

INSTRUCTION MANUAL



NL120 Ethernet Module

Revision: 12/10



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About this manual

Please note that this manual was originally produced by Campbell Scientific Inc. (CSI) primarily for the US market. Some spellings, weights and measures may reflect this origin.

Some useful conversion factors:

Area: 1 in² (square inch) = 645 mm²

Length: 1 in. (inch) = 25.4 mm
1 ft (foot) = 304.8 mm
1 yard = 0.914 m
1 mile = 1.609 km

Mass: 1 oz. (ounce) = 28.35 g
1 lb (pound weight) = 0.454 kg

Pressure: 1 psi (lb/in²) = 68.95 mb

Volume: 1 US gallon = 3.785 litres

In addition, part ordering numbers may vary. For example, the CABLE5CBL is a CSI part number and known as a FIN5COND at Campbell Scientific Canada (CSC). CSC Technical Support will be pleased to assist with any questions.

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Section 1. NL120 Ethernet Module Overview

Campbell Scientific's NL120 Ethernet Module enables 10baseT Ethernet communications. It allows the datalogger to communicate over a local network or a dedicated Internet connection via TCP/IP. This small, rugged communication device connects to the 40-pin peripheral port on a CR1000 or CR3000 datalogger.

This section of the manual surveys the NL120 and its functions. It also explains how to quickly begin using an NL120 for straightforward Ethernet communications. The second section of the manual describes in detail the TCP/IP functionality of the NL120.

1.1 Specifications

Power Requirements:	12 V supplied through datalogger's peripheral port
Current Drain:	20 mA (CR1000 w/NL120 communicating over Ethernet)
Operating Temp. Range:	-25°C to +50°C Standard -40°C to +85°C Extended
EMI and ESD Protection:	Meets requirements for a class A device under European Standards Application of Council Directive(s): 89/336/EEC as amended by 89/336/EEC and 93/68/EEC Standards to which conformity is declared: EN55022-1; 1995 and EN50082-1: 1992
Cable Requirements:	Ethernet cable must be shielded if the length is greater than 9 ft.
Software Requirements:	LoggerNet 3.2 or later PC400 1.3 or later
Dimensions:	4.0" x 2.5" x 1.1"
Weight:	2.35 oz



FIGURE 1-1. NL120 Ethernet Module

1.2 Physical Description

The NL120 connects to a datalogger peripheral port and has a 10 Base T Ethernet port.

1.3 Power

The Ethernet Module is powered by 12 VDC received from the datalogger through the peripheral port.

1.4 Function

The NL120 Ethernet Module enables 10 Base T Ethernet communication with the datalogger.

1.5 Quick Start Procedure

This section describes the basics of communicating via Ethernet with the NL120.

1.5.1 Physical Set-up

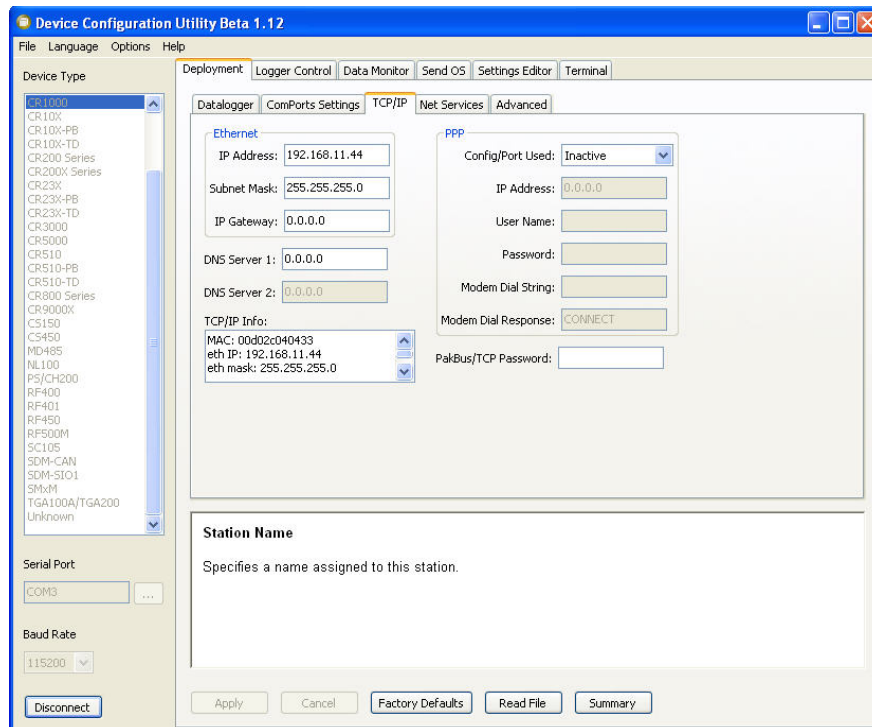
CAUTION Always power down the datalogger before installing or removing the NL120 to/from the datalogger.

