Display Setup & Programming Guide

NCD RS-232 Networkable Graphic Display Controllers

DMF50773NF-SLY

160x128 LED Backlit Graphic LCD

DMF50773NB-FW

160x128 Blue CCFL Backlit Graphic LCD

DMF50773NF-FW

160x128 Black CCFL Backlit Graphic LCD

Device Features

Control 256 Devices Simultaneously or Individually from a Single Serial Port
User-Selectable Communication Rates from 9600 to 115.2K Baud
E3C Compliant Command Set
Holds more than 3,000 Icons for Large Characters and Small Animations
Store and Recall Full-Screen Images
8 User-Programmable Character Fonts
Software Controlled Backlight
Horizontal Image Scrolling

Introduction to the DMF50773 Graphic LCD Displays

The DMF50773 Series Graphic LCD Displays are the largest and most powerful modules we offer. The hardware capabilities of these screens make them perfect for just about any display application. The DMF50773 modules are capable of storing a 480x128 image in display memory, and offer a large 240x128 display area. These modules support horizontal scrolling. The scroll command is used to move the 240x128 viewing area over the 480x128 image buffer, allowing for some fantastic scrolling effects. Other features include a hardware 30x16 character generator which can be superimposed over the graphic layer. The graphic layer can be scrolled without affecting the text layer.

The DMF50773NF-SLY module is LED backlight. The DMF50773FB-FW & DMF50773NF-FW series are CCFL backlit.

The firmware we have custom developed for communicating to these displays adds a user-programmable character generator for displaying ASCII text on the graphic layer. Since there is only one hardware graphic layer built-into the display, the NCD graphical character generator will change any graphics that may already exist on the display screen. Likewise, if you send commands to change graphics on the screen, text drawn on the graphic layer will be overwritten. The graphical character generator should not be confused with the hardware character generator. The graphical character generator is built into the NCD controller and draws text on the graphic layer of the display. The hardware character is built into the actual display and operates independently of the graphic layer. The NCD graphical character generator allows you to change fonts. The hardware character generator has a fixed font.

The DMF50773 firmware adds many features to these displays, making them much more powerful than their native hardware would normally allow. All NCD display controllers support a software-controlled backlight, E3C compliance (for allowing 256 devices to share a single serial port), a user-programmable character generator with 8 fonts that may be mixed on the display screen at any location. All NCD display controllers are capable of storing and recalling full-screen images, over 3,000 icons (small graphic images that may be pasted anywhere on the screen, often used for buttons and small screen animations). Other features include direct screen dump, allowing you to directly upload image data to the screen from the serial port, user-definable startup screen, user-upgradeable memory for storing additional full-screen images, vertical scrolling, and much more.

The NCD Image Loader Utility
It is possible to use your favorite Windows paint program to draw custom fonts, icons, and full-screen graphics. Once you have completed your custom artwork, the NCD Image Loader Utility (ILU) is used to permanently store your graphics into the display controller. This utility allows you to easily manage the storage of all art work into the controller as well as review store images, icons, and fonts.

The ILU is also used to set default hardware options such as default backlight status and E3C device number. Additionally, the ILU helps you learn how to send commands to the display controller using an integrated help guide. The help guide is used to show actual data being sent to the display.

Additional information and documentation on the ILU can be found at www.controlanything.com. This guide should be used specifically for wiring diagrams and programming information. This guide assumes you have already used the ILU to store images in the display controller. Do NOT proceed to the programming section of this guide until you have explored the functions of this controller using the ILU. The ILU is a powerful and necessary Windows application that is used to configure your controller and graphically teach you how to use it.

Command Sets
This display controller has three types of command sets. ILU Commands, E3C Commands, and User Display Commands.

ILU commands are used exclusively by the NCD Image Loader Utility to configure the user interface. ILU commands are used to permanently store images and icons in the display controllers memory. They are also used to define the limits of scroll bars and identify display models and backlight options to the user interface. ILU commands are issued by the user using the NCD Image Loader Utility. The ILU command set is proprietary and will remain undocumented, as these commands are used strictly for the purposes of initially setting up and customizing the graphics in the display controller. In daily operation of the display controller, ILU commands have little value.

E3C commands are used to control up to 256 displays or other E3C compliant devices using a single serial port. An extensive explanation of the E3C command set can be found on page 6. The NCD Image Loader Utility is used to define the E3C device number of the display controller.

User Display Commands are used by the user in daily operation of the controller. They allow you to scroll the graphic screen, upload image data directly to the screen from the serial port, recall stored images and icons, and display text at any location on the screen. UDCs make the display controller very easy to use and greatly reduce the programming required to control the graphic display.

