	page 8-19
General Status and Configuration Status	These provides miscellaneous information on what the bar code scanner is doing, and configuration information that impacts the operation of the network port.	Read only status indicators. No handshake required.	page 8-23 page 8-25
Serial Data	These provide nearly the same control over the bar code scanner as the RS-232/422 serial comm ports. The host can use these attributes to send serial data to and from the scanner. Note that this is not a “serial gateway”. The scanner only sends serial data to the host when it receives a serial command that requires a serial response. In other words, the scanner does not send a copy of the serial data that is sent out the RS-232/422 ports to the network port.	Uses a two-way handshake method called Serial Data to Network Handshake (abbreviated as “STNH”) and Serial Data from Network Handshake (abbreviated as “SFNH”) to guarantee coherent delivery to the host.	page 8-28

Read Cycle Attributes

Read Cycle Attributes are data generated when the bar code scanner completes a read cycle. The Read Cycle Attributes are updated at the end of the read cycle. The Read Cycle Handshake is used to guarantee coherent delivery of the Read Cycle Attributes to the network host.

Requirements

The host's requirements for receiving read cycle attributes are as follows:

- If the network host requires read cycle data through the network port, then a **Read Cycle Handshake** is required. See **page 8-10**.
- **Bar Code Output** must be enabled to receive read cycle attributes through the network port. If **Bar Code Output** is disabled, none of the read cycle attributes are changed at the end of a read cycle. Only the historical counters (**page 8-11**) will change at the end of a read cycle. See **"Configuration Status" on page 8-25** and the <K705> command in the Interface section of Microscan's ***MS-880 Industrial Long Range Scanner User's Manual.***
- **Noread Output** must be enabled if the network host requires notification of noreads. If **Noread Output** is disabled and the bar code scanner does not decode any symbols during a read cycle, then the read cycle attributes are not changed at the end of the read cycle. Only the historical counters (**page 8-11**) will change at the end of a read cycle. See **"Configuration Status" on page 8-25** and the <K714> command in the Interface section of Microscan's ***MS-880 Industrial Long Range Scanner User's Manual***. It is recommended that **Noread** messages be enabled to ensure that the read cycle attributes are updated with every read cycle.
- The network host must be able to read and process read cycle data faster than the bar code scanner's triggering rate. If the network host does not read and process read cycle data before another read cycle ends, then the new data will be lost. See the **"Read Cycle Result Code" on page 8-7**.

Attributes

- Bar Code Buffer
- Bar Code Offsets and Lengths
- Bar Code Result Codes
- Read Cycle Result Code
- Total Bar Code Count
- Output Bar Code Count
- Noread Count
- Handshake Request
- Handshake Response

Bar Code Buffer

Data Type. Buffer of 8-bit character bytes.

Size. Network-specific. See specific network chapters.

At the end of a read cycle, the scanner writes all the bar codes that qualify for output into the Bar Code Buffer. The bar codes are written as one consecutive string, with a user-defined separator character between individual bar codes. The location of the individual bar codes in the buffer is indicated by the Bar Code Offset and Length attributes. The size of the buffer and the number of bar codes that can be output is dependent on the installed network port. See Chapters **3**, **5**, and **6** for network-specific information.

The bar code string format

The status of the optional items is indicated by its configuration status (**page 8-25**). Items in brackets [] are optionally configured by the user. The network host must either assume that certain optional items are enabled or process the configuration status information. The bar code string has the following format:

[AUX ID][SYMB ID]decoded data[QUALITY][SEP][AUX ID]
[SYMB ID]decoded data[QUALITY][SEP]…[AUX ID][SYMB ID]
decoded data[QUALITY]

Where:

AUX ID = One or two characters which identifies the scanner in a daisy chain configuration that decoded the bar code.

SYMB ID = Three character AIM symbology identifier.

decoded data = Actual data decoded from the bar code symbol. (It may have custom formatting.)

QUALITY = Number of decodes of this symbol in the read cycle. Has the format of one separator character and a five-digit ASCII decimal number. For example: /13254.

SEP = One character separator such as a comma.

Bar Code Offset (up to 12) and Bar Code Length (up to 12) Array

Data Type. 16-bit numbers.

Size (quantity). Network-specific. See specific network chapter.

Bar Code Offset and **Length** provide the "address" information needed to locate individual bar codes in the Bar Code Buffer. The size of the Bar Code Buffer and the number of Bar Code Offsets and Lengths determines the number of bar codes that can be output by the scanner and parsed by the host, and is dependent on the installed network port. See Chapters **3**, **5**, and **6** for network-specific information.

- Bar code separator characters are not included in the Length values.
- All optional output fields are included in the Length value if they are enabled. Optional output fields include Aux ID, Symbology ID, and Quality.
- The values of Offset and Length correspond to the location of 8 bit character bytes in the Bar Code Buffer.
- The number of valid pairs of Offset and Length values is guaranteed to be the same as the Output Bar Code Count. For example, if there are three bar codes in the Bar Code Buffer, then the Output Bar Code Count will be three, and there will be three valid pairs of Offset and Length values.
- A valid value for Offset and Length is non-zero, with one exception. The first Offset value is always zero. This is because the first bar code always begins at the first byte of the Bar Code Buffer.
- Valid Offset and Length values always begin with the first position in the array.
- If there are fewer bar codes output than a network port is capable of, the unused Offset and Length values will be zero.

To find a bar code in the Buffer, add the value of the respective Offset to the address of the Bar Code Buffer. Then read the number of bytes indicated by the respective Length value.

Example:

Table 8-2 Read Cycle Attributes

Bar Code Offset[0] = 0	Bar Code Length[0] = 10
Bar Code Offset[1] = 11	Bar Code Length[1] = 6
Bar Code Offset[2] = 18	Bar Code Length[2] = 8
Bar Code Offset[3] – [11] = 0	Bar Code Length[3] – [11] = 0
Output Bar Code Count = 3	
Bar Code Buffer[] = ABCDE12345,FGH678,IJKL9012	

Bar Code Buffer Explanation:

Bar Code Buffer[] = **ABCDE12345,FGH678,IJKL9012**

Separator character = **,**

First Bar Code = **ABCDE12345**

Address = Bar Code Offset[0] = **0**
Length = Bar Code Length[0] = **10**

Second Bar Code = **FGH678**

Address = Bar Code Offset[1] = **11**
Length = Bar Code Length[1] = **6**

Third Bar Code = **IJKL9012**

Address = Bar Code Offset[2] = **18**
Length = Bar Code Length[2] = **8**

Notes:

- Output Bar Code Count, Offset, and Length are 16 bit values. Each data value shown in the example is in decimal notation.
- Bar Code Buffer is an array of 8 bit bytes. Each data character shown in the example is represented as an 8 bit ASCII character.
- The commas shown in the Bar Code Buffer data are the default separator characters.

