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## 1.0 Introduction

The Omega Engineering CN491A controllers use serial, half-duplex communication mode with multi-drop link to exchange information.

The CN491A-SOFT is a Windows<sup>®</sup>-based software that allows an operator to completely configure and monitor up to 31 CN491A controllers with communications option, via a 2-wire EIA-485 serial communications line. It works on systems running Windows NT, Windows<sup>®</sup>95, or later versions. The controllers will be polled one at a time and are identified by their station numbers. The main display window includes a real-time trend display, a bar graph and a table with the current process values of all the stations. The trend display can be assigned up to six stations at a time. This lets the user observe the behavior of six different processes in six different colors. The bar display lets the user observe the variations of process value, setpoint, and the amount of output from the controller. The display could be set for a specific station or to scan all the stations sequentially. The historical process database and the parameter data can be exported to a file and analyzed by other application programs.

## 2.0 Installation

The installation procedure provides the necessary steps required to directly link up to 31 controllers (remote units) to the host computer (master).

### 2.1 System Requirements

- a. CN491A controller with RS485 communications (C4 option). Example: CN491A-R1-R2-C4
- b. RS-485 to RS-232 converter.  
Example: Omega Part No. CAT-285
- c. Host computer  
RAM: 16MB  
Hard Disk: 20MB free space  
CD-ROM drive  
SVGA: 800x600 resolution, 256 colors.  
Operating System: Windows<sup>®</sup>95, Windows<sup>®</sup>NT, or later.
- d. Application Software: CN491A-SOFT

### 2.2 Installation of CN491A-SOFT

- The host computer should be running Windows 95<sup>®</sup> or a later version.
- Insert the CD-ROM provided with the controller. Open folder "Disk 1" and click on "Setup.exe"
- The "CN491A-SOFT Setup" dialog box will be displayed. Click "change directory" button if necessary.
- Create a new directory, C:\CN491A-SOFT (for example), if necessary, then click the "OK" button.
- Click the installation icon to install the CN491A-SOFT application to the specified destination directory.
- After finishing the CN491A-SOFT setup, you can start the program by clicking on the CN491A-SOFT icon in the program menu.

## 2.3 Communications Setup

### a. Connect the controller and the computer

Remove power from both the controller and the computer before connecting them together.

The RS485 communications uses a two-wire, half-duplex system. You can have up to thirty-one controllers (remote units) connected to a host computer (master) via a multi-drop link as shown below.

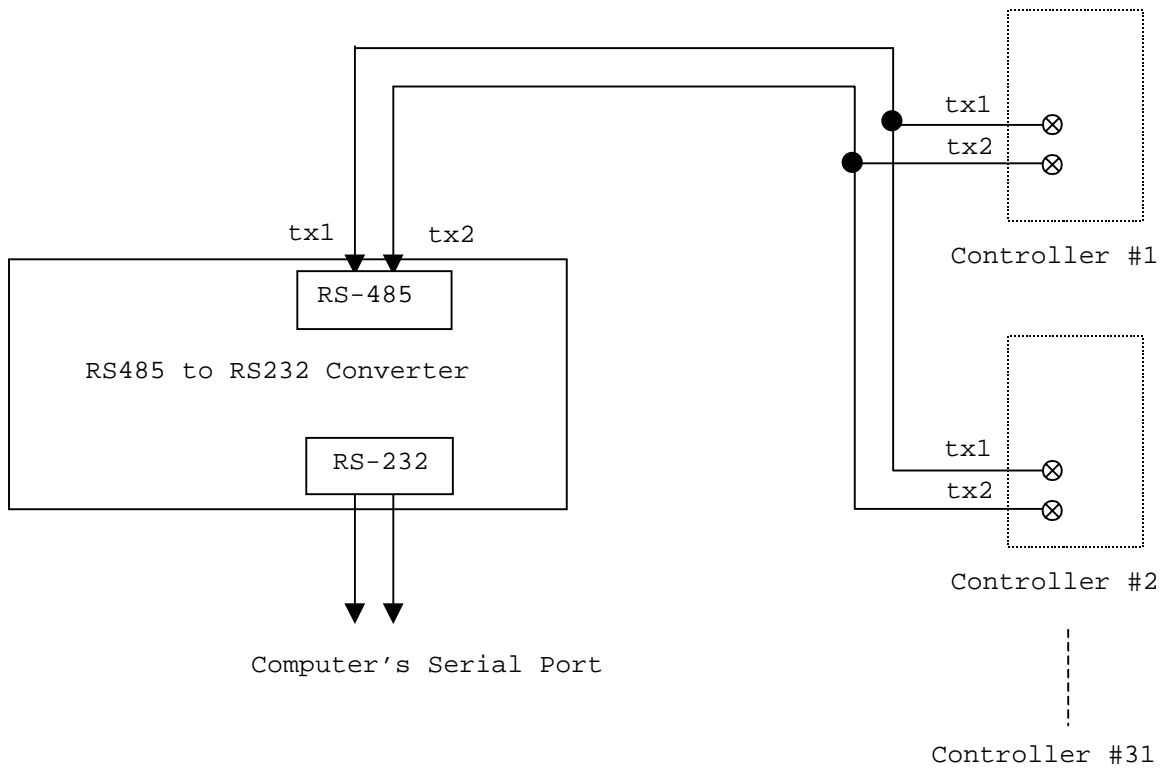


Figure 2.1 RS485 interface wiring diagram when an external converter is used

b. Set up the remote address from the controller's front panel



## 3.0 CN491A-SOFT Operation

Features of CN491A-SOFT:

- Up to 31 controllers can be connected simultaneously. A built-in database lets users access and manage both the parameters and historical process data. It works like a data logger.
- CN491A-SOFT could function like a 6-channel recorder. A trend display lets the user observe the dynamic behaviour of up to six processes (addresses). The image of the trend display can be printed out to a system or network printer.
- A bar display lets users monitor the Process Value (PV), Set Value (SV), percent of output, or, manipulated variable (MV), data for a specific controller. This bar display can also be set to scan all the stations in a fixed time interval automatically.
- User programmable DevHi/DevLo alarm and display for monitoring real-time process values.
- A data grid control handles the data communication of polling/modifying parameters from/to all assigned addresses, and also performs the function of updating parameters automatically.
- The historical process database (PV) and the parameter data can be exported out to a file and analyzed by other applications.
- CN491A-SOFT is a built-in DDE (Dynamic Data Exchange) source application. You can develop your own application to take the data through the DDE mechanism.

### 3.1 Start-up

#### 3.1.1 Initial Set-up of CN491A-SOFT

You can run CN491A-SOFT by clicking the item CN491A-SOFT in the Windows<sup>®</sup> program files list, and the Initial Setup window will appear.

### 3.1.2 Com Port and Database Selection

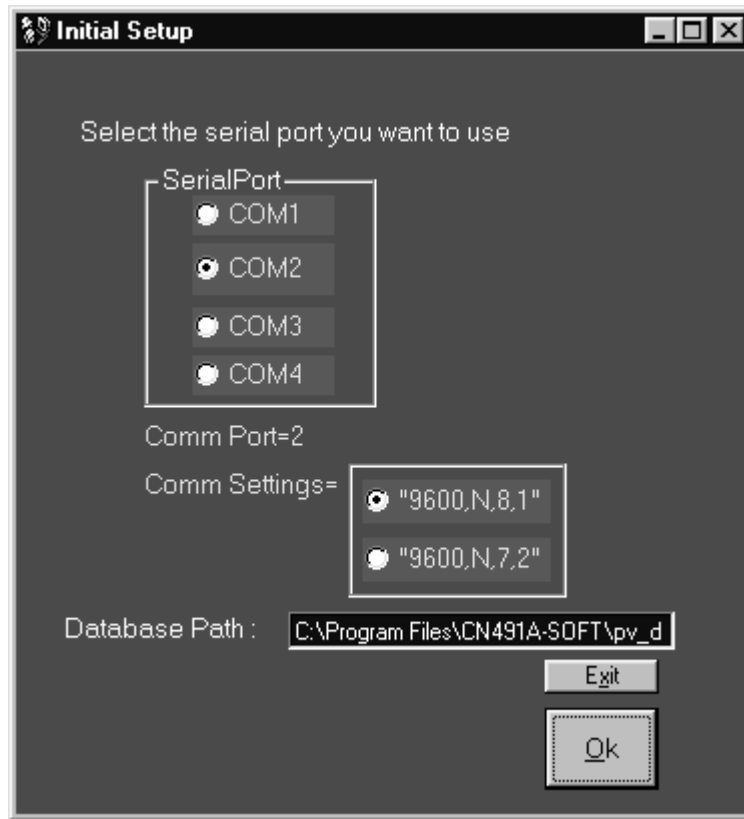


Figure 3.1 The Initial Setup window

- Select COM1, COM2, COM3, or COM4 as the serial Com Port
- Select the database file pv\_database.mdb. Whenever the program is started, the database path is directly pointed to the directory you have created during software installation.
- Click "OK" Button to finish the set-up of Com Port and Database. The Address Selection window will open.
- If you have to exit, Click "Exit" to stop execution of the program. Some error messages will be displayed if incorrect port or database path is specified.
- There are two options for Comm Settings, "9600,N,8,1" or "9600,N,7,2". The default setting is "9600,N,8,1"  
"9600,N,8,1"= 9600 Baud, No Parity,8 Data bits,1 Stop bit.



