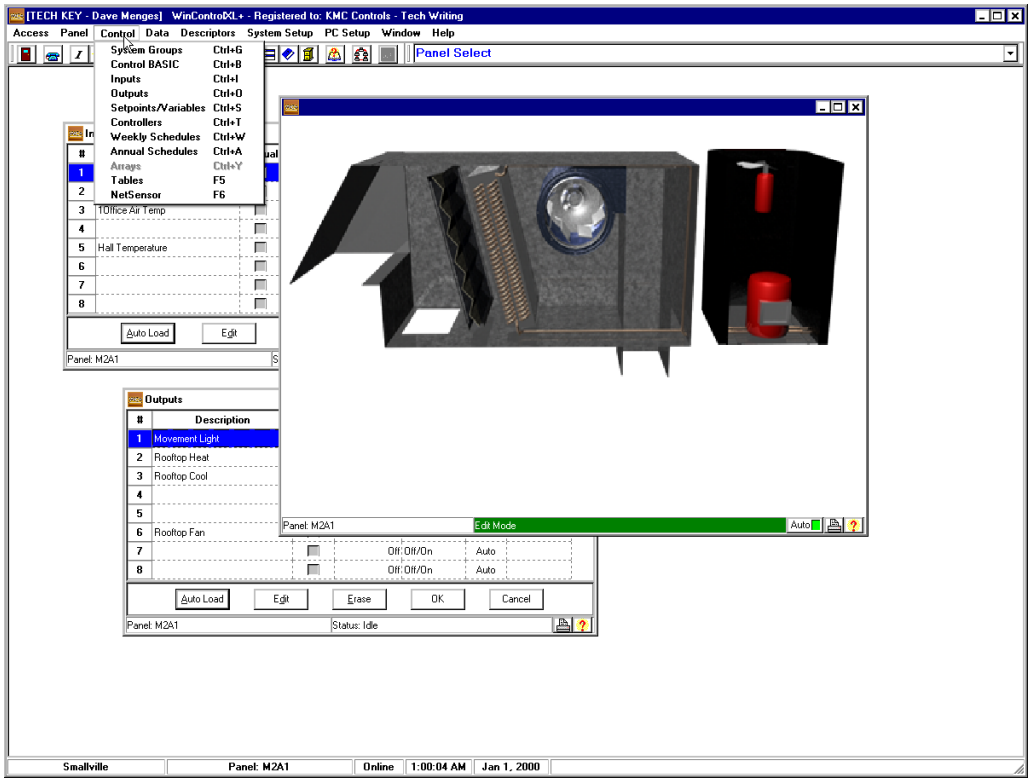
KMD-5791

WinControl XL Plus



Reference guide and
Installation and operating instructions

Revision Q

Important notices

Printed in U.S.A.

Disclaimer

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About this manual

This publication is an installation, operation, and reference manual for WinControlXL Plus, an operator workstation for KMD series controllers. Review this material in its entirety before installing or using WinControlXL Plus.

This manual offers detailed information about the following functions of WinControlXL Plus. Sections in this manual include the following topics:

- Installing and licensing WinControlXL Plus.
- Connecting WinControlXL Plus to controllers on a network.
- Configuring controllers for network operation.
- The WinControlXL Plus operating environment.
- Reference to program commands and functions.

Conventions used

Some of the text in this publication uses special formatting to indicate emphasis or keystrokes. The text conventions are as follows:

Menu and dialog items	Highlights items in the program interface, including buttons, dialog names, menus and commands in menus.
`Control Basic`	Highlights text that can be used in Control Basic programming.
`File names`	Highlights names of files and extensions.
Italics	Indicates a book or section title, a Control Basic keyword, mnemonic, or a value.
KEY NAMES	Indicates a specific key on the keyboard such as SHIFT, or ENTER.

If you encounter difficulty

If you experience difficulty with WinControl XL Plus, KMC Controls provides the following assistance.

Help Programs from KMC Controls install with context a help system. Click the question mark icon to view a detailed explanation about the subject.

The KMC Controls web site Navigate to the support section on the KMC Controls partner web site for the latest information for WinControl XL Plus and other KMC Controls products.

partners.kmccontrols.com

KMC technical support Our distribution partners have unlimited and free access to our team of Technical Support representatives. We provide coast-to-coast, and toll-free, support from 8:00 AM to 5:00 PM.

Toll-Free Technical Support: 866.303.4562

Safety considerations

KMC Controls assumes the responsibility for providing you a safe product and safety guidelines during its use. Safety means protection to all individuals who install, operate, and service the equipment as well as protection of the equipment itself. To promote safety, we use hazard alert labeling in this manual. Follow the associated guidelines to avoid hazards.

Danger represents the most severe hazard alert. Bodily harm or death will occur if danger guidelines are not followed.

Warning represents hazards that could result in severe injury or death.

Caution indicates potential personal injury or equipment or property damage if instructions are not followed.

Note: Notes provide additional information that is important.

Tip: Provides programing tips and shortcuts that may save time.

Section 1: About WinControlXL Plus

WinControlXL Plus is the operator interface for the KMC digital energy management and control system. With WinControlXL Plus you can program, operate and monitor all devices used in a KMC digital network.

Topics in this section:

System requirements

To operate WinControl XL Plus, you will need a computer that meets the minimum requirements listed in the table *Computer system requirements*.

Table 1–1 Computer system requirements

Component	Windows 2000 Windows XP	Vista Business Vista Enterprise	Windows 8 Professional Windows 7 Professional Windows 7 Ultimate
Processor speed	300 MHz or faster	2 GHz or faster	2 GHz or faster
RAM memory	128 megabytes RAM or greater	2 GB or greater	2 GB or greater
Hard disk space	100 megabytes of hard drive space available after installation	100 megabytes of hard drive space available after installation	100 megabytes of hard drive space available after installation
Monitor	SVGA with minimum 800 x 600 resolution.	SVGA with minimum 800 x 600 resolution.	SVGA with minimum 800 x 600 resolution. DirectX 9 graphics processor
Network connection	Ethernet 10BaseT connection	Ethernet 10BaseT connection	Ethernet 10BaseT connection
Serial connection	Serial or USB port with KMD–5579	Serial or USB port with KMD–5579	Serial or USB port with KMD–5579
License key	USB port dedicated to hardware key	USB port dedicated to hardware key	USB port dedicated to hardware key

Computer system requirements (continued)

Component	Windows 2000 Windows XP	Vista Business Vista Enterprise	Windows 8 Professional Windows 7 Professional Windows 7 Ultimate
Sound output and speakers	Required for audible alarm notification	Required for audible alarm notification	Required for audible alarm notification

What's new in this version

For a list of new features and changes to the program, see bulletin TB0705B, WinControl XL Plus version history. This bulletin is available on our partners web site.

partners.kmccontrols.com

Section 2: Installing WinControlXL Plus

This section covers installing WinControl XL Plus on a single computer.

Information in this section covers the following topics:

Installation and licensing

You must install WinControl XL Plus from the installation USB flash drive onto your hard drive; WinControl XL Plus will not run from the flash drive. To install WinControl XL Plus, you will need the following:

- The installation flash drive.
- The hardware key shipped with the drive.
- A name and password to establish the site administrator.

Note: The first time a hardware key is plugged into a computer, Windows will notify you that new hardware has been found. In the following procedure, the last two steps are not required after the key is inserted the first time.

1. Insert the flash drive into any USB port.
2. Use Windows Explorer to locate and open the flash drive. The flash drive is labeled Removable Disk.
3. On the flash drive double-click the **SETUP** icon.
4. Follow the on-screen installation instructions.
5. When prompted, choose a location for the program. KMC Controls recommends the default location.
6. Plug the hardware key into any USB port in the computer.
7. When the Found New Hardware Wizard opens, choose the **Install the software automatically** option. This may take several minutes.
8. When the wizard finishes installing the software for the hardware key, installation is complete.

Uninstalling WinControl XL Plus

To uninstall WinControl XL Plus, do the following:

1. Select Windows Start>Settings>Control Panel>Add or Remove Programs.
2. Select WinControl XL Plus 2.00 .
3. Click on **Change/Remove**.
4. Follow instructions to remove WinControl XL Plus.

Section 3: Getting started with WinControlXL Plus

WinControl XL Plus is a controls technicians tool for configuring KMD controllers from KMC Controls, Inc. This section briefly covers the first steps toward using WinControl XL Plus.

The following topics are included in this section.

Starting WinControl XL Plus

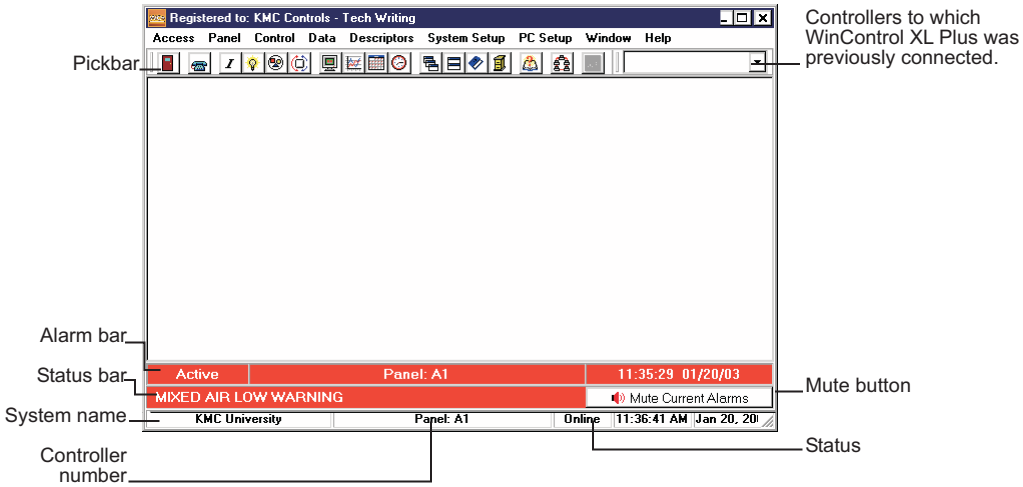
You start WinControl XL Plus just as you would any software application. To start WinControl XL Plus, do the following:

1. Insert a valid hardware key or verify that a hardware key is inserted into a USB port.
2. Choose *Start* > *Programs* > *KMC Controls* > *WCXL* and then *WinControlXL Plus*.

The WinControl XL work window

When WinControl XL Plus starts, the work window opens. The work window contains controls, menu bar, pickbar and status information.

Illustration 3–1 WinControl XL Plus work window



Pickbar The pickbar icons provide shortcuts to many of the often used menu commands.

Status bar At the bottom of the WinControl XL Plus screen there is a row of boxes that displays information about the system.

Starting from the left, the System Name is shown, then the connected controller address, the communication status, network time and date, and a message verifying whether the descriptors have been loaded from the computer's hard drive. If descriptors are not loaded, it will be necessary to load them to view the labels and descriptions. See *Load Descriptors From Network* on page 102 and *Load Descriptors From Panel* on page 102.

Alarm bar The alarm bar displays all alarms that have been sent from the KMC network. This bar is displayed near the bottom of the screen, above the status bar, when alarms have been received at the work station. If there are no alarms in the system the Alarm bar does not appear. The bar displays the point with an alarm condition, the alarm description as assigned in Control Basic, the time the point went into alarm, and the current alarm status.

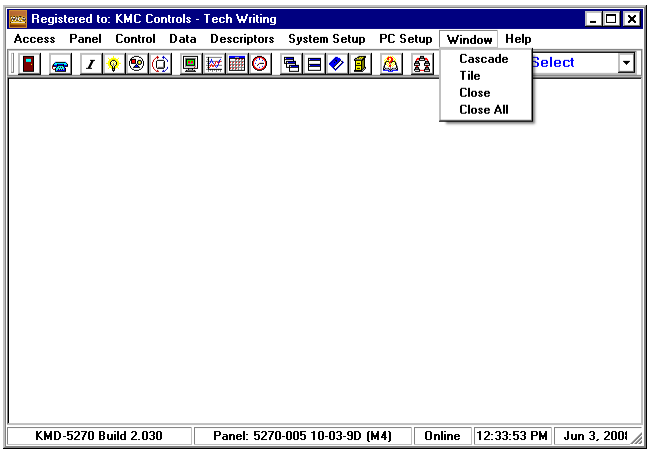
- Double click the alarm bar to display the Alarms window.
- Press mute button to quiet audible alarms.

Most alarms will originate from notifications generated by Control Basic. However, Tier 1 controllers will report error conditions as alarms. See *KMD Tier 1 alarm messages* on page 189 for a list of these alarms.

The Window menu

The Window menu sets the order open in which WinControl XL Plus displays pop-up menus.

Illustration 3–2 Window menu



Cascade Arrange all open windows to be visible in a stack.

Tile Arranges and resizes all open windows to fill the available space.

Close Closes the active window or the window on top of the stack.

Close All Closes all open WinControl XL Plus windows.

Help menu

Choosing the Contents menu within help displays additional topics. Click on a book next to the main topic. Sub topics are displayed beneath the main topic.

Contents Displays a list of menu topics. Click on the menu to display the items found under that menu title. Click on the item in question to display more detailed information.

Help on help Gives information on how to get the most out of the help file.

About WinControl XL Plus Displays the current WinControl XL Plus software release number, version number and copyright information.

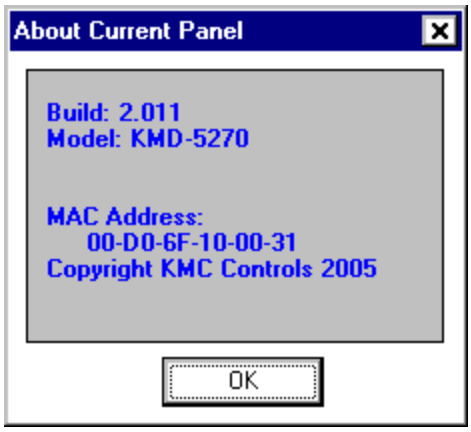
Illustration 3–3 WinControl XL Plus

The version number allows you to differentiate between new and old versions of software. It is also a convenient reference in determining what features are included in this version of software. If you have any questions concerning WinControl XL Plus and wish to get assistance, be sure to check the version number before calling for technical support.

About Current Panel

Open *About Current Panel* from the *Help* menu to display the version of the firmware in the controller. *About Current Panel* displays build number, date and time for Tier 1 and Tier 2 controllers.

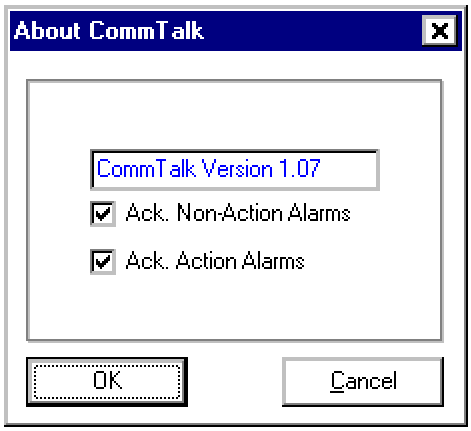
Illustration 3–4 About Current Panel dialog



About CommTalk

Open *About CommTalk* from the *Help* menu to display the firmware version in the connected KMD–5559 CommTalk. About CommTalk is displayed only when connecting to a Tier 2 network with a KMD–5559.

Illustration 3–5 About CommTalk dialog



Ack. Non-Action Alarms Check to enable alarms that are sent only to a computer running WinControl. The computer must be directly connected to a Tier 2 network through a CommTalk. Operators can also retrieve non-action alarms by establishing a modem connection between a computer and Tier 2 network with a modem and CommTalk.

Ack. Action Alarms Check to enable alarms sent with *NPAGE* on page 161, *TPAGE* on page 177, or *PHONE* on page 165 from Control Basic. Action alarms are programmed into a controller to dial, through a modem, a computer running WinControl or a text or numeric pager service. See the topic *Alarms* on page 37 for additional information on programming and viewing alarms.

Section 4: Programming steps

This section describes a logical sequence for programming a KMC Controls digital network.

Gather system information

Start with a diagram of the entire system. This diagram may take the form of a simple hand sketch or several mechanical drawings. Regardless of the form, it must include the key components on a network.

This system level drawing should include:

- controllers
- sensors
- computers
- modems
- repeaters

Where applicable, include also Ethernet hubs, routers, switches and servers.

In addition to the information and instructions presented in this manual, the following sources may also be useful.

- Product sales literature
- Installation sheets and guides
- The KMC *Digital Designers Guide* manual
- The KMC web site at www.kmccontrols.com

Create controller information lists

Create a list of the input and output connections for every controller in the network.