Bar Code Result Code (up to 12)

An array of flag fields corresponding to a bar code in the Bar Code Buffer. Each bar code has its own set of flags.

Bit 0. Match/Good.

Set (1) if Matchcode is enabled and this bar code matches a master. Otherwise, this bit is a redundant indicator that a bar code was decoded or received on the aux port. See **"Configuration Status" on page 8-25** to determine if Matchcode is enabled.

Bit 1. Mismatch.

Set (1) if Matchcode is enabled and this bar code did not match a master. See **"Configuration Status" on page 8-25** to determine if Matchcode is enabled.

Bit 2. Received from aux port.

Set (1) if aux port is in Daisy Chain mode and the bar code symbol was not decoded by this scanner but received from the Aux port. See **"Configuration Status" on page 8-25**.

Bit 3. Low read quality.

Set (1) if reads per trigger is enabled and this bar code's read quality was below the user-specified threshold.

Bit 4. Contains a NUL.

Set (1) if Bar Code contains a NUL (0x00) data characters. This can occur with PDF417 or full ASCII Code 39 or Code 93 symbols.

Bit 5. Contains a Separator.

Set (1) if bar code contains a character that is the same as the separator. Use Offset and Length to locate individual bar codes in the buffer.

Bit 6. New Master.

Set (1) if the read cycle saved this bar code (decoded data, not user-defined format) as a master symbol.

Bit 7. Reformatted.

Set (1) when the decoded content of the bar code has been reformatted per user configuration.

Bit 8. – Bit 15. Unused.

Read Cycle Result Code

The entire read cycle has a result code associated with it, and is dependant on the configuration of the bar code scanner with respect to what happened during the read cycle. Also included are abnormal error indications.

Normal Operation Bit Flags

Bit 0. Match/good. This is mutually exclusive with Mismatch and Noread flags. It will never be set (1) if either Mismatch or Noread flag is set.

Set (1) when:

a) Matchcode is disabled and the number of bar codes required are decoded or received from the aux port if in daisy chain mode; **OR**

b) Matchcode is enabled, the number of bar codes required are decoded or received from the aux port if in daisy chain mode, and all decodes match the master symbol.

Bit 1. Mismatch.

Set (1) if at least one bar code was a mismatch. Mutually exclusive with Match/good flag. This will never be set (1) if the match/good flag is set.

Bit 2. Noread.

Set (1) if the required number of bar codes were not decoded or received from aux port. Mutually exclusive with Match/good flag. This will never be set (1) if the match/good flag is set.

Bit 3. Not all output.

Set (1) if one or more bar codes did not output because of configuration (match/mismatch).

If read cycle output is configured to output matched or mismatched bar codes and the opposite condition is true for a given bar code symbol, then the bar code data is not output.
See **“Configuration Status” on page 8-25**.

Bit 4. – 7. Unused.

Error Bit Flags:

Bit 8. Buffer Overflow.

Set (1) if one or more bar codes could not be placed in the Bar Code Buffer. This is caused when the sum total length of the bar codes is larger than the size of the Bar Code Buffer. The size of the Bar Code Buffer is network-specific.

Bit 9. Too Many Decodes.

Set (1) when there are not enough Bar Code Offset and Length slots. This occurs when the bar code scanner decodes and outputs more bar codes than the network port is capable of. The Bar Code Buffer may contain all of the bar codes, but there were not enough Offset and Length slots to provide the addresses of the bar codes in the buffer. Since the number of Bar Code Offset and Length slots is network-specific, see Chapters **3**, **5**, and **6**. See also **“Configuration Status” on page 8-25** for the “Incompatibility” warning flag associated with this condition.

When this bit is set, the network host must parse the bar code buffer using the separator character to find individual bar codes not mapped by an Offset and Length. Unfortunately it will be impossible to determine the last bar code because a separator character is not placed at the end of the last bar code.

Bit 10. Read Cycle Data Lost.

Set if read cycle data has been lost because the network did not perform the previous read cycle handshake quick enough. The bar code scanner cannot send read cycle data if it is still waiting for the network to send a handshake response. If this occurs, the bar code scanner does not send read cycle data to the network, but does still transmit to other ports (host, aux, config).

Bit 11. – Bit 15. Unused.

Total Bar Code Count

Indicates the number of bar codes that were decoded or received from the aux port during the re**“Output Bar Code Count” on page 8-9**.

Output Bar Code Count

Data Type: Network-specific. Typically a 16-bit number.

Size: One 16-bit number.

Indicates the number of bar codes output. The value of this attribute will correspond to the number of bar codes that meet the scanner's configuration status. Note that this also indicates the number of Bar Code Offsets, Lengths and Bar Code Result Codes that are valid.

When no bar codes have been decoded at the end of a read cycle, the only read cycle attributes that will be valid are:

a) Total Bar Code Count will be 0,

b) Output Bar Code Count will be 0,

c) Noread Count will be greater than 0,

d) Read Cycle Result Code will indicate that a noread occurred.

e) Historical Read Cycle Counters will increment trigger and noread counts.

Noread Count

Data Type: Network-specific. Typically a 16-bit number.

Size. One 16-bit number.

Indicates the number of noreads that occurred at the end of the read cycle. This value is for a single read cycle only. It is not the same value as the "Historical Noread Count".

Noread Count assumes that Bar Code Output and Noread are enabled. If either Bar Code Output or Noread is disabled, and on bar codes have been decoded, then only the Historical counters will be updated at the end of the read cycle.

When no bar codes are decoded at the end of a read cycle, the only read cycle attributes that will be valid are:

a) Total Bar Code Count will be 0,

b) Output Bar Code Count will be 0,

c) Noread Count will be greater than 0,

d) Read Cycle Result Code,

e) Historical Read Cycle Counters.

Read Cycle Attributes Handshake (RAH)

Includes Request to Network and Response from Network

Data Type. 16-bit number.

Size (quantity). One Request and one Response number.

The Request and Response attributes are used to guarantee coherent delivery of read cycle data to the host network. The read cycle attributes that use the handshake are:

- Bar Code Buffer
- Bar Code Offsets and Lengths
- Bar Code Result Codes
- Read Cycle Result Codes
- Total Bar Code Count
- Output Bar Code Count
- Noread Count

No other attributes use the Read Cycle Handshake.

Requirements

The host's requirements for receiving Read Cycle Attributes are as follows:

1. If the network host requires read cycle data through the network port, then operation of the Read Cycle Handshake is required.
2. To receive Read Cycle Attributes through the network port, bar code output must be enabled. If bar code output is disabled, none of the Read Cycle Attributes are changed at the end of a read cycle. See **"Configuration Status" on page 8-25** and the command in the Interface section of Microscan's ***MS-880 Industrial Long Range Scanner User's Manual.***
3. The network host must be able to read and process read cycle data faster than the bar code scanner's triggering rate. If the host network does not read and process read cycle data before another read cycle completes, then the new data will be lost.