National Control Devices

DO NOT EXCEED +12 VOLTS DC
USE REGULATED SUPPLY ONLY

2.5 mm Power Connector:
Center: +12 Volts DC, 2 Amp MAX
Outer Ring: Ground

DB-9 Serial Connections:

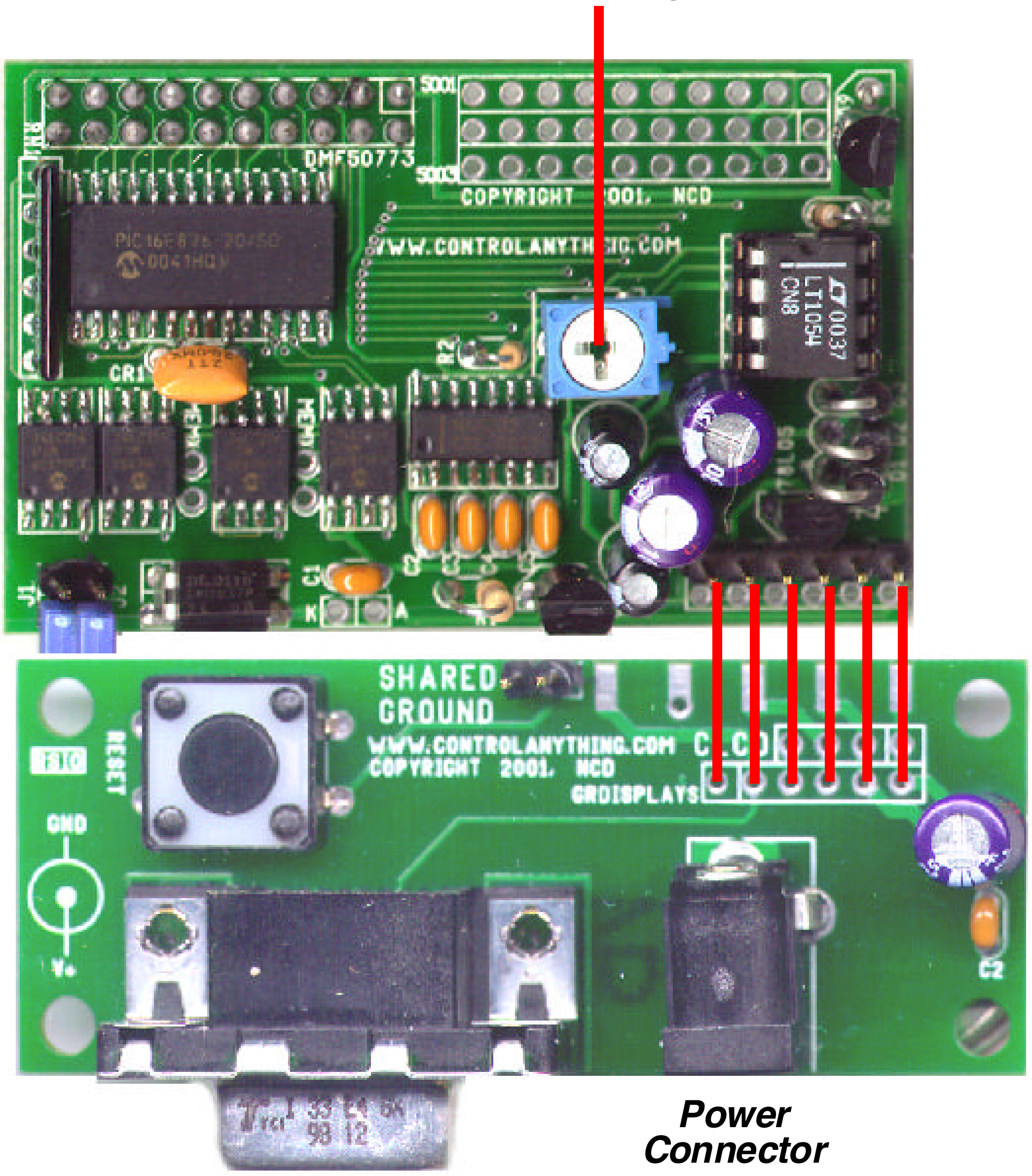
1	*Not Used*
2	*RS-232 Data Input Connects to RS-232 Output*
3	*RS-232 Data Output Connects to RS-232 Input*
4	*Not Used*
5	*RS-232 Signal Ground*
6-9	*Not Used*

Version 1.0 Firmware Supports up to 8 Memory Chips. Your controller comes with 4. Please contact us for upgrade information.

Contrast Adjustment

Baud Select:

Baud	***J1***	***J2***
9600	Off	Off
19.2K	On	Off
38.4K	Off	On
115.2K	On	On



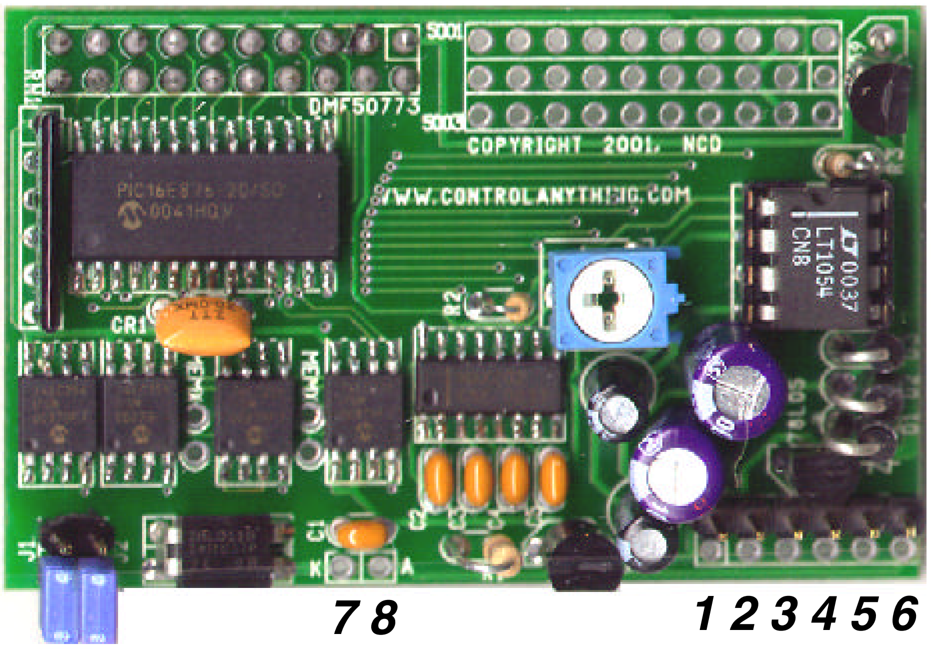
CPU RESET BUTTON

Power Connector

DB-9 Serial Connector

Use This Wiring Diagram when using the NCD Image Loader Utility.

National Control Devices



Please See Data Sheets for DMF50773, DMF5001, and DMF5003 for Pinout info, Available from Optrex USA.

Pin 1 is surrounded by a white box for all display models.

Baud Select:

Baud	***J1***	***J2***
9600	Off	Off
19.2K	On	Off
38.4K	Off	On
115.2K	On	On

1 RESET: Normally High, Connect to Ground Momemtarily for RESET
2 RS-232 DATA OUTPUT: Connect to RS-232 Data Input of Computer
3 RS-232 DATA INPUT: Connect to RS-232 Data Output of Computer
4 GROUND for RS-232 Data Singal AND Power Supply
5 GROUND for RS-232 Data Signal AND Power Supply
6 +5 Volt 1 Amp MAX Regulated Power Supply Input

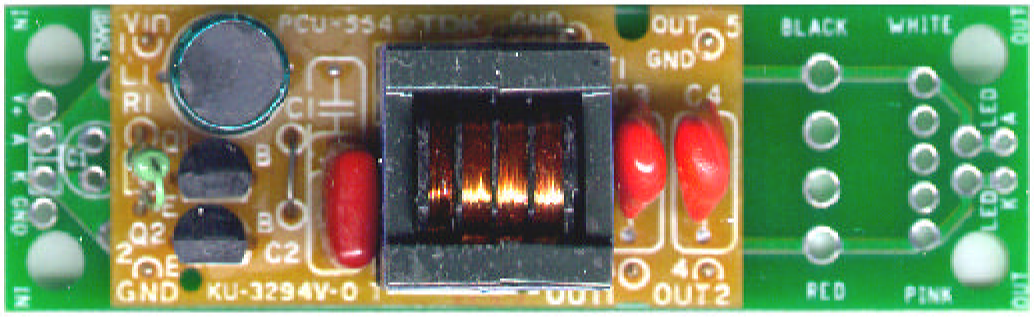
Software Controlled Backlight Connections:
7 K - Cathode: Switched Ground, Connects to K on CCFL Inverter or LED Resistor Pack.
8 A - Anode: +12 Supply, Connects to A on CCLF Inverter or LED Resistor Pack.

CCFL Backlight Inverter Module:

WARNING: High Voltage Outputs DO NOT TOUCH!!!

Input Side:
To 7 *A - Anode*
To 8 *K - Cathode*

Input Side Connects to Controller



High Voltage Output Side:
A - Anode

Output Side Connected to Backlight on Display

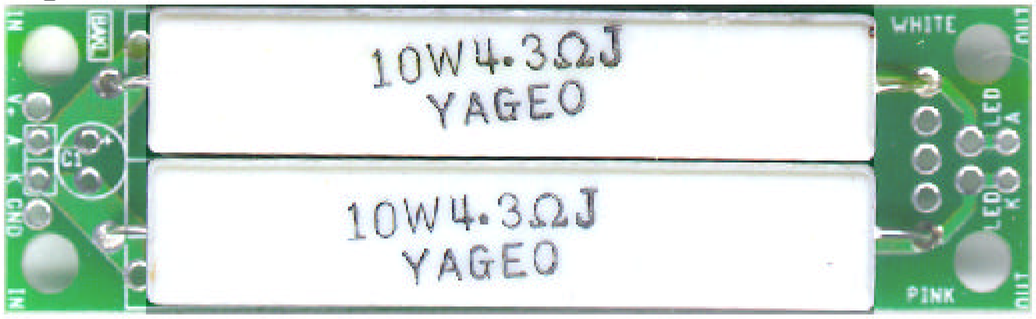
K - Cathode

LED Backlight Resistor Pack:

WARNING: Resistor Pack Gets VERY Hot DO NOT TOUCH!!!