Each controller information list should include the following items:

- Physical location
- Model number of each controller
- KMC address of each controller
- All inputs and outputs by number
- A logical name for each point. KMC controllers use descriptors—up to 20-characters and labels—up to 8 characters—to name controllers.
- Device type: analog or digital
- Input signal type (4-20 milliampere current loop, 1-5 volts, etc.)
- Normal position (if applicable)
- A sequence of operation for each point managed from the controller.

Program the inputs

Choose *Inputs* from the *Control Menu* to set the parameters for each input point.

See *Inputs* on page 72 for details on using the *Inputs* menu.

- Enter a description and label that fully describes each input. You will use the description or label to identify the input when programming the controller with Control Basic.
- Select the range. If no standard range will work with the sensor, create a table. See *Tables* on page 86.
- Send and reload the inputs
- If you are on-line with a controller, check for correct readings and if required, enter calibration values.

Program the outputs

Choose *Outputs* from the *Control Menu* to set the parameters for each output point. See *Outputs* on page 75.

- Enter a description and label that fully describes the output. You will use the description or label to identify the output when programming the controller with Control Basic.
- Select the output range.
- Enter low and high voltages as required for analog output.
- Enter start delays as required for digital output.
- If required, set a security level for each output.
- Send the outputs and check for correct readings.

Define program variables

Choose *Variables/Setpoints* from the *Control Menu* to define program variables. See *Setpoints /Variables* on page 77.

- Enter a description and label that will fully describes each varible. You will use the description or label to identify the input when programming the controller with Control Basic.
- Select the units range.

Add schedules

Program weekly and annual schedules to change operation at specific times and on special days. See *Weekly Schedules* on page 82 and *Annual Schedules* on page 83.

Build system groups

Use *System Groups* to build a graphic representation of the system.

To build system group graphics, see the topic *System Groups* on page 58.

Write Control Basic programs

Program the controller with Control Basic. See *About Control Basic programs* on page 123.

Back up the program

To save the program to a computer file, see *Backup Panel* on page 39.

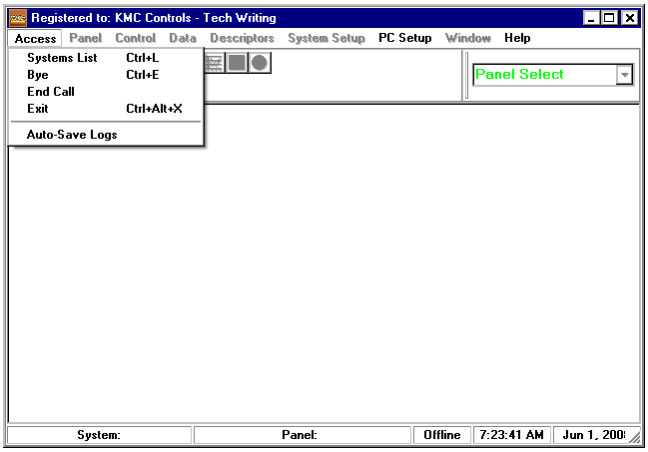
Section 5: The Access menu

Use the Access Menu to establish a communication link between WinControl XL Plus and a KMC controller or network.

Use the Access menu for the following functions:

- *System List* on page 26
- *Bye* on page 30
- *End Call* on page 31
- *Exit* on page 31
- *Auto-Save Logs* on page 31

Illustration 5–1 Access menu



System List

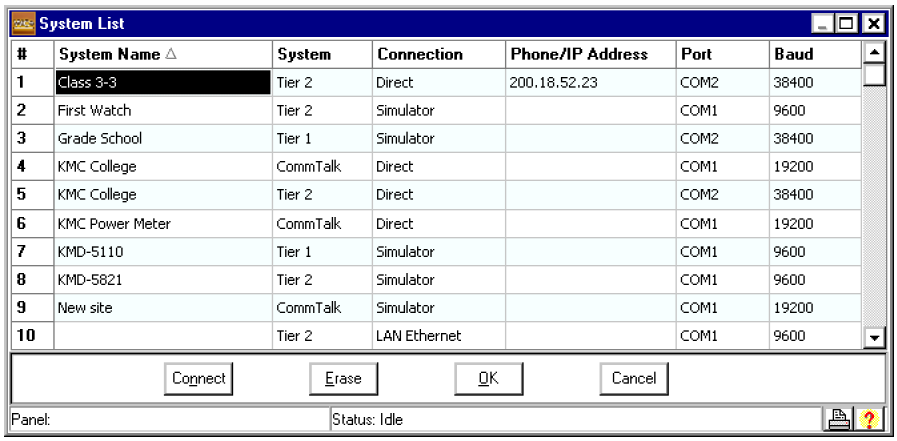
Select *System List* to connect a computer running WinControl XL Plus to a system or controller. The Systems List is an address book in which information is recorded about each individual job-site. WinControl XL Plus uses the system list information two ways.

- When connecting with a job-site via Ethernet, directly connecting through a serial port or with a telephone line and modem
- Automatically opening the correct information stored in the job folder.

Before using the System list see the following:

- *Computer Connections to KMC controllers* on page 185
- *The System Setup menu* on page 105 for software settings

Illustration 5–2 System List menu



#	System Name	System	Connection	Phone/IP Address	Port	Baud
1	Class 3-3	Tier 2	Direct	200.18.52.23	COM2	38400
2	First Watch	Tier 2	Simulator		COM1	9600
3	Grade School	Tier 1	Simulator		COM2	38400
4	KMC College	CommTalk	Direct		COM1	19200
5	KMC College	Tier 2	Direct		COM2	38400
6	KMC Power Meter	CommTalk	Direct		COM1	19200
7	KMD-5110	Tier 1	Simulator		COM1	9600
8	KMD-5821	Tier 2	Simulator		COM1	9600
9	New site	CommTalk	Simulator		COM1	19200
10		Tier 2	LAN Ethernet		COM1	9600

System Name

Enter up to 20 characters for the system name. This entry must match exactly the name entered in *Set System Name* under the *System Setup* menu. WinControl XL Plus creates a directory with the same name in which all information associated with this system name is stored. Up to 250 sites may be entered in the system list.

System

Choose the type of system associated with the site. The choices are listed in the table *System connections*.

Table 5–1 System connections

Option	Use with controller
Tier 1	Tier 1 controller
Tier 2	Tier 2 controller
Comm Talk	Tier 2 controller with KMD–5559

Connection

Choose one of the following methods to connect the computer running WinControl XL Plus to the KMD network.

Direct The computer on which WinControl XL Plus is running is connected to a Tier 1 controller through a serial cable connection.

Modem/485 The computer on which WinControl XL Plus is running connects to a Tier 1 controller over a modem connection. The Tier 1 controllers are connected to each other with the Tier 1 (formally Main Network) connection.

MNC Ethernet The computer on which WinControl XL Plus is running connects to a network of KMD-5100 Multi Net controllers using the Ethernet LAN. The connection between the controllers is through third-party Ethernet adaptors.

Simulator Select *Simulator* for off-line programming. See *Using the simulator mode* on page 32 for additional information about WinControl XL PLus software simulator.

LAN Ethernet The computer on which WinControl XL Plus is running connects to a network of KMD-5205, KMD-5210, or KMD-5270 Tier 1 controllers using the Ethernet LAN.

Modem/Ethernet The computer on which WinControl XL Plus is running connects to a Tier 1 controller over a modem connection. The Tier 1 controllers are connected to each other using the Ethernet LAN connections.

Phone/IP Address

Add either a telephone number for modem connections or an Ethernet address for the selection made in Connections.

IP address To connect over a local area network, choose *LAN Ethernet* and then enter the IP address of a Tier 1 controller. The periods (.) must be entered between each group of numbers.

IP address with network address translation (NAT) Connecting to a system through network address translation requires that both the router performing the translation and WinControl XL Plus are configured correctly.

- Configure the translating router to handle traffic for port 21068 at the private IP address of one of the Tier 1 controllers on the KMD network. This configuration is usually performed by the IT department.
- In *IP address*, enter the IP address of the router instead of the IP address of a Tier 1 controller. Enter either the letter *R* or *F* in front of the IP address. The periods must be entered between each group of numbers.
- Choose *LAN Ethernet* from *Connection*.

Table 5–2 Network address translation prefixes

Prefix	Description
R	WinControl handles traffic to and from the translating router as if it was from a Tier 1 controller. Only the controller with the IP address in the translating router is accessible in the network status list.
F	WinControl handles traffic to and from the translating router as if it was from a Tier 1 controller. All Tier 1 controllers in the network status list are accessible.

Phone numbers

To connect to a remote site over a telephone line, choose *Modem/485* or *Modem/Ethernet* and then enter the telephone number of the remote site. For dialing options, see the table *Dialing options*.

Table 5–3 Dialing options

Symbol	Action
Dash (-)	The dash is optional. Use it to make the telephone phone number easier to understand.
Period (.)	Example: 555-1212.31 Place a period in the dial string to pause dialing until you click the telephone on-hook switch to continue dialing. Use when dialing automatic answering systems which require entering an extension number.
Comma (,)	Example: ,9,555-1212 The comma creates a pause in the dialing sequence. The pause time, typically 2 seconds for each comma, is set by the modem setup registers. A typical use for the comma is to provide a delay after dialing an access number for an outside telephone line.

Port

Choose the serial port on the computer to which the controller is connected. Valid ports are *COM1* to *COM32*.

Baud

Select the baud of the Tier 2 network to which WinControl will connect. Choose the same network baud as set in HCM.

Sorting the system list

To change the order in which systems are displayed in the system list, click the header at the top of the column. WinControl XL Plus will sort the system list in ascending order. Clicking the column header the second time sorts the system list in descending order.

Creating site shortcuts

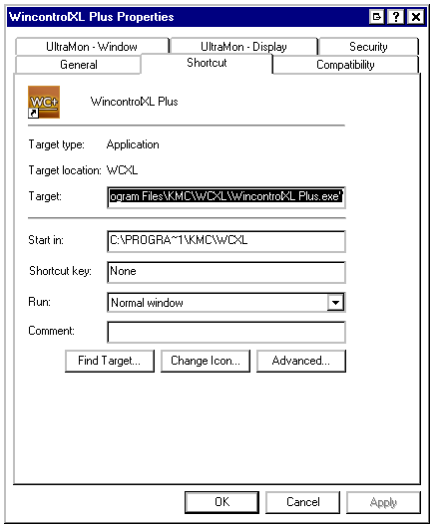
If you have several systems to which you frequently connect, you can create shortcut icons on your desktop for each site.

Illustration 5–3 WinControl desktop icon

To create a shortcut icon on the desktop, do the following:

1. Right-click on the icon. The properties dialog opens.
2. Add a space, the letter *S* and then the number of the site in the system list to the end of *Target*.

Illustration 5–4 Shortcut properties

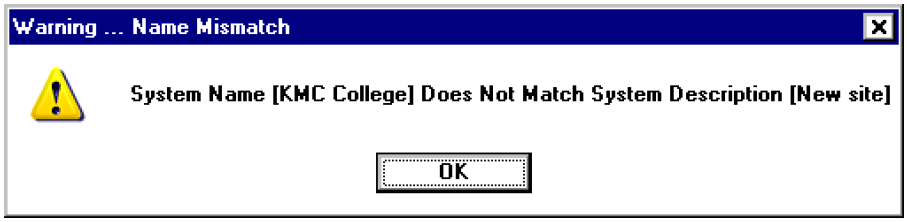


When the shortcut is launched, WinControl XL Plus automatically looks to the system list for its settings and starts the connection to the system.

System Name mismatch warning

During the connection process, a warning is displayed if the system name does not match the name in the row you chose in the System List.

Illustration 5–5 System name mismatch



To correct a system name mismatch:

Existing network Change the name in the system list to match the name that appears in the lower left corner of the WinControl XL Plus status bar. Then reconnect to the system by clicking the *Connect*.

New network *System Name* is empty or incorrect for new systems. Ignore the warning and then assign the system name to the network. See *System Name* on page 106.

Bye

Use to change users without disconnecting from the network or controller. Another user can then sign on and connect to another local system.

WinControl remains connected to the network with the System Sign-On dialog open. The modem does not hang up.

Related topics

- *End Call* on page 31
- *Exit* on page 31

End Call

Disconnects the computer from the network or controller. To reconnect, choose a system from the system list.

Related topics

- *Bye* on page 30
- *Exit* on page 31

Exit

Disconnects the computer from the network or controller and then closes WinControl XL Plus.

Related topics

- *Bye* on page 30
- *End Call* on page 31

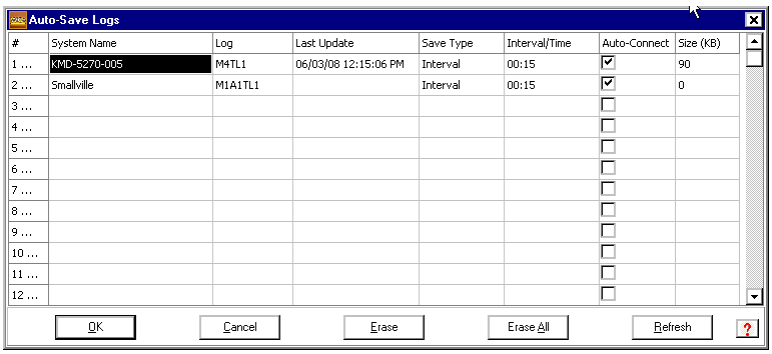
Auto-Save Logs

Use the Auto-Save Logs to designate an automatic connection for retrieving trend or runtime logs from one or more systems.

Do the following before setting up the auto-save log function:

- Enter the systems in the system list. See *System List* on page 26.
- Set up the trend or runtime logs in the individual controllers as described in *Trend Log Data* on page 44 or *Runtime Logs* on page 48.

Illustration 5–6 Auto-Save Logs dialog



System Name Click in a System Name box to select a system name for polling. The connection method will be the method in the system list for the selected system name.

Log Enter the controller address followed by the type of log to save.

- TL# designates a trend log.
- RL# designates a runtime log.

Table 5–4 Examples of log entries

Example	Description
M1TL1	Trend log in Tier 1 controller #1
M2B4RL2	Runtime log in Tier 2 controller #4 connected to Tier 2 network B on Tier 1 controller #2

Last Update Lists the last time that WinControl XL Plus automatically connect to a remote system and retrieved a log.

Save Type Select either Interval or Time to set when WinControl XL Plus connects to a system to retrieve a log.

- Select Interval to connect to the system at regular intervals throughout the day.
- Select Time to connect to the system once per day at a preset time.

Interval/Time Enter the polling interval or time of day for polling.

Auto-Connect Select the Auto-Connect check box to enable WinControl XL Plus to automatically connect to the system and retrieve a log.

Size (KB) The size of the history file stored on the computer on which WinControl XL Plus is running.

Using the simulator mode

WinControl XL Plus supports off-line programming with a simulator mode. When using the simulator for off-line programming, the following constraints are in place.

- Control Basic programs may be compiled and saved but cannot run.
- Animated graphics reflect the state of the point to which they are associated. For example, if an animated fan is associated with a digital output point, the fan will rotate when the point is On and will not rotate when the point is Off.

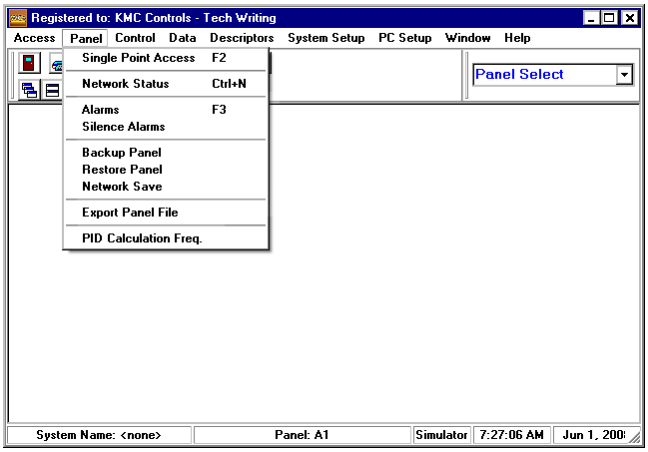
Section 6: The Panel menu

Use the Panel menu for network level operations. Through the Panel menu you can check system details, respond to and manage alarms and navigate through the network by selecting specific controllers.