Operation

The network host performs the Read Cycle Handshake and receives read cycle data as follows:

1. Initializes Request and Response to 0 whenever the network host “resets”, or before connecting to the bar code scanner on a connection-based network like DeviceNet and Profibus-DP.

   This allows the bar code scanner to detect that the network host has “reset”.
2. Reads Request from the bar code scanner.

   If Request is 0, the bar code scanner has experienced a reset since the last read cycle. It does not process the read cycle attributes. Skips to step 6.
3. Compares Request to Response. If Request and Response are the same, returns to step 2.
4. Reads and processes the Read Cycle Attributes. Performs all actions dictated by the content of the read cycle data.
5. Checks the Read Cycle Result Code “Data Lost” flag.

   If it is set (1), then the host network is too slow for the bar code scanner’s triggering rate.
6. Acknowledges the handshake by setting Response to the same value as Request.
7. Returns to step 2.

Historical Read Cycle Counters

Includes Trigger, Match/Good, Mismatch, and Noread Counters

All counters are 16 bit values. The counters do not rollover. Once they reach 65535, they remain at that value until cleared or the bar code scanner resets. If a counter reaches a value of 65535, the network operator should assume that the counter has overrun.
The bar code scanner always updates the value of the counters at the end of read cycle. The Read Cycle Handshake does not specifically apply to the counters, even though the counters are grouped with read cycle data in some network configurations.

See **“Discrete Inputs” on page 8-12**, or Microscan’s ***MS-880 Industrial Long Range Scanner User’s Manual.*** for information on clearing the historical counters.

Discrete Inputs

The bar scanner outputs the status of its physical inputs and allows the network host to activate its programmed operation of the inputs through the network port. The operation of the discrete inputs is programmable. See the Discrete I/O section of the Microscan's ***MS-880 Industrial Long Range Scanner User's Manual*** for configuration instructions.

Attributes

- Discrete Input Physical Status
- Discrete Input Logical Status
- Discrete Input Logical Override

Data Type. Bit field.

Size. 8 bits per attribute.

Arrangement

The bits of all the discrete input attributes correspond as follows:

Bit 0. Trigger

Bit 1. New Master

Bit 2. Programmable Input 1

Bit 3. Bit 3 - Bit 7. Unused

Discrete Input Physical Status

Read/write. Read Only.

Corresponds to the physical state of the optoisolator inputs:

0 = Open (no opto current)

1 = Closed (opto current present)

The state of the physical status bits can change at any time to reflect the state of the physical optoisolator inputs. No handshake is used.

Discrete Input Logical Status (DI Logical Status)

Read/write. Read Only.

Corresponds to the logical state of the input, according to the bar code scanner's configuration:

0 = Inactive

1 = Active

Bit 0. Trigger is active (1) when:

a) Internal trigger state is active (external or serial trigger initiated a new read cycle), OR

b) Discrete Input Logical Override: Trigger bit is active AND Trigger Mode is Network.

Bit 1. New Master is active (1) when:

a) internal new master state is active (opto input activated), OR

b) Discrete Input Logical Override:New Master bit is active.

Bit 2. Programmable Input 1 is active (1) when:

a) Programmable Input 1 is in the active state (opto input) according to bar code scanner's configuration, OR

b) Discrete Input Logical Override:Programmable Input 1 bit is active.

Bit 2. Programmable Input 1 is active when:

a) Discrete Input Physical State: Programmable Input 1 is in the active state, OR

b) Discrete Input Logical Override State: Programmable Input 1 bit is active.

Discrete Input Logical Override (DI Override)

Read/write. Read/write.

The network host can activate the programmed operation of the discrete inputs by changing the state of these bits. The action performed is dependent on the bar code scanner's configuration.

Requirements

- By setting (1) a bit, the network host activates the corresponding input.
- By clearing (0) a bit, the network host deactivates the corresponding input.
- The input bits operate in “positive edge logic” mode. They are activated when a bit changes from low (0) to high (1). When activated, the logical status of the input stays active (1) until the bar code scanner performs the requested action (triggered read cycle begun, new master acquired, etc.). Once an Input Override is activated, changing the state of it has no effect until after the action is performed by the bar code scanner.

Network Trigger Operation

Note: Network trigger mode must be enabled in the bar code scanner's configuration for the network override to take effect. It operates similar to external edge mode. See the <K200> command in the Interface section of Microscan's ***MS-880 Industrial Long Range Scanner User's Manual.***

1. Activate DI Override:Trigger (set Bit 0 = 1) to start a new read cycle.
2. Wait for DI Logical Status:Trigger to activate (Bit 0 = 1). The bar code scanner has begun a new read cycle.
3. Clear DI Override:Trigger (clear Bit 0 = 0).
4. Wait for DI Logical Status:Trigger to go inactive (Bit 0 = 0).
5. Wait for Read Cycle Handshake Request To Network to change.

   If the result of the read cycle is not qualified for output (due to Bar Code Output disabled or Noread disabled), Request To Network will not change and there will be no output for the read cycle. In this case the host should timeout and stop waiting. The host may return to step 1 and send a new trigger when it is ready for the next read cycle.
6. Perform Read Cycle Attribute Handshake procedure.
7. Return to step 1 to start a new read cycle.

New Master Operation

Note: The New Master pin does NOT need to be enabled in the bar code scanner's configuration for the network override to take effect. See the <K225> command in the "Interface" chapter of Microscan's ***MS-880 Industrial Long Range Scanner User's Manual.***

1. Activate DI Override: New Master (Bit 1 = 1).
2. Wait for DI Logical Status: New Master to go active (Bit 1 = 1).
3. Clear DI Override: New Master (Bit 1 = 0).

   DI Logical Status: New Master will stay active until a new master is acquired.
4. Wait for DI Logical Status: New Master to go inactive (Bit 1 = 0). This will occur at the end of the next read cycle in which the bar code scanner acquires a new master symbol.

Programmable Input 1 Operation

Note: Programmable Input 1 MUST be enabled in the bar code scanner's configuration for the network override to take effect. See the <K730> command in the "Interface" chapter of Microscan's ***MS-880 Industrial Long Range Scanner User's Manual.***

1. Activate DI Override: Programmable Input 1 (Bit 2 = 1).
2. Wait for DI Logical Status: Programmable Input 1 to go active (Bit 2 = 1).

   The scanner has performed the action assigned to Programmable Input 1.
3. Clear DI Override: Programmable Input 1 (Bit 2 = 0).
4. Wait for DI Logical Status: Programmable Input 1 to go inactive (Bit 2 = 0).

Discrete Outputs

The bar scanner provides the state of its physical outputs through the network port. The operation of the discrete outputs is programmable. See the “Discrete I/O” in Microscan’s ***MS-880 Industrial Long Range Scanner User’s Manual*** for configuration instructions.