Input Side:
To 7 *A - Anode*
To 8 *K - Cathode*

Input Side Connects to Controller



Output Side:
A - Anode
K - Cathode

Output Side Connected to Backlight on Display

Sending Commands to the Display Controller

The display controller is capable of sending and receiving data via RS-232 serial communications and is compatible with just about any computer or microcontroller ever produced, including the Macintosh, Amiga, Basic Stamp, and of course, Windows & DOS based machines.

Regardless of the system you are using, you will need access to a programming language that supports program control of the serial port on your system.

A terminal program is not suitable for controlling this device. Commands should be sent using ASCII character codes 0-255 rather than ASCII characters (A, B, C etc.). See "ASCII Codes vs. Characters" on this page.

Most systems require you to open the appropriate serial port (COM port) prior to sending or receiving data.

Because there are so many different ways to send and receive data from various languages on various platforms, we will provide generic instructions that can be easily converted to your favorite language.

For example, if this manual says "Send ASCII 254", the user will need to translate this instruction into a command that is capable of sending ASCII character code 254.

To Send ASCII 254 from Visual Basic, you will use the following line:

MSComm1.Output = Chr$(254)

In Qbasic, you can send ASCII 254 using the following line of code:

Print #1, Chr$(254);

Note that sending ASCII character code 254 is NOT the same as sending ASCII characters 2, 5, and 4 from a terminal program. Typing 2, 5, and 4 on the keyboard will transmit three ASCII character codes.

Your programming language should support commands for reading data from the serial port. It is important to familiarize yourself with these instructions for reliable operation.

For your convenience, we have provided several programming examples in various popular programming languages for controlling this display controller. These examples should greatly speed development time. You may want to visit **www.controlanything.com** for the latest software and programming examples.

Programming examples for this device are much more extensive for Visual Basic 6 users than for any other programming language. If you are not a VB programmer, you may consider looking at the VB6 source code, as it is easily translated into other popular languages.

Regardless of your programming background, the provided Visual Basic 6 source code is very easy to understand and will likely resolve any communication questions you may have. VB6 programming examples may be viewed in any text editor.

ASCII Codes vs. Characters

The differences between ASCII codes and ASCII characters tend to generate a lot of confusion among first-time RS-232 programmers. It is important to understand that a computer only works with numbers. With regard to RS-232 data, the computer is only capable of sending and receiving numbers from 0 to 255.

What confuses people is the simple idea that the numbers 0 to 255 are assigned letters. For instance, the number 65 represents the letter A. The number 66 represents the letter B. Every character (including numbers and punctuation) is assigned a numeric value. This standard of assignments is called ASCII, and is a universal standard adopted by all computers with an RS-232 serial port.

ASCII characters codes can be clearly defined as numbers from 0 to 255.

ASCII characters however are best defined as letters, A, B, C, D, as well as punctuation, !@#$%, and even the numbers 0-9.

Virtually all programming languages permit you to send ASCII in the form of letters or numbers. If you wanted to send the word "Hello" out the serial port, it is much easier to send the letters H, e, l, l, and o than it is to send the ASCII character codes that represent each letter.

For the purposes of controlling NCD devices however, it is much easier to build a numeric command set. Especially when communicating to devices that have numeric parameters, such as the E3C command set.

Put simply, it is easier to control NCD devices using ASCII character codes 0 to 255 than it is to use ASCII characters A, B, C, D, etc.

Because terminal programs are ASCII character based, it may be difficult to generate the proper series of keystrokes that would be necessary to activate a particular function. Therefore, terminal programs are not suitable for controlling NCD devices. In a real world control application, a terminal program would not likely be used to control NCD devices anyway. Therefore, a programming language that supports the transmission and reception of ASCII character codes 0 to 255 is highly recommended.

The E3C Command Set: Software Control of Multiple NCD Devices

The E3C command set allows you to control up to 256 NCD devices from a single serial port. It is OK to mix different types of devices, as long as the devices are E3C compliant. This display controller supports the full set of E3C commands.

How does E3C Work?
First of all, each device must be assigned a device number from 0 to 255. The display controller must be programmed with a device number using the NCD Image Loader Utility.

E3C stands for Enabled 3-Wire Communication. Put simply, when you first power up your computer and all the devices attached to the serial port, all devices will respond to your commands.

Using the E3C command set, you can specify which devices will listen and which devices will ignore your commands. Note that E3C commands are never ignored by any device, regardless of the commands you send to the controller.

The number to the left of each command indicates the ASCII character code that must be sent to issue the command. All commands must be preceded with ASCII character code 254 to place the device in command mode. See examples at right.

The E3C Command Set

248 Enable All Devices:
Tells all devices to respond to your commands.

249 Disable All Devices:
Tells all devices to ignore your commands.

250 Enable a Selected Device:
Tells a specific device to listen to your commands.

251 Disable Selected Device:
Tells a specific device to ignore your commands.

252 Enable Selected Device Only:
Tells a specific device to listen to your commands, all other devices will ignore your commands.