Use the Panel menu for the following functions:

- *Single Point Access* on page 34
- *Network Status* on page 34
- *Alarms* on page 37
- *Backup Panel* on page 39
- *Restore Panel* on page 39
- *Export Panel File* on page 40
- *PID Calculation Freq.* on page 40

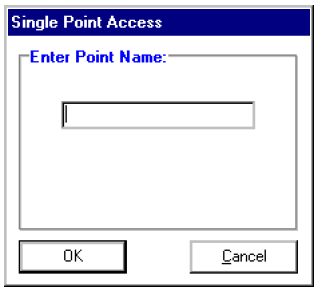
Illustration 6–1 Panel menu



Single Point Access

Use *Single Point Access* to quickly retrieve information about a single point, schedule, controller or variable. *Single Point Access* retrieves information quicker than other methods because it moves less data over the network.

Illustration 6–2 Single Point Access dialog



Enter the point name in mnemonic, label or description format and click OK. WinControl XL Plus will open the dialog for display or editing for just that item.

Two additional functions may also be used from *Single Point Access*.

CLEAR PRG (#) Clears a complete Control Basic program from a controller. This may be useful to eliminate a corrupt program from a controller.

CLEAR GRP (#) Clears a complete system group from a controller.

Network Status

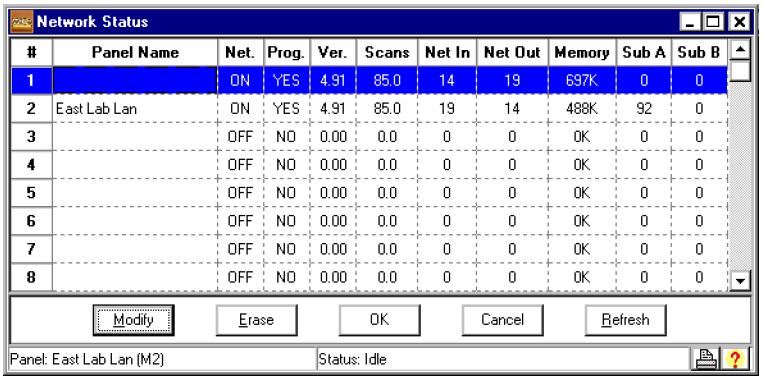
The Network Status dialog lists a variety of useful information about all controllers on a network as recorded by the current controller. Each controller is listed in numerical order according to its address. The Network Status dialog is different for Tier 1 and Tier 2 controllers.

- For Tier 1 controllers, see *Main Network Status* on page 34.
- For Tier 2 controllers, see *Sub Network Status* on page 36.

Main Network Status

If connected to a Tier 1 controller, the following information is displayed:

Illustration 6–3 Network Status



#	Panel Name	Net.	Prog.	Ver.	Scans	Net In	Net Out	Memory	Sub A	Sub B
1		ON	YES	4.91	85.0	14	19	697K	0	0
2	East Lab Lan	ON	YES	4.91	85.0	19	14	488K	92	0
3		OFF	NO	0.00	0.0	0	0	0K	0	0
4		OFF	NO	0.00	0.0	0	0	0K	0	0
5		OFF	NO	0.00	0.0	0	0	0K	0	0
6		OFF	NO	0.00	0.0	0	0	0K	0	0
7		OFF	NO	0.00	0.0	0	0	0K	0	0
8		OFF	NO	0.00	0.0	0	0	0K	0	0

Modify/Display To enter a name for a controller, change the *Network Status* to *Edit* mode by clicking *Modify* and then entering a name in the *Panel Name* column. When finished, click *Display*.

Erase Clears the current information in the network status list and reloads if from the system.

OK Accepts changes and closes the dialog.

Cancel Closes the dialog without entering changes.

Refresh Loads current information from the network.

Panel Name Displays the name previously entered for the controller. If *Panel Name* is empty, you may enter up to 18 characters to name the controller. See Modify/Display to add a name.

Net Indicates if the controller is reporting on-line with the network.

Prog Indicates when Control Basic programs are running in the controller.

Ver The revision level of the firmware in the controller.

Scans *Scans* is the rate the microprocessor is reading all Control Basic programs in the controller and responding to its instructions. Typical scan rates range from 5 to 50 scans per second. See *About Control Basic scans* on page 130 for additional information on scans.

Net In / Net Out The total number of data points shared between controllers over the network. Clicking on a *Net In* or *Net Out* number opens a prompt to specify *MAIN*, *SUB A*, or *SUB B* networks. An item-by-item listing of all shared points is then displayed.

Memory The amount of free memory, in bytes, available for programs, trend logs, runtimes, etc.

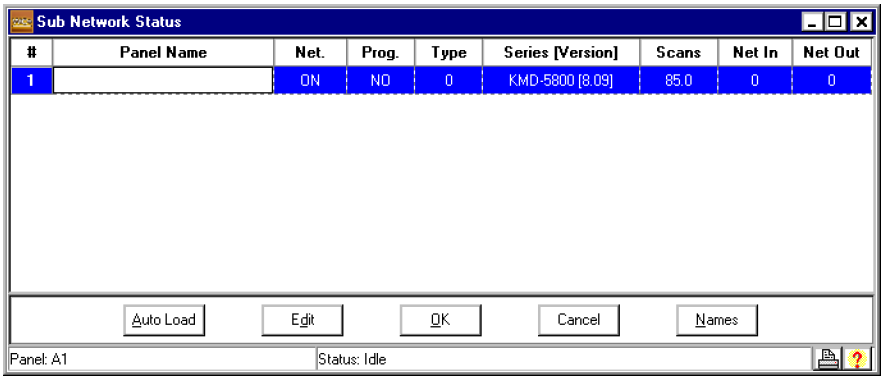
Sub A / Sub B The hightest addressed controller on the Tier 2 network. (A or B). Clicking on the number opens the *Sub Network* list.

Note: See *Transferring values between controllers* on page 135 for information on how points are transferred between controllers.

Sub Network Status

Each Tier 2 network controller is listed in numerical order by controller address and shown with its corresponding controller name.

Illustration 6–4 Tier 2 status list



Auto Load Continuously updates the display with network status information.

Edit/End Edit To enter a name for a controller, change the *Network Status* to *Edit* mode by clicking *Edit* and then entering a name in the *Panel Name* column. When finished, click *End Edit*.

OK Accepts changes and closes the dialog.

Cancel Closes the dialog without entering changes.

Names Use *Names* to refresh the network information. Retrieves the name of each controller and updates the panel status list. If the WinControl XL Plus cannot find a previously listed controller for an address, it lists the name of the last known controller. Use Names to refresh the network information.

Panel Name Enter up to a 20-character description of the controller.

Type A controller type may be assigned to a particular controller or group of controllers to allow them to use identical point descriptions and labels. For details on using controller types, see *Descriptors and controller type* on page 103.

Network Indicates the controller is reporting on-line with the network. If any panel is not communicating with the rest of the controllers on the network, this column will indicate *Off*.

Program Indicates when Control Basic programs are running in the controller.

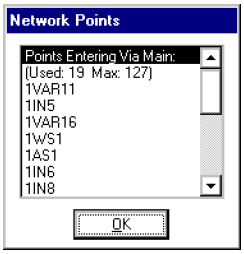
Version The firmware version of the controller.

Scans *Scans* is the rate the microprocessor is reading all Control Basic programs in the controller and responding to its instructions. Typical scan rates range from 5 to 50 scans per second. See *About Control Basic scans* on page 130 for additional information on scans.

Net In / Net Out The total number of data points shared between controllers over the network.

Any points this controller requires from other controllers on the network will appear as *want-points* in the *Network Profile* window.

Illustration 6–5 Tier 2 network points entering a controller



Note: Use *Initialize Network* to temporarily clear shared points over the network. This allows the controllers to regenerate the transfer list with only the points they require. See *Transferring values between controllers* on page 135 for a details on transfer points between controllers.

Alarms

Alarms in a KMC digital system are classified into three separate status categories.

Active The condition which created the alarm has not changed. Active alarms start an audible alarm signal until an operator views the alarms screen.

Restored Indicates with the abbreviation *RES* that the condition which caused the alarm has been corrected but, the alarm message has not been acknowledged or erased by an operator. *Restore* also cancels the audible alarm from the computer.

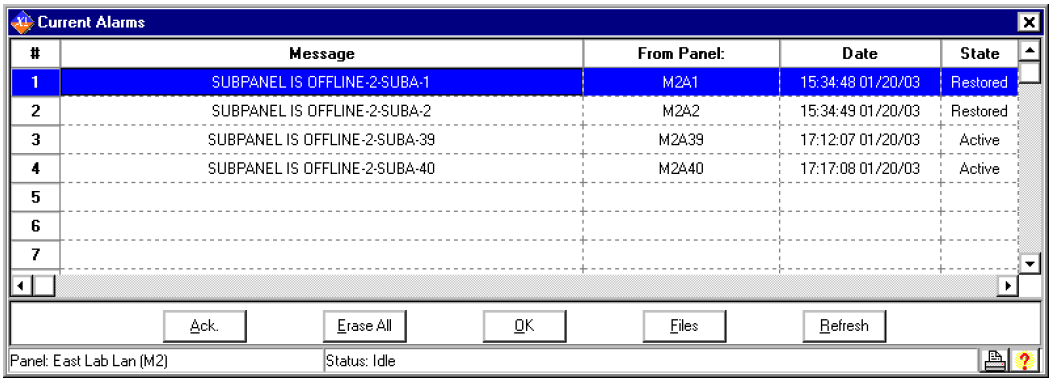
Acknowledged An operator has reviewed the alarm but has not deleted if from the list.

Note: WinControl XL Plus will continue to place alarms in the *Current Alarms* list until the condition that created it is corrected.

Managing the Current Alarms list

Review and manage alarms from the *Current Alarms* list.

Illustration 6–6 Current Alarms list



#	Message	From Panel:	Date	State
1	SUBPANEL IS OFFLINE-2-SUBA-1	M2A1	15:34:48 01/20/03	Restored
2	SUBPANEL IS OFFLINE-2-SUBA-2	M2A2	15:34:49 01/20/03	Restored
3	SUBPANEL IS OFFLINE-2-SUBA-39	M2A39	17:12:07 01/20/03	Active
4	SUBPANEL IS OFFLINE-2-SUBA-40	M2A40	17:17:08 01/20/03	Active
5				
6				
7				

Ack (Acknowledged) Allows the operator to acknowledge the alarm without deleting it from the alarm list.

To review details of a specific alarm such as the controller from which the alarm originated or the time and date the alarm was detected, double click on the message or highlight with the cursor and press *Insert*. Right clicking *Alarm* clears individual alarms. A dialog box will appear for each item selected.

Files Opens a dialog that lists the alarm log. WinControl XL Plus creates one alarm file every month an alarm is generated. After choosing an alarm log from the list, the log can be opened with Microsoft Notepad or WordPad. See *WinControl job files and folders* on page 181 for additional information about the alarm file.

Erase All Deletes all alarms from the alarm list.

Refresh Retrieves all alarms from the network and updates the alarm list.

Working with alarms

A variety of alarm conditions can be written in the Control Basic programming to alert users of problems or abnormalities in the system.

If an operator has a computer connected to a KMC digital system, any alarms detected are displayed immediately in the alarm message bar at the bottom of the screen. In addition, an audible alarm in the computer alerts the

operator that a new alarm condition has been detected. When multiple alarms are present, the message bar will scroll each active message across the screen.

In addition to the scrolling alarm messages, a detailed alarm screen lists each alarm detected as well as the status of each condition. Choose *Alarms* from the Panel Menu.

KMC controllers continuously report recent alarms until the computer is connected to the KMC controller or network and the alarms are received by the computer. If a KMD–5559 CommTalk is being used, alarms are held in the CommTalk for the next connection to the network by a computer.

Note: The computer must have WinControl XL running to send e-mail. See *Startup Defaults* on page 117 for setting up e-mail.

For details on creating and managing alarm messages, see the following:

- Sending alarms to WinControl, see the keywords *ALARM* on page 139 and *DALARM* on page 146.
- To setup audible alarms and e-mail, see *Startup Defaults* on page 117.
- To send alerts or alarms to pagers see *NPAGE* on page 161 and *TPAGE* on page 177.
- To program a KMC system to dial a remote computer when an alarm occurs, see *PHONE* on page 165.
- To configure a KMD–5559 from WinControl XL Plus, see *Help menu* on page 17.

Backup Panel

Use *Backup Panel* to save the current connected controller program to the computer. Inputs, outputs, variables, controllers, Control Basic routines, descriptors, and other user programming will be stored in a `.pnl` file.

Restore Panel

Use *Restore Panel* to retrieve a saved PNL file from the computer and send it to the current connected controller. Inputs, outputs, variables, controllers, Control Basic routines, descriptors and any other user configuration information will be sent to the controller.

Network Save

Saves programming from the current network

Tier 2 controllers Saves all information for the Tier 2 network to which the controller is connected.

Tier 1 controllers Saves all information for the controller and the controllers on the Tier 1 networks connected to it.

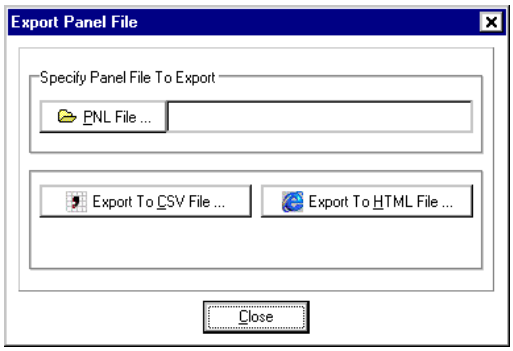
Export Panel File

Opens a panel file (PNL) and save it in one of the following formats.

Table 6–1 Panel file formats

File name extension	Format
.html	Hypertext markup language
.csv	Comma separated values

Illustration 6–7 Export Panel File dialog



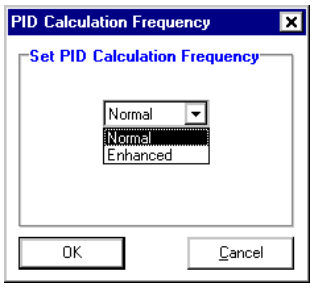
PID Calculation Freq.

Choose *Normal* or *Enhanced* to set the PID control loop calculation frequency.

Table 6–2 PID calculation speed

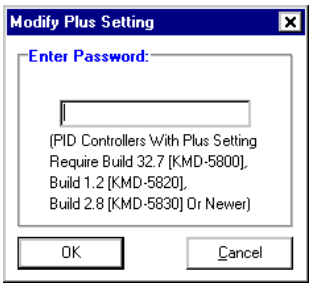
Mode	Calculations per Second
Normal	1
Enhanced	16 If the scan rate falls below 16, calculation frequency is the scan rate.

Illustration 6–8 PID Calculation Frequency



Plus Mode must be enabled to set the controller to the enhanced calculation frequency. To enable *Plus Mode*, choose the controller name from the *Series (Version)* column in the Network Status list and then enter the password in the *Modify Plus Setting* dialog box.

Illustration 6–9 Modify Plus Setting dialog box



Tip: The PID calculation frequency and Plus mode features are available only in specific controllers. Check the specification section of the installation guide that is supplied with the controller to determine if these features are available.

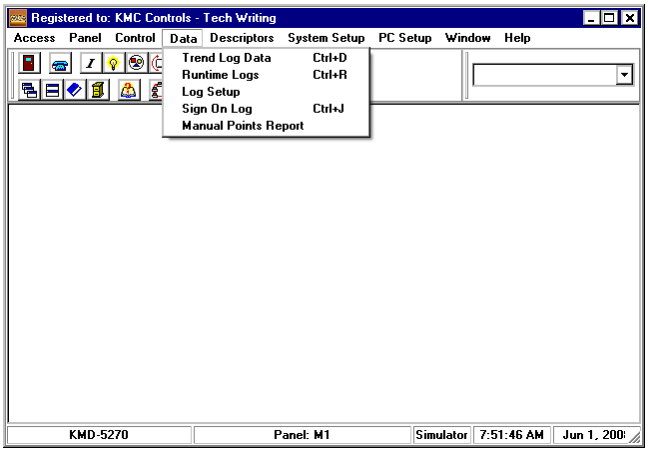
Section 7: The Data menu

Use the logs in the Data menu to monitor, record and track processes or conditions.