### 3.1.3 Address Selection

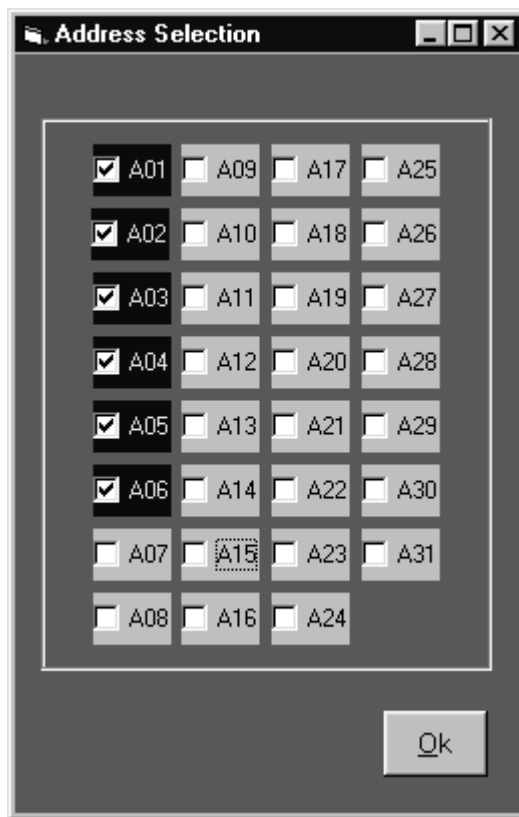


Figure 3.2 Address Selection window

- Click on icons "A01...A31" to enable/disable the addresses, and make sure the assigned addresses have the corresponding controllers with the same value for the parameter "Addr". Make sure that no two controllers are assigned the same address number.
- Click "OK" to finish all the set-ups. The CN491A-SOFT graphical interface and RS485 Communication and Parameter Table windows will be opened, and the program begins operating.
- During Initial Setup, it fetches the old selected address stored in the database and displays in the Address Selection window, and once you click the "OK", it updates the new assigned Com Port, Com Settings and addresses into the database as new default settings.

## 3.2 CN491A-SOFT Graphical Interface

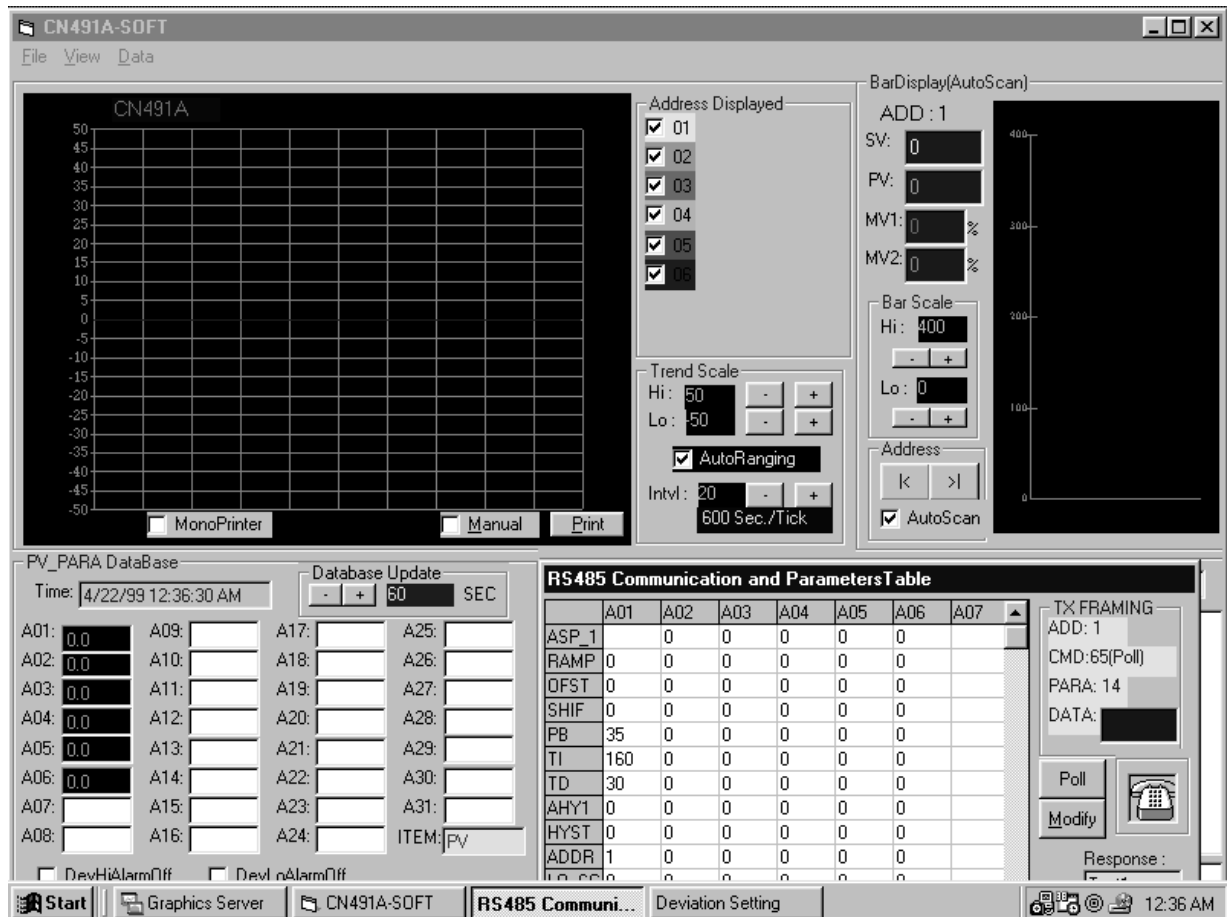


Figure 3.3 CN491A-SOFT Graphical Interface

Functional Descriptions: (from top to bottom, left to right)

- Main Menu
- Trend Display
- PV Display and Database Control
- Bar Display
- RS485 Communication and Parameters Table
- Communication Status

### 3.2.1 Trend Display/ Trend Printing

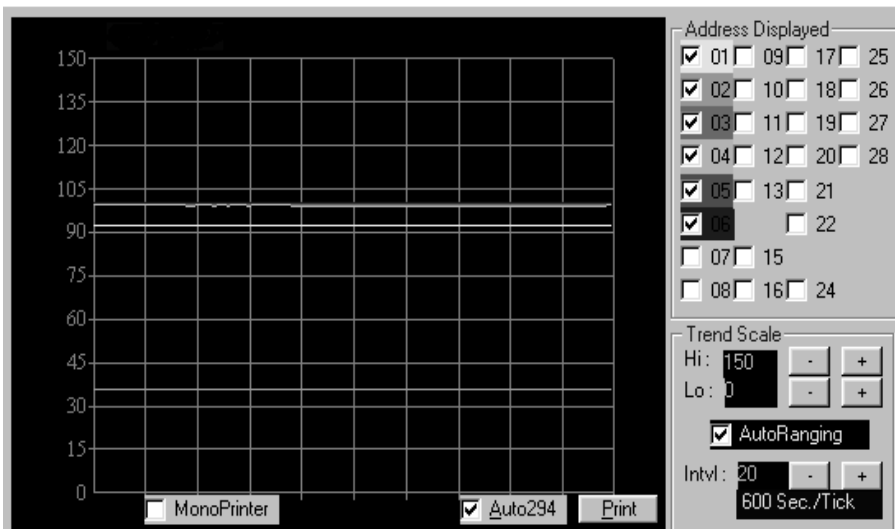


Figure 3.3.1 Trend Display

- There are up to 6 trends that can be selected in trend display. You can click on the "Address Displayed" frame members to add or remove trends assigned to the selected addresses. A different color for each trend helps you distinguish them.
- There is a text-box in the upper-left corner of trend display. You can enter a 6-character title name that will be saved in the database and shows in print-outs.
- In the "StopRanging" mode, you can click "+", "-" button in the "TrendScale" frame by altering the ScaleHi and ScaleLo with 50 Counts/Click or 10 Counts/Click.
- In the "AutoRanging" mode, the ScaleHi and ScaleLo will be changed to their appropriate value automatically.
- Check or uncheck the AutoRanging/StopRanging checkbox to select AutoRanging or StopRanging alternately.
- Click the "+", "-" button in the "Intvl" frame to change the trend display interval. The interval unit is secs/tick.
- Click the Print button to print the trend display by the system printer.
- Check or uncheck the ColorPrinter/MonoPrinter checkbox if using a color or monochrome printer.
- The trend display can also be printed out periodically, if the Auto/Manual checkbox is set on Auto mode.