253 Disable a Selected Device Only:
Tells a specific device to ignore your commands, all others will listen.

E3C Visual Basic Programming Examples

The E3C command set is easily used from any programming language that supports serial communication. The following Visual Basic 6 Example source code demonstrates subroutines that can be used to control which devices will listen and which devices will ignore your commands.

Many commands issued to the display controller are acknowledged by sending ASCII character code 85 back to the host compute. E3C commands are not acknowledged.

Sample Code: The E3C Command Set

```
Public Sub EnableAllDevices()
    'Enable All E3C Devices
    MSComm1.Output = Chr$(254)    'Enter Command Mode
    MSComm1.Output = Chr$(248)    'E3C Enable All Device Command
End Sub

Public Sub DisableAllDevices()
    'Disable All E3C Devices
    MSComm1.Output = Chr$(254)    'Enter Command Mode
    MSComm1.Output = Chr$(249)    'E3C Disable All Device Command
End Sub

Public Sub EnableSpecificDevice(Device)
    'Enable A Specific E3C Devices, Other Devices will be unchanged
    MSComm1.Output = Chr$(254)    'Enter Command Mode
    MSComm1.Output = Chr$(250)    'E3C Disable Specific Device Command
    MSComm1.Output = Chr$(Device) 'Device Number that will be Disabled
End Sub

Public Sub DisableSpecificDevice(Device)
    'Disable A Specific E3C Devices, Other Devices will be unchanged
    MSComm1.Output = Chr$(254)    'Enter Command Mode
    MSComm1.Output = Chr$(251)    'E3C Disable Specific Device Command
    MSComm1.Output = Chr$(Device) 'Device Number that will be Disabled
End Sub

Public Sub DisableAllDevicesExcept(Device)
    'Disable All E3C Devices Except (Device)
    MSComm1.Output = Chr$(254)    'Enter Command Mode
    MSComm1.Output = Chr$(252)    'E3C Disable All Device Except Command
    MSComm1.Output = Chr$(Device) 'Device Number that will be Active
End Sub

Public Sub EnableAllDevicesExcept(Device)
    'Enable All E3C Devices Except (Device)
    MSComm1.Output = Chr$(254)    'Enter Command Mode
    MSComm1.Output = Chr$(253)    'E3C Enable All Device Except Command
    MSComm1.Output = Chr$(Device) 'Device Number that will be Inactive
End Sub
```

The DMF50773 Series Graphic LCD Display Controller Command Set

This display controllers supports an extensive command set, used to control many types of graphic functions directly on the display screen. The best way to familiarize yourself with the capabilities of this display device is to carefully read through the command set in this section. The “plain English” examples provide a quick, easy to understand definition of what each command does.

The number to the left of each command indicates the ASCII character code that must be sent to issue the command. All commands must be preceded with ASCII character code 254 to place the device in command mode. See examples at right.

Controlling the Display

0 Test 2-Way
This command is used to test 2-way communication between the display controller and the host computer. The host computer will receive ASCII character code 85 if the device is properly connected and functioning.

1 Send Command
This command is used to send a direct hardware command to the display. This function will not report data back to the computer, nor can it be used to ask the display for screen information. A list of commands that may be issued to the display can be found in the data sheet for the controller built into the display screen. For the most part, this command was used for development purposes but may be useful for issuing commands not yet supported by our firmware. For experienced users only.

2 Send Data
This command is used to send parameter or screen data. This command should only be used in conjunction with ***Send Command*** above. For experienced users only.

3 Get Model Info

4 Get Stored Settings

5 Store Settings

6 Store Icon Bank

7 Store Image
The commands above are issued by the NCD Image Loader Utility only. The protocol for using this command is complex and will remain undocumented.

GetReply
Some commands report ASCII character code 85 back to the host computer to tell your program that the display has completed the last command sent to it. The ***GetReply*** function is used to stall your program until the display has completed its drawing operations. This function is ONLY recommended for some commands, look for the ***GetReply*** function call as the last line of the programming examples.

GetReply is NOT required for proper operation of the display. A two-second delay in your program can be used to stall your program to ensure all graphic operations have completed. ***GetReply*** does allow your program to run a little faster because most drawing operations can be completed in less than 2 seconds.

Visual Basic Programming Examples

Many Visual Basic 6 programming examples are provided in the following pages to assist in the development of software for controlling this display controller. Additional source code can be found on our web site at www.controlanything.com.