After powering down the datalogger, plug the NL120 into the datalogger peripheral port. Attach Ethernet cable to the 10 Base T port. Restore power to the datalogger.

1.5.2 Communicating via Ethernet

Step 1 – Configure Datalogger

- a. Connect serial cable from PC COM port to datalogger RS-232 port.
- b. Open Campbell Scientific's Device Configuration Utility. Select the device type of the datalogger (CR1000 or CR3000), the appropriate Serial Port and baud rate. Connect to the datalogger.
- c. Under the TCP/IP tab, input the IP Address, Subnet Mask and IP gateway. These values should be provided by your network administrator.



- d. Press the Apply button to save the changes and then close the Device Configuration Utility.

NOTE A temporary IP address may be obtained from a DHCP server. For more information see Section 2.8.

NOTE The NL120 must be connected to the datalogger before configuring the datalogger with the Device Configuration Utility. If it is not connected, the TCP/IP settings will not be displayed.

Step 2 – LoggerNet Set-up

The next step is to run LoggerNet and configure it to connect to the datalogger via the Ethernet port.

- a. In LoggerNet's Setup Screen press Add Root and choose IPPort. Input the datalogger's IP address and port number. The IP address and port number are input on the same line separated by a colon. (The datalogger's default port number is 6785. It can be changed using Device Configuration Utility or by modifying its value in the Status Table.)
- b. Add a PakBus Port and set the desired baud rate.
- c. Add the datalogger (CR1000 or CR3000). Input the PakBus address of the datalogger.