### 3.2.2 Bar Display

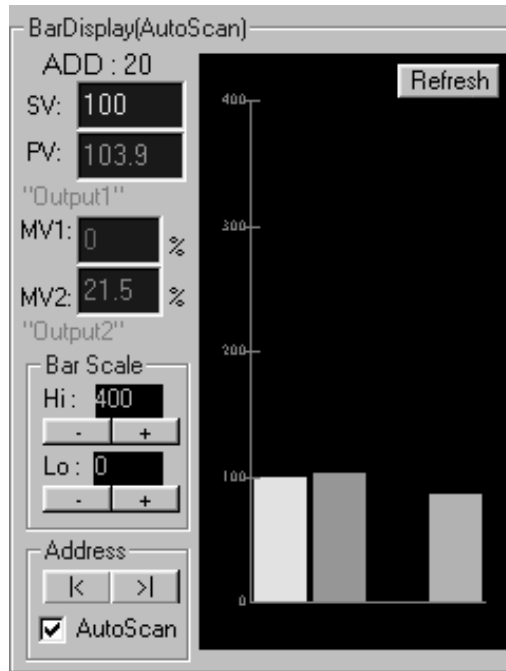


Figure 3.3.2 Bar Display Window

- The Bar display uses different colors for the Process Variable (PV), Setpoint Value (SV), Manipulated Variable (MV1 for output1, and MV2 for output2). Manipulated variable is the amount of control output that the controller delivers to the load.
- There are 2 modes for the Bar display: "AutoScan", and "StopScan". Check or uncheck "AutoScan/StopScan" checkbox in the "Address" frame to switch between these two modes.
- In "AutoScan" mode, the bar display will scan all stations periodically.
- In "StopScan" mode, the Bar display will scan a particular station. You can select the station to be displayed by clicking the ">|" or "|<" button in "Address" frame.
- Click the "+", "-" button in the "BarScale" frame to change the high and low scale of the bar display.
- Clicking the "Refresh" button will force the main program to update the active bar display.

### 3.2.3 PV Display, DevHi/DevLo Alarm and Database Control

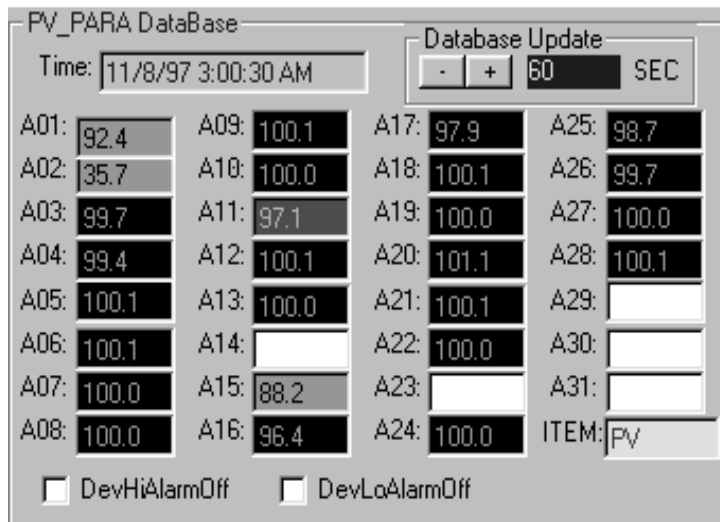


Figure 3.3.3 PV and Database Control

- Real-time process values (PV) are displayed in the "A01" to "A31" text box of the PV PARA DataBase frame. Note that the process values are always displayed to one decimal place.
- Different background color for each cell, from A01 to A31, indicates whether the corresponding process variable is inside the DevHi/DevLo limit or not.

**Red background color:  $PV > (DevHi+SV)$**

**Black background color :  $(SV-DevLo) < PV < (DevHi+SV)$**

**Green background color:  $PV < (SV-DevLo)$ .**

Note: The parameters DevHi/DevLo-Deviation High/Deviation Low are tools used only on the graphical interface on the PC, independent of the parameters *dvhi/dvLo* used on the controllers.

- You can change the value of DevHi/DevLo in run time as described in section 3.4.3.
- Check/uncheck the DevHiAlarmOn/DevHiAlarmOff checkbox to enable/disable the DevHiAlarm.
- Check/uncheck the DevLoAlarmOn/DevLoAlarmOff checkbox to enable/disable the DevHiAlarm/DevLoAlarm
- The database name, called pv\_database.mdb which is created by the Data Manager of Visual Basic, is an Access database that is directly linked with the data control designed in the PV PARA Database frame. You can open it in

real time by Datman32.exe attached in the path created by set-up, and refresh and view the historical records in the database, but do not edit it directly. See Appendix A.

- The database update interval, which indicates the time period for updating the database table "PVS1" (historical records of the process value), is 60 seconds for default setting. Click the "+" / "-" button to change the database update interval.

### 3.2.4 Communication Status Display

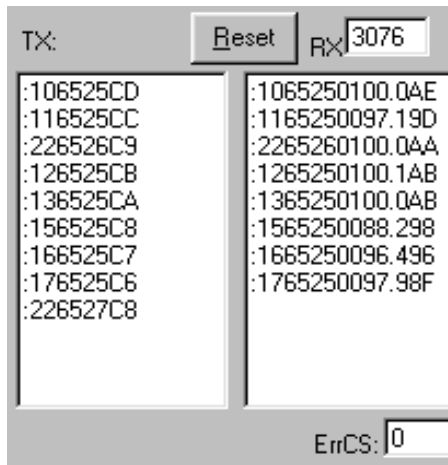


Figure 3.3.4 Communication Status Display

- The "RX" text records the number of response messages the assigned remote controllers send back to the host computer.
- The "Err" text records the number of incorrect Checksum responses.
- The "TX" text and "RX" text boxes indicate the Transmit and Receive data exchange.
- Click "Reset" button to reset all the above statistics.

### 3.3 Communication and Parameters Table

RS485 Communication and ParametersTable							
	A01	A02	A03	A04	A05	A06	A07
ASP_1	18	18	18	18	18	18	18
RAMP	0	0	0	0	0	0	0
OFST	0	0	0	0	0	0	0
SHIF	0	0	0	0	0	0	0
PB	18	18	18	18	18	20	18
TI	120	120	120	120	120	120	120
TD	40	40	40	40	40	40	40
AHY1	0	0.1	0.1	0.1	0.1	0.1	0.1
HYST	0	0.1	0.1	0.1	0.1	0.1	0.1
ADDR	1	2	3	4	5	6	7
LO_SC	0	0	0	0	0	0	0
HI_SC	999.9	999.9	999.9	999.9	999.9	999.9	999.9


**TX FRAMING**

ADD: 15

CMD:65(Poll)

PARA: 20

DATA: XXXXXXXXXX

Poll 

Modify

Response:

SaveParaS.

Figure 3.4: Communication and Parameters Table

- The parameter table is designed by the grid control, which serves as a mechanism to display data in a tabular format. However, unlike a spreadsheet, you cannot type data inside the cell directly. Reading/writing data from/to a cell is controlled by the source code.
- The columns show the addresses "A01" to "A31", and the rows show the data for the parameters.
- The values of the parameters are fetched from the database that was pointed to during start-up.

#### 3.3.1 Polling Parameters

- Click the relative cell position on the parameters table to select the target address and the parameter, and the corresponding "ADD" and "PARA" in "TX Framing" frame will be changed with the new selection.
- Click the "poll" button to read parameter from the selected remote controller, the corresponding "CMD:65(POLL)" in the "TX Framing" frame will be displayed to reflect this selection.
- After you have selected the "ADD", "POLL", and "PARA", click the telephone icon to send the data in TX Framing to the communication port.
- The received result will be displayed in the "Response"

text, and updated in the corresponding cell of the parameters table.

### 3.3.2 Modifying Parameters

- Click the relative cell position on the Parameters table to select the target address and parameter, and the corresponding "ADD" and "PARA" in the "TX Framing" frame will be changed with the new selection.
- Click the "Modify" button to write parameters to the selected controller. The corresponding "CMD:66(Modify)" in the "TX Framing" frame will be displayed to reflect this selection.
- Enter the desired data in the "DATA" text of the "TX Framing" frame.
- After you have selected the "ADD", "MODIFY", "PARA" and "DATA", click the telephone icon to send the text frame "ADD, Modify, PARA, DATA" to the communication port.
- The Receive result will be displayed in the "Response" text, and updated in the corresponding cell of the parameter table.