Sample Code: Controlling the Display

```
Public Sub Test2Way()
    MSComm1.Output = Chr$(254)   'Enter Command Mode
    MSComm1.Output = Chr$(0)     'Send Test-2-Way Command
    GetReply                     'Wait for ASCII 85 from Controller
End Sub

Public Sub CMD(Byte)
    MSComm1.Output = Chr$(254)   'Enter Command Mode
    MSComm1.Output = Chr$(1)     'Issue Hardware Command to Display
    MSComm1.Output = Chr$(Byte)  'Send Hardware Command Byte
End Sub

Public Sub DAT(Byte)
    MSComm1.Output = Chr$(254)   'Enter Command Mode
    MSComm1.Output = Chr$(2)     'Issue Hardware Data to Display
    MSComm1.Output = Chr$(Byte)  'Send Hardware Data Byte
End Sub

Public Function GetReply()       'Get a Byte of Data from the Displays
    'Wait for a Byte to Be Received
    Do Until Form1.MSComm1.InBufferCount >= 1
        TimeOutCounter = TimeOutCounter + 1  'Start the Counter
        If TimeOutCounter >= 90000 Then      'If the Counter Times Out
           'The Device Did NOT Respond
           Debug.Print "Device Did Not Respond."
           GoTo Escape                                     'Exit the Routine
        End If
        DoEvents   'Allow Windows to Service Other Tasks
    Loop
    DataIn = Asc(Form1.MSComm1.Input)   'Read the Serial Port
    If DataIn = 85 Then                 'If 85 Is Received
        Debug.Print "OK."; DataIn       'Device Responded with OK
    Else
        'Device Responded with Alternate Value
        Debug.Print "Device Returned: "; DataIn
    End If
  Escape:
    GetReply = DataIn         'GetReply Holds Received Data if Any
    For Dela = 0 To 63: DoEvents: Next Dela
End Function
```

Recalling Stored Images

8 Copy Stored Image to Screen

This command copies an image stored in non-volatile EEPROM to the display screen. Images can be draw using your favorite paint program and stored into the controller using the NCD Image Loader Utility.

To successfully copy an image, you will need to supply this command with an image number. The image number tells the controller which stored image to copy to the display screen. The maximum available image number is determined by how much memory is installed on your display controller. When in doubt, use the ***GetFrames*** command to ask the controller how many images are available. Note that you can also use the NCD Image Loader Utility to find out how many images may be stored in the display controller. Simply click on the ***Hardware Settings*** button. The maximum image number is shown in the lower right corner of the window. Also note that the startup screen is ALWAYS image 0.

Note that this command updates the entire 480x128 virtual screen image. It is possible to update 240x128 segments of the screen using the Half-Copy command found later in this manual.

Once drawing operations have completed, the display controller will send ASCII character code 85 back to the host computer.

NEVER SEND DATA TO THE CONTROLLER WHILE DRAWING OPERATIONS ARE IN PROGRESS. DOING SO MAY HANG THE DISPLAY CONTROLLER CPU.

Sample Code: Recalling Stored Images

```
Public Sub CopyStoredImageToScreen(Image)
    MSComm1.Output = Chr$(254)   'Enter Command Mode
    MSComm1.Output = Chr$(8)     'Copy Store Image to Screen Command
    MSComm1.Output = Chr$(Image) 'Stored Image to Copy
    GetReply                     'Wait for Display to Finish Command
End Sub
```

NCD Graphical Text & Scrolling

9 Display Scrolling

Scrolling is one of the most powerful features offered by our display controller. To understand how it works, image an image that is 480x128. You can only view a 240x128 area at one time. The scroll command is used to horizontally position the 240x128 view port over the 480x128 image. You can randomly jump to any portion of the 480x128 image using this command. The display scrolls horizontally 8 pixels at a time. Scrolling values exceeding the maximum area allowed by the screen will be internally limited by the display controller.

10 Shift Up

Not Used by this Display

11 Shift Down

Not Used by this Display

12 Graphical Text

This text command is used to draw text using the NCD Graphical Character Generator. Up to eight 6x8 character fonts may be displayed using this command (fonts are changed using the ***SetFont*** command below). Fonts are stored as Icon banks 1-8 using the NCD Image Loader Utility. The source file for fonts can be found in the Graphics directory of the NCD Image Loader Utility. Look for the file, ICONS.BMP. This command allows you to set the X and Y start location of text. Up to 84 characters may be stored in the display controllers receive buffer. Additional characters beyond 84 will be ignored. Text will begin drawing on the graphic layer of the screen when ASCII character code 255 is received by the controller. When drawing operations have completed, the controller will send ASII character code 85 back to the host computer. NEVER SEND DATA TO THE CONTROLLER WHILE DRAWING OPERATIONS ARE IN PROGRESS. DOING SO MAY HANG THE DISPLAY CONTROLLER CPU.

13 Set Font

The ***SetFont*** command is used to change text fonts. Up to 8 fonts may be displayed on the screen at one time. This command only affects the ***Graphical Text*** command and does not have any affect on displays that have a hardware character generator. This command has 2 parameters, Font and Kerning. Font is a value of 1 to 8, which directly corresponds to Icon banks 1 to 8 stored using the NCD Image Loader Utility. Kerning sets the character width, in this case, 8x8. The kerning for this display controller should always be set to 6. Other kerning options may become available in later versions of the firmware. The effects of this command will not be seen until the next time the ***Graphical Text*** command is issued.