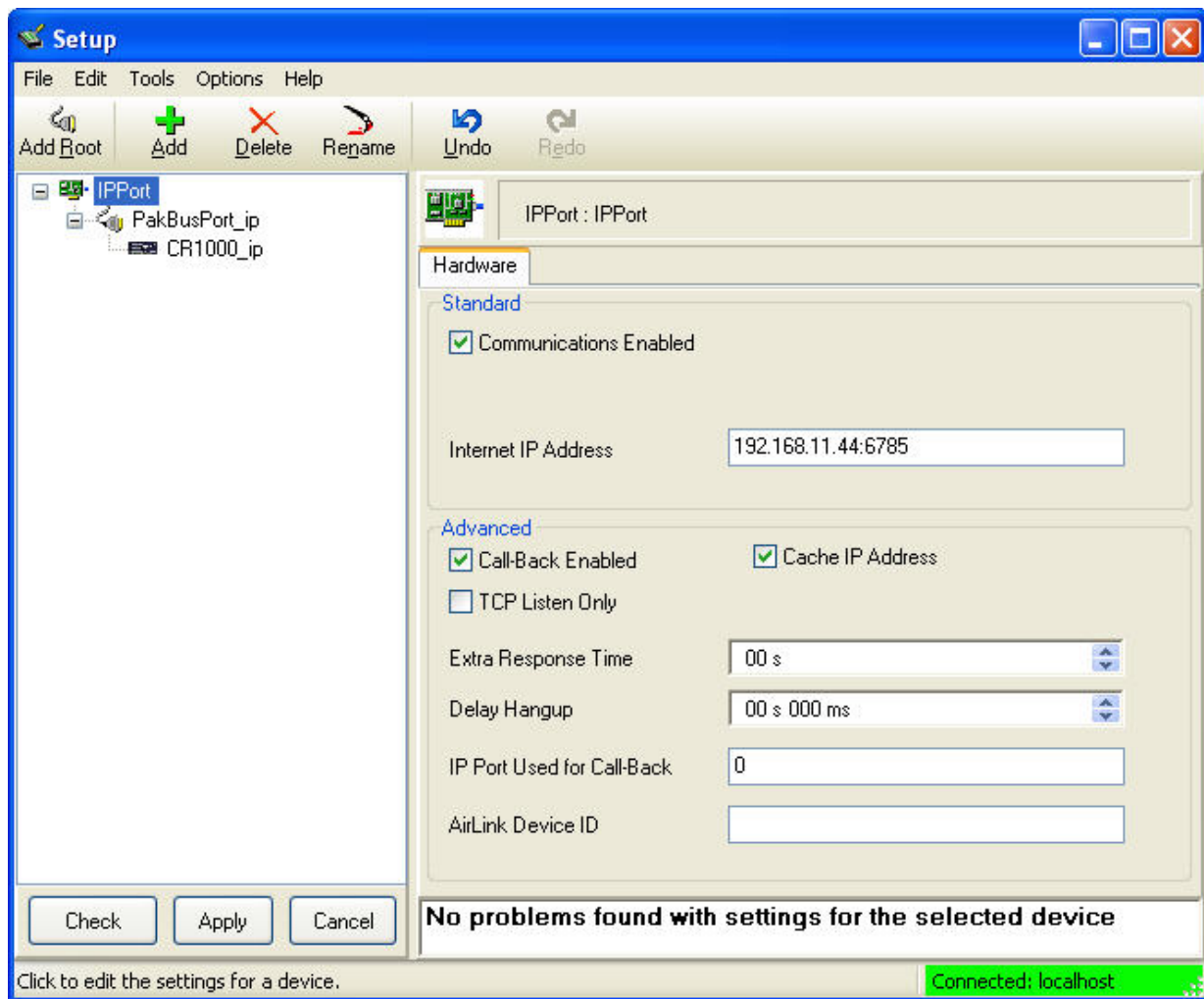


FIGURE 1-2. LoggerNet Setup

Step 3 – Connect

You are now ready to Connect to your datalogger using the LoggerNet Connect screen.

Datalogger program transfer, table data display, and data collection are now possible.

Section 2. TCP/IP Functionality

This section describes the main TCP/IP functionality of a datalogger with an NL120 attached. Additional functionality may be added in the future. For more information, refer to the Information Services section of the datalogger manual and CRBasic Editor Help.

2.1 Communicating over TCP/IP

Once the datalogger, the NL120, and LoggerNet have been setup as described in Sections 1.5.1 and 1.5.2, communications are possible over TCP/IP. This includes program send and data collection. These are straightforward operations and are accomplished through LoggerNet's Connect screen. For more information see the LoggerNet manual.

Data call-back and datalogger-to-datalogger communications are also possible over TCP/IP, as well as the creation of simple html pages to view datalogger variables using a web browser.

2.1.1 Data Call-back

The following program is an example of doing data call-back over TCP/IP. It first checks to see if a port to the LoggerNet Server already exists. (The LoggerNet Server is assumed to be at the default PakBus Address, 4094.) If not, a socket to LoggerNet is opened using the TCPOpen instruction. The SendVariables instruction is then used to send data.

PROGRAM

```
' CR1000
' IP_Callback.cr1
' LoggerNet server Pak Bus Address assumed = 4094
' PC IP address assumed = 192.168.7.231
' LoggerNet IPPort "IP Port Used for Call-Back" = 6785
' LoggerNet IPPort "Call-Back Enabled" is checked
' LoggerNet CR1000 "Call-Back Enabled" is checked
' LoggerNet PakBusPort "PakBus Port Always Open" is checked
' IP Call-back using auto-discover (-1) neighbor in SetVariables

Public PanelTemperature, BatteryVoltage, Result1, dummy1

Dim Socket as LONG

DataTable (CLBK1,1,1000)
    DataInterval (0,0,Sec,10)
    Sample (1,PanelTemperature,FP2)
    Sample (1,BatteryVoltage,FP2)
EndTable
```

```

BeginProg

  Scan (5,Sec,6,0)

    PanelTemp (PanelTemperature,250)
    Battery (BatteryVoltage)

    If not Route(4094) then Socket = TCPOpen ("192.168.7.231",6785,0)

    SendVariables (Result1,Socket,-1,4094,0000,100,"Public","Callback",dummy1,1)

    CallTable CLBK1

  NextScan

EndProg

```

2.1.2 Datalogger-to-Datalogger Communication

Communications between dataloggers is possible over TCP/IP. In order to do this, a socket must be opened between the two dataloggers. This is done using the TCPOpen instruction. The socket opened by this instruction is then used by the instructions performing datalogger-to-datalogger communications.