Use the Data menu to access the following functions:

- *Trend Log Data* on page 44
- *Runtime Logs* on page 48
- *Log Setup* on page 51
- *Sign-On Log* on page 53
- *Manual Points Report* on page 53

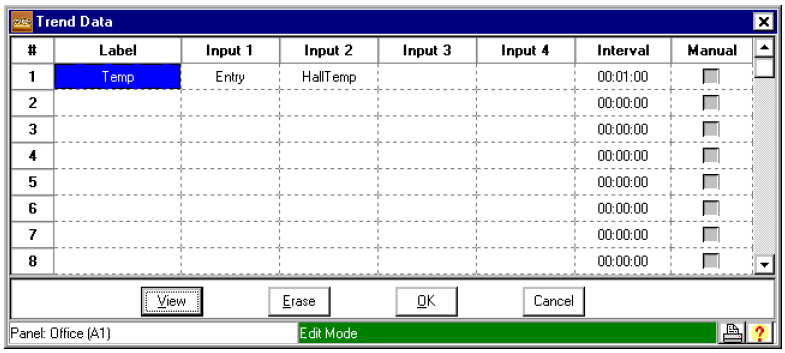
Illustration 7–1 Data menu



Trend Log Data

Choose *Trend Log Data* to record data from analog points. Trend log parameters are set in the *Trend Data* list. Any security level can view the Trend Data data list but Level 2 security access is required to save data and Level 3 security access is required to enable and disable a trend log. Level 4 security access is required to create and modify trend logs.

Illustration 7–2 Trend Data list



Each trend log can store 400 periodic readings for each point listed in an input column. You may specify the points in the input columns using any of three different notations:

Table 7–1 Notation examples

Notation	Example
mnemonic	IN1
label	OAT
descriptor	Outside Air Temperature

When the log becomes full, it deletes the oldest data and replaces it with the latest readings to create a moving window of the most recent information.

Note: Use a trend log to record events that are longer than one-second. Recording shorter events will result in missed or erroneous data.

About the trend log list

View Select a trend log and then choose *View* to display a trend log graph. You may also click the numeral in the first (#) column.

Label An 8-character name for the log.

Input 1...Input 6 Enter the mnemonic, label or descriptor of the points to be recorded in trend log input columns. The logged points can be inputs, outputs, variables and can be from other controllers on the network. The exact number of points you place in the list depends on the type of controller to which you are connected.

Interval Specify a time interval between readings. The interval is entered as *hours*: *minutes*: *seconds*.

Each data log holds 400 points. The time span of each log is calculated by multiplying the interval by 400.

Manual An X indicates the trend log is collecting data under command from Control Basic instead of performing automatic sampling based on the period set by *Interval*. When Control Basic encounters a *TLx = -1* statement, a new record is placed in the trend log. The record includes all points assigned to the trend log and a real-time record of the time and date. When using this method, set *Interval* to 00:00:00.

The following example adds to trend log *TL1,* one sample on the first day of each month.

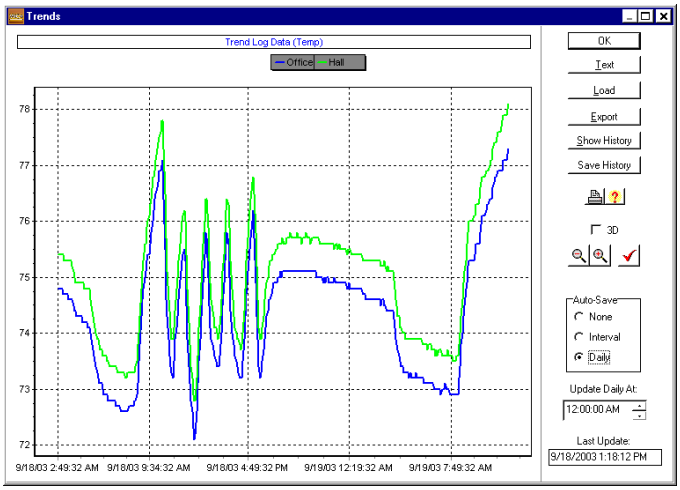
```
20 IF+ DOM < 2 THEN TL1 = -1
```

Once a trend log is returned to automatically sampling at the period set by *Interval*, all previous data is erased and new data is recorded.

Trend Log details

The WinControl XL Plus Plus trend log graph displays collected data plotted over time. Each of the listed input fields plots on separate line graphs. WinControl XL Plus automatically scales the graph to include all logged data over the period it was collected. The graph below displays two input fields.

Illustration 7–3 Trend Log graph window

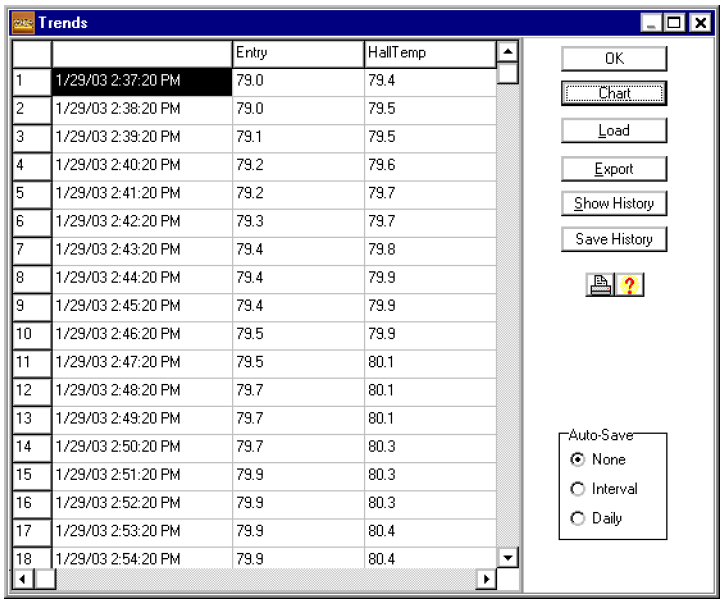


To the right of the graph there are command buttons. The command buttons perform the following functions:

OK Closes the chart and opens the trend data list.

Text Displays the recorded numeric values and the time they were collected. Choose *Chart* to return to the graph.

Illustration 7–4 Text display of logged data



		Entry	HallTemp
1	1/29/03 2:37:20 PM	79.0	79.4
2	1/29/03 2:38:20 PM	79.0	79.5
3	1/29/03 2:39:20 PM	79.1	79.5
4	1/29/03 2:40:20 PM	79.2	79.6
5	1/29/03 2:41:20 PM	79.2	79.7
6	1/29/03 2:42:20 PM	79.3	79.7
7	1/29/03 2:43:20 PM	79.4	79.8
8	1/29/03 2:44:20 PM	79.4	79.9
9	1/29/03 2:45:20 PM	79.4	79.9
10	1/29/03 2:46:20 PM	79.5	79.9
11	1/29/03 2:47:20 PM	79.5	80.1
12	1/29/03 2:48:20 PM	79.7	80.1
13	1/29/03 2:49:20 PM	79.7	80.1
14	1/29/03 2:50:20 PM	79.7	80.3
15	1/29/03 2:51:20 PM	79.9	80.3
16	1/29/03 2:52:20 PM	79.9	80.3
17	1/29/03 2:53:20 PM	79.9	80.4
18	1/29/03 2:54:20 PM	79.9	80.4

Export Saves the trend data in one of three formats.

Table 7–2 Trend log file formats

File name extension	Format
.htm	Hypertext markup language
.csv	Comma separated values
.xls	Microsoft Excel spreadsheet

Load Retrieves the data stored in the controller. Use *Load* to redraw the graph from the most recent data.

3-D Clicking the 3D button toggles between two-dimensional and three-dimensional views of the displayed data.

Display numerical data The checkbox displays the numerical value for each data point. Clicking the button scrolls through each of the graphed lines.

Show History View the history file stored in the WinControl XL Plus job folder. See *History files* on page 54.

Save History Save trend log data to the history file in the WinControl XL Plus job folder. See *History files* on page 54.

Zoom tools Use the magnifying glasses buttons to zoom in or out from the center of the window.

To magnify a specific area Left click and drag from left to right over the points you want to examine.

Full graph view Left click and drag from right to left over the same area. The magnifying glasses buttons can also be used to perform a zoom in or out.

Pan To move the data forward or backward to view earlier or later data samples, right click and drag the area of interest to the center of the screen.

Auto Save When A*uto Save* is enabled, at regular intervals WinControl XL Plus automatically appends the trend log data to the history file. See *History files* on page 54.

Table 7–3 Auto Save options

None	**Auto Save not enabled.**
Interval	Saves Trend Log at preset intervals.
Daily	Saves Trend Log preset a daily time. 12:00 Noon every day or 08:00 every morning.
Last Update	(View only) Displays the time a history file was saved.

Tip: WinControl must be running and connected to the system for the *Auto Save* options to function. When closing WinControl XL Plus and one of the Auto Save options are checked, a prompt will open to confirm that it is okay to close WinControl XL Plus which will stop *Auto Save*.

Update Interval Use to set the interval for automatic appending data to the history file.

- When *Auto Save Interval* is selected, enter the period from one auto save to the next.
- When *Auto Save Daily* is selected, enter the time of day the data is appended to the history file.

Calculating the Interval or Daily update time

KMC controllers have a limited amount of memory to store trend log information. Once the memory is full, the oldest sample is dropped from the log to make room for a new sample. For long term trend log storage over months or years, the trend data can be place into a history file by WinControl. To create a history, open the trend in either Chart or Text view.

You first need to know the storage capability of the trend:

Table 7–4 Trend log capacity

Controller type	Number of samples
Tier 1	255 samples
Tier 2	400 samples

Multiply the number of samples times by the entry in Interval in the Trend Log data list (see *Trend Log Data* on page 44). This will calculate the time it takes from when a sample enters the trend log to when it is erased to make room for another sample. The time a log spans is calculated as follows:

Samples/period x Total samples = Log span time

Example A KMD–5801 is operating with a trend log sampling at 5 second intervals.

5 seconds/sample x 400 samples = 2000 seconds

2000 seconds/60 seconds per minute= 33.33 minutes

For this example, setting *Update Interval* to 30 minutes saves the log with a little overlap.

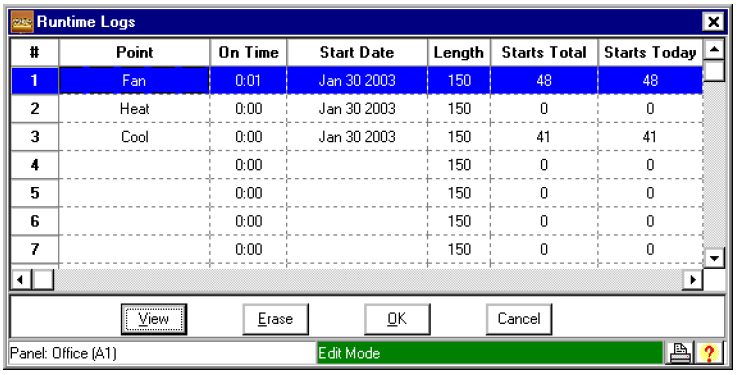
When several history files are saved throughout the day, choose a time of day when there will be minimal operator activity. This will reduce the computer load and improve performance.

Runtime Logs

Use Runtime Logs to monitor digital points. Runtime logs record the number of cycles on a digital point and saves the cumulative total of runtime hours for that point.

Any security level can view runtime logs but a level four security access is required to modify or create new runtime logs.

Illustration 7–5 Runtime Logs list



#	Point	On Time	Start Date	Length	Starts Total	Starts Today
1	Fan	0:01	Jan 30 2003	150	48	48
2	Heat	0:00	Jan 30 2003	150	0	0
3	Cool	0:00	Jan 30 2003	150	41	41
4		0:00		150	0	0
5		0:00		150	0	0
6		0:00		150	0	0
7		0:00		150	0	0

Note: Use a runtime log to record events that are longer than one-second. Recording shorter events will result in missed or erroneous data.

About the runtime logs list

Point Enter the point to be logged. Points can be inputs, outputs, variables and can be from other controllers on the network. The exact number of points you place in the list depends on the type of controller to which you are connected.

On Time Displays the total amount of time the point has been on since the start date. *On Time* is displayed in hours: minutes. Reset to 0:00 by clicking on *Start Date*.

Start Date The date the log began. Enter zero in *Start Date* to reset it to the current date. Zero also sets all count cycles and runtime totals to zero.

Length Sets the number of on/off samples recorded in the runtime log. The number of samples set depends upon the type of controller.

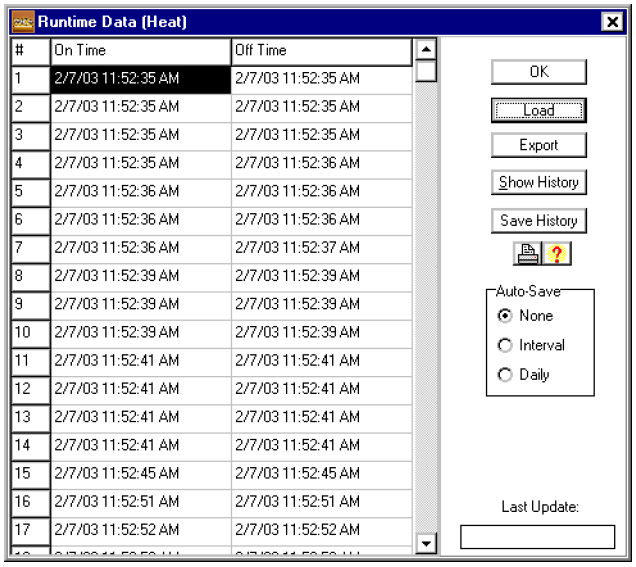
Starts Total Displays the total number of starts since the start date.

Starts Today Displays the number of starts for the current calendar day.

Viewing runtime logs

To view an individual runtime log, select the log number in the left column.

Illustration 7–6 Run-Time data



#	On Time	Off Time
1	2/7/03 11:52:35 AM	2/7/03 11:52:35 AM
2	2/7/03 11:52:35 AM	2/7/03 11:52:35 AM
3	2/7/03 11:52:35 AM	2/7/03 11:52:35 AM
4	2/7/03 11:52:35 AM	2/7/03 11:52:36 AM
5	2/7/03 11:52:36 AM	2/7/03 11:52:36 AM
6	2/7/03 11:52:36 AM	2/7/03 11:52:36 AM
7	2/7/03 11:52:36 AM	2/7/03 11:52:37 AM
8	2/7/03 11:52:39 AM	2/7/03 11:52:39 AM
9	2/7/03 11:52:39 AM	2/7/03 11:52:39 AM
10	2/7/03 11:52:39 AM	2/7/03 11:52:39 AM
11	2/7/03 11:52:41 AM	2/7/03 11:52:41 AM
12	2/7/03 11:52:41 AM	2/7/03 11:52:41 AM
13	2/7/03 11:52:41 AM	2/7/03 11:52:41 AM
14	2/7/03 11:52:41 AM	2/7/03 11:52:41 AM
15	2/7/03 11:52:45 AM	2/7/03 11:52:45 AM
16	2/7/03 11:52:51 AM	2/7/03 11:52:51 AM
17	2/7/03 11:52:52 AM	2/7/03 11:52:52 AM

The runtime data window includes:

On Time Time stamp of when the point went ON, became true, or equal to "1".

Off Time Time stamp of when the point went OFF, became false, or equal to "0".

Load Retrieves the current runtime information from the controller.

Auto Save When A*uto Save* is enabled, WinControl XL Plus automatically, at regular intervals, appends the runtime data to the history file. See *History files* on page 54.

Table 7–5 Auto Save options

Option	Description
None	Auto Save not enabled
Interval	Saves runtime data at preset intervals.
Daily	Saves trend data by a daily time 12:00 Noon every day or 08:00 every morning.
Last Update	Displays the time the history file was saved.

Runtime logs and loss of power

All runtime data is stored in RAM memory in the KMC digital controllers. In Tier 2 controllers, RAM memory may not be backed up with battery power.

This can lead to loss of data during a power failure. To guard against data loss, the total runtime hours and total number of cycles are automatically written into nonvolatile memory every day. When power is restored to the controller, the runtime totals are automatically carried forward as a starting point for the accumulation process.

Programming with runtime logs

Control Basic can read total hours from a runtime log. The On Time is automatically rounded to whole hours.

Using a Runtime log in Control Basic:

```
10 IF+ TIME > 9:00:00 AND DOW = TUE THEN GOTO 20 ELSE GOTO
30
20 IF RT1 > RT2 then START PUMP2 ELSE START PUMP1
30 END
```

In this example, the output for *PUMP1* is logged in the first runtime log (RT1), and the output for *PUMP2* is logged in the second runtime log (RT2). The pump with the lowest runtime will be chosen to run at 9:00 AM each Tuesday.

```
10 ALARM RT1 > 299, 1, TIME TO CHANGE AHU#1 FILTER. PRESS
PUSHBUTTON ON UNIT TO RESET TIME COUNTER
20 IF+ RESET-BUTTON THEN START RT1
```

Using a Control Basic statement to *START* a runtime log resets the accumulated *On* time and total number of cycle counts to zero. This is equivalent to manually changing *Start Date* on a runtime Log setup worksheet, except *Start Date* remains the same as before.