Sample Code: NCD Graphical Text & Scrolling

```
Public Sub VerticalScroll(Xpos, YPos)
    MSComm1.Output = Chr$(254)   'Enter Command Mode
    MSComm1.Output = Chr$(9)     'Send Scroll Command
    MSComm1.Output = Chr$(XPOS)  'X Start Position of 240x64 Window
    MSComm1.Output = Chr$(YPOS)  'Y Start Position of 240x64 Window
End Sub

Public Sub GraphicalText(Xpos, Ypos, Text$)
    MSComm1.Output = Chr$(254)   'Enter Command Mode
    MSComm1.Output = Chr$(12)    'NCD Graphical Text Command
    MSComm1.Output = Chr$(Xpos)  'X Start Position of Text
    MSComm1.Output = Chr$(Ypos)  'Y Start Line of Text
    MSComm1.Output = Text$       'Text to Send, 84 Characters MAX
    MSComm1.Output = Chr$(255)   'Terminate Function and Draw Text
    GetReply                     'Wait for Display to Finish Command
End Sub

Public Sub SetFont(IconBank)
    MSComm1.Output = Chr$(254)     'Enter Command Mode
    MSComm1.Output = Chr$(13)      'Set Font Command
    MSComm1.Output = Chr$(IconBank)'Select Icon Bank 1-8 for Text Font
    MSComm1.Output = Chr$(6)       'Set Kerning Width to 6
End Sub
```

The DMF5001 & DMF5003 Graphic LCD Display Controller Command Set

Pasting Icons on the Display Screen

14 Paste Icon

The ***Paste Icon*** command is one of the most powerful commands offered by our display controller. An Icon is simply a small graphical image. The display controller is capable of storing 3,076 icons in non-volatile EEPROM. Icons are often used for buttons, small logos, and even small animation. Icons bring the display to life by graphically updating user-selected portions of the graphical display screen. Icon graphics are stored under the file name "ICONS.BMP" located in the Graphics folder, which is located in the NCD Image Loader folder. This file may be manipulated using your favorite paint program. Once you have completed changes to the file, use the NCD Image Loader Utility to store your icons in the display controller. Then, use the ***Paste Icon*** command to draw your icons on the screen.

The ***Paste Icon*** command has 4 parameters outlined below:

BANK is a value from 1 to 16 and directly corresponds to the Banks shown in the ICONS.BMP file. A value outside the range of 1 to 16 will be truncated to the highest or lowest available bank number.

ICON specifies an individual icon to paste. Icons are numbered within each bank. Icon 0 is always in the upper left corner of each bank. Icons are numbered from left to right, and from top to bottom. Some icon banks store more icons than others. The controller will limit the user-input to the maximum number of available icons for the selected bank.

XPOS Specifies the horizontal X COLUMN (8-pixel intervals). for the upper left corner of the icon. Valid ranges are from 0 to 60. Ranges outside the display range will cause the icon to wrap around to the left side of the screen.

YPOS Specifies the vertical line in pixels. Valid ranges are from 0 to 127. Values outside these ranges will truncate the icon.

15 Reserved for Future Expansion

16 Clear Text

Clears the hardware 30x16 text layer. Returns ASCII code 85 when operation is complete.

17 Clear Graphic

Clears the virtual 480x128 display screen. Returns ASCII code 85 when operation is complete.

18 Set Bright

Turns the Backlight On or Off

Sample Code: Pasting Icons

```
Public Sub PasteIcon(Bank, Icon, Xpos, Ypos)
    MSComm1.Output = Chr$(254)   'Enter Command Mode
    MSComm1.Output = Chr$(14)    'Paste Icon Command
    MSComm1.Output = Chr$(Bank)  'Select an Icon Bank
    MSComm1.Output = Chr$(Icon)  'Select an Icon to Paste
    MSComm1.Output = Chr$(Xpos)  'X Start Position of Icon
    MSComm1.Output = Chr$(Ypos)  'Y Start Line of Icon
    GetReply                     'Wait for Display to Finish Command
End Sub

Public Sub ClearText()
    MSComm1.Output = Chr$(254)   'Enter Command Mode
    MSComm1.Output = Chr$(16)    'Send Clear Text Screen Command
    GetReply                     'Wait for Display to Finish Command
End Sub

Public Sub ClearGraphic()
    MSComm1.Output = Chr$(254)   'Enter Command Mode
    MSComm1.Output = Chr$(17)    'Send Clear Graphic Screen Command
    GetReply                     'Wait for Display to Finish Command
End Sub

Public Sub SetBright(Level)
    MSComm1.Output = Chr$(254)   'Enter Command Mode
    MSComm1.Output = Chr$(18)    'Send Backlight Brightness Command
    MSComm1.Output = Chr$(Level) 'Backlight Off: Level=0, On: Level=1
End Sub
```

Miscellaneous Commands

19 Get Frames

Asks the display controller how many images can be stored in EEPROM. Frame 0 is always the startup screen. The more memory installed, the larger the number of available frames.