### 3.3.3 Updating Parameters Automatically

If, for some reason, the parameters of the remote controllers get changed, CN491A-SOFT can detect the change.

There is a timer interrupt designed in the program. Once the timer interrupt is enabled, it forces the main program to service the "Polling parameters" subroutine immediately, that will poll the parameter for that interrupt, and then poll all the other parameters. So the parameters table always keeps the newly updated parameters.

You may click on any cell in the parameter table to disable the timer interrupt, and click on the telephone to alternately enable it.

Please review the steps of Polling/Modifying parameters in section 3.3.1 and 3.3.2. The timer interrupt is disabled at the instant you click a cell in the parameters table, and is enabled at the instant you click the telephone icon.



### 3.3.4 Saving the Updated Parameters to Database

Click the "SaveParaS" button to save the updated parameters to the database that was pointed to in the Initial Setup window, in section 3.1.2. This means that you must decide when to do "SavePara" function, otherwise, the database will always keep the old parameters.

### 3.4 Modifying All Addresses, Modifying Single Address and DevHi/Lo Settings

- When CN491A-SOFT is launched, it fetches the parameters from the database that was pointed to in the Initial Setup window, and then fills the parameters in the cells of the grid table.
- Unlike the grid table in section 3.3, the parameters in the grid table are not updated in run-time. It just keeps the initial (default) parameters for later use.
- You can open a different database file that refers to a different process, during start-up and then do ModifyAll to replace all parameters with the new settings.

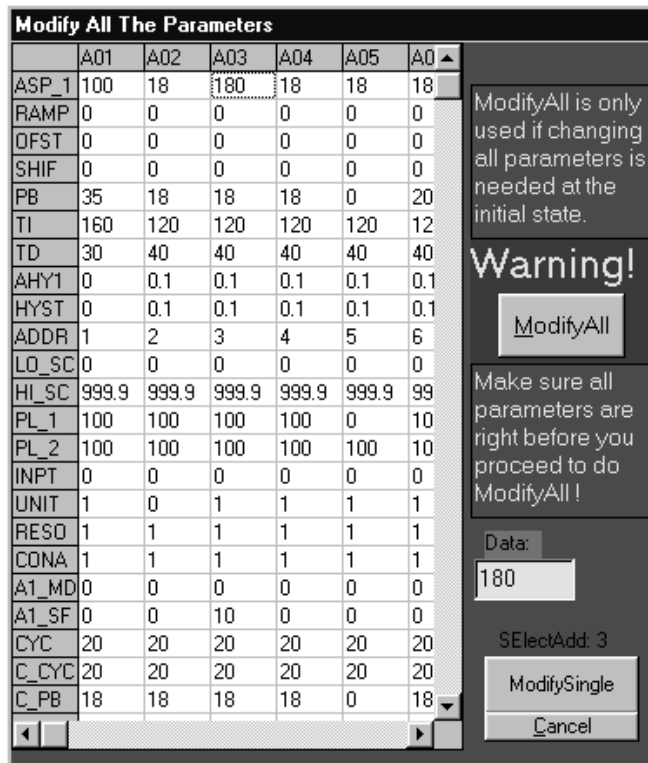
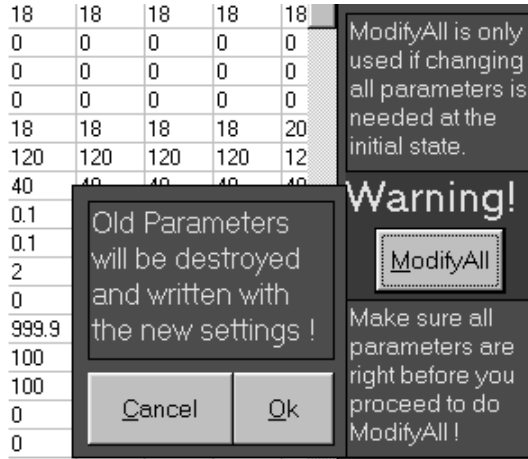


Figure 3.5: Modify All Parameters

### 3.4.1 Modifying Parameters to All Addresses

- To change a parameter, click the relative cell in the grid. The "Data" text will display its value. Enter the desired data in the "Data" text, and the new data will be displayed in the relative cell.



- Click the "ModifyAll" button to write all the parameters in the grid to the corresponding remote controller.
- ModifyAll is used only if changing all parameters is needed at the initial state. Please make sure that all parameters are right before you proceed to do Modifyall.

- After clicking ModifyAll button, a warning frame will be displayed, and you can click "Ok" button to continue, or click "Cancel" button if you decide to exit ModifyAll operation.

### 3.4.2 Modifying Parameters to a Single Address

- Click a grid cell which corresponds to an address of the parameter you are going to modify.
- Click the ModifySingle button (on the bottom-right of Figure 3.5) to write parameters to the selected address.
- Click Cancel button to exit.

### 3.4.3 Changing the DevHi/DevLo Settings

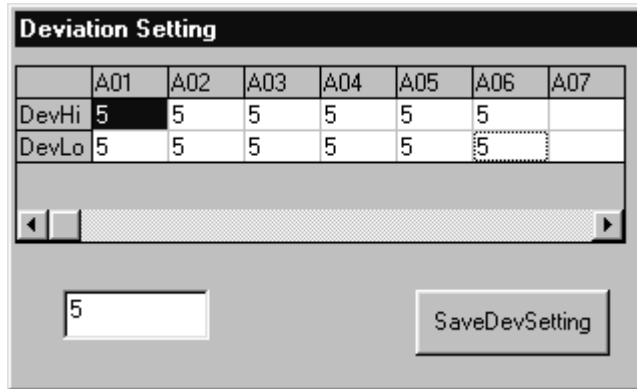
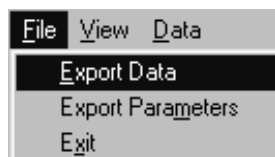


Figure 3.6: Deviation Hi/Lo Settings

- Click View/ DevHi/DevLo setting on the menu, and the Deviation Setting window will be displayed.
- To change a DevHi/DevLo setting, click the corresponding cell in the grid, and the data box will display its value. Enter the desired data in the box, and the new data will fill in the corresponding cell.
- After Changing the DevHi/DevLo setting, you must click the SaveDevSetting button to save the new setting to database.
- To find out how it works, go to section 3.2.3

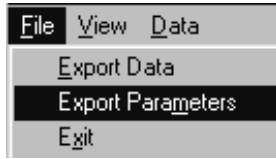
## 3.5 Main Menu Operation

### 3.5.1 Export Data



- Click File/Export Data to export data. A file-export dialog box will be displayed.
- Specify a filename and the path the data file needs to be exported.
- The exported data file can easily be processed by any text editor or imported to spreadsheets like Microsoft™ Excel.

### 3.5.2 Export Parameters



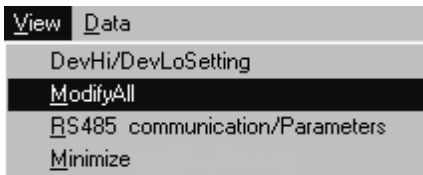
- You can use the "Export Parameters" function to export the parameters saved in the database table to any specified file.
- Click the File/ExportParameters in the "File" menu to export parameters. A dialog box will be displayed asking you whether to export parameters or not.
- Click "Yes" button, and a "File Save" dialog box will be displayed to let you specify the path of the file that you want the parameters exported to.
- The exported file is a simple text file, every field of a record will be separated by comma, and every record will be separated by CR and LF. So it can easily be processed by any text editor or exported to spreadsheets like Microsoft™ Excel or Wordpad. See Appendix B.

### 3.5.3 RS485 Communication and Parameters Table



- Click the "View/RS485 Communication/Parameters" item, the "RS485 Communication and Parameters Table" window will be displayed.

### 3.5.4 ModifyAll



- Click the "View/ModifyAll" item, and the "ModifyAll" window will be displayed.

### 3.5.5 Minimize



- Click the "Minimize" item to minimize the CN491A-SOFT graphical interface to an icon.

### 3.5.6 DevHi/DevLo Setting



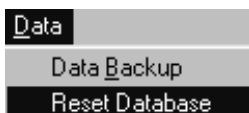
- Click the "DevHi/DevLOSetting" item, the Deviation Hi/Lo setting window will be displayed.

### 3.5.7 Data Backup



- Click the "Data/Data Backup" to backup the database file, and a dialog box will be displayed to inform you to backup the database file.
- Click the "Yes" button, and a dialog box will be displayed to let you specify the path of file that you want to backup the database to.
- The database file will have the format of a Microsoft™ Access data file with the extension name "\*.mdb"

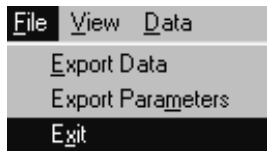
### 3.5.8 Reset Database



- Click the "Data/Reset Database" item to clear all the historical records in the "PVS1" table of the database file.