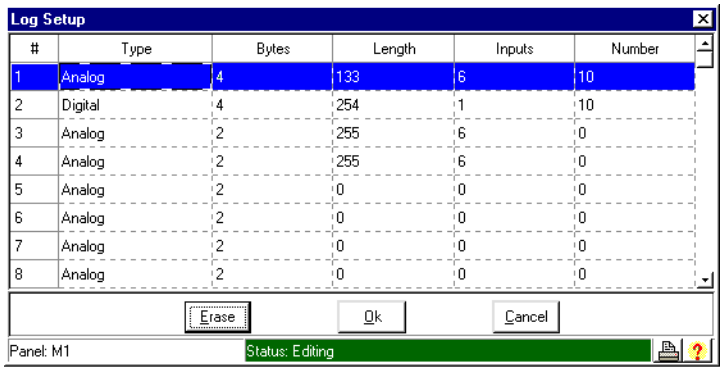
Log Setup

Log Setup is a memory allocation feature of the KMD-5100 controller. Use it to allocate memory for trend and runtime logs. You can choose the number of digital and analog trends and set the number of samples for each type.

Note: Log Setup is available only in KMD-5100 series controller.

Level 4 security access is required to modify *Log Setup.*.

Illustration 7–7 Log Setup



#	Type	Bytes	Length	Inputs	Number
1	Analog	4	133	6	10
2	Digital	4	254	1	10
3	Analog	2	255	6	0
4	Analog	2	255	6	0
5	Analog	2	0	0	0
6	Analog	2	0	0	0
7	Analog	2	0	0	0
8	Analog	2	0	0	0

The worksheet contains the following fields:

Type Toggles between an analog or digital log.

Bytes Sets the significant digits which controls the precision of the recorded data. A setting of 2 is less precise than the default setting of 4, but uses less of the controllers memory. For most applications 2 will get the job done (2 bytes are accurate up to a value of 65,535, but any larger data will result in an erroneous value).

Length Sets the total number of samples stored for each log. Once a log is full, the controller deletes the oldest sample to make room for the next sample.

Inputs Sets the number of input fields. Defaults to 1 for digital runtime logs.

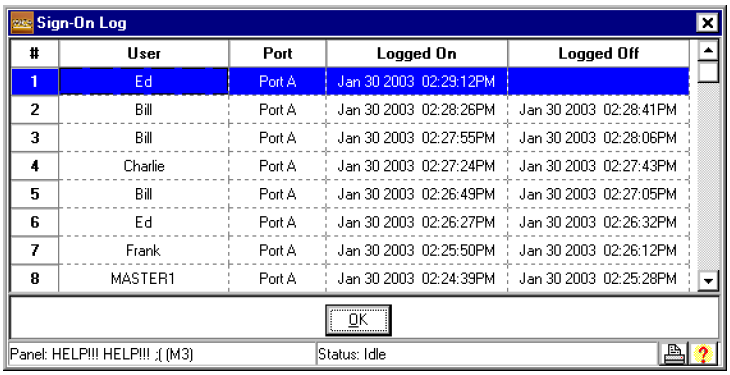
Number Sets the number of logs of a specified type, resolution, length, etc.

Any modifications made to existing values and fields within a worksheet clears all trend log and runtime log data samples held in memory. Additions to an existing worksheet have no effect on data memory.

Sign-On Log

The *Sign-On Log* records the previous 32 users who have logged on to the current controller. A level four security access is required to view the Sign On Log.

Illustration 7–8 Sign-On Log



#	User	Port	Logged On	Logged Off
1	Ed	Port A	Jan 30 2003 02:29:12PM	
2	Bill	Port A	Jan 30 2003 02:28:26PM	Jan 30 2003 02:28:41PM
3	Bill	Port A	Jan 30 2003 02:27:55PM	Jan 30 2003 02:28:06PM
4	Charlie	Port A	Jan 30 2003 02:27:24PM	Jan 30 2003 02:27:43PM
5	Bill	Port A	Jan 30 2003 02:26:49PM	Jan 30 2003 02:27:05PM
6	Ed	Port A	Jan 30 2003 02:26:27PM	Jan 30 2003 02:26:32PM
7	Frank	Port A	Jan 30 2003 02:25:50PM	Jan 30 2003 02:26:12PM
8	MASTER1	Port A	Jan 30 2003 02:24:39PM	Jan 30 2003 02:25:28PM

The display contains the following fields:

User The name of the user. The field displays *ATTEMPT!* after three consecutive unsuccessful sign on attempts.

Port The computer port used. A, B, D and E are valid ports.

Logged On Displays the date and time the user logged on to the system.

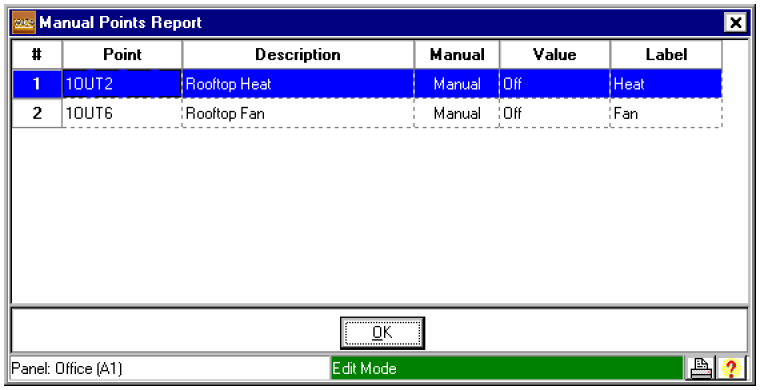
Logged Off Displays the date and time the user signed off of the system. *Logged Off* remains empty if a user is currently signed on or if a communication error terminated the session.

Manual Points Report

The Manual Points Report identifies points on the network that are set to manual.

A level two security access is required to modify any field in the display.

Illustration 7–9 Manual Points Report



The *Manual Points Report* contains the following fields:

Point Displays the mnemonic name of the point that is under manual control.

Description The 20-character description of the point.

Manual All points in this display initially display as *Manual*. Toggle this field to place the point in *Auto*.

Value Displays the current value of the point. Enter this field to change the value of the point.

Label The 8-character label of the point.

History files

History files store long-term trend log data to a connected computer. The data can then be accessed at any time for analysis. WinControl XL Plus automatically creates the file and stores it in the data folder inside of the job folder. See *WinControl job files and folders* on page 181 for details about the job folder. There are two methods to view a history file:

- Open a trend data graph and choose *Load History.*
- Use a text or spreadsheet application.

An example format of spreadsheet file is shown in illustration *History file format in a spreadsheet* on page 55.

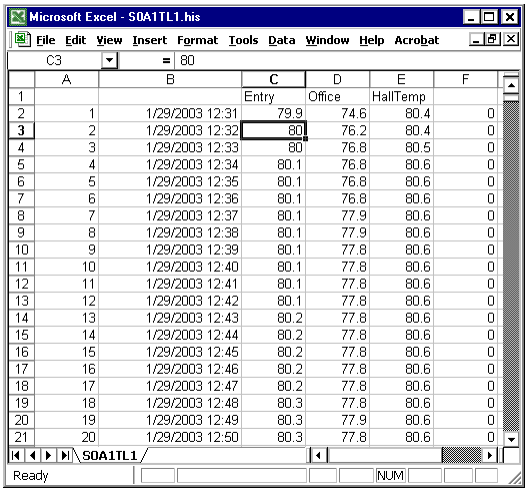
Column A The sequential record number of the stored data.

Column B The date and time the record was recorded. The date and time is based on the date and time maintained in the controller.

Columns C, D, and E The recorded data values. The source of the data is stored in the first row of the column as either the mnemonic, label, or descriptor of the recorded point.

Column F Indicates if the data was recorded manually or automatically. A zero (0) indicates the data was recorded automatically.

Illustration 7–10 History file format in a spreadsheet

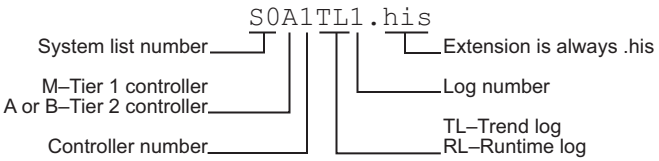


	A	B	C	D	E	F
1			Entry	Office	HallTemp	
2	1	1/29/2003 12:31	79.9	74.6	80.4	0
3	2	1/29/2003 12:32	80	76.2	80.4	0
4	3	1/29/2003 12:33	80	76.8	80.5	0
5	4	1/29/2003 12:34	80.1	76.8	80.6	0
6	5	1/29/2003 12:35	80.1	76.8	80.6	0
7	6	1/29/2003 12:36	80.1	76.8	80.6	0
8	7	1/29/2003 12:37	80.1	77.9	80.6	0
9	8	1/29/2003 12:38	80.1	77.9	80.6	0
10	9	1/29/2003 12:39	80.1	77.8	80.6	0
11	10	1/29/2003 12:40	80.1	77.8	80.6	0
12	11	1/29/2003 12:41	80.1	77.8	80.6	0
13	12	1/29/2003 12:42	80.1	77.8	80.6	0
14	13	1/29/2003 12:43	80.2	77.8	80.6	0
15	14	1/29/2003 12:44	80.2	77.8	80.6	0
16	15	1/29/2003 12:45	80.2	77.8	80.6	0
17	16	1/29/2003 12:46	80.2	77.8	80.6	0
18	17	1/29/2003 12:47	80.2	77.8	80.6	0
19	18	1/29/2003 12:48	80.3	77.8	80.6	0
20	19	1/29/2003 12:49	80.3	77.9	80.6	0
21	20	1/29/2003 12:50	80.3	77.8	80.6	0

History file name format

WinControl XL Plus automatically names the History file as shown in the following illustration.

Illustration 7–11 Format for History file name

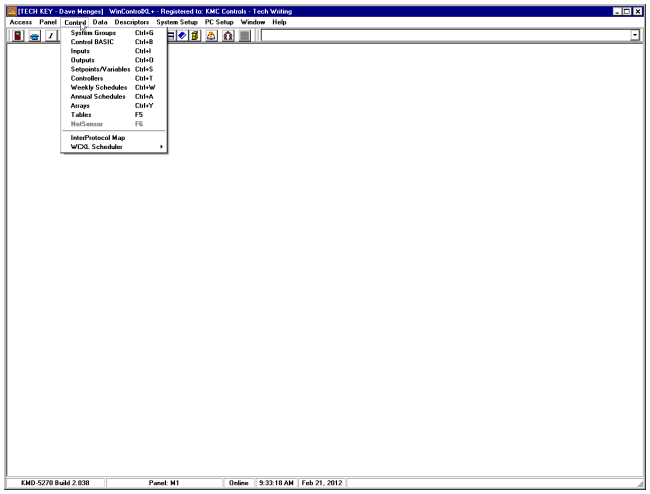


Section 8: The Control menu

The control menu provides programming control of system groups, inputs, outputs, variables, controllers, schedules arrays and tables. It is also the selection for entering Control Basic programs and programming for the KMC Controls NetSensor.

Use the Control menu to access the following functions:

Illustration 8–1 Control menu



System Groups

System Groups are custom designed windows created to provide quick access to the most often used parts of a system. A system group can be a few text based controls or a complex graphical user interface that includes animated displays and site plans. With the library of graphics in WinControl XL Plus you can display all parts of a system such as temperature, setpoints and equipment settings. Links can be placed in system groups which open links to other system groups.

To configure and view system groups, see the following topics.

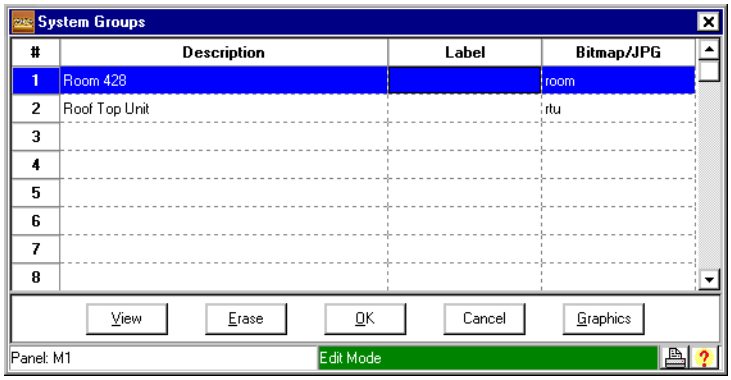
- *Using the System Groups list* on page 58
- *Viewing the System Group* on page 61
- *Creating a System Group* on page 60
- *Adding points, links and animation to system groups* on page 63
- *Designing System Group Graphics* on page 207
- To change startup defaults, see *System Group options* on page 118.

Using the System Groups list

The System Groups list displays the system groups which have been created in a controller. The list has two purposes:

- To select a previously configured system group. See *Viewing the System Group* on page 61.
- To enter basic information about a new system group, including the name of the background graphic. See also *Creating a System Group* on page 60.

Illustration 8–2 Systems Groups list



Description Enter up to 20 characters for the description of the system group.

Label Enter a short name of the system group. The label can be up to eight characters long. *Label* is an optional field.

Bitmap/JPG Enter the name of a background graphic file that is stored in the *Pictures* folder. When entering a name, do not enter the file name extension (BMP or JPG). WinControl XL Plus displays the file as the background for a *System Groups* window.

View Select a system group and then choose *View* to display the group. You may also click the numeral in the first column.

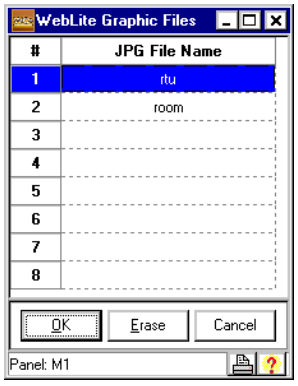
Erase Use to remove the system group from the controller. System groups may also be erased or cleared from Single Point Access. See *Single Point Access* on page 34.

Graphics (KMD–5270 only) Enter the file name of the background graphic to be stored in the KMD–5270 for viewing with a web browser.

- Enter the file name without the extension.
- The file type must be `.jpg` and cannot be larger than 50kB.
- Enter the same name in the *Bitmap/JPEG* column in the System Groups list window.
- Place the file in the *Pictures* directory in the job folder. See the section *WinControl job files and folders* on page 181 for the *Pictures* folder location.

Note: The KMD–5270 must be connected by Ethernet to the computer running WinControl XL Plus to load graphics. WinControl XL Plus 2.0 or later is required to load browser graphics into a KMD–5270.

Illustration 8–3 KMD–5270 background graphics list



Caution

A background graphic file name may be compatible with WinControl XL Plus but not with all browsers. WinControl XL Plus will send a background graphic with an incompatible file name to the controller but the browser may not display it. If unsure about browser compatibility, use only letters and numbers. File names are limited to 10 characters by WinControlXL Plus.

Creating a System Group

System groups are usually the final step in programming a controller or system. The basic steps for creating a system group are:

- Plan the points, variables and schedules for display and control in a system group.
- Create a background graphic for each group and enter the name in the system group list.
- Place text, links and animated graphics over background images.
- If required, create a site system group which links to other system groups.
- Test the links and controls to verify proper operation.

System groups are created with two types of graphics:

- Background graphics which display the overall view of the system
- Animated graphics which display motion and provide control

Background graphics

A background graphic is the base graphic for a system group and must be either `.bmp` or `.jpg` file format.

Table 8–1 System Group graphic file formats

File format	Description
JPG	Small, highly compressed JPG files load faster but may blur detail
BMP	Bitmap files preserve detail but the larger file size takes longer to load

See *Designing System Group Graphics* on page 207 for complete instructions on creating background graphics with the WinControl XL Plus graphics library.