Attributes

- Discrete Output Physical Status
- Discrete Output Logical Status
- Discrete Output Logical Override

Data Type. Bit field.

Size. 8 bits per attribute.

Arrangement

All of the discrete output bit fields correspond as follows:

Bit 0. Output 1

Bit 1. Output 2

Bit 2. Output 3

Bit 3 - Bit 7. Unused

Discrete Output Physical Status

Read/Write. Read Only.

Corresponds to the physical state of the physical optoisolator output:

0 = Open (no opto current)

1 = Closed (opto current present)

Discrete Output Logical Status

Read/Write. Read Only.

Corresponds to the logical state of the output, according to the bar code scanner’s configuration:

0 = Inactive 1 = Active

Discrete Output Logical Override

Note: Discrete Output Override is not yet available in the bar code scanner's firmware.

Read/write. Read/write.

Diagnostics

Last Reset Cause

0 to 255 value.

Indicates the cause of the last reset.

1 = power-up, firmware update, or fatal system error

2 = serial port command

4 = Watchdog

Time Since Reset

0 – 15300. Number of minutes (up to 255 hours) since the last reset. Value stops at 15300 and does not roll over.

Number of Cold Resets

0 – 65535. The number of times the bar code scanner has been powered up. Value stops at 65535 and does not roll over.

Number of Hot Resets

0 – 65535. The number of times the bar code scanner has been issued a hot restart command. Hot reset occurs when the scanner receives an <A> or <Z> serial command or exits the embedded programming menus. See Microscan's ***MS-880 Industrial Long Range Scanner User's Manual.***

Value stops at 65535 and does not roll over.

Operating Temperature

0 – 50. Temperature (Celsius). This occurs after reset and may take up to two minutes for a temperature reading to take effect.

NOTE: 255 indicates a temperature reading is not immediately available.

Temperature Status

0 = Internal temperature is ok.

1 = Internal temperature is too high according to user defined level.

2 = Internal temperature is too low according to user defined level.

See the "Diagnostics" in Microscan's ***MS-880 Industrial Long Range Scanner User's Manual.***

Laser Current Status

0 = Laser current is within the to of factory calibration.

1 = Laser current is too high. Scanner may need repair if condition persists.

2 = Laser current is too low. Scanner may need repair if condition persists.

4 = Factory calibrated laser current reference has been lost. Scanner needs repair.

Service Status

0 = Service timer is less than user defined value.

1 = Service timer has exceeded the user defined value.

The scanner has been in service for the amount of time that the user has chosen to perform routine maintenance. For example, clean the front window.

See the “Diagnostics” in Microscan’s ***MS-880 Industrial Long Range Scanner User’s Manual.***

NOVRAM Status

Bit 0. Factory NOVRAM bad. Scanner needs repair.

Bit 1. User NOVRAM bad. Scanner may need repair. This is set (1) when the scanner detects a failure in the user NOVRAM, or when the user defaults the NOVRAM settings.

Bit 2. Laser reference NOVRAM bad. Scanner needs repair.

Bit 3. Diagnostic NOVRAM bad. Scanner needs repair.

Control Services

Control Services provide miscellaneous control of the bar code scanner that is not related to discrete I/O. There are sixteen Control Services available, arranged in bit field form. The default state (at reset) of all Control Services is 0.

Control Service Signals

Data Type. Bit field.

Size. 16 bit.

Bit 0. Clear Historical Trigger counter

Bit 1. Clear Historical Match/ Good counter

Bit 2. Clear Historical Mismatch counter

Bit 3. Clear Historical Noread counter

Bit 0 - 3 allow the host to clear one or more historical counters by setting (1) the associated bits. The host may clear the counters at any time. The bar code scanner clears the counters as soon as the service is received. Note that if the counters are cleared at the same time that a read cycle is updating them, the resulting counter values is not guaranteed to be zero the next time they are read.

Bit 4. Read Rate symbol Mode. 0 = Single Symbol, 1 = Multisymbol

Bit 5. Read Rate Mode: 0 = Decode Rate, 1 = Percent

Bit 6. Read Rate Symbology Mode. 0 = Linear Bar Code, 1 = PDF417 (multi-row)

Note: When Read Rate Symbology Mode is set to PDF417, two Control Service and Acknowledgement Signal Bits are forced to the following state:

a) Signal Bit 4 Read Rate Symbol Mode = Single Symbol

b) Signal Bit 5 Read Rate Mode = Decode Rate

Bit 7. Read Rate Control: 0 = Read Rate disabled, 1 = Read Rate enabled

Note: Read Rate can also be enabled by a serial communication port with the <C> command. In either case, the Control Service Acknowledge Signal Bit 7-In Read Rate must be set (1) for the following signals to be valid:

a) Control Service and Acknowledgement Signal Bits 4-6 (Read Rate Mode)

b) General Status Signal Bits 0-3 (Read Rate Performance)

Bit 8. Unused

Bit 9. Unused.

Bit 10. Laser Scanning Control: 0 = enabled, 1 = disabled

Bit 11. Scan Motor Control: 0 = enabled, 1 = disabled

Bit 12. Unused

Bit 13. Clear Reset Indicator

Bit 14. Clear Serial Comm error

Bit 15. Clear Net Port problem

Control Service Operation

When the host network requests a Control Service, the corresponding Acknowledge Signal will respond to the state of the Control Signal when the bar code scanner performs the action requested.

To request Control Services 0-11 (Signal bits 0-11):

1. Start with the Control Service Signal clear (0). This is the default state at reset.
2. Request the desired service by setting (1) the associated Control Service Signal.
3. Wait until the bar code scanner sets (1) the associated Control Service Acknowledge Signal.
4. Clear (0) the Control Service Signal.
5. Wait until the bar code scanner clears (0) the associated Control Service Acknowledge.

To request Control Services 12 -15 (Signal bits 12-15):

1. Start with the Control Service Signal clear (0). This is the default state at reset.
2. Request the desired service by setting (1) the associated Control Service Signal.
3. Wait until the bar code scanner clears (0) the associated Control Service Acknowledge Signal.
4. Clear (0) the Control Service Signal.

Control Service Acknowledgement Signals

These provide direct acknowledgement of the corresponding Control Service Signals. Note that the Control Service Acknowledge Signals change state in response to requests from both the host network and the serial communication ports, or other events.

Data Type. Bit field.

Size. 16 bit

Bit 0. Historical Trigger Counter clear acknowledgement

Bit 1. Historical Match/ Good Counter clear acknowledgement

Bit 2. Historical Mismatch Counter clear acknowledgement

Bit 3. Historical Noread Counter clear acknowledgement

Bits 0-3 always acknowledge the state of Control Service

Bit 4. Read Rate Symbol Mode. 0 = Single Symbol, 1 = Multisymbol

Bit 5. Read Rate Mode. 0 = Decode Rate. 1 = Percent.