The example program below gets the battery voltage from a remote datalogger and sends its panel temperature to the remote datalogger. The remote datalogger is at IP address 192.168.7.125 and port 6785 is used for communication between the dataloggers. The remote datalogger must have its battery voltage stored in a public variable, BattVolt. It must also have a Public variable declared, PTemp_Base. This will be used to store the panel temperature of the base datalogger.

PROGRAM

```

'CR1000
'DL-to-DL_Comms_1.cr1
'Send this program to CR1000 #1
'Remote CR1000 #2 has PBA = 2, IP addr = 192.168.7.125, and port 6785

Public BattVolt,, BattVolt_Remote
Public PTemp
Public Result1, Result2

Dim Socket as LONG

DataTable (Test,1,-1)
  DataInterval (0,12,Sec,10)
  Minimum (1,BattVolt,FP2,0,False)
EndTable

```

```
BeginProg

  Scan(2,Sec,0,0)

    Socket = TCPOpen("192.168.7.125",6785,0)

    BatteryVoltage(BattVolt)
    PanelTemp(PTemp,250)

    GetVariables (Result1,Socket,-1,2,0000,50,"Public","BattVolt",BattVolt_Remote,1)
    SendVariables (Result2,Socket,-1,2,0000,50,"Public","PTemp",PTemp_Base,1)

    CallTable(Test)

  NextScan

EndProg
```

2.2 HTTP Web Server

Typing the datalogger's IP address into a web browser will bring up its home page as shown in Figure 2-1. This default home page provides links to the current record in all tables, including Data Tables, the Status Table and the Public Table. Clicking on a Newest Record link will bring up the latest record for that table. It will be automatically refreshed every 10 seconds. Links are also provided to the last 24 records in each Data Table. Clicking on a Last 24 Records link will bring up the last 24 records for that table. The Last 24 Records Display must be manually refreshed. In addition, links are provided to all HTML files, all XML files, and all JPEG files in the datalogger.