- After clicking the "Data/Reset database" item, a dialog box will be displayed to inform you whether to clear all the historical records in the database file or not.
- If you click the "Yes" button, all the historical records in table "PVS1" of the database file will be deleted.

### 3.5.9 Exiting



- Click the "File/Exit" item to end CN491A-SOFT. A Yes/No box will be display. Click "Yes" button to continue Exit or Click "No" button to cancel Exit.
- Clicking on the "close" button in the control box on the top-right corner of CN491A-SOFT window will also let you exit the program.

## 4.0 Database of CN491A-SOFT

- The database that is created by the Data Manager of Visual Basic is called pv-database.mdb. It is designed to store the initial setup process Value (PV), and parameter information essential for operation.
- Whenever the program starts, it fetches the initial setup variables and parameters from the database pointed by start-up as described in section 3.1. During the program run-time, the real-time PV values are written into the database at the specified interval. To store the updated parameters into database, please follow the steps in section 3.3.4.
- The database is composed of two tables: PVS, PVS1. PVS stores all the parameters and initial settings for all remote controllers. PVS1 stores the historical data of process values (PV) for all remote controllers.
- It is a standard Access™ database file, so you can easily open it by any Access compatible tools. But in the program run-time, you have to open it by Dataman32.exe that is attached with Visual Basic tools, because database is directly linked to CN491A-SOFT through Data Control.

## 5.0 Protocol

In the half-duplex, multi-drop system, the Data Terminal Equipment (DTE) are connected together by two wires as shown in Figure 2.1. Therefore we must ensure that all transmissions are carried out in a controlled way and that two transmissions do not occur simultaneously. Such architectures are normally used in applications that involve a single master computer communicating with a number of remote computers.

In order to control access to the shared transmission messages equitably, a character-oriented data link protocol is used to operate in a poll-modify mode. When the master wishes to receive data from a remote unit it sends the remote unit a poll framing, and then stops and waits until a poll-response framing is received. If the master wants to send data to a remote unit, it sends a Modify command and then stops and waits until a Modify response framing is received.

### 5.1 ASCII Framing

Framing in ASCII transmission mode is accomplished by the use of the unique colon ":" character to indicate beginning of frame and carriage return "CR" and line feed "LF" to delineate end of frame. The line feed character also serves as a synchronizing character which indicates that the transmitting station is ready to receive an immediate reply. See Figure 5.1.

BEG. OF FRAME	ADD ADDRESS	CMD COMMAND	PARA PARAMETER	DATA	CHECKSUM CS1+CS2	EOF	READY TO RECEIVE
:	2-CHAR	2-CHAR	2-CHAR	6-CHAR	2-CHAR	CR	LF

Figure 5.1 ASCII Message Frame Format

#### 5.1.1 Address Field

The address field immediately follows the beginning of frame and consists of 2 ASCII characters that indicate the user-assigned address of remote device.

Each remote unit must be assigned a unique address and only the addressed remote unit will respond to a query that contains its address. When the remote unit sends a response, the address of that unit lets the master know which unit it is communicating with. The addresses for the remote units can be set from 1 to 191.

#### 5.1.2 Command Field

The Command Field follows the address field and consists of



2 characters (ASCII decimal) that specify the poll or modify query the master wants to send to the assigned address. See Command Codes Table, section 6.1

In response to the poll or modify query from the master, the response message from the assigned address must contain the same command code.

Poll command code = 65  
Modify command code = 66.

### 5.1.3 Parameter Field

The parameter field also consists of 2 characters. Every parameter on the remote controller must be assigned a corresponding code for data exchange. See Parameter and Data Codes Table, section 6.2.

Example:  
Parameter = RAMP  
Code = 02

In response to a query from the master, the response message from the assigned address must contain the same parameter code.

### 5.1.4 Data Field

The data field consists of 6 characters. It is a 6-digit decimal number specified in section 6.2, Parameter and Data Codes Table.

Example:  
Data = K thermocouple input  
Code = 000001

The "+" character is assumed if the data is unsigned, and the "-" character is always the first digit of the data field. Decimal point character is also assigned a digit.

### 5.1.5 Checksum Protocol

The Checksum is used to increase security on the RS485 link. The protocol enables both the master and the remote units to detect errors in transmission, making the data exchange more reliable.

The procedure for adding checksum

- a. Take the Sum of the ASCII code of the message's character in the "ADD", "CMD", "PARA" and the "DATA" fields. Ignore the carries of Sum.
- b. Take the 2's complement of Sum.  
2's Complement Sum = 1's complement Sum + 1

The 2's complement sum is an 8-bit binary, and can be formatted with 2-Hex.

- c. Take Checksum1 = the hex of the four MSBs of 2's

complement sum

Checksum2= the hex of the four LSBs of 2's CSum.

**Example 5.1:** If ADD=01, CMD=65, PARA=27 then checksum = ?.

Code	ASCII
ADD 0	0011 0000
1	0011 0001
CMD 6	0011 0110
5	0011 0101
PARA 2	0011 0010
7	0011 0111
Sum	0011 0101
1's C Sum	1100 1010
	+ 1
2'CSum	1100 1011

2'Csum = Checksum = CB (Hex)

So the ASCII frame = ":" + "016527CB" + "CR" + "LF"

**Example 5.2:** If ADD=01, CMD=66, PARA=26, DATA = -12.5 then checksum = ?.

Code	ASCII
ADD 0	0011 0000
1	0011 0001
CMD 6	0011 0110
6	0011 0110
PARA 2	0011 0010
6	0011 0110
DATA -	0010 1101
0	0011 0000
1	0011 0001
2	0011 0010
.	0010 1110
5	0011 0101
Sum	0101 1000
1's CSum	1010 0111
	+ 1
2'CSum	1010 1000

2'Csum = Checksum = A8 (Hex)

So the ASCII frame = ":" + "016626-12.5A8" + "CR" + "LF"

## 5.2 Command Summary

### 5.2.1 Poll a Parameter from the Assigned Address

START CHAR	ADD		CMD		PARA		CHECK SUM		CR	LF
:	X	X	6	5	X	X	X	X	CR	LF

Figure 5.2 Poll Framing

A "Poll Framing" message sent to the RS485 port allows the master to read a parameter from any controller on the RS485 link.

Figure 5.2 shows the "poll framing" message format. The following codes must be entered into its corresponding field.

ADD: from 0 to 191, the assigned address

CMD: 65 (poll)

PARA: See section 6.2, the Parameter & Data Codes Table.

Checksum: See Section 5.1.5, Checksum Protocol.

START CHAR	ADD		CMD		PARA		DATA						CHECK SUM		CR	LF	
:	X	X	6	5	X	X	X	X	X	X	X	X	X	X	X	CR	LF

Figure 5.3 Poll Response Framing

When there is a "Poll" request from the master, only the assigned address can answer with the "poll response framing" to inform the master of the parameter and the data attached with it. The codes of "ADD", "CMD" and "PARA" in the "poll response framing" must be the same as the codes in the "poll framing." Figure 5.3 shows the poll response framing.

### 5.2.2 Modify a parameter to the Assigned Address

START CHAR	ADD		CMD		PARA		DATA						CHECK SUM		CR	LF	
:	X	X	6	6	X	X	X	X	X	X	X	X	X	X	X	CR	LF

Figure 5.4 Modify Framing

A "Modify Framing" message to the RS485 port allows the master to write a parameter to any controller on the RS485 link.

Figure 5.4 shows the "modify framing" message, and the

following codes must be entered into its corresponding field.

ADD: from 0 to 191, the assigned address

CMD: 65 (poll)

PARA: See section 6.2, the parameter and data codes table for reference.

See section 5.1.4 and section 5.1.5

Checksum: See Section 5.1.5, Checksum protocol

STA CHAR	ADD		CMD		PARA		DATA						CHECK SUM		CR	LF	
:	X	X	6	6	X	X	X	X	X	X	X	X	X	X	X	CR	LF

Figure 5.5 Modify Response Framing

In response to the "Modify" request from the master, only the assigned address can answer the "Modify response framing" to inform the master that the "modify command" is followed completely. The codes of the "ADD", "CMD" and "PARA" in the "Modify response framing" must be same as the codes in the "modify framing". Figure 5.5 shows the Modify Response framing.