Bit 6. Read Rate Symbology Mode. 0 = Linear Bar Code, 1 = PDF417 (multi-row).

Note: When Read Rate Symbology Mode is set to PDF417, two Control Service Acknowledgement Signal Bits are forced to the following state:

a) Bit 4 Read Rate Symbol Mode = Single Symbol.

b) Bit 5 Read Rate Mode = Decode Rate.

Bit 7. In Read Rate

This signal bit is set (1) when the bar code scanner is in Read Rate Mode. Note that Read Rate can be enabled by either Control Service Signal Bit 7-Read Rate Control or a serial communication port with the <C> command.

This signal bit must be set for the other following signals to be valid:

a) Control Service Acknowledgement Signal Bits 4-6 (Read Rate Mode)

b) General Status Signal Bits 0-3 (Read Rate Performance).

Bit 8. Unused

Bit 9. Unused

Bit 10. Laser Scanning Control

This bit is clear (0) if laser scanning is enabled.

This bit is set (1) if laser scanning is disabled. This occurs when:

a) One of the communication ports has disabled laser scanning with <I>. No read cycle can begin until laser scanning is re- enabled with <H>.

b) Control Service-Laser Scanning Control went from enable to disable.

Bit 11. Scan Motor Control

This bit is clear (0) if the scan motor is enabled.

This bit is set (1) if the scan motor is disabled. This occurs when:

a) One of the communication ports has turned off the scan motor with the <K501> command. No read cycle can begin until the motor is turned on with <K500> command.

b) Control Service Signal 11-Scan Motor Control is disabled (1). No read cycle can begin until it is cleared (0) or scanner receives a <K500> serial command to turn the scan motor on.

Bit 12. Unused

Bit 13. Reset Indicator

This bit is set (1) when the bar code scanner experiences a reset. It stays set until the corresponding Control Signal is set to clear it.

Bit 14. Serial Comm Error

This bit is set (1) when the bar code scanner receives a bad serial command from any serial port (including network serial data). It stays set until the corresponding Control Signal is set to clear it.

Bit 15. Net Port Problem

This bit is set (1) when the bar code scanner experiences a problem with its network port. It stays set until the corresponding Control Signal is set to clear it. Note that the network port will typically still be able to operate normally even when a problem is indicated.

Force Reset

Note: This service is not yet available in the bar code scanner's firmware.

General Status

General Status provides additional run-time status information about the bar code scanner. This can change at any time and does not use a handshake.

Data Type. Bit field.

Size. 16 bit.

Read/write. Read Only.

Bit 0. 20% Read Rate Performance

Bit 1. 40% Read Rate Performance

Bit 2. 60% Read Rate Performance

Bit 3. 80% Read Rate Performance

Bits 0-3 are set (1) when the bar code scanner is in Read Rate and is decoding a bar code symbol in 20 - 80% of its scans.

Note: These indicators are only valid when Read Rate is enabled (Control Service Acknowledge Bit 7-In Read Rate=1).

Bit 4. 100% Read Rate / Good Decode

This is set (1) when one of these conditions is true:

a) (a). Read Rate Mode is enabled (Control Service Acknowledge Bit 7-In Read Rate=1) and Read Rate is 100%.

b) (b). At the end of the previous read cycle, the number of required symbols were decoded or received on the aux port.

Bit 5. Unused

Bit 6. Unused

Bit 7. In Read Cycle

This is set (1) when the bar code scanner is in a read cycle. Note that this bit is always set when the read cycle mode is Continuous or Continuous 1, or Read Rate Mode is enabled.

Bit 8. Unused

Bit 9. Unused

Bit 10. Laser Status

This is set (1) when:

a) The laser is configured to turn off at the end of a read cycle and the read cycle has ended. Also indicates the raster mirror is paused if configured to do so at the end of read cycle.

b) One of the serial communication ports has disabled laser scanning with the <I> serial command, or has turned off the scanning motor with <K501>. No read cycle

can begin until laser scanning is re- enabled with <H> or the motor is turned on with <K500>.

c) Control Service Signal Bit 10-Laser Scanning Control is disabled.

Bit 11. Unused

Bit 12. Unused

Bit 13. Unused

Bit 14. Unused

Bit 15. Serial Port Exclusive.

This is set (1) when a serial port has exclusive control of the bar code scanner's data and services.

When this flag is set, the only bar code scanner attributes that will be valid are the General Status indicators. All other attributes will be idle.

Events that acquire exclusive control of the bar code scanner include:

a) Firmware update

b) System test

c) Raster calibration

d) Focus calibration

e) Menu configuration

Configuration Status

The configuration status is solely dependent upon the configuration of the bar code scanner. These attributes change whenever the bar code scanner receives a configuration command from a serial port. The configuration status is arranged as two bit fields of sixteen bits each.

For more details on the operation of the bar code scanner, refer to Microscan's ***MS-880 Industrial Long Range Scanner User's Manual.***

Operations/Communication Mode

Data Type. Bit field

Size. 16 bit

Read/write. Read Only

Bit 0. Trigger mode (least significant bit)

Bit 1. Trigger mode

Bit 2. Trigger mode (most significant bit)

Bits 0-2 are a three-bit value indicating the triggering mode:

Bits 210	Value	Trigger Mode
000	0	Continuous
001	1	Continuous 1
010	2	External Level
011	3	External Edge
100	4	Serial
101	5	Serial or External Edge
110	6	Network
111	7	Undefined

Bit 3. Unused

Bit 4. Single Character Serial Trigger (1 = enabled)

When enabled, the bar code scanner will trigger on the configured single trigger character.

Bit 5. Matchcode (1=enabled).

When enabled, bar code scanner will perform matchcode on all decoded bar codes.

Bit 6. Aux Port Daisy Chain (1=enabled)

When enabled, bar code scanner will receive bar codes from the aux port.

Bit 7. Unused

Bit 8. Unused

Bit 9. Unused

Bit 10. Unused

Bit 11. Unused

Bit 12. Unused

Bit 13. Unused

Bit 14. Unused

Bit 15. Incompatibility with installed network

When this is set (1), it indicates that the bar code scanner is configured to output more symbols in a read cycle than the installed network port is capable of handling. See Chapters **3**, **5**, and **6** for network-specific information.

Data Output Mode

These indicate the format of the Bar Code Buffer.

Data Type. Bit field

Size. 16 bit

Read/write. Read Only

Bit 0. Read Cycle Output On (least significant bit)

Bit 1. Read Cycle Output On (most significant bit)

Bits 0 and 1 are a two-bit value

Bits10	Value	Read Cycle Output On Mode
00	0	Output Disabled. None of the Read Cycle Attributes will change at the end of a read cycle. Only the Historical Read Cycle Counters will change as a direct result of a read cycle.
01	1	Output on Match. Only bar codes that match a master code are output at the end of a read cycle.
10	2	Output on Mismatch. Only bar codes that do not match a master code are output at the end of a read cycle.
11	3	Output on Good Decode. Every decode is output at the end of a read cycle.