Animated graphics

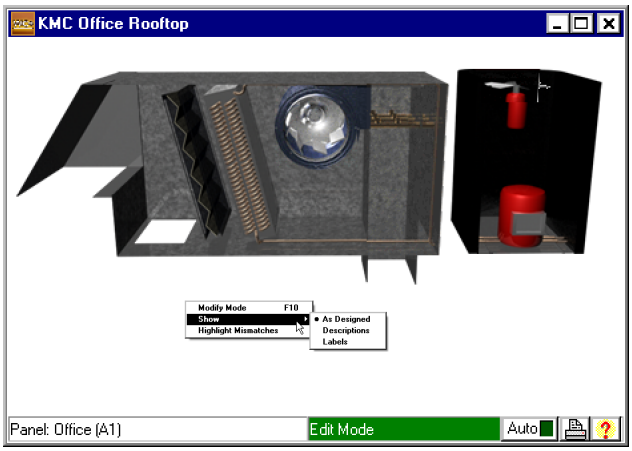
Animated graphics must be file GIF format. The animated graphics in the KMC Controls animation folder are designed to compliment the KMC Controls background graphics. To use the animated graphics, copy the files you need into the *Picture* folder in the job folder. See *Add Animated GIF* on page 65for detail instructions to add animation to a background.

Viewing the System Group

After choosing a group from the *System Groups* list, the group opens in a window. A new system group opens with only the background graphic.

Right-click over an open area to change viewing options or change to *Modify Mode* to add points, controls and animated graphics to the system group. See *Adding points, links and animation to system groups* on page 63.

Illustration 8–4 System Group with background



Modify Mode (F10) Toggles to *Modify* mode. The status bar changes to *Edit Mode*.

Show Includes the following options:

- **As Designed** Displays description or label as the group was created.
- **Descriptions** Displays points by their 20-character description.
- **Label** Displays points with their 8-character label.

Set mode and appearance for *System Groups* windows when they open in *PC Setup*, *Startup Defaults* dialog. See *Startup Defaults* on page 117.

Highlight Mismatches/Hide Mismatches Choose *Highlight Mismatches* to identify elements in a system group that may not function or display correctly. The elements are highlighted with a red rectangle. Rolling the cursor over the elements in the system group displays a tool tip with a list of the mismatched system group elements.

Choose *Hide Mismatches* to continue using the system group without correcting the mismatch.

Illustration 8–5 System Group Mismatch

Mismatches take place when a system group is modified from more than one computer and the *Groups* folder from the job folder is not copied to all other computers that connect to the system. Data for the system group is stored both in the computer and in the controller. When the data does not match, WinControl XL Plus alerts the operator to the mismatch condition. The mismatch may be as simple as a slight change in position or as serious as an object bound to the wrong point.

- See *Restore From File* on page 66 for instructions on restoring the system group data in the controller to the same settings as the system group file.

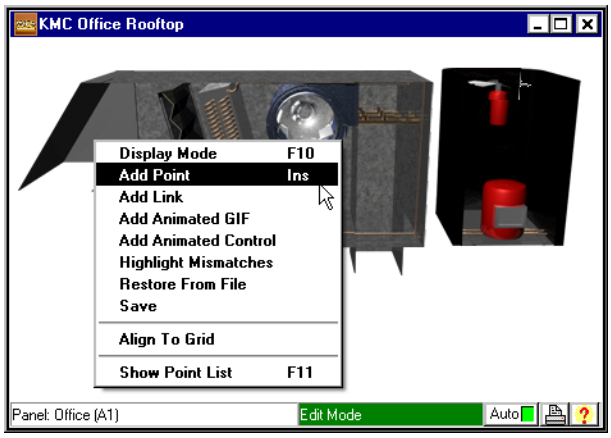
- See *Highlight Mismatches/Hide Mismatches* on page 62 to enable or disable this feature.

Auto Choose *Auto* for automatic screen updates every few seconds.

Adding points, links and animation to system groups

A system group must be in the edit mode before adding or editing items. To add or edit an object, right-click over an open area in the system group. The *Modify* dialog opens.

Illustration 8–6 Modify mode options



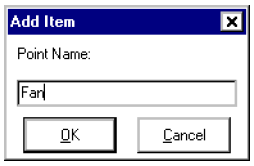
Tip: System groups in a local controller or terminal unit controller can have up to 32 different items on each screen. These items can be points from any controller residing on that particular network. Each system group in a Tier 1 controller can contain up to 160 items. These items can be retrieved from any controller in the Tier 2 network connected to that Tier 1 controller, or from any other Tier 1 controller on the Tier 1 network.

Local and terminal unit controllers do not contain on-board memory dedicated to store location and color details for points on a system group. WinControl XL Plus creates a file in the job folder to store this information.

Display Mode F10 End modify mode and return to display mode.

Add Point Add any valid point from the network. Define the point by typing its mnemonic (OUT6), its 8-character label (FAN) or its full 20-character description (Rooftop Fan). An item can be any point, variable, controller or schedule in the system.

Illustration 8–7 Add point dialog



Add Link Adds a link which starts selected WinControl XL Plus menu items.

Illustration 8–8 Add link dialog for system groups

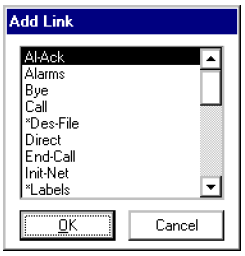


Table 8–2 Link commands

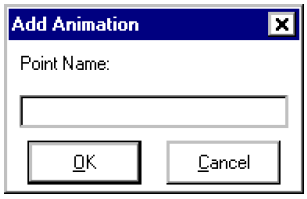
Link	Action
Al-Ack	Acknowledges alarms in current alarms screen
Alarms	Displays current alarms screen
Bye	Logs out the current user and opens the System Sign-On dialog. Similar to *Bye* on page 30.
Call	Displays System List - allows dialing a remote site
Direct	Single point access
End-Call	End connection with remote system. Similar to *End Call* on page 31.
Init-Net	Issues the *Initialize Network* command on the current network
Load-DES	Loads descriptors from the currently connected controller (shown on the information bar)
Log-setup	Displays the Tier 1 Controller Trend and Runtime memory allocation table
Manual	Manual Points Report
Open File	Opens Windows Explorer
Network	Displays Network Status dialog
Panel	Select network status
Passwords	Displays the user passwords dialog
Ports	PC ports setup screen
Print Des	Prints descriptors from the current controller
Set-Time	Allows system time and date to be set

Link commands (continued)

Link	Action
Setup	Startup defaults for WinControl
Sub panel	Network status screen
Sys-Name	Allows the system name to be changed
Text	Inserts a text block be used to display titles or other text information.
Units	Custom Units table
Users-Log	Displays a list of users that have logged onto and off of the system.

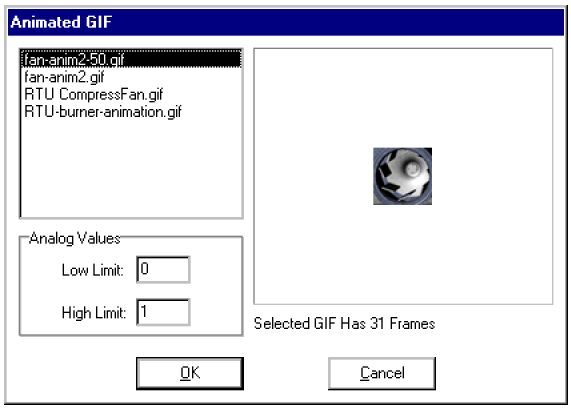
Add Animated GIF Choose *Add Animated GIF* to add motion to system groups. Animated graphics add motion to backgrounds which helps to display equipment status. When you choose *Add Animated GIF*, a dialog opens. Enter a mnemonic, label or descriptor of the point you are adding to the system group.

Illustration 8–9 Add Animated GIF dialog



When the point is entered, a second dialog opens with which you can choose the animation file. Only animation files placed in the *Pictures* folder for the digital system on which you are programming will be listed. Before you start programming a system group, copy animation files from the *Animation* folder on the KMC WinControl CD to the *Pictures* folder.

Illustration 8–10 Animation selection dialog



When you click *OK* in the animation selection dialog, the animated object will appear in the group window. Drag the object over the area to animate.

Illustration 8–11 System Group window with animated fan

Save Sends changes to the controller. *Save* also stores the system group configuration in the job folder.

Choosing *Yes* simultaneously sends the system group to all controllers of the same type. See *Network Status* on page 34 for additional information.

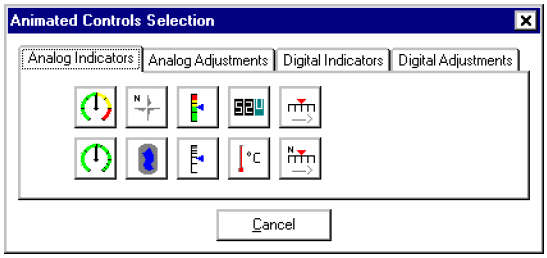
Restore From File Restores the condition of a system group in a controller to match the settings with the file stored within the *Groups* folder. This overrides system group settings in the controller. Use *Restore From File* only with a system group file that is known to be correct.

- See *Highlight Mismatches/Hide Mismatches* on page 62 for details on locating system group mismatches.
- See *WinControl job files and folders* on page 181for the location of the *Groups* folder.

Tip: The *Restore From File* function is compatible only with system group files created by WinControl XL Plus 2.04 or a later release.

Add Animated Control Animated controls are a set of common controls and indicators which can be added to a system group in the same way animated GIF files are added, but do not require placing files in the picture folder. Choosing animated controls opens the dialog shown in the illustration See "Animated controls dialog" on page 67.

Illustration 8–12 Animated controls dialog

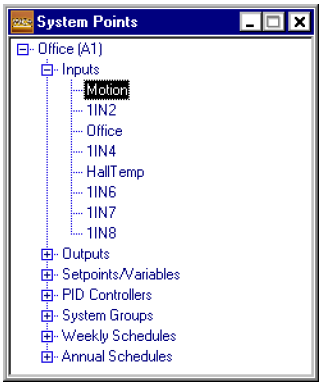


There are four types of animated controls:

- Analog Indicators
- Analog Adjustments
- Digital Indicators
- Digital Adjustments

Show Points List Use the points list to drag and drop a point from the list into a system group. Click the plus sign (+) to expand the list for inputs, outputs, variables, controllers, groups and schedules. Labels are listed where assigned.

Illustration 8–13 System Points dialog



Modifying an object

To modify an animated GIF, text or control, right-click on the item and select *Modify Mode (F10)*.

Move Item Changes the location of the point. The pointer will move an outline of the object which can be placed anywhere in the system group.

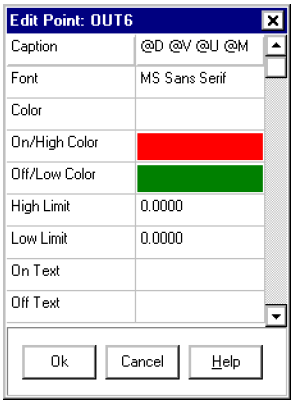
Delete Item Permanently removes the point from the system group.

Edit Item Displays the edit window for the object. Animated GIFs, text and controls each have edit properties unique to that object.

Editing text captions

For points displayed as text (points added with *Add Points* or from *Show Points List*).

Illustration 8–14 Text Captions dialog



Press *OK* to save changes or *Cancel* to close the window without saving changes.

Caption control codes

Use control codes in combination with text entered in this window to customize what is displayed. Use the following control codes from the table *Caption control codes* on page 69 in text captions to display specific point attributes. For example, you can enter:

The current outside temperature is @V degrees

The sentence will be displayed as typed but with *@V* replaced with the actual value of the point when in display mode:

The current outside temperature is 65.2 degrees.

Font Opens a dialog with which you can choose font characteristics.

Color Sets the color of the point in the normal state. If there are high or low limit colors set, the point displays in those colors.

ON/High Color Sets the color for the point if the value of the point exceeds the defined high limit. Use with digital or analog points.

OFF/Low Color Sets the color for the point if the value of the point falls below the defined high limit. Use with digital or analog points.

Set *On/High Color* and *Off/Low Color* to a tint other than the background color. This will prevent loosing the point against the background. If you lose a point you can find it again by moving the cursor over the area where the point was placed. When the cursor is over the point, it changes from the arrow to the hand symbol.

On Text Text displayed when the point is *On* or equal to 1.

Off Text Text displayed when the point is *Off* or equal to 0.

Table 8–3 Caption control codes

Code	Display from WinControl	KMD–5270
@A	Inserts the current date.	No display
@D	Inserts the description of the point.	Inserts the description of the point. If placed after *@L* or *@P* it overrides them and always displays the description. Only the mnemonic of the controller and point displays from a browser.
@E	Inserts *-D* if the point is decommissioned.	No display

Caption control codes (continued)

Code	Display from WinControl	KMD–5270
@L	Inserts the label of the point.	Inserts the label of the point - If placed after @*D* or @*P* it overrides them and always displays the label. Only the mnemonic of the controller and point displays from a browser.
@M	Inserts *-M* if the point is in manual mode.	Inserts *-M* if the point is in manual mode and *Units* are also displayed.
@N	Inserts the panel name.	No display
@P	Inserts either the label or description of the point depending on the setting *Show Labels in Groups/Show Descriptions in Groups* in *Startup Defaults* on page 117.	Inserts either the label or description of the point depending on the setting of *Show Labels in Groups/Show Descriptions in Groups* in *Startup Defaults* on page 117 when the system group was saved. Following @*P* with @*D* or @*L* will override it and render this code meaningless. Only the mnemonic of the controller and point displays from a browser.
@S	Inserts the system name.	No display
@T	Inserts the time.	No display
@U	Inserts the units for analog points. (C, F, Volts, FPM....)	Displays units if the point is not configured as a digital point.
@V	Inserts the actual point value.	The value of the point is always displayed regardless of the presence of the @*V* code.

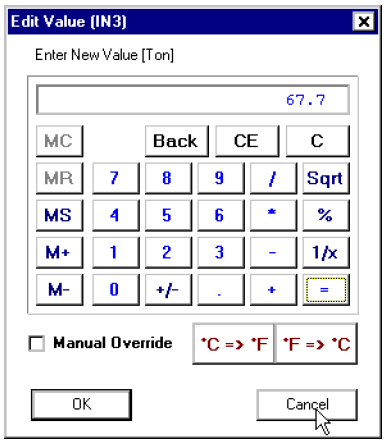
Creating invisible buttons

By entering spaces instead of caption codes you can create a hidden button in a system group. This is useful when the background file has buttons specifying links to other graphics or on building overviews where you want to be able to access details on certain areas by clicking anywhere in that area.

Controlling points manually

Points can be changed through the objects in the system group. To change a point, click on an object and the *Edit Value* dialog opens.

Illustration 8–15 Edit Value dialog



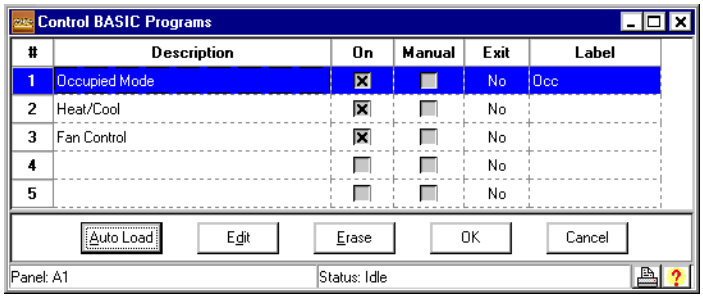
Edit New Value Indicates the state for digital points or actual numeric value for analog points of the selected item.

Manual Override Indicates if the point is in automatic or manual operation.

Control Basic Editor

Control Basic programming is the method by which automation is added to a KMC Controls system. See *About Control Basic programs* on page 123.

Illustration 8–16 Control Basic Programs list



Inputs

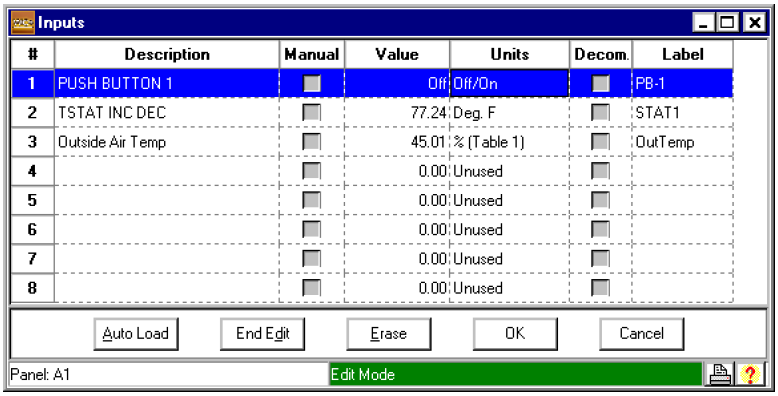
Use *Inputs* to configure the input signals to the controller.

AutoLoad/EndAuto When in AutoLoad mode, continuously updates the controller with the data in the *Inputs* list.

Edit/End Edit When WinControl XL Plus is in edit mode, the values and settings are not updated. When either *End Edit* or *Ok* is clicked, all of the values from the input list for a block of inputs are sent to the controller.