20 Full Frame Image Transfer

It may be necessary to upload image data directly to the full display buffer (even the area outside the viewing area) from the RS-232 serial port. The Full Frame Image Transfer command allows you to do this with minimal programming. The examples shown fill the screen (including the virtual display area outside the viewing area) by turning on all pixels. A byte value of 0 will clear the display. Try different byte values to explore this command further. The image will draw beginning in the upper-left corner, ending in the lower-right corner. For best results, 115.K baud operation will yield the highest screen refresh rates.

21 Screen Size Image Transfer

It may be necessary to upload image data directly to the display screen from the RS-232 serial port. This command is used to ONLY update the viewing area beginning in the upper left corner of the screen. The Screen Size Transfer command allows you to do this with minimal programming. The examples shown fill the screen by turning on all pixels. A byte value of 0 will clear the display. Try different byte values to explore this command further. The image will draw beginning in the upper-left corner, ending in the lower-right corner. For best results, 115.K baud operation will yield the highest screen refresh rates.

22 SetXY

This command is used to position the graphic cursor anywhere on the virtual display screen. Maximum X value is columns is 60, maximum Y value in pixels is 127. This command should only be used by experienced users who need to refresh controlled portions of the screen.

Sample Code: Miscellaneous Commands

```
Public Function GetFrames()
    MSComm1.Output = Chr$(254)   'Enter Command Mode
    MSComm1.Output = Chr$(19)    'Paste Icon Command
    GetFrames = GetReply         'Report Available Frames Back to User
End Sub

Public Sub FullFrame()
    MSComm1.Output = Chr$(254)      'Enter Command Mode
    MSComm1.Output = Chr$(20)       'Full Frame Image Transfer
    For n = 1 to 7680               'Fill Full 480x128 Image Buffer
       Byte = 255                   'Display Data
       MSComm1.Output = Chr$(Byte)  'Data to Send to Display
    Next n
End Sub

Public Sub ScreenSize()
    MSComm1.Output = Chr$(254)      'Enter Command Mode
    MSComm1.Output = Chr$(21)       'Full Frame Image Transfer
    For n = 1 to 3840               'Fill Screen of DMF5005/5010
       Byte = 255                   'Display Data
       MSComm1.Output = Chr$(Byte)  'Data to Send to Display
    Next n
End Sub

Public Sub SetXY(Xpos, Ypos)
    MSComm1.Output = Chr$(254)   'Enter Command Mode
    MSComm1.Output = Chr$(22)    'Paste Icon Command
    MSComm1.Output = Chr$(Xpos)  'X Column of Pixels
    MSComm1.Output = Chr$(Ypos)  'Y Line of Pixels
End Sub
```

Miscellaneous Commands

23 Half Copy

The NCD display controller supports a very powerful image retrieval command called Half Copy. Half Copy is used to retrieve a 240x128 portion (left or right) of a 480x128 stored image and copy it to the Left or Right side of the 480x128 image buffer. The Half Copy command should be used to update portions of the screen that are not visible to the user. The NCD Image Loader Utility is very helpful for understanding how this command works, as it provides a graphical user interface so you can actually see the effects of this command. Make sure the Guide is turned on to view source code for the parameters of this command.

Portion Numeric Assignments:

1 = Left-most 240x128 Portion of Image or Display Screen

2 = Right-most 240x128 Portion of Image or Display Screen

24 Quarter Copy

This command is not supported by this display controller. The controller will report ASCII character code 85 back to the computer if this command is issued. The display will be unaffected.

25 Native Text

The DMF50773 series have a character generator built into the screen, which operates independently of the graphic layer. The Native Text command is used to position and display text directly on the display screen using the hardware character generator. The hardware character generator differs from the NCD graphical character generator in many ways. There is no 84 character limit to the Native Text command. Text can be streamed to the display until ASCII character code 255 is received. The hardware character generator is limited to one font. Graphics may be scrolled underneath the hardware character generator. The NCD graphical character generator draws text on the graphic layer, and may be drawn anywhere on the 480x128 virtual display area. The hardware character generator is limited to a 30x16 area.

The Xpos and Ypos parameters allow you to set the start position of text on the display screen.

Sample Code: Miscellaneous Commands

```
Public Sub HalfCopy(Image,SLR,DLR)
    MSComm1.Output = Chr$(254)   'Enter Command Mode
    MSComm1.Output = Chr$(24)    'Send Quarter Copy Command
    MSComm1.Output = Chr$(Image) 'Image Number to Retrieve
    MSComm1.Output = Chr$(SLR)   'Source (1=Left, 2=Right)
    MSComm1.Output = Chr$(DLR)   'Destination (1=Left, 2=Right)
    GetReply
End Sub

Public Sub NativeText(Xpos, Ypos, Text$)
    MSComm1.Output = Chr$(254)   'Enter Command Mode
    MSComm1.Output = Chr$(25)    'Send Native Text Command
    MSComm1.Output = Chr$(Xpos)  'X Start Position of Text
    MSComm1.Output = Chr$(Ypos)  'Y Start Line of Text
    MSComm1.Output = Text$       'Text to Send, 84 Characters MAX
    MSComm1.Output = Chr$(255)   'Terminate Function and Draw Text
    GetReply                     'Wait for Display to Finish Command
End Sub
```