## 6.0 Command, Parameter and Data Codes Tables

### 6.1 Command Codes Table

<b>CMD</b>	<b>CODE</b>	<b>MEANING</b>	<b>ACTION</b>
<b>Poll</b>	65	Read the parameters with data from the selected address by the master	<ol style="list-style-type: none"><li>1. Only the master can issue the "poll" request. It allows the master to retrieve the parameter with data from the selected remote address.</li><li>2. The "poll framing" is defined in Figure 5.2</li><li>3. Only the selected remote address is permitted to answer the "poll response framing", which is defined in Figure 5.3, to the master.</li></ol>
<b>Modify</b>	66	Write the parameters with data from the master to the selected remote address	<ol style="list-style-type: none"><li>1. Only the master can issue the "modify" request, It allows the master to write the parameter with data to the selected remote address.</li><li>2. The "modify framing" is defined in Figure 5.4.</li><li>3. Only the selected remote address is permitted to answer the "modify response framing", which is defined in Figure 5.5, to the master.</li></ol>

## 6.2 Parameter and Data Codes Table

PARAMETERS			DATA	
PARA	CODE	DESCRIPTION	CODE	VALUE
<b>ASP_1</b>	<b>01</b>	Alarm 1 Set Point Value or Dwell Time (A1_SF = T0_ON or T0_OFF)	<b>XXXX.X</b>	Low Scale to High Scale Value (for Full Scale Alarm), -110.0 to 111.0°C or -199.9 to 199.9 °F (for Deviation and Deviation Band Alarm), 0 to 999.9 minutes (for Dwell Time) **18.0 °F
<b>RAMP</b>	<b>02</b>	Ramp Rate	<b>XXXX.X</b>	0 to 55.55 °C/minute or 0 to 99.9 °F/minute
<b>OFST</b>	<b>03</b>	Offset Value for Manual Reset	<b>XXX.XX</b>	0 to 100 % ** 0.0
<b>SHIF</b>	<b>04</b>	Shift Process Value	<b>XXXX.X</b>	-111.0 to 111.0 °C or -199.9 to 199.9 °F ** 0.0 °F
<b>PB</b>	<b>05</b>	Proportional Band of Output 1	<b>XXXX.X</b>	0 to 200 °C or 0 to 360 °F 0: For ON-OFF Control / **18.0 °F
<b>TI</b>	<b>06</b>	Integral (Reset) Time of Output 1	<b>XXXXXX</b>	0 to 3600 Seconds ** 120
<b>TD</b>	<b>07</b>	Derivative (Reset) Time of Output 1	<b>XXXXXX</b>	0 to 1000 Seconds ** 40
<b>AHY_1</b>	<b>08</b>	Hysteresis of Alarm 1	<b>XXXX.X</b>	0 to 11.0 °C or 0.1 19.9 °F **0.0
<b>HYST</b>	<b>09</b>	Hysteresis of On/Off Control	<b>XXXX.X</b>	0 to 11.0 °C or 0.1 19.9 °F **0.0
<b>ADDR</b>	<b>10</b>	Address of the Unit for Communication	<b>NONE</b>	1 to 199, Poll (Read) Only
<b>LO_SC</b>	<b>11</b>	Low Scale of Range Adjust for your process	<b>XXXX.X</b>	Minimum Value for the Selected Input (INPUT) to High Scale (HISC) **000.0 °F
<b>HI_SC</b>	<b>12</b>	High Scale of Range Adjust for your process	<b>XXXX.X</b>	Low Scale (LOSC) to maximum value for the selected Input (INPUT) **999.9 °F
<b>PL1</b>	<b>13</b>	Power Limit of Output 1	<b>XXXXXX</b>	0 to 100 % **100
<b>PL2</b>	<b>14</b>	Power Limits of Output 2	<b>XXXXXX</b>	0 to 100 % **100

PARAMETERS			DATA	
PARA	CODE	DESCRIPTION	CODE	VALUE
<b>INPT</b>	<b>15</b>	Input Type Selection	<b>000000</b>	<b>J-tC</b> : J Type T/C
			<b>00 0001</b>	** <b>K-tC</b> : K Type T/C
			<b>000002</b>	<b>t-tC</b> : T Type T/C
			<b>000003</b>	<b>E-tC</b> : E Type T/C
			<b>000004</b>	<b>b-tC</b> : B Type T/C
			<b>000005</b>	<b>r-tC</b> : R Type T/C
			<b>000006</b>	<b>S-tC</b> : S Type T/C
			<b>000007</b>	<b>n-tC</b> : N Type T/C
			<b>000008</b>	<b>Pt_dn</b> : PT100 DIN
			<b>000009</b>	<b>Pt_JS</b> : PT100 JIS
			<b>000010</b>	<b>4-20</b> : 4 to 20 mA
			<b>000011</b>	<b>0-20</b> : 0 to 20 mA
			<b>000012</b>	<b>0-1V</b> : 0 to 1V
			<b>000013</b>	<b>0-5V</b> : 0 to 5V
			<b>000014</b>	<b>1-5V</b> : 1 to 5V
<b>000015</b>	<b>0-10V</b> : 0 to 10V			
<b>UNIT</b>	<b>16</b>	Units Selection	<b>000000</b>	<b>C</b> : Degree C
			<b>000001</b>	** <b>F</b> : Degree F
			<b>000002</b>	<b>P.U</b> : Process Unit (Voltage or Current Input)
<b>RESO</b>	<b>17</b>	Resolution Selection	<b>000000</b>	<b>no.dP</b> : No Decimal Point
			<b>000001</b>	<b>1.dP</b> : 1 Digit Decimal
			<b>000002</b>	<b>2.dP</b> : 2 Digit Decimal ( Only for Linear Voltage or Current Input)
<b>CONA</b>	<b>18</b>	Control Action of Output 1	<b>000000</b>	<b>dirt</b> : Direct (Cooling) Action
			<b>000001</b>	** <b>rEvr</b> : Reverse(Heating) Action

PARAMETERS			DATA	
PARA	CODE	DESCRIPTION	CODE	VALUE
<b>A1_MD</b>	<b>19</b>	Alarm 1 Mode	<b>000000</b>	<b>** dv_hi</b> : Deviation High Alarm
			<b>000001</b>	<b>dv.Lo</b> : Deviation Low Alarm
			<b>000002</b>	<b>db.hi</b> : Deviation Band High Alarm
			<b>000003</b>	<b>db.Lo</b> : Deviation Band Low Alarm
			<b>000004</b>	<b>FS.hi</b> : Full Scale High Alarm
			<b>000005</b>	<b>FS.Lo</b> : Full Scale Low Alarm
<b>A1_SF</b>	<b>20</b>	Alarm 1 Special Function	<b>000000</b>	<b>** nonE</b> : No Special Function
			<b>000001</b>	<b>LtCh</b> : Alarm with Latch Function
			<b>000002</b>	<b>hoLd</b> : Alarm with Hold Function
			<b>000003</b>	<b>Lt.ho</b> : Alarm with Latch and Hold Function
			<b>000004</b>	<b>to.on</b> : Dwell Timer ON as Timeout
<b>000005</b>	<b>to.oF</b> : Dwell Timer Off as Timeout			
<b>CYC</b>	<b>21</b>	Proportional Cycle time of Output 1	<b>XXXXXX</b>	0 to 99 Seconds, 0 for Linear Current / Voltage Output **20
<b>CCYC</b>	<b>22</b>	Cooling Cycle Time	<b>XXXXXX</b>	0 to 99 Seconds, 0 for Linear Current / Voltage Output **20
<b>C_PB</b>	<b>23</b>	Cooling P Band	<b>XXXX.X</b>	0.0 to 200.0 °C or 0.1 to 360.0 °F , **18.0 °F
<b>D_B</b>	<b>24</b>	Dead Band for PB and CPB	<b>XXXX.X</b>	-111.0 to 111.0 °C or -199.9 to 199.9 °F , ** 0.0°F
<b>PV</b>	<b>25</b>	The Process Value	<b>None</b>	Poll (Read) Only
<b>SV</b>	<b>26</b>	Set Point Value	<b>XXXX.X</b>	From Low Scale to High Scale Value
<b>MV1</b>	<b>27</b>	Amount of Control Output 1	<b>None</b>	0 to 100.0%, Poll (Read) Only
<b>MV2</b>	<b>28</b>	Amount of Control Output 2	<b>None</b>	0 to 100.0%, Poll (Read) Only

Note: \*\* Denotes the Default Setting



## 7.0 Programming Examples

### Example 7.1:

The master wants to read the Process Value (PV) from the Remote address (03). What is the "ASCII framing" that has to be sent to the RS485 port by the master?

#### Answer:

Refer to the "Poll framing" format shown below.

START CHAR	ADD		CMD		PARA		CHECK SUM		CR	LF
:	X	X	6	5	X	X	X	X	CR	LF

ADD = "03", the assigned remote address

CMD = "65", Poll command

PARA = "25", code for "PV". Refer to the Parameter and Data Codes Table in section 6.2.

Checksum = "CB". To get the checksum, follow the steps as described in section 5.1.5.