See *Single Point Editing* on page 74 for instructions on updating a single input.

Illustration 8–17 Inputs List



Description A 20-character description of the device connected to the input. See *About descriptors* on page 102 for an explanation about how a description is used.

Manual Indicates the input is either in auto or manual mode. When in manual mode (checked), the value will remain as displayed until changed by a user. When in auto mode (unchecked), the actual value of the input signal will be displayed.

Value The current level, quantity, or state of the point.

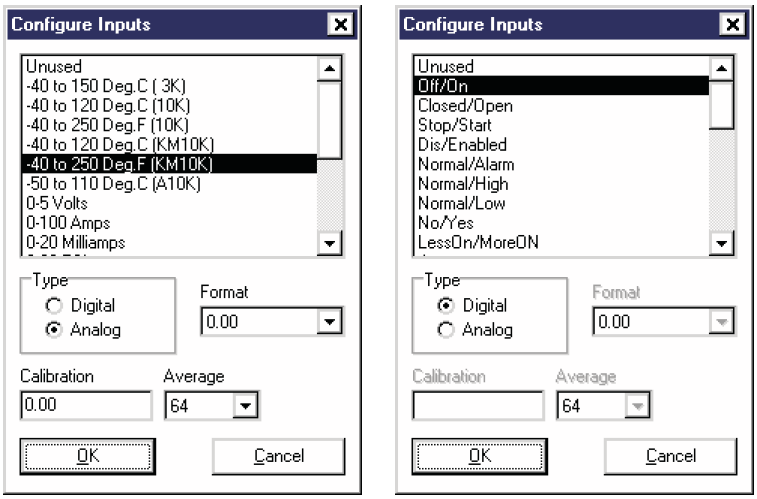
Decom. Indicates the input value has been out of range for more than two minutes. If the point is reading normally, this column will be empty. If the letter *Y* is present and the input is reading normally, it has at some time been out of range which may indicate an intermittent problem. *Decom.* is valid only for inputs configured for a KMC thermistor or table.

See the Control Basic keyword *DECOM* on page 149 to detect the state of *Decom.* in Control Basic.

Label The 8-character description of the input. See *About descriptors* on page 102 for the way labels are used.

Unit Use *Unit* to select the unit of measure and scale factor for the input signal. To set the value, click *Unit* to display a list of available units of measure.

Illustration 8–18 Configure input dialog



Analog units of measure **Digital units of measure**

Units of measure list Select the unit of measure appropriate for the input device.

In the scroll box, the digital units of measure are shown as a pairs. The first unit is the normal state. When referencing digital inputs in Control Basic, the left hand state is *False* (0) and the right hand state is *True* (1).

Type Select either analog or digital.

- Analog–Devices with modulating inputs that operate from a varying voltage (0-5 volts)
- Digital–Devices which require one of only two states (*On* or *Off*)

If the type is changed, a new list of ranges will appear in the *Configure Input* dialog.

Note: When the pull-up resistor is installed, an open input will read 5 volts DC. A closed contact input reads 0 volts DC. When the pull-up resistor is removed the input will read 0 volts DC open or closed.

Note: Select *10K* units for STE-1200 series sensor. For STE-5000 series thermostats use *KM10K* units. For platinum RTD inputs, choose *Type 85* or *Type 91*. See

the installation and operation guide for the controller for hardware input configuration when using a platinum RTD.

Format Enter a value for the fixed number of digits or decimal places to display in *Value*. Not applicable for digital inputs.

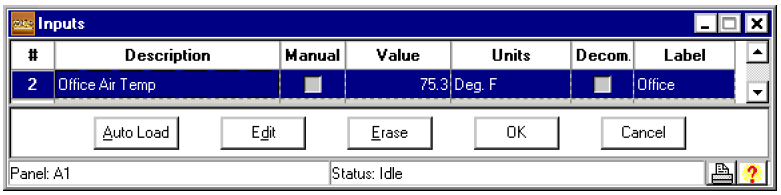
Calibration Use to enter a calibration factor to adjust the input for sensor inaccuracies. The valid range for a calibration factor is from -30 to 30. The default value is 0 (no calibration). Not applicable for digital inputs.

Average Sets the number of samples which are averaged together to calculate the displayed value. A sample is taken on each scan.

Single Point Editing

Use single point editing while an input, output or variable list is open and not in Edit mode. Choosing *Manual* or *Value* opens an additional dialog for entering changes. When you choose OK, only the point in the single point editing dialog is sent to the controller.

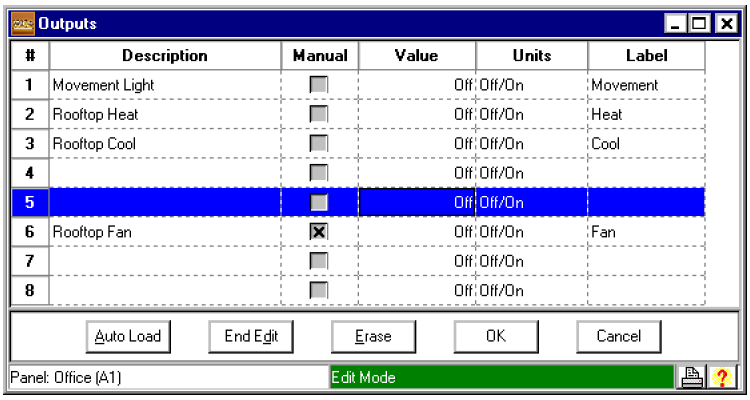
Illustration 8–19 Single Point editing dialog



Outputs

Use the Outputs list dialog to view and manage output points.

Illustration 9–1 Outputs dialog box



AutoLoad/EndAuto When in AutoLoad mode, the program continuously updates the controller with the data in the *Outputs* list.

Edit/End Edit When WinControl XL Plus is in edit mode, the values and settings are not updated. When either *End Edit* or *Ok* is clicked, all of the values displayed in the output list for a block of outputs are sent to the controller.

See *Single Point Editing* on page 74 for instructions on updating a single output point.

Ampersand (#) The output point number.

Description A 20 character description of the device connected to the output. See *About descriptors* on page 102 for an explanation on how descriptions are used.

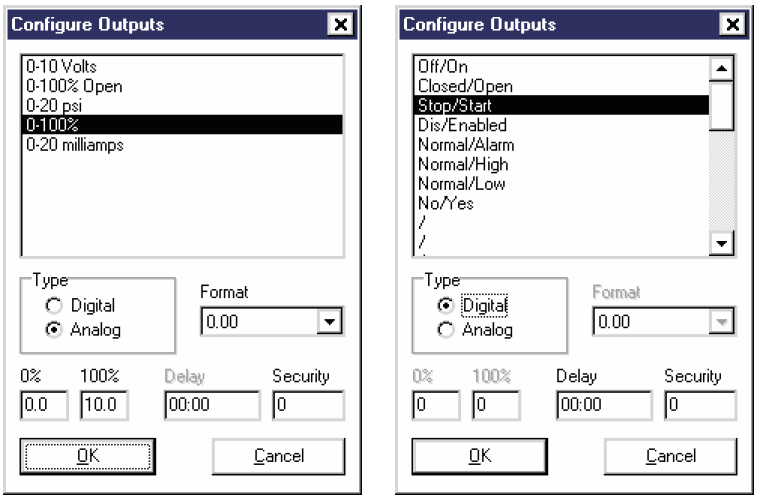
Manual Indicates the output is either in auto or manual mode. When in manual mode (checked), the output will remain as displayed until changed by a user. When in auto mode (unchecked), Control Basic programming sets the output value of the point.

Value The current level, quantity, or state of the point.

Label The 8-character description of the output. See *About descriptors* on page 102 for how labels are used.

Units Click in the *Units* column to modify the output range and units. The *Configure Outputs* dialog opens.

Illustration 9–2 Configure output units



Configure analog output **Configure digital output**

Units of measure list Select the unit appropriate for the output device.

Outputs can be set up for one of several standard or custom units. In addition there are also inverted digital units, which reverse the display of the output of the standard digital unit pairs.

In the digital outputs scroll box, the units of measure are shown as a pairs. The first unit is the normal state. When referencing digital points in Control Basic, the left hand state is *False* (0) and the right hand state is *True* (1). Custom Units do not have an inverted range. If an inverted custom range is required you must reverse the setup on the custom unit or create a reversed custom unit.

Type Select either analog or digital

- Analog–Devices which modulating outputs that operate from a varying voltage (0-10 Volts)
- Digital–Devices which require one of only two states

When *Type* is changed, a new list of units of measure will open in the range selection window.

Format Choose the number of digits or decimal places to display when the point value is shown. Not applicable for digital outputs.

0% Sets the voltage at the output which corresponds to 0% output. Applicable only when using units of percent (%).

100% Sets the voltage at the output which corresponds to 100% output. Applicable only when using units of percent (%).

Delay Sets a delay in minutes and seconds which sets a period before the output changes to *ON* after being *OFF*. This timer takes precedence over any Control Basic program. The maximum start delay is 99 minutes and 50 seconds.

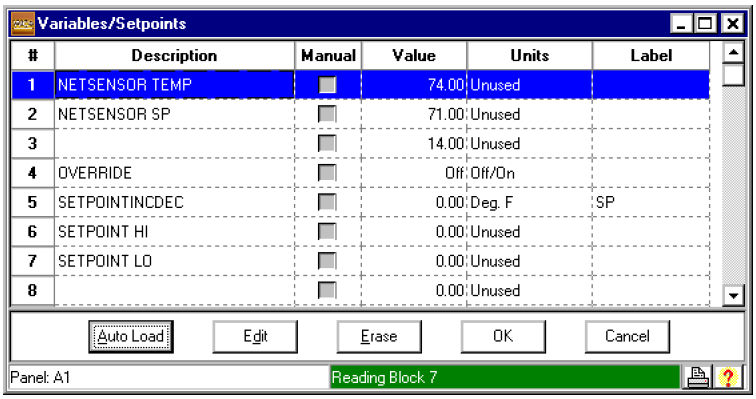
Security Enter the output security level assigned to the point. A user must have a security level at or above this value to make changes to the point.

Setpoints /Variables

Use *Setpoints/Variables* to define program variables used in Control Basic. Variables are place holders for information such as setpoints, time delays and modes. Minimum, maximum and average and average values, counters and flags are also applications for program variables. Only a limited number of variables may be passed between controllers. See *Transferring values between controllers* on page 135 for details.

All security levels can view the variables list. Level two security access is required to modify the values and a level four security access is required to change the description or label fields, add new variables or change the unit selections.

Illustration 9–3 Setpoints variables dialog



AutoLoad/EndAuto When in AutoLoad mode, the program continuously updates the controller with the data in the *Variables/Setpoints* list.

Edit/End Edit When WinControl XL Plus is in edit mode, the values and settings are not updated. When either *End Edit* or *Ok* is clicked, all of the values displayed in the *Variables/Setpoints* list for a block of variables are sent to the controller.

See *Single Point Editing* on page 74 for instructions on updating a single output point.

The Variables/Setpoints list contains the following fields:

The variable number.

Description A 20 character description of the variable. See *About descriptors* on page 102 for an explanation on how descriptions are used.

Manual Indicates the variable is either in auto or manual mode. When in manual mode (checked), the variable will remain as displayed until changed by a user. When in auto mode (unchecked), Control Basic programming sets the output value of the point.

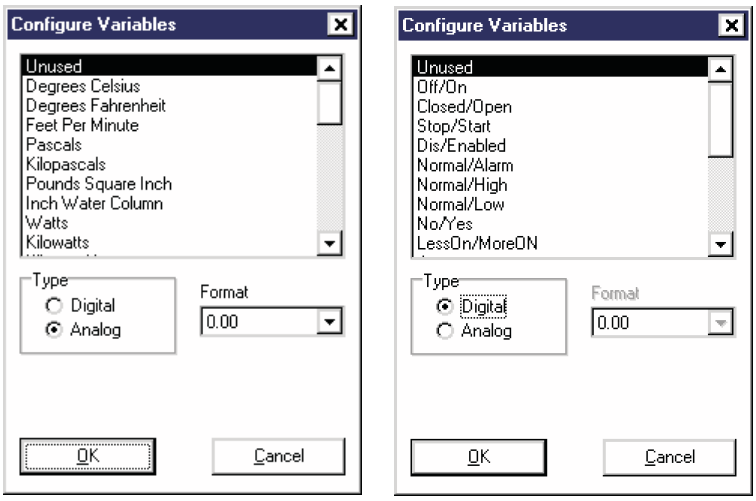
Value Current value assigned to the variable.

Label An 8-character description of the variable. See *About descriptors* on page 102 for an explanation on how labels are used.

Units To set a unit of measure, click the *Unit* column.

Type Choose *Analog* or *Digital*. Analog points can be any real number. Digital points can only be one of two states. Analog and Digital types have separate Units listings.

Illustration 9–4 Configure Variable Units



Configure analog variables **Configure digital variables**

Units of measure list Unit of measure assigned to the variable. When referencing digital unit states in Control Basic, the left-hand state is *False* (0) and the right-hand state is *True* (1).

Format Choose the number of digits or decimal places to display when the point value is shown. Not applicable for digital variables.

Controllers

Use *Controllers* to manage the PID controller loops in the connected controller.

About PID control loops

A PID controller is a mathematical function which calculates the analog output required to maintain a process at or near a setpoint.

For example, a system composed of a room with a temperature sensor and a modulating radiant hot water valve. By entering the room temperature, setpoint and PID controller parameters into the controller, the controller compares the room temperature to the setpoint and then calculates the output which opens or closes the radiant hot water valve to maintain the setpoint.

Assign the PID controller output to the hot water valve with a Control Basic program.

```
10 OUT1 = CON1
```

A level two security access is required to modify the status of a controller from auto to manual as well as change the controller output.

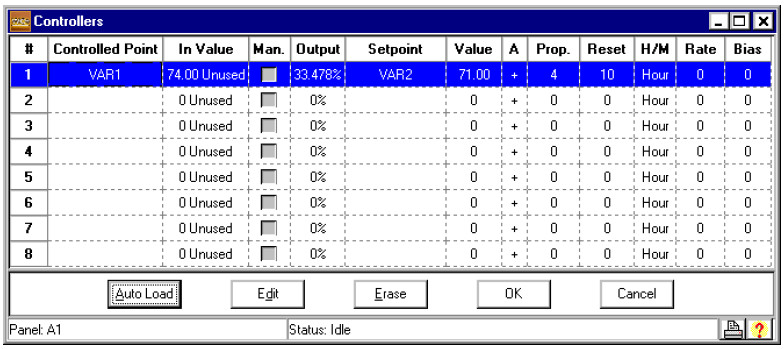
A level three security access is required to change *In Value*, *A*, *Prop*, *Reset*, *Rate* and *Bias*.

A security access level of at least four is required to modify all fields and to add new controllers.

PID Controller Details

The *Controllers* list contains the following fields:

Illustration 9–5 PID controller list



#	Controlled Point	In Value	Man.	Output	Setpoint	Value	A	Prop.	Reset	H/M	Rate	Bias
1	VAR1	74.00 Unused		33.478%	VAR2	71.00	+	4	10	Hour	0	0
2		0 Unused		0%		0	+	0	0	Hour	0	0
3		0 Unused		0%		0	+	0	0	Hour	0	0
4		0 Unused		0%		0	+	0	0	Hour	0	0
5		0 Unused		0%		0	+	0	0	Hour	0	0
6		0 Unused		0%		0	+	0	0	Hour	0	0
7		0 Unused		0%		0	+	0	0	Hour	0	0
8		0 Unused		0%		0	+	0	0	Hour	0	0

Controlled Point The name of the input measuring the condition under control.

The input to the PID controller is the sensed value that is to be maintained at the setpoint value

In Value Displays the value of *Controlled Point*.

Man Indicates whether the controller is in auto or manual. In auto (unchecked), the controller automatically generates an output value once every scan. When the controller is in manual (checked), the output value of the controller is overridden and remains as shown in the output column.

Output Displays, in percent, the current output value of the controller. The value of the output is the mathematical sum of the four functions (PROP +RESET +RATE +BIAS).

Setpoint Enter the target value of *Controlled Point*. Use a mnemonic, label or description to define *Setpoint*.

Value Displays the value of the setpoint.

A (Action) The action of the controller. Action can either be direct acting or reverse acting.

- Direct acting controllers (+) increase the output as the input rises above the setpoint.
- Reverse acting controllers (-) decrease the output as the input rises above the setpoint.