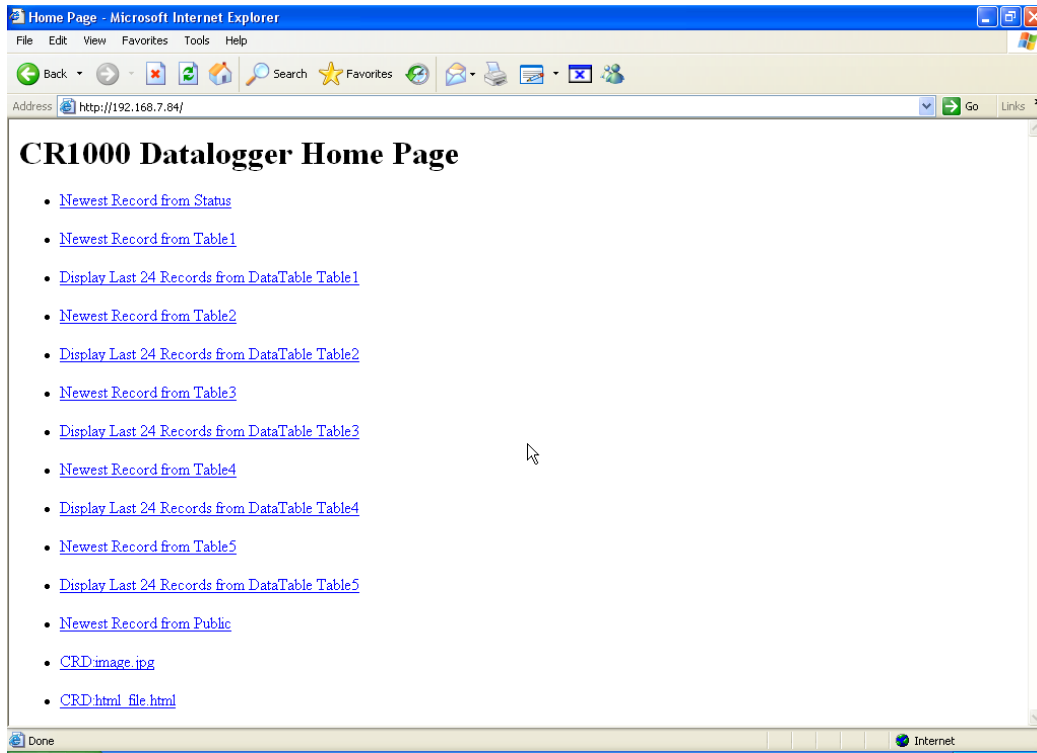


FIGURE 2-1. Datalogger Home Page

If there is a default.html file on the datalogger, this will automatically become the user-configurable home page.

The WebPageBegin/WebPageEnd declarations and the HTTPOut instruction can be used in a datalogger program to create HTML or XML files that can be viewed by the browser. For more information on using these instructions, see the datalogger manual or CRBasic Editor Help.

NOTE

FileOpen and FileWrite can be used to create html pages, but this requires first writing the file to the datalogger's USR drive. It is less convenient, and the page will be only as current as it is written to the file.

2.3 FTP

2.3.1 FTP Server

With an NL120 attached, the datalogger will automatically run an FTP server. This allows Windows Explorer to access the datalogger's file system via FTP. In the FTP world, the "drives" on the datalogger are mapped into directories (or folders). The "root directory" on the datalogger will include CPU and possibly USR. The files will be contained in one of these directories. Files can be pasted and copied to/from the datalogger "drives" as if they were drives on the PC. Files on the datalogger drives can also be deleted through FTP.