So the "ASCII framing" = ":" + "036525CB" + "CR" + "LF"

Note: After sending the "poll framing" to the RS485 port, the master must stop and wait until it receives a "poll response framing" from the assigned remote address "03" on the RS485 port.

### Example 7.2:

The master wants to write the Setpoint Value (SV) to the Remote address(01) with a value 99.5. What is the "ASCII framing" that should be sent to the RS485 port by the master?

#### Answer:

Refer to the "Modify framing" format shown below.

START CHAR	ADD		CMD		PARA		DATA						CHECK SUM		CR	LF	
:	X	X	6	6	X	X	X	X	X	X	X	X	X	X	X	CR	LF

ADD = "01", the assigned remote address.

CMD = "66", Modify command.

PARA = "26", code for "SV". Refer to the Parameters and Data Codes Table in section 6.2.

Checksum = "96". To get the checksum, follow the steps as described in section 5.1.5.

So the "ASCII framing" =

":" + "0166260099.596" + "CR" + "LF"

Note: After sending the "Modify framing" to the RS485 port, the master must stop and wait until it receives a "Modify response framing" from the assigned remote address 01 on the RS485 port.

**Example 7.3:**

How can you program the Com Port if using an RS232/485 converter box?

**Answer:**

If using an RS232/485 converter box, switching between transmitting and receiving is controlled by the RTS (Request to Send) handshaking signal.

When the PC wishes to transmit data to a remote unit, the PC must enable the RTS first. On the contrary, when the PC wishes to receive data from a remote unit, the PC must disable the RTS.

So the following steps are needed for programming:

1. Set up the Com Port
2. Enable the Com Port
3. Enable RTS
4. Move the TX Framing to the Com Port
5. Wait until TX Framing has finished transmission
6. Disable the RTS, and wait for the RX response
7. If timed out (about 0.4 second for poll (read) command, and 0.8 second for modify (write) command), then restart
8. Read the RX Response in the Com Port
9. Restart next cycle and go to step 3.

Note: If the RTS signal is not controlled in time, for example, your program enables/disables the RTS during TX/RX, but the Com Port does not respond immediately, a framing error will occur and causes transmission failure.

## 8.0 DDE to other Applications

The CN491A-SOFT supports DDE communication. Users can write their own application to read/write data from/to CN491A-SOFT.

1. This version now supports reading PV, SV, MV1, MV2, PB, TI, TD and writing SV, PB, TI, TD data for all remote addresses.

2. The DDE protocols are as follows:

```
Application : CN491A-SOFT
Topics : frmDDE
Items : PV_DATA ( n )
        SV_DATA ( n )
        MV_DATA ( n )
        MV2_DATA ( n )
        PB_DATA ( n )
        TI_DATA ( n )
        TD_DATA ( n )    (n is the remote address)
```

3. Please create DDE link in run-time. You can reference the following codes. Maybe it is suitable to substitute them during initialization like form load:

```
Text1.LinkMode = vbLinkNone
Text1.LinkTopic = "CN491A-SOFT|frmDDE"
Text1.LinkItem = "PV_DATA(1)"
Text1.LinkMode = vbLinkAutomatic
```

Assume Text1 is a text control that you want to link to PV of remote Address 1.

4. You can write back to remote controllers through DDE LinkPoke. The parameters that can be modified are: SV, PB, TI, TD. The DDE protocol is similar to item 2. A sample code is illustrated as follows:

```
Text2.LinkMode = vbLinkNone
Text2.LinkTopic = "CN491A-SOFT|frmDDE"
Text2.LinkItem = "SV_DATA(1)"
Text2.LinkMode = vbLinManual
Text2.Text = InputBox("Enter New SV:")
Text2.LinkPoke
Text2.LinkMode = vbLinkAutomatic
```

Assume Text2 is linked to SV of Remote node 1. The CN491A-SOFT will check the data poked from DDE. If it is different from the parameter in database, communication will be started to set the corresponding parameter to a new value.

5. Copy & Post Link mechanism to create DDE link in design time is not supported.

## 8.1 DDE Demo

Design a DDE to read/write data from/to Address01

### Design Time:

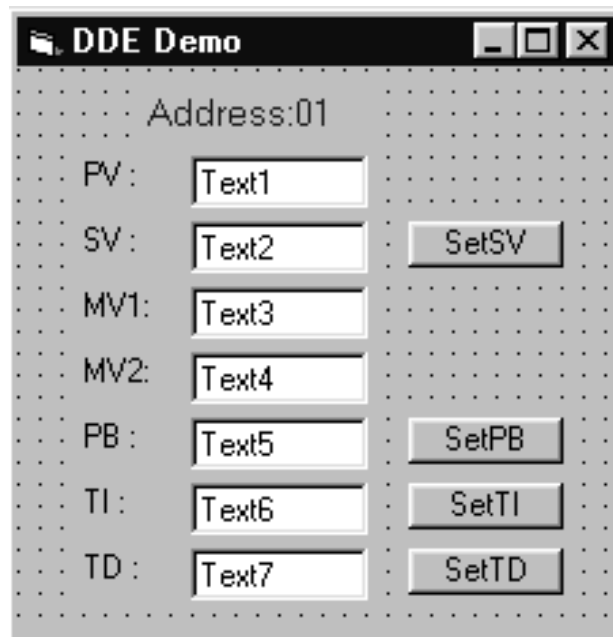


Figure 8.1 the from DDE Demo

- Design a form like Figure 8.1
- Write source code:

Option Explicit

```
Private Sub cmdSetSV_Click()  
    Text2.LinkMode = vbLinkNone  
    Text2.LinkTopic = "CN491A-SOFT|frmDDE"  
    Text2.LinkItem = "SV_DATA(1)"  
    Text2.LinkMode = vbLinkManual  
    Text2.Text = InputBox("Enter SV")  
    Text2.LinkPoke  
    Text2.LinkMode = vbLinkAutomatic  
End Sub
```

```
Private Sub cmdSetTI_Click()  
  
    Text6.LinkMode = vbLinkNone  
    Text6.LinkTopic = "CN491A-SOFT|frmDDE"  
    Text6.LinkItem = "TI_DATA(1)"  
    Text6.LinkMode = vbLinkManual  
    Text6.Text = InputBox("Enter TI")  
    Text6.LinkPoke  
  
    Text6.LinkMode = vbLinkAutomatic  
  
End Sub
```

```

Private Sub cmdSetTD_Click()

    Text7.LinkMode = vbLinkNone
    Text7.LinkTopic = "CN491A-SOFT|frmDDE"
    Text7.LinkItem = "TD_DATA(1)"
    Text7.LinkMode = vbLinkManual
    Text7.Text = InputBox("Enter TD")
    Text7.LinkPoke

    Text7.LinkMode = vbLinkAutomatic

End Sub

Private Sub cmdSetPB_Click()

    Text5.LinkMode = vbLinkNone
    Text5.LinkTopic = "CN491A-SOFT|frmDDE"
    Text5.LinkItem = "PB_DATA(1)"
    Text5.LinkMode = vbLinkManual
    Text5.Text = InputBox("Enter PB")
    Text5.LinkPoke

    Text5.LinkMode = vbLinkAutomatic

End Sub

Private Sub Form_Load()

    Text1.LinkMode = vbLinkNone
    Text2.LinkMode = vbLinkNone
    Text3.LinkMode = vbLinkNone
    Text4.LinkMode = vbLinkNone
    Text5.LinkMode = vbLinkNone
    Text6.LinkMode = vbLinkNone
    Text7.LinkMode = vbLinkNone

    Text1.LinkTopic = "CN491A-SOFT|frmDDE"
    Text2.LinkTopic = "CN491A-SOFT|frmDDE"
    Text2.LinkTopic = "CN491A-SOFT|frmDDE"
    Text3.LinkTopic = "CN491A-SOFT|frmDDE"
    Text4.LinkTopic = "CN491A-SOFT|frmDDE"
    Text5.LinkTopic = "CN491A-SOFT|frmDDE"
    Text6.LinkTopic = "CN491A-SOFT|frmDDE"
    Text7.LinkTopic = "CN491A-SOFT|frmDDE"

    Text1.LinkItem = "PV_DATA(1)"
    Text2.LinkItem = "SV_DATA(1)"
    Text3.LinkItem = "MV_DATA(1)"
    Text4.LinkItem = "MV2_DATA(1)"
    Text5.LinkItem = "PB_DATA(1)"
    Text6.LinkItem = "TI_DATA(1)"
    Text7.LinkItem = "TD_DATA(1)"

```

```

Text1.LinkMode = vbLinkAutomatic
Text2.LinkMode = vbLinkAutomatic
Text3.LinkMode = vbLinkAutomatic
Text4.LinkMode = vbLinkAutomatic
Text5.LinkMode = vbLinkAutomatic
Text6.LinkMode = vbLinkAutomatic
Text7.LinkMode = vbLinkAutomatic

```

End Sub

- Make an executable file named: DDECLT.exe

### Run Time:

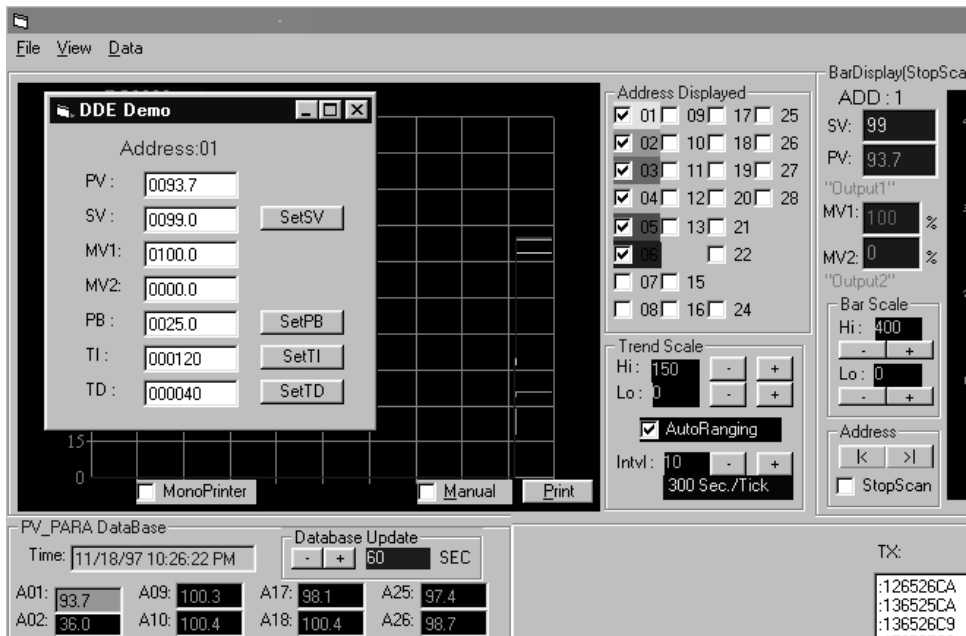


Figure 8.2 The DDECLT linking CN491A-SOFT

- Execute the file DDECLT.exe, and a form like Figure 8.2 will appear. The DDECLT.exe is now linked to CN491A-SOFT! The corresponding text box shows the linked data.
- To write SV, PB, TI, TD to Address 01 through DDECLT.exe, click the corresponding Set\_\_ button. An input box will show; enter a set value and click "OK" button to write it to CN491A-SOFT or click "Cancel" button to cancel it.

## 9.0 Appendix

### Appendix A

Open the database file named: PV\_Database.mdb by Datman32.exe.

- execute Datman32.exe in run time
- open the file PV\_Database.mdb, you will see a form like Figure 9.1.

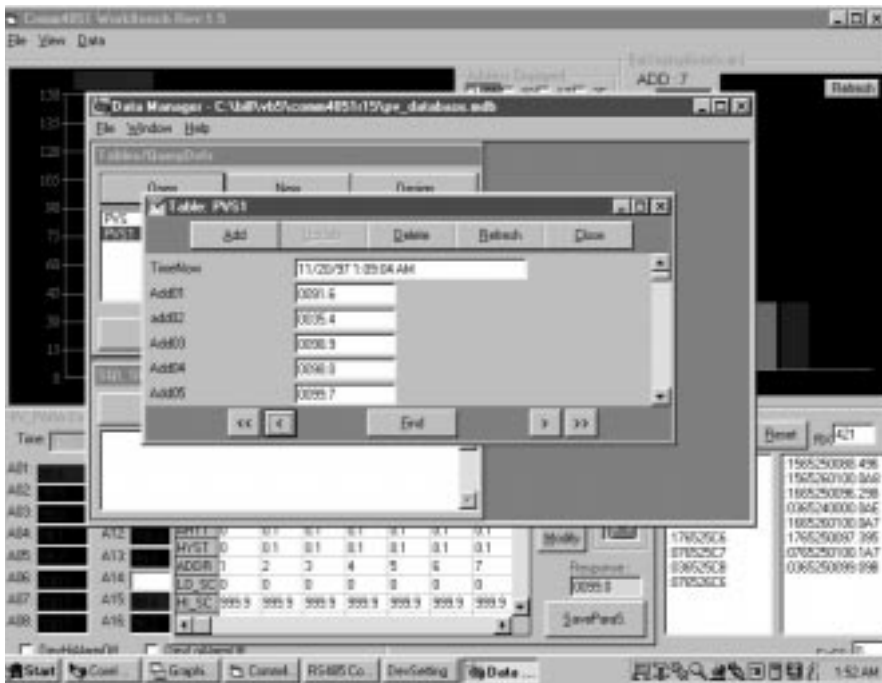


Figure 9.1 Opening database in run time

- Click the "Refresh" button. You may view the new updated data but do not edit it unless it is necessary.





# Appendix C

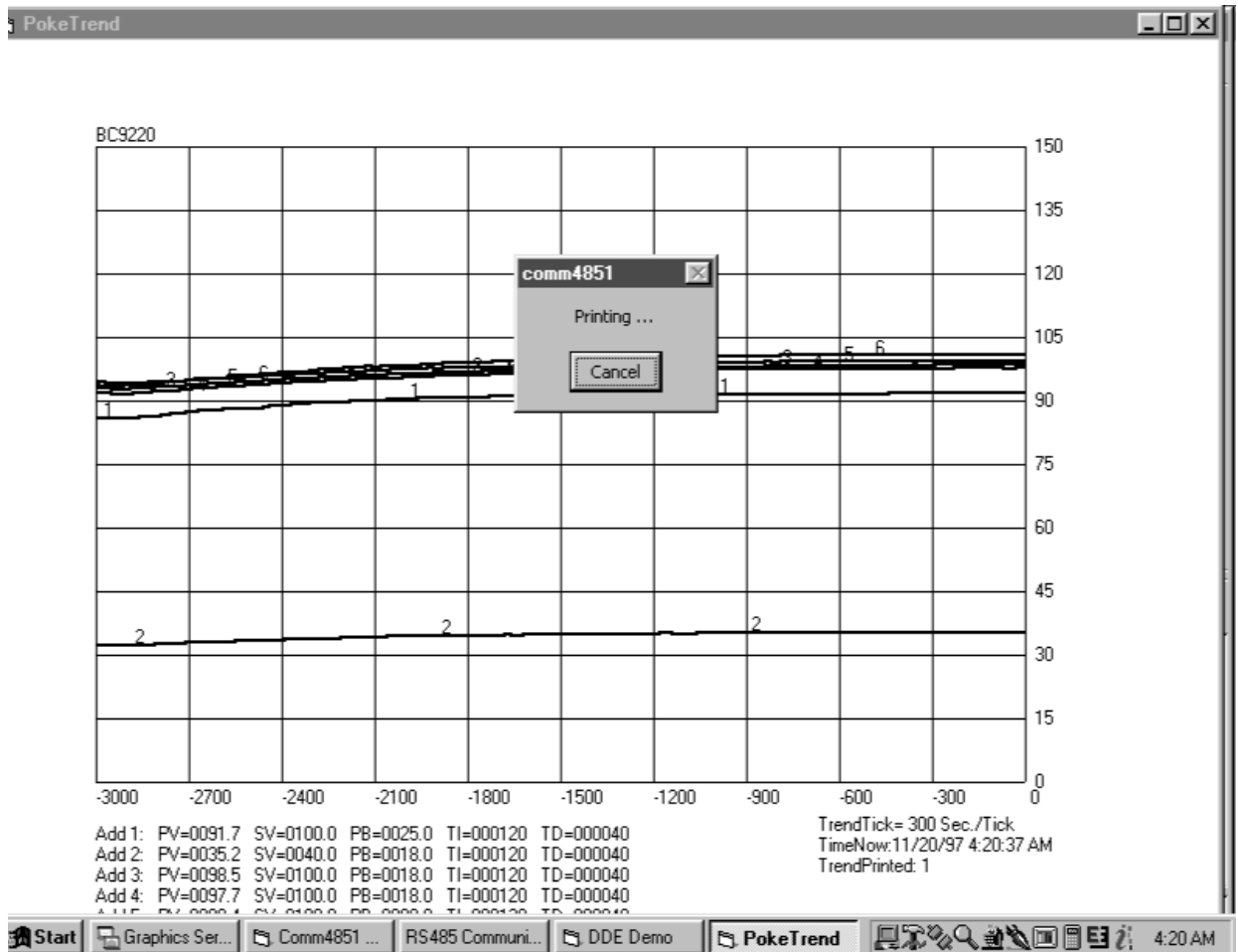


Figure 9.3 Trend Recording Print-out

## Notes

## Notes

## Notes