Prop The proportional value is the amount of sensed change that will cause the output to move from 0 to 100%.

For example, in a chilled water system designed to operated a valve from fully closed to fully open over 5 degrees, specify a positive proportional band of 5. When the temperature is at the setpoint, the valve will be completely closed or 0% output. When the temperature is 5 degrees above the setpoint, the valve will be completely open or 100% output and trying to cool the space. Any deviation between the setpoint and the actual sensed temperature is known as error or offset.

The proportional parameter is the *P* in PID.

To program *Proportional* with Control Basic, see the keyword *CONPROP* on page 145.

Reset and H/M Reset adds a correction factor to the control loop based on how long the condition has been outside the setpoint. It specifies the number of times the magnitude of the error is added or subtracted to the output signal, over time, to eliminate the offset. *Reset* rate is specified in a repeats per hour (H) or per minute (M).

For example, a system maintaining a continuous error of two units and a reset of five per hour were specified, the output of the controller will change by ten units per hour in a direction to reduce the error.

Reset can also be thought of as the time integral of the error. Integral is the *I* in PID.

The KMD PID controllers have an anti-windup feature when using *Reset*. In typical loops the integral will continue to increase as long as there is a positive error. For most HVAC applications, such as space temperature control, integral windup is undesirable. To avoid windup, KMC PID controller algorithms are programmed with an integral capping feature. This limits the integral portion of the output to the percentage below 100% not used by proportional correction. If the proportional value is 60%, the integral can only increase to 40%. As the error increases, the rate that the integral adds into the output will increase but the integral will actually decrease because it has less room. The proportional amount will continue to squeeze out integral until the input value is outside the proportional band at which point integral value is 0. Integral windup can only happen within the proportional band and is eliminated as the error increases.

To program *Reset* with Control Basic, see the keyword *CONRESET* on page 146.

Rate Rate slows the rate of change of the error. Rate is specified in minutes.

Use rate to reduce overshoot. If the error is changing at 1.0 per second (60/min) and the rate was .25 minutes then the derivative component would equal 60 /Min X .25 Min =15%. This 15% would be added in over the 1 minute in a direction to reduce the rate of changing regardless of whether the input is above or below the setpoint.

Caution

Use Rate only in systems without time lags. The input must start responding immediately to an output change. If there is a time delay the control loop will be unstable and will perform better without rate correction.

Rate is the *D* (derivative) in PID.

To program *Rate* with Control Basic, see the keyword *CONRATE* on page 146

Bias Sets the output value at setpoint.

The bias is the value the controller will reach at equilibrium when reset is not used.

Weekly Schedules

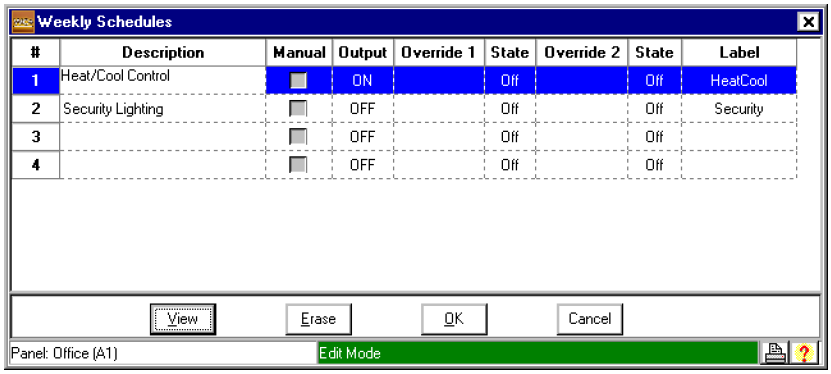
Weekly schedules are convenient methods for scheduling recurring daily events. Once a schedule is entered, Control Basic can then test the state of the schedule to determine if it is *On* or *Off*.

To link a point to a weekly schedule, write a Control Basic line similar to the following:

```
10 Occupancy_Status = WS1
```

A security access level of two is required to modify the fields and a security access level of four is necessary create new schedules.

Illustration 9–6 Weekly Schedules list



#	Description	Manual	Output	Override 1	State	Override 2	State	Label
1	Heat/Cool Control		ON		Off		Off	HeatCool
2	Security Lighting		OFF		Off		Off	Security
3			OFF		Off		Off	
4			OFF		Off		Off	

About the Weekly Schedule list

Each weekly schedule includes a seven-day week and two overrides. Each day has four *On* and four *Off* times. Using twenty-four hour clock notation, you may enter any combination of *On* and *Off* sequencing.

To access the times of a specific weekly schedule click *View* or click the schedule number.

The menu contains the following fields:

Description A 20-character description of the schedule. For an explanation on how descriptions are used, see *About descriptors* on page 102.

Manual Indicates whether the schedule is in manual (checked) or automatic (unchecked) mode.

Output Indicates whether the schedule is *On* or *Off*.

Override 1 and Override 2 Enter the descriptor that will enable this override. If this override is *On*, the state of the weekly schedule will follow the schedule in the weekly schedule details OR1 column (See the *Entering*

times in a weekly schedule on page 83). If *Override 1* is *On* then *Override 2* is disregarded.

State Indicates the state of point in *Override 1* or *Override 2*.

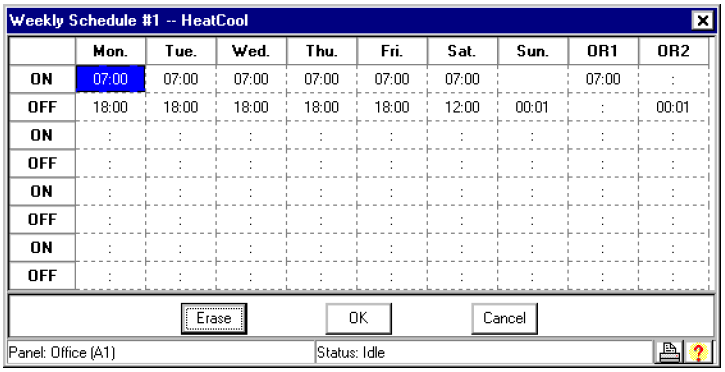
Label An 8-character label of the schedule. See *About descriptors* on page 102 for an explanation on how labels are used.

Entering times in a weekly schedule

Selecting a schedule from the Weekly Schedules list opens a daily details dialog. When entering the daily schedule, observe the following:

- Times are entered in *hour:minutes*, 24-hour clock format.
- Entering 00:00 clears the field.
- When more than one *On* and *Off* time is entered per day, times must be entered in ascending order.
- Enter 00:01 (1 minute after midnight) to designate midnight.
- Do not leave empty days. If the *On* or *Off* state is to continue from a previous day, enter 00:01 in the first *On* or *Off* row for that day.

Illustration 9–7 Weekly Schedule daily details



	Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	Sun.	OR1	OR2
ON	07:00	07:00	07:00	07:00	07:00	07:00		07:00	:
OFF	18:00	18:00	18:00	18:00	18:00	12:00	00:01	:	00:01
ON	:	:	:	:	:	:	:	:	:
OFF	:	:	:	:	:	:	:	:	:
ON	:	:	:	:	:	:	:	:	:
OFF	:	:	:	:	:	:	:	:	:
ON	:	:	:	:	:	:	:	:	:
OFF	:	:	:	:	:	:	:	:	:

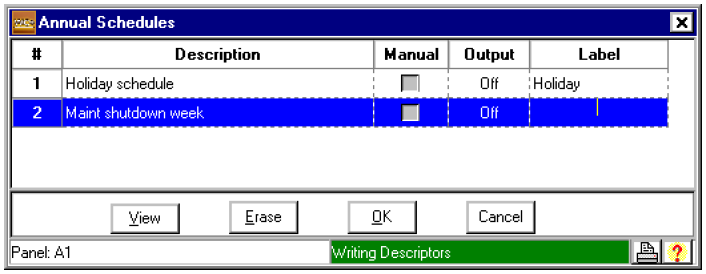
OR1 and OR2 schedule times are used when the value entered in the Override 1 or Override 2 column becomes *True* (1) or *On*.

Annual Schedules

Use annual schedules to designate special days during a year. As each special day arrives, the annual schedule will be *On*. Annual schedules are either *On* or *Off*. Use annual schedules to place overrides in weekly schedules.

A level two security access is required to modify the fields and a security access level of at least four is required to create new annual schedules.

Illustration 9–8 Annual schedule list



About the Annual Schedule list

Description A 20-character description.

Manual Indicates whether the schedule is in manual mode (checked) or automatic mode (unchecked).

Output Indicates whether the schedule is *On* or *Off*.

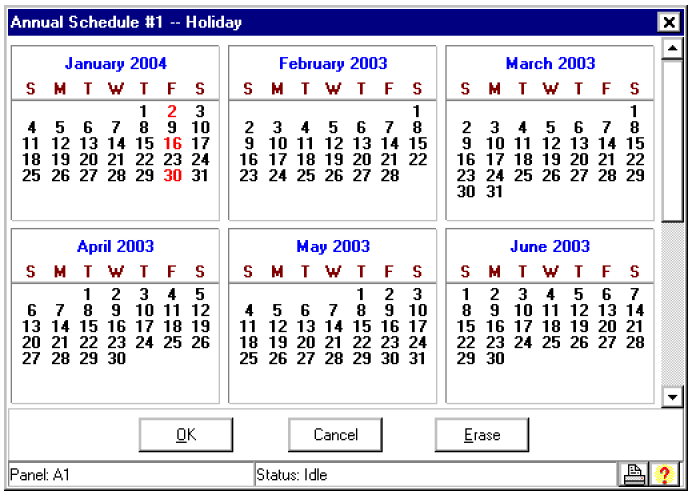
Label An 8-character label name.

To access the days of a particular annual schedule, click the schedule number or select the line and press *Enter*.

Selecting days in for an annual schedule

To select or deselect days that enable an annual schedule, click the day or press *Enter* on the calendar dates shown. Enabled dates appear highlighted. When the highlighted day begins, the annual schedule will be *On*.

Illustration 9–9 Annual Schedule #1



Scroll down to access the remaining months of the year. To link the annual schedule to a weekly schedule, enter the descriptor or mnemonic of the annual schedule into the appropriate override field of the weekly schedule list.

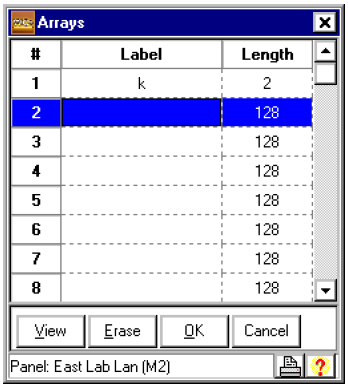
Array Setup

An array is a special kind of table. It contains only one column and up to 128 rows which are also referred to as elements. The elements of the array can take on any numerical value and each element value can be recalled or updated at any time using Control Basic. An example of an array would be the storing of the highest temperature every day of the month.

Note: Available only in Tier 1 controllers.

A level two security access is required to create arrays.

Illustration 9–10 Tier 1 Arrays dialog



The Arrays dialog contains the following fields:

Label An 8-character label name. Use this label to reference the array from Control Basic.

Length The total number of elements in the array numbered from 1 to 128. This is the number of values that the array can contain. Once an array label name and length have been specified, the elements of the array can be assigned either manually or from a Control Basic program. To view the entire contents of an array, select the array number.

Index The first column displays the element number of the array. This number is used to reference data in the value column. The number of elements in an array is set in the length column of Array setup.

Value The actual data can be manually entered in the *Value* column or a Control Basic program can read or write the data. When specifying an element within an array, the form *AYN [x]* must be used, where *N* is the

array number and *x* is the element number within the array. Both *N* and *x* must be whole numbers. The array label can also be used to reference the array in Control Basic:

TEMPS [4]

These examples show how to set the value of a variable from an array element:

```
10 REM Set Variable 6 to the value of Array 2, element 11
20 1VAR6 =AY2 [11 ]
```

Or, using the point labels:

```
10 REM Make the set point equal to the value of element 11
in the AHUWEST Array.
20 SETPNT =AHUWEST [11 ]
```

This example shows how to set the values of an Array named *AHUDATA*:

```
10 IF+ MAT < 55 THEN GOSUB 30
20 END
30 IF X > 127 THEN X = 0
40 X = X + 1
50 AHUDATA[ X ] = MAD
60 X = X + 1
70 AHUDATA[ X ] = MAT
80 RETURN
```

This program records the position value of the mixed air damper (MAD) and the time of day when the mixed air temperature falls below 55 degrees. Local variable *X* selects the element where the data is to be stored. Time values are recorded in hours (12:30 PM =1250). The array should be configured for 128 elements. Once the array is full, new data will be written over the oldest data.

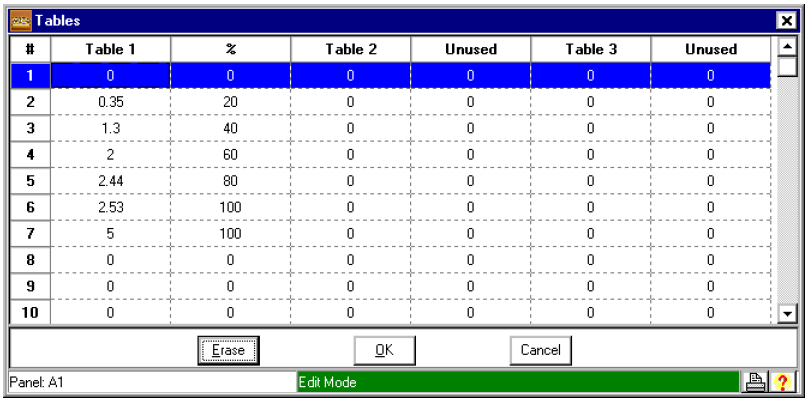
Tables

Use *Tables* to create look-up tables for any of the following conditions:

- a custom input range is required for a sensor that is not listed
- to create functions within Control Basic
- the value of an expression is nonlinear or requires a complicated calculation

A level three security access is required to modify tables.

Illustration 9–11 Tables dialog



#	Table 1	%	Table 2	Unused	Table 3	Unused
1	0	0	0	0	0	0
2	0.35	20	0	0	0	0
3	1.3	40	0	0	0	0
4	2	60	0	0	0	0
5	2.44	80	0	0	0	0
6	2.53	100	0	0	0	0
7	5	100	0	0	0	0
8	0	0	0	0	0	0
9	0	0	0	0	0	0
10	0	0	0	0	0	0

The Tables dialog displays, side by side, all of the tables in a controller. Each table consists of up to 15 data pairs stored in two columns.

Values in the *Table* column must be entered in ascending order. The tables produce a linear interpolation between data pairs. To assign units such as percent (*%)* or *Deg. F* to the dependent variable, click *Unused* and then choose from the choices in the dialog.

See the keyword *TBL* on page 175for using tables in Control Basic.

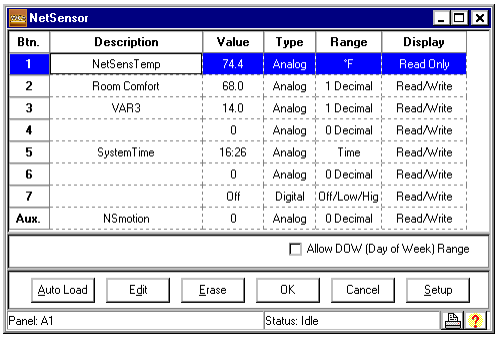
Configuring the NetSensor

The NetSensor is a wall mounted display and sensor unit that connects directly to a KMC Controls controller. The unit consists of an LCD or LED display, a thermistor, seven buttons and an optional humidity sensor.

Additional information for the NetSensor is available from the following sources:

- In the installation guide shipped with the NetSensor
- In the following topic, *Programming for the NetSensor* on page 91
- In the topic *NetSensor button assignments* on page 90.
- In the topic *NETSENSOR-STATUS* on page 161

Illustration 9–12 NetSensor dialog



Description Points to a variable that stores the button value. The description can be a mnemonic, label or description from either the connected controller or any other controller on the Tier 2 network.

Value Displays–in engineering units–the value of the point listed in *Description*.

Type Sets the button as either and analog or digital function.

Range Select a unit of measure from the *Range* list.

- Units listed in the table *NetSensor analog display formats* are active when *Type* is set to *Analog*
- Units listed in the table *NetSensor binary display formats* are active when *Type* is set to *Digital*.

Display Read/write status of the button.

- *Read Only* indicates the operator may only view the data displayed on the NetSensor.
- *Read/Write* indicates an operator may use the buttons to change the data.

Table 9–1 NetSensor analog display formats