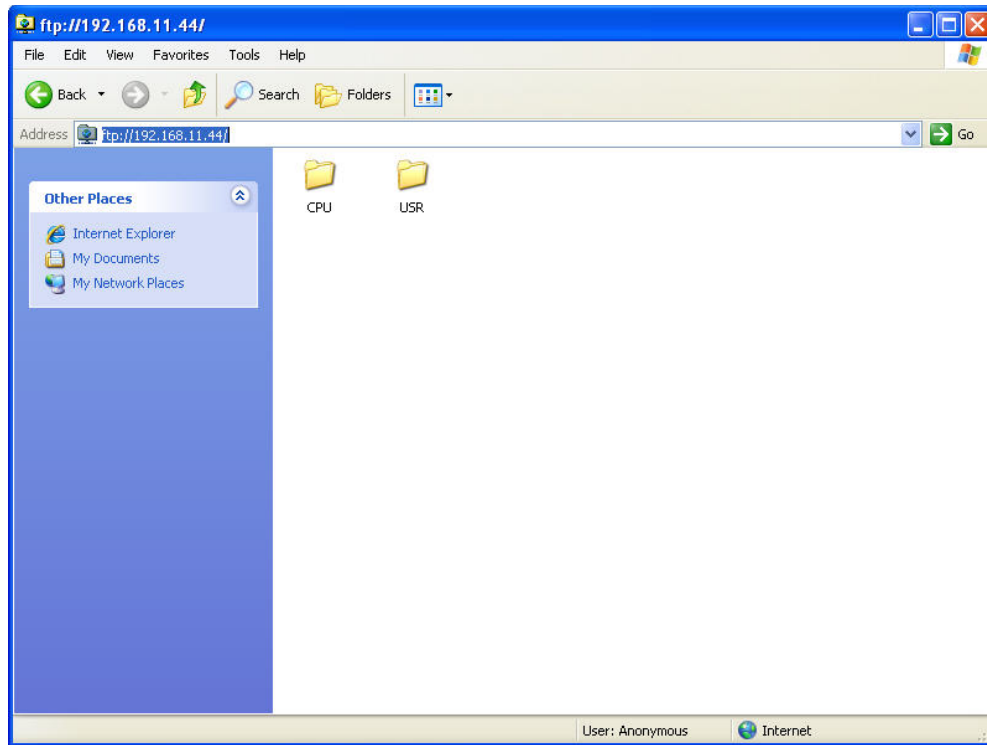


FIGURE 2-2. FTP Root Directory

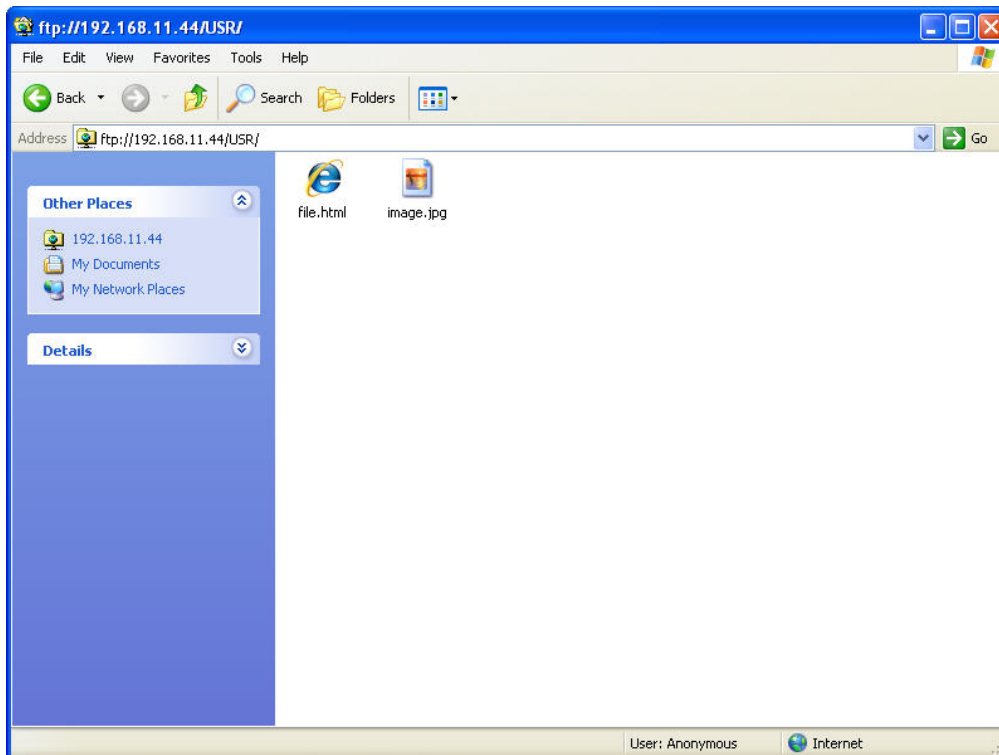


FIGURE 2-3. FTP USR Directory

In order to use FTP, the datalogger's FTP User Name and FTP Password must be set. This is done using Device Configuration Utility.

Step 1 – Configure Datalogger

- a. Connect serial cable from PC COM port to datalogger RS-232 port.
- b. Open Campbell Scientific's Device Configuration Utility. Select the device type of the datalogger (CR1000 or CR3000), the appropriate Serial Port and baud rate. Connect to the datalogger.
- c. Under the Net Services tab, verify that FTP Enabled is checked. Input the FTP User Name and FTP Password.
- d. Press the Apply button to save the changes and then close the Device Configuration Utility.

NOTE Using "anonymous" as the user name with no password allows FTP access without inputting a user name or password.

Step 2 – Access File System

- a. Datalogger must be set up for Ethernet communications as explained in Section 1.5.1 and 1.5.2 (Step 1 only).
- b. Open a Windows Explorer window. Enter <ftp://username:password@nnn.nnn.nnn.nnn> where nnn.nnn.nnn.nnn is the IP address of the datalogger.

NOTE If the user name is "anonymous" with no password, enter <ftp://nnn.nnn.nnn.nnn> where nnn.nnn.nnn.nnn is the IP address of the datalogger.