Bit 2. Unused

Bit 3. Noread Message Status (1 = enabled)

When enabled, noread messages are appended to the end of the bar code string when a noread occurs.

Bit 4. Reformatted bar code output (1 = enabled)

When enabled, the output format of individual bar codes is customized.

Bit 5. Sorted bar code output (1 = enabled)

When enabled, the output order of the bar codes is sorted.

Bit 6. Unused

Bit 7. Unused

Bit 8. One Character Aux Id (1 = enabled)

When enabled, bar codes are prefixed with a single character Aux Daisy Chain Id.

Bit 9. wo Character Aux Id (1 = enabled)

When enabled, bar codes are prefixed with a two-character Aux Daisy Chain Id.

Bit 10. Unused

Bit 11. Unused

Bit 12. Symbology Id (1 = enabled)

When enabled, bar codes are prefixed with a three-character Symbology Id.

Bit 13. Read Quality (1 = enabled)

When enabled, bar codes are post-fixed with a read quality value.

Bit 14. - Bit 15. Unused

Serial Data

The serial data attributes give the network host nearly the same control over the bar code scanner as the RS-232/422 communication ports. This allows the host to use Microscan's serial protocol to access features in the bar code scanner that are not directly mapped into dedicated attributes. The following are a few examples of features that require use of the serial data attributes:

1. Master Symbol download, <K231> command.
2. Access to actual read rate data, <C> command.
3. Extended PDF information, <a1> command.

Attributes

Serial data from the network host to the bar code scanner:

- Serial data from Network
- Serial data Length from Network
- Handshake request from Network
- Handshake response to Network

Serial data from the bar code scanner to the network host:

- Serial Data to Network
- Serial Data Length to Network
- Handshake Request to Network
- Handshake Response from Network

Other related attributes:

- Control Service “Read Rate Control”
- Control Service Acknowledge “Serial Comm Error”
- General Status “Serial Port Exclusive”

Serial Data Operation

Requirements

- All serial commands to the bar code scanner must be in the format of Microscan's serial command protocol. See Microscan's ***MS-880 Industrial Long Range Scanner User's Manual*** for more detail.
- All serial transactions require a handshake.
- The bar code scanner will typically require 20 milliseconds to acknowledge a network serial data transaction. This is the scanner's latency in reacting to the serial data when it is received.
- Serial data always begins at the first byte of the serial data buffer.

Recommendations

- Use the Control Service Acknowledge "Serial Comm Error" signal to detect errors.
- Use the General Status "Serial Port Exclusive" flag to detect when another port has exclusive control of the bar code scanner. When this occurs, the network host cannot perform serial communication with the scanner.
- Although the Serial Data attributes can be used to configure the bar code scanner, it is recommended that configuration be done "offline" via the RS-232/422 serial communication ports.

Details

- The bar code scanner acknowledges serial data from the network host before performing the action associated with the command.
- If serial command data from the host is "bad" (does not adhere to Microscan protocol), the bar code scanner will still acknowledge it (perform the handshake). When a bad command is received, the scanner will set the Control Service Acknowledge "Serial Comm Error" flag.
- Serial commands may be "fragmented" if a command exceeds the size of the serial data buffer. That is, the serial data stream may be broken up into multiple transactions as long as the when the data is re-assembled that it adheres to the Microscan serial protocol. Fragmented serial data is not considered "bad", so the scanner does not set the Serial Comm Error flag.

  For example, if the host needs to download a master symbol to the bar code scanner with the serial command <K231,1,Master Symbol Data1>, the following is valid:

Transaction	Serial Data from Network	Serial Data Length
1	<K231,1,	8
2	Master	5
3	symbolData1>	11

- The bar code scanner does not use the Serial Data to Network attributes to send all serial data that it transmits out of its RS-232/422 ports. Serial data is only sent to the network host when:

1. The network host sends a serial command to the bar code scanner that requires a serial data response. For example, if the network host wants to check the scanner's configuration and firmware checksums, it sends <K?><!>. The bar code scanner will send back <K100,4,1,0,0> - <K743,0><!a/1234><!b/5678>.
2. If the network host enables Read Rate via the serial data attributes or Control Service Signal “Read Rate Control”, the bar code scanner sends the serial read rate data to the host via the Serial Data to Network attributes. The network host is not required to read the serial data. While this will not adversely affect the performance of the bar code scanner, it will eventually cause an internal buffer to overflow. If this occurs, the scanner will set the Control Service Acknowledge “Serial Comm Error” signal.

Serial Data from Network (to the bar code scanner)

These are the attributes the network host uses to send serial commands to the bar code scanner:

- Serial Data from Network
- Serial Data Length from Network
- Handshake Request from Network
- Handshake Response to Network

Other related attributes:

- Control Service Acknowledge “Serial Comm Error”.
- General Status “Serial Port Exclusive”.

Serial Data from Network

Data type. Buffer of 8 bit ASCII or binary character bytes.

Size. Network-specific.

This is where the network host writes the serial commands that are sent to the bar code scanner.

Serial Data Length from Network

Data type. Number of 8-bit character bytes in the serial data buffer.

Size. Network-specific (See Chapters **3**, **5**, and **6** for network-specific information.). Typically a 16-bit number.

This is where the network host sets the length of the command string in the serial data buffer. The Length attribute tells the bar code scanner how many data characters it should read from the serial data buffer. The Length must be set before performing the handshake.

Request from Network and Response to Network

Data type. 16-bit number.

These are the handshake attributes used by the network host to send serial data to the bar code scanner. The bar code scanner detects that serial data is available when the Request and Response values are different. When the Request and Response values are different, the bar code scanner reads the serial data buffer and acknowledges the transaction by setting Response to the same value as Request. Then the scanner processes the serial command.

Serial Data from Network Operation

To send serial data commands to the bar code scanner, please review Serial Data Operation. Specifically, the network host is responsible for the following:

- All commands must be formatted according to Microscan's serial protocol.
- Multiple commands and fragmented commands may be written to the serial data buffer.
- The Serial from Network Handshake (SFNH) must be performed for every serial data transaction.
- For every serial data transaction (handshake), the first command written to the serial data buffer must start at the beginning of the buffer.

The network host uses the following procedure to send serial data to the bar code scanner:

1. Initialize Request and Response to 0 whenever the network host “resets”, or before connecting to the bar code scanner on a connection-based network like DeviceNet and Profibus-DP.

   This allows the bar code scanner to detect that the network host has “reset”.
2. Optional: Check if a serial port has exclusive control of the bar code scanner by checking the General Status “Serial Port Exclusive” flag. Wait until the condition clears.
3. Optional: Check if a serial comm error has occurred by checking the Control Service Acknowledge “Serial Comm Error” signal. Clear the signal if it is set.
4. When ready to send serial data to the bar code scanner, read Response from the bar code scanner.
5. If Response is 0 and Request is not 0, then set Request to 0 and return to step 2.
6. This is a test to determine if the bar code scanner has experienced a reset.
7. Compare Response to Request. If they are different, then return to step 2.

   This is a test to determine if the bar code scanner has acknowledged the previous serial data transaction. The bar code scanner will typically require 20 milliseconds to acknowledge.
8. Write the command(s) to the Serial Data buffer, beginning with the first byte of the buffer.

9. Write the length of the serial data in the buffer to the Length attribute.
10. Increment Request and write it to the bar code scanner.
11. Note: Do not write 0 to Request. If Request rolls over to 0 when incremented, increment it again to 1.
12. Return to step 2.

Serial Data to Network (from the bar code scanner)

These are the Serial Data to Network attributes:

- Serial Data to Network
- Serial Data Length to Network
- Handshake Request to Network
- Handshake Response from Network

Other related attributes:

- Control Service Acknowledge “Serial Comm Error”.
- General Status “Serial Port Exclusive”.

Serial Data to Network

Data type. Buffer of 8 bit ASCII or binary character bytes.

Size: Network-specific

This is where the bar code scanner writes the serial data that is sent to the network host.

Serial Data Length to Network

Data type. Number of 8-bit character bytes in the serial data buffer.

Size. Network-specific. Typically a 16-bit number.

This is where the bar code scanner sets the length of the serial data in the serial data buffer. The Length attribute tells the network host how many data characters it should read from the serial data buffer. The Length is always set before the bar code scanner performs the handshake.

Request to Network and Response from Network

Data type. 16-bit number.

These are the handshake attributes used by the bar code scanner to send serial data to the network host. The network host detects that serial data is available when the Request and Response values are different. When the Request and Response values are different, the network host reads the serial data buffer and acknowledges the transaction by setting Response to the same value as Request. Then the host can process the serial data.

Serial Data to Network Operation

To received serial data from the bar code scanner, please review Serial Data Operation.

The network host uses the following procedure to receive serial data from the bar code scanner:

1. Initialize Request and Response to 0 whenever the network host “resets”, or before connecting to the bar code scanner on a connection-based network like DeviceNet and Profibus-DP.

   This allows the bar code scanner to detect that the network host has “reset”.
2. Optional: Check if a serial port has exclusive control of the bar code scanner by checking the General Status “Serial Port Exclusive” flag. Wait until the condition clears.
3. Optional: Check if a serial comm error has occurred by checking the Control Service Acknowledge “Serial Comm Error” signal. Clear the signal if it is set. Read Request from the bar code scanner.

   If Request is 0, the bar code scanner has experienced a reset since the last output. Do not process the serial data. Skip to step 7.
4. Compare Request and Response. If they are the same, no new data is available. Return to step 2.
5. Read and process the Serial Data and Length attributes.
6. Set Response to the same value read from Request.
7. Return to step 2.

Identification

Format

Represents the format of the bar code scanner's attribute mapping.
Example: Profibus DP (standard) = 2, DeviceNet (standard) = 3.

Major Version, Minor Version

Represents the version of the bar code scanner's attribute mapping.
Example: Major version = 1, Minor version = 0

Firmware Part Numbers

Boot code. 12 character string representing the bar code scanner's boot code.
App code. 12 character string representing the bar code scanner's app code.
Example: Boot code = 35-558002-10, App code = 35-558001-11

Unfinished Network Data and Services

Discrete Output Override

Output override bits have no effect.

Force Reset

Has no effect.

Appendix

Contents

Determining Which Card Is Installed

On MS-880's that have an unknown network card installed, it is possible to query the card type from a terminal attached for example to the programming port. From this terminal, send the **<n>** command. A typical response will look like this:

<n/PID=5,MajRev=1,MinRev=0,NID=2,MajRev=1,MinRev=0,VID=360,DIV=1,
ODF=0,FWID=2,MajRev=1,MinRev=18,MID=498,MajRev=1,MinRev=0,SN=20037,
MS=3,MC=0,AC=0,NSF=0,NSC=5,ISF=0,ISC=1,IOSF=0,IOSC=0,#EL=0,ES=0,
EMC=0,EAC=0,SD=03,PE=1,PSMC=ONLINE,PSAC=12,PWF=0000:0000:00:00>

From this list of options, the following are useful for trouble shooting:

Table A-1 Explanation of <n> Network Status Fields

Field	Description	Response format
PID=	Personality ID read from network card.	"1" = 98-000009-05, DeviceNet "4" = 98-000009-04, DataHighway standard "5" = 98-000009-02, Profibus, multi-symbol "6" = 98-000009-06, Profibus, single symbol
MajRev=	Major Version of network card	0-255 ASCII decimal
MinRev=	Minor Version of network card	0-255 ASCII decimal
NID=	Network ID detected by the MS-880.	"1" = DeviceNet "2" = Profibus "4" = DataHighway
MajRev=	Major Version of Network ID according to MS-880 app code.	0-255 ASCII decimal
MinRev=	Minor Version of Network ID according to MS-880 app code.	0-255 ASCII decimal
VID=	Microscan Vendor ID.	"360"
DIV=	Microscan Division.	"1"
ODF=	Microscan Data Format.	"0"
FWID=	Network card Firmware ID.	0-65535 ASCII decimal
MajRev=	Major Version of Network card Firmware.	0-255 ASCII decimal
MinRev=	Minor Version of Network card Firmware.	0-255 ASCII decimal
MID=	Network card hardware ID.	0-65535 ASCII decimal
MajRev=	Major Version of Network card hardware.	0-255 ASCII decimal
MinRev=	Minor Version of Network card hardware	0-255 ASCII decimal
SN=	Network card Serial Number.	0- 4294967295 ASCII decimal

Table A-1 Explanation of <n> Network Status Fields

SD=	Switch Data used by most network modules for address and baud rate.	0-255 ASCII decimal string.
PE=	MS-880 Network Port Status.	“0” = Disabled “1” = Enabled
PSMC=	Port State Main Code, signals the current state of the network port.	“NA” = Scanner has just reset. No status fields are valid yet. “NO_PORT” = No network port was detected. “ERROR” = An error occurred on the net port that the MS-880 is attempting to recover from. “FAIL” = Too many errors occurred when connecting to net port. Port has been shut down. Scanner must be reset to restart the connection. “CONFIG” = Net port is in configuration mode. “OFFLINE” = Net port is currently offline. “ONLINE” = Net port is online with network.

Wiring Connections

Table A-2 Fieldbus Terminal Network Connections in Wiring Box

Wiring Box Pin	DeviceNet	ProfiBus	Profibus DB9 Connector Pin
1	Shield	Shield	1
2	V+	VP	6
3	V–	RXD/TXD-P (B)	3
4	CANH	RXD/TXD-N (A)	8
5	CANL	N/C	N/C
6	N/C	DGND	5

Note that there are two ways to connect the Profibus network cable to the wiring box of the MS-880:

1. Directly to the fieldbus terminal strip, or
2. By a short drop cable to a standard Profibus DB9 connector.

   The drop cable should be connected to the wiring box using the connections from table A-1.

Terminations

Note: Termination resistors are only installed at the physical ends of the network trunk, NOT on every device. They are connected directly to the fieldbus terminal strip.

DeviceNet: pin 4—120Ω—pin 5

Data Highway Plus. Line 1—82Ω or 150Ω—Line 2. Consult the Allen-Bradley network product documentation to determine when these resistors are required.

Profibus: When the Profibus cable is connected directly to the wiring box, the termination resistors are connected directly to the fieldbus connector as per **table A-3**. If the MS-880 is connected to Profibus via a drop cable with a standard Profibus connector, the termination resistors can be enabled with the switch on the connector.

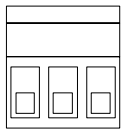
Table A-3 Profibus Termination Resistors

From Pin	Signal	Resistor (Ohm)	To Pin	Signal
2	Vp	390	3	RxD/TxD-P **(B)**
3	RxD/TxD-P (B)	220	4	RxD/TxD-N **(A)**
4	RxD/TxD-N (A)	390	6	DGND

Network Connectors

DataHighway Plus

The DataHighway Plus module includes a removable 3 pole Phoenix Combicon network connector. The replacement part number for this connector is MSTB 2,5/3-ST-5,08.



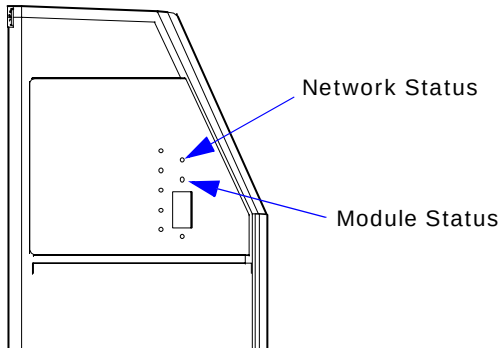
Pin	Description	Typical Line Color[a]
1	Line2	Blue
2	Shield	Shield
3	Line1	Clear

a. The recommended convention is to connect the clear conductor wire to Line 1 terminals and the blue conductor wire to Line 2 terminals. Some installation sites may have an opposite local convention.

Terminators. Line 1—82Ω or 150Ω—Line 2. Consult the Allen-Bradley network product documentation to determine when these resistors are required.

LEDs

Network and Module LEDs are located on the MS-880 on the same side as the 9-pin connector and only apply to DeviceNet and Profibus. For DataHighway Plus, the LEDs are located on the interface cards and are only visible when the wiring box is detached from the MS-880.



Module Status LEDs

Table A-4 DeviceNet Module Status LEDs

LED State	Module Status
Off	No power
Flashing Red[a]	Configuration Fault (contact technical support)
Solid Red	Hardware error (contact technical support)
Flashing Green[a]	No errors, client interface is not open
Solid Green	No errors, client interface is active
Amber (Red/Green)	Configuration Mode

a. Nominal flash rate is 500ms on, 500ms off.

Table A-5 Profibus-DP Module Status LEDs

LED State	Module Status
Off	No power
Flashing Red[a]	Configuration Fault (contact technical support)
Solid Red	Hardware error (contact technical support)
Flashing Green[a]	No errors, data exchange interface not open
Solid Green	No errors, data exchange interface active
Amber (Red/Green)	Configuration mode

a. Nominal flash rate is 500ms on, 500ms off.

Network Status LEDs

Note: Indications on the Network Status LED are only valid when the Module Status LED is solid green.

Table A-6 DeviceNet Network Status LEDs (see page A-6)

LED State	Network Status
Off	Network interface offline / No network power
Flashing Green[a]	Device is online but has no open connections (client or server)
Solid Green	Device online with at least one established connection (client or server)
Flashing Red[a]	I/O connection(s) in timed-out state or other Recoverable Fault
Solid Red	Unrecoverable Fault (duplicate MAC ID checked failed, critical bus fault, etc.)
Flashing Green/Red[a]	Device is in Communication Faulted state and responding to an Identify Communication Faulted Request

a. Nominal flash rate is 500ms on, 500ms off

Table A-7 Profibus-DP Network Status LEDs (see page A-6)

LED State	Network Status
Off	Network interface not OPEN or client interface has faulted
Flashing Red[a]	Slave not configured or configuration error with master
Solid Red	Baud rate not detected, no bus
Flashing Red/Green[a]	Online, network in Data Exchange-Clear mode
Solid Green	Online, network in Data Exchange mode

a. Nominal flash rate is 500ms on, 500ms off

Interface Card Status LEDs

For DataHighway Plus, the LEDs are located on the interface cards and are only visible when the wiring box is detached from the MS-880.

Table A-8 Data Highway Plus Module Status LEDs (see page A-6)

LED State[a]	Module Status
Off	No power
Flashing Red[b]	Configuration Fault (contact technical support)
Solid Red	Hardware error (contact technical support)
Flashing Green[b]	No errors, data exchange interface is not open
Solid Green	No errors, data exchange interface active
Amber (Red/Green)	Configuration mode, reset, or power up sequence

a. Note that the Module status LED is located on the interface card. The LED on the side of the scanner will always be off.

b. Nominal flash rate is 500 mS on, 500 mS off.

Table A-9 DataHighway Plus Network Status LEDs (see page A-6)

LED State[a]	Network Status
Off	No other stations detected (no token)
Solid Green	Online, other stations detected (token being passed)
Flickering Green	Transmit activity (responses transmitted)
Flashing Red	Network error (most likely blue and clear conductor wires swapped)

a. Note that the network status LED is located on the interface card. The LED on the side of the scanner will always be off.

Data Descriptions

The following tables define the meaning of the Data Type and Data Flow columns in the Network-specific attribute mappings that follow.

Data Types

Table A-10 Data Types

Data Type	Size (bits)	DeviceNet Description	Profibus Description
CHAR1	8	Single character of a text string	-
BYTE	8	Array of 8 bits	8 bit value or array of 8 bits.
UINT1	8	8 bit value	-
WORD	16	Array of 16 bits	16 bit value or array of 16 bits. Bytes are arranged [LSB][MSB].
UINT2	16	16 bit value	-

Data Flow

Table A-11 Data Flow

Data Flow	Description
INPUT	Data produced by the bar code scanner and sent to the network
OUTPUT	Data produced by the network and sent to bar code scanner

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