



# **Setting up Digi One IAP for Rockwell bridging, including linking a serial PLC and serial HMI**

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# 1 Introduction

## Abstract

This application note explains how to set up the Digi One IAP's pass-through port to connect an Allen-Bradley PanelView 300 Micro (or other DF1 **master**) to an SLC 5/03 PLC (or other DF1 **slave**). It shows how to set up:

- Network masters
- Serial masters
- Network slaves
- Serial slaves

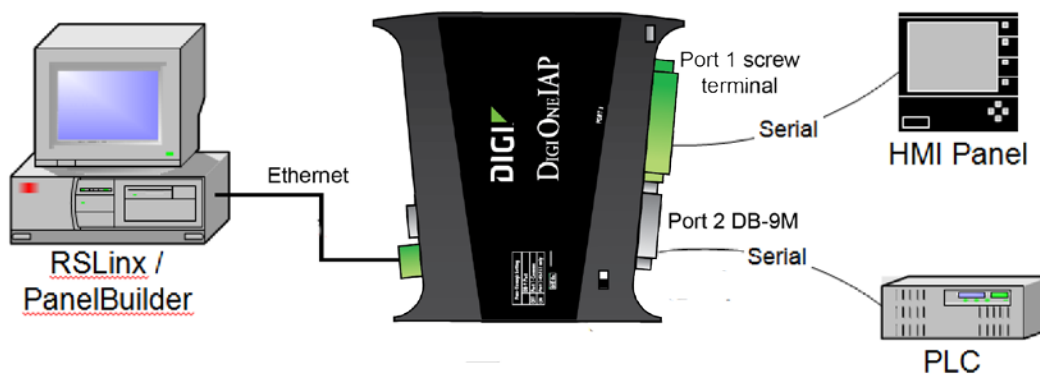
After reading this guide you should be able to combine these into several configurations such as enabling the PLC to issue MSG blocks to remote devices including other Digi One IAP, ControlLogix, PLC5, SLC5/05, and 1761-NET-ENI modules.

**Note** This document assumes the HMI and PLC are pre-programmed, and the Digi One IAP's Ethernet interface is configured. If you require additional assistance in configuring the Digi One IAP, see the [Digi One IAP support page](#).

## 1.1 Example application

Your system has a serial master and single-port slave, for example a local HMI and low-end PLC. The Digi One IAP allows you to retrofit this system so the serial master can share this slave with the world.

**Note** This diagram shows the HMI connected to the screw terminal serial port and the PLC to the DB-9 port. Depending on your needs, this can be reversed. The order does not matter, but you need to adjust the steps shown as appropriate.



In this example, we poll a local HMI or operator panel on port 1 and a single-port PLC on port 2. When pass-through is enabled:

- Port 1 is the screw terminal and can be EIA-232, 422 or 485.
- Port 2 is the DB-9 and is EIA-232 only.

## 1.2 Theory of operation

The Digi One IAP supports this application because it is Rockwell protocol aware. It understands DF1 Full Duplex, AB/Ethernet (CSP) and Ethernet/IP requests and responses. It also understands how slave or destination addresses are added.

The Digi One IAP is able to act a bit like a network print server. It can juggle and interleave requests from many masters to many slaves. Requests from the HMI are destined for the PLC or can even be for a remote PLC. The same is true of requests from remote RSLinx, remote AB processors, or even MSG block requests from the slave PLC.

## 2 Setup

### 2.1 Enable pass-through port

1. Power off the Digi One IAP.
2. Set the pass-through DIP-switch to **On**. This lone DIP-switch is on the side of the unit opposite the MAC address and serial number labels. It is *not* in the 4-switch block used for EIA-232/485 selection.
3. Power on the Digi One IAP.

The pass through DIP-switch is only read during boot up, so changing it while the unit is powered has no effect.

### 2.2 Connect your devices

The HMI and PLC can be connected to either physical serial interface. This document assumes that the HMI is on the **screw terminal** block and the PLC is connected via the **DB-9** connector. If you connect in the opposite order you'll just need to modify the steps below as necessary.

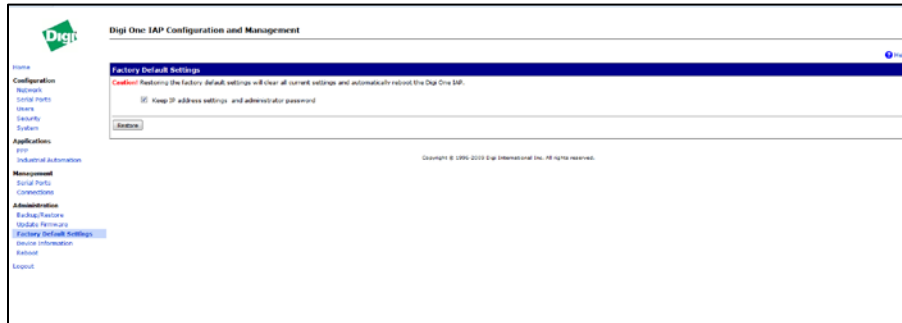
### 2.3 Configure the Digi One IAP

There are two options for configuring the Digi One IAP. You can use your web browser to access the Industrial Automation Wizard, or you can use HyperTerminal (or any telnet/comms app) to access the Digi One IAP by **TCP port 23**.

The login is **root**, and the default password is **dbps**.

### 2.4 Reset the config

It is best to go to the **Admin** and select the **Factory Default Settings** option. Click **Restore** to reset. This reset is important because some of the non-IA settings affect IA protocol behavior.



## 2.5 Start the Industrial Automation Wizard

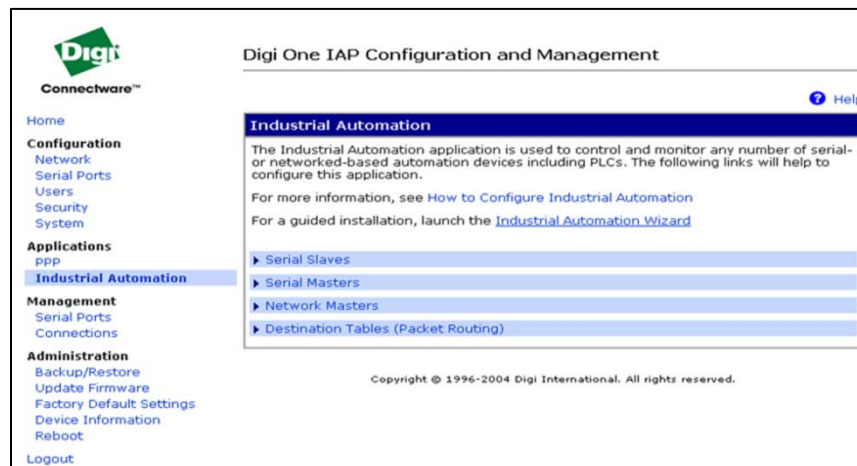
At the left navigation pane, select **Applications** and then **Industrial Automation**. A series of pages appears. They are fairly self-explanatory. You can click **Next** to go to the next page or **Previous** to go to the previous page.

## 3 Web setup

We define where messages originate. In this example, it is AB/Ethernet (CSP) from RSLinx and DF1 Full Duplex of the HMI.

### 3.1 Web interface

Click the **Industrial Automation** link under Applications, then you can start the Industrial Automation Wizard.

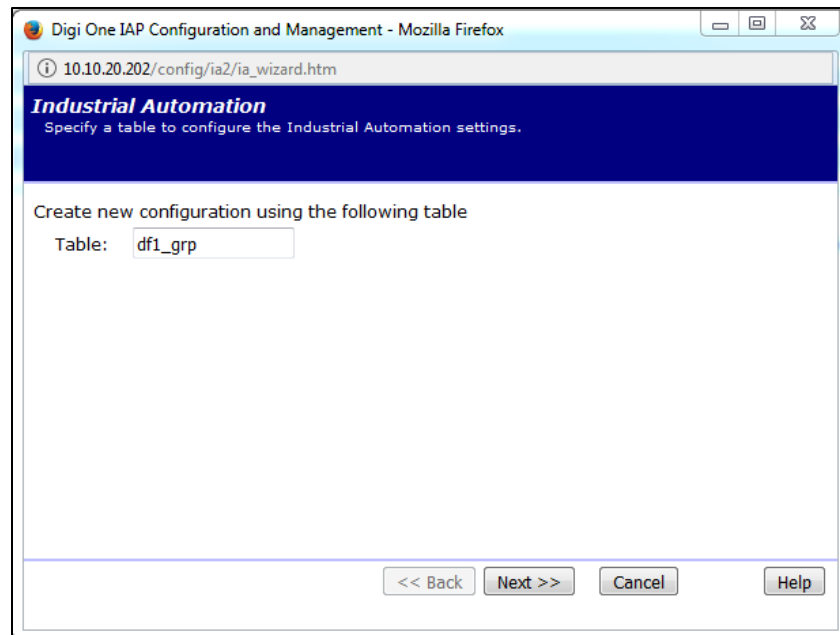


### 3.2 Select the table: consider resetting IA config

The first page of the wizard allows you to select which table to use and assigns a name. On a Digi One IAP you'll likely only have one table. You can have two groups. For example: you can have a Modbus PLC on port 1 and DF1 PLC on port 2, and do simple protocol bridging to each, as if this Digi One IAP were two single-port units with one IP address.

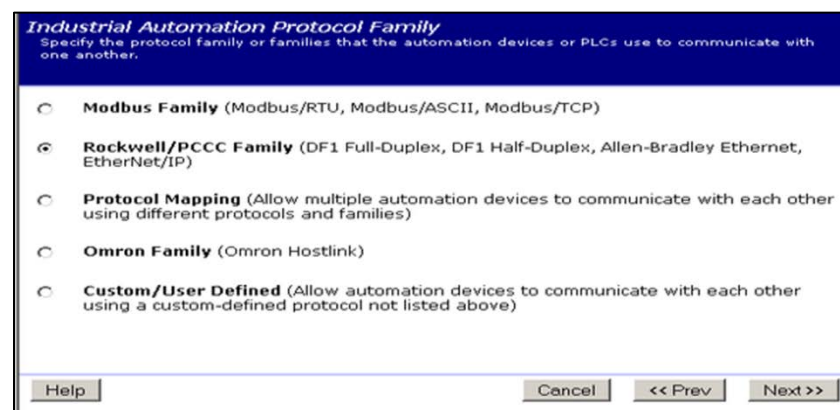
If you don't know what non-IA settings may be there, do a full reset on the Digi One IAP home page. You will see the **Factory Default Settings** under **Administration**. This reset is important because some of the non-IA settings affect IA protocol behavior. This is a great feature if you need special behavior. It can be disastrous if you don't expect any special behavior.

Since the **table1** group always exists, you can select to modify that group or define your own new name such as **df1\_grp**.



### 3.3 Limit the group to PCCC family

If you are only using Rockwell protocols, limit this group to only offering Rockwell options. Click **Next** and start defining where messages come from.



### 3.4 Define first master/message source – the HMI

Our HMI is on serial port 1. Click **Next** and set the appropriate value in the following screens. Press **Help** if you need more explanation.

**Message Source Location**  
Specify the location and how the serial- or network-device communicates with the Digi device.

Receive messages from network devices connecting using the network  
Protocol: Allen-Bradley Ethernet  
Transport: TCP  
Network port: 2222

Receive messages from serial device connected to a serial port  
Protocol: DF1 Full-Duplex  
Serial port: 1

<< Back   Next >>   Cancel   Help

When you get to the **Message Sources (Masters)** page, click the **Continue creating more message sources** check box, so we can define our incoming Ethernet master or message sources. Click **Next**.

**Messages Sources (Masters)**  
Specify where messages originate from, otherwise known as masters. Masters typically send messages to one or more slave devices.

The following sources have currently been defined:

Protocol	Source	Action
DF1 Full-Duplex	Serial port 1	Remove

Continue creating more message sources

Help   Cancel   << Prev   Next >>

### 3.5 Define second master/message source – the PLC

Although this is not required, you can enable the PLC to issue MSG blocks. Follow the same steps as above for serial port. Because of the way DF1 Full-Duplex works as a peer-to-peer protocol, this will not affect the use of the PLC as a slave device.



192.168.1.64/config/ia2/ia\_wizard.htm

**Message Source Location**  
Specify the location and how the serial- or network-device communicates with the Digi device.

Receive messages from network devices connecting using the network  
Protocol: Allen-Bradley Ethernet ▾  
Transport: TCP ▾  
Network port: 2222

Receive messages from serial device connected to a serial port  
Protocol: DF1 Full-Duplex ▾  
Serial port: 2 ▾

<< Back   Next >>   Cancel   Help

### 3.6 Define third master/message source – remote PLC and RSLinx

Click the **Receive messages from network devices connecting using the network** radio button and set the protocol to Allen-Bradley Ethernet (or CSP). The Network port should set itself to 2222. RSLinx cannot use Ethernet/IP to talk to your PLC because RSLinx doesn't recognize the Digi One IAP as a Rockwell product. However, you can loop and create a third master if you also want Ethernet/IP active for incoming ControlLogix messages.

For RSLinx we want AB/Ethernet. Click **Next** and set the appropriate value in the following screens. Press **Help** if you need more explanation.

**Message Source Location**  
Specify the location and how the serial- or network-device communicates with the Digi device.

Receive messages from network devices connecting using the network  
Protocol: Allen-Bradley Ethernet ▾  
Transport: TCP ▾  
Network port: 2222

<< Back   Next >>   Cancel   Help

When you get to the **Message Sources (Masters)** page, *uncheck* the **Continue creating more message sources** radio button to stop adding masters or message sources. Click **Next**.



### 3.7 Assign master priority

This option allows a serial master to compete with many network masters. For example, suppose you have 49 network masters and one serial master connected. The normal priority design will give each master fair access to the shared slave. So if all are active and polling, the serial master obtains just 2% of the serial bandwidth, which at 9600 baud likely means 1 message every 10 seconds. By setting priority on the serial master, you give it roughly 50% of the serial bandwidth and force all network masters to compete for the remaining 50%.



Assigning all masters the same level of priority should be fine for Rockwell protocols and products. The only situation where changing this would matter is if some third-party ActiveX or OPC opens multiple sockets to attempt faster access. For example, a single client opening 10 sockets to ask 10 polls in parallel would unfairly get nine times more access than a second client who asks 10 polls over one socket.

### 3.8 Create the first destination – the PLC

One very major change in Release E is that all masters have the option to forward messages based on a protocol address. For DF1 this is the DST byte, but in AB/Ethernet or Ethernet/IP this is the DH+ destination link or node address. We'll send all messages addressed from 0 to 9 to the PLC, which really is likely acting as DST=1. This makes RSLinx easier to set up, since it is often difficult to understand how RSLinx sets these addresses.

192.168.1.64/config/ia2/ia\_wizard.htm

### Message Destination Addresses

Specify the address or range of addresses of the destination devices. Messages sent to these addresses will be sent to these destinations.

Send all messages to this destination

Send only messages matching specific protocol address  
Address:

Send only messages in a range of protocol addresses  
Addresses:  to

<< Back   Next >>   Cancel   Help

1. Click the Send messages to serial device connected to serial port radio button.
2. Click the **Protocol** dropdown and select **DF1 Full-Duplex**.
3. Click the **Serial Port** dropdown and select **2**. Go through the following pages and set values as desired. Click **Help** if you need more information.

### Message Destination Location

Specify the location of where messages sent by masters are sent to.

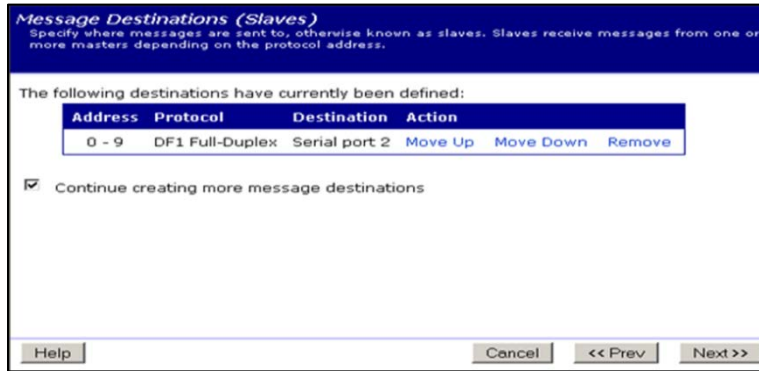
Send messages to serial device connected to serial port  
Protocol:   
Serial port:

Send messages to network device  
Hostname:   
Protocol:   
Transport:   
Network port:

Ignore messages and do not send to any devices

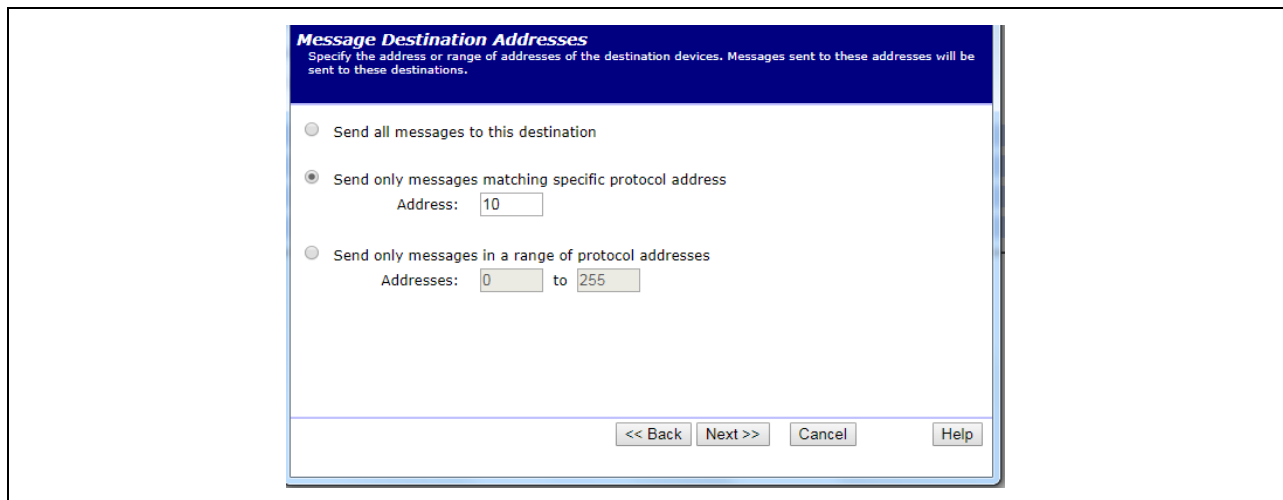
<< Back   Next >>   Cancel   Help

When you reach the **Message Destinations (Slaves)** page, check the **Continue creating more message destinations** check box. You can add more destinations to allow the PLC to issue MSG blocks to other PLCs.



### 3.9 Create the second destination – the HMI

Follow the same steps above to define node 10 as the HMI. This allows the PLC to use MSG blocks to read or write the HMI – if that has any value. It also allows remote Rockwell network masters to access the HMI as DST or node or link 10. However, note that it is not a good idea to use more than one slave or device at an IP address of a non-Rockwell product, as RSLinx will behave unpredictably.



**Message Source Location**  
Specify the location and how the serial- or network-device communicates with the Digi device.

Receive messages from network devices connecting using the network  
Protocol: Allen-Bradley Ethernet  
Transport: TCP  
Network port: 2222

Receive messages from serial device connected to a serial port  
Protocol: DF1 Full-Duplex  
Serial port: 1

<< Back   Next >>   Cancel   Help

### 3.10 Create more destinations – remote Digi One IAP, PLC5 or SLC5/05

Since we allow the PLC slave to issue MSG blocks, we can point them at **remote PLC**. Continue creating destinations and select an address of 11. Notice that the **Serial** destination option is not visible. There are no more available serial ports. You can enter either an IP or DNS name. AB/Ethernet is our suggested protocol to access the Rockwell PLC that supports it, such as the PLC5E or SLC5/05.

**Message Destination Location**  
Specify the location of where messages sent by masters are sent to.

Send messages to serial device connected to serial port  
Protocol: DF1 Full-Duplex  
Serial port: 1

Send messages to network device  
Hostname: 192.168.1.61  
Protocol: Allen-Bradley Ethernet  
Transport: TCP  
Network port: 2222

Ignore messages and do not send to any devices

<< Back   Next >>   Cancel   Help

### 3.11 Create more destinations – remote ControlLogix

To illustrate, we'll set up a remote destination as remote ControlLogix. We are still in the Continue Creating destination loop, so we won't repeat showing all the screens. The Ethernet/IP protocol normally uses Network port 44818.

**Message Destination Location**  
Specify the location of where messages sent by masters are sent to.

Send messages to serial device connected to serial port  
Protocol: DF1 Full-Duplex  
Serial port: 1

Send messages to network device  
Hostname: 192.168.1.62  
Protocol: EtherNet/IP  
Transport: TCP  
Network port: 44818

Ignore messages and do not send to any devices

<< Back Next >> Cancel Help

Digi One IAP lets you control the outgoing connection. You can select connected (CM) or unconnected (UCMM) messaging. Connected messaging is safer with ControlLogix, since it allocates very limited resources for handling UCMM. You'll also need to define the slot number for the Logix processor. "s0" is common, but Digi One IAP allows addressing other slots or even multiple processors in a rack. If the remote Ethernet/IP server is another Digi One IAP, you can use this slot number to define an explicit DST or node value. So "S12" on a Digi One IAP to a DF1 serial slave would cause the DST byte to be set to 12.

**Message Destination Protocol Settings**  
Specify the settings of the protocol for the message destination.

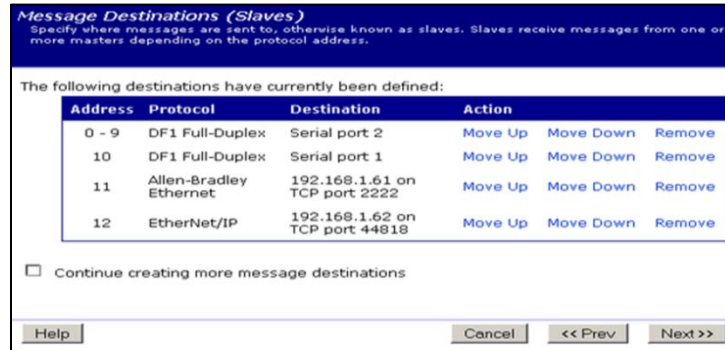
Explicit Messaging Class:  
 Unconnected  
 Connected Class 3

Forward Open Connection Path:  
s0 (nothing or s0-s255 for Slot number)

Help Cancel << Prev Next >>

### 3.12 The finished destinations table

The finished destination table follows. You could continue to add destinations. The Digi One IAP can manage up to 64 incoming and outgoing connections, so you could easily have 25 or even 60 remote destinations. Note that the Digi One IAP scans this table from top to bottom, stopping at the first route to match the address. This means if you change the first route from 0-9 to be 0-20, routes 2-4 would never be seen. You can use the **Move Up** and **Move Down** links to shuffle the table order.



### 3.13 Reboot the Digi One IAP

You can make minor changes to the Digi One IAP configuration. However, when changing the number or type of masters (message sources) or number or type of slave (message destinations), you should reboot. This is because these changes affect the number and type of tasks running in the Digi One IAP RTOS and occasionally these changes will not be applied correctly without a reboot.

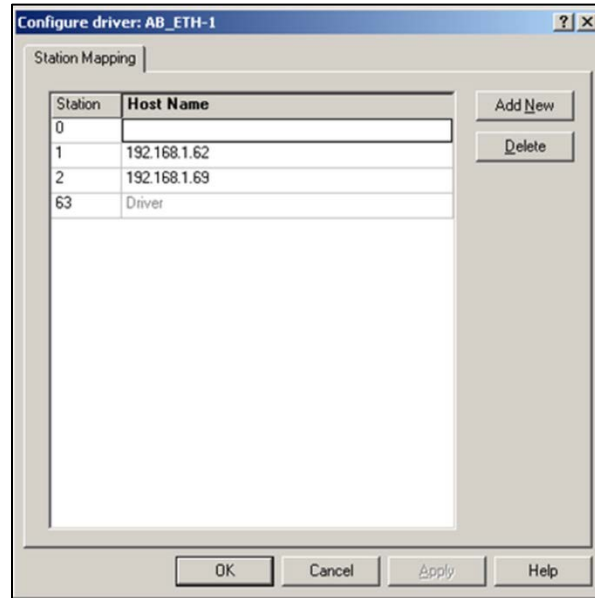
### 3.14A note on RSLinx setup

When you set up RSLinx, select the **Ethernet Devices** communication drive, not the Ethernet/IP driver.

When you set up the table, you see the **Configure drive: AM\_ETH-1** dialog. Notice the **Station** column. This is an important field. RSLinx uses this column as the **DH+** destination node address within the AB/Ethernet (CSP) packet header. The Digi One IAP uses it as if it were the **DF1 DST** byte.

Messages follow the Destination table settings using this value. In the example illustrated in the application guide, we set up the PLC as slave address 0-9. This allows you to enter the Digi One IAP's IP address in any of the station slots from 0 to 9. If you enter it in station rows 10 to 63, the Digi One IAP will *not* work as set up in this application guide.

You can compensate for any required RSLinx setting. Suppose you must set up the Digi One IAP's IP address in the station=57 row. All you need to do is make sure an entry exists within the Digi One IAP's destination table to forward PCCC messages for slave address=57 to the PLC. The PLC will see the DF1 DST byte = 57, but by default AB PLC ignore the DST byte in DF1 Full-Duplex messages.



## 4 Hyperterminal setup

### 4.1 Copy this script and paste into Notepad

Acrobat will allow you to select and copy the text below and paste it into a text editor like NotePad.exe. Edit it as you require – you can also save it as documentation. Note that this script clears ALL industrial protocol settings when it starts, but it will not affect the IP address or other non-IA settings.

```
# clear all IA config revert ia=factory

# setup port 1 (screw term) as DF1 (baud = 19200,8,N,1) set port ra=1 dev=ia
set line ra=1 baud=19200 csize=8 parity=N stopb=1 set ia serial=1 protocol=df1fd type=master
table=1

# setup port 2 (db9) as DF1 (baud = 19200,8,N,1) set port ra=2 dev=ia
set line ra=2 baud=19200 csize=8 parity=N stopb=1 set ia serial=2 protocol=df1fd type=master
table=1

# setup network for AB/Ethernet (CSP) incoming
set ia master=1 active=on protocol=abethernet transport=tcp ipport=2222 table=1

# setup destination table set ia table=1 name=table1

# port #1 is our HMI/Master – claim is address DST 10 set ia table=1 addroute=1 active=on
protocol=df1fd set ia table=1 route=1 protaddr=10 type=serial port=1
# port #2 is our PLC – claim is address DST 1 (0-9) set ia table=1 addroute=2 active=on
protocol= df1fd set ia table=1 route=2 protaddr=0-9 type=serial port=2
```

### 4.2 Copy/paste from Notepad to Hyperterminal

Use HyperTerminal or telnet to log into your Digi One IAP. You must enter the IP address of your Digi One IAP and use the telnet port of 23.

In HyperTerminal use the **Edit | Paste to Host** menu option. You should not see any errors. You can use the **show ia all** command to verify the settings.



### 4.3 Reboot the Digi One IAP

You can make minor changes to the Digi One IAP configuration. However, when changing the number or type of masters (message sources) or number or type of slave (message destinations), you should reboot. These changes affect the number and type of tasks running in the Digi One IAP RTOS. Occasionally these changes fail to take effect correctly without a reboot.

### 4.4 Getting fancy ... MSG blocks to remote PLC

You can add this third and fourth route to your table to enable use of outgoing MSG blocks to remote nodes 11 and 12. *Note that you must change the IP addresses defined.* Digi One IAP supports up to 64 in/outgoing TCP sockets, so you should be able to connect to about 60 remote devices.

```
# setup remote Ab/Ethernet slaves such as Digi One IAP, PLC5E, or SLC5/05 set ia table=1
addroute=3 active=on protocol=abetherenet

set ia table=1 route=3 protaddr=11 type=ip iport=2222

set ia table=1 route=3 connect=active ipaddress=192.168.1.63 set ia table=1 addroute=4
active=on protocol= abetherenet

set ia table=1 route=4 protaddr=12 type=ip iport=2222

set ia table=1 route=4 connect=active ipaddress=192.168.1.64
```

## 5 Troubleshooting tips

### 5.1 Baud rates

A-B HMIs and PLCs normally default to full-duplex, 19,200 baud, and CRC. The exception is Control/Compact Logix which tend to default to BCC.

### 5.2 DST address

RSLinx using DF1 full-duplex defaults to the PLC is DST=1. This is why we set up the route table that way. Even though we are calling the HMI as DST=10, it is doubtful you can get RSLinx to issue messages to it. However, third-party packages may allow this. The HMI must issue DF1 requests to DST=1 (or any number in the routed range) for this design to work.

### 5.3 RSLinx notes

You should set up RSLinx to use the **Ethernet driver**, not the Ethernet/IP driver. This forces you to create a table of IP addresses.

**Note** Some versions of RSLinx use the table index (station number) as the DST address. This is why we set the PLC up to DST=0-9. So the above setup won't work if you place the Digi One IAP's IP address as the 50<sup>th</sup> entry in this table.

Note also that RSLinx gets confused if you enter the same address twice. While it would be nice to create entries for both the HMI and PLC, RSLinx will only show one address, but which one is unpredictable. Using the Alt-IP feature in the Digi One IAP, you can access the HMI and PLC. That is an advanced feature.

## 5.4 EDS Files

Rockwell may say that the Digi One IAP needs an EDS file. That's strictly true, since the EDS file does not document handling of PCCC messages. However, you'll find information on EDS files in the application notes on the [Digi One IAP support page](#).

## 5.5 Setting the timeouts

Setting a valid combination of timeouts requires the correct relationship between the four key timeouts you need to manage. The best defaults to start are:

- Your master application's slave timeout: 3 seconds
- The Digi One IAP's message timeout: default of 2.5 seconds
- The Digi One IAP's slave timeout: default of 1 second
- The Digi One IAP's character timeout: 50 milliseconds

These defaults safely allow two remote masters to share most slaves. For more information related to timeouts see [Understanding timeout settings in Digi One IAP](#).