2.3.2 FTP Client

The datalogger can also act as an FTP Client to send a file to or get a file from an FTP Server; for example, another datalogger or web camera. This is done using the FTPClient instruction. The following program is an example of using the FTP Client instruction to send a file to another datalogger and get a file from that datalogger. The first parameter in the instruction is the FTP Server's IP address. The second parameter is the FTP username. The third parameter is the FTP password. The fourth parameter is the local filename. The fifth parameter is the remote file name. The final parameter is the put/get option: 0 for put and 1 for get. The instruction returns -1 if the instruction was successful and 0 if it was not.

PROGRAM

```

' CR1000
' FTPClient.cr1

Public Result1, Result2

BeginProg

    Scan (20,Sec,1,1)

        Result1 = FTPClient("192.168.7.85","user","password","USR:pic.jpg","USR:pic.jpg",0)
        Result2 = FTPClient("192.168.7.85","user","password","USR:file.html","USR:file.html",1)

    NextScan

EndProg

```

2.4 Telnet

Telnetting to the datalogger's IP address allows access to the same commands as the Terminal Emulator in LoggerNet Connect screen's Datalogger menu.

2.5 Ping

Pinging the datalogger's IP address may be used to verify communications.

2.6 Serial Server

With an NL120 attached, the datalogger can be configured to act as a serial server over the 10 Base T port. (A serial server is a device that allows serial communications over a TCP/IP port.) This function may be useful when communicating with a serial sensor over an Ethernet.

2.6.1 Serial Input

The TCPOpen instruction must be used first to open up a TCP socket. An example of this instruction is shown below. The first parameter in TCPOpen is the IP address to open a socket to. "" means to listen on this port rather than connect. The second parameter is the port number to be used. The third parameter is buffer size. For a SerialIn() instruction that will use this connection, it gives a buffer size. The TCPOpen instruction returns the socket number of the open connection or '0' if it cannot open a connection.

```
socket = TCPOpen ("",6784,100)
```

Once a socket has been opened with the TCPOpen instruction, serial data may be received with a SerialIn Instruction. An example of this instruction is shown below. The first parameter is the string variable into which the incoming serial data will be stored. The second parameter is the socket returned by the TCPOpen instruction. The third parameter is the timeout. The

fourth parameter is the termination character. The last parameter is the maximum number of characters to expect per input. For more information on this instruction see the CRBasic Editor Help.

SerialIn (Received,socket,0,13,100)

2.6.2 Serial Output

The TCPOpen instruction must be used first to open up a TCP socket. An example of this instruction is shown below. The first parameter in TCPOpen is the IP address to open a socket to. The second parameter is the port number to be used. The third parameter is buffer size. The TCPOpen instruction returns the socket number of the open connection or '0' if it cannot open a connection.

socket = TCPOpen ("192.168.7.85",6784,100)

Once a socket has been opened with the TCPOpen instruction, serial data may be sent out with a SerialOut Instruction. An example of this instruction is shown below. The first parameter is the socket returned by the TCPOpen instruction. The second parameter is the variable to be sent out. The third parameter is the wait string. The last parameter is the total number of times the datalogger should attempt to send the variable. For more information on this instruction see the CRBasic Editor Help.

result = SerialOut (socket,sent,"",0,100)

2.7 TCP ModBus

With an NL120 attached, the datalogger can be set up as a TCP ModBus Master or Slave device. For information on configuring the datalogger as a TCP ModBus Master or Slave, see the ModBus section of the datalogger manual.

2.8 DHCP

The IP address of the datalogger may be obtained through DHCP, if a DHCP server is available. The DHCP address will be automatically assigned if there is a DHCP server available and no static IP address has been entered. The IP address should be available a few minutes after the datalogger has been powered up with the NL120 attached and Ethernet cable plugged in. The IP address can be found with Device Configuration Utility's Settings tab under TCP/IP info. It can also be found using a CR1000KD attached to the datalogger. Go to Configure, Settings | Settings, scroll down to IP Status and press the right arrow.

An IP address obtained through DHCP is not static but is leased for a period of time set by the network administrator. The address may change, if the datalogger is powered down.

2.9 DNS

The datalogger provides a DNS client that can query a DNS server to resolve a fully qualified domain name. When a DNS server is available, domain names can be used in place of the IP address in the datalogger instructions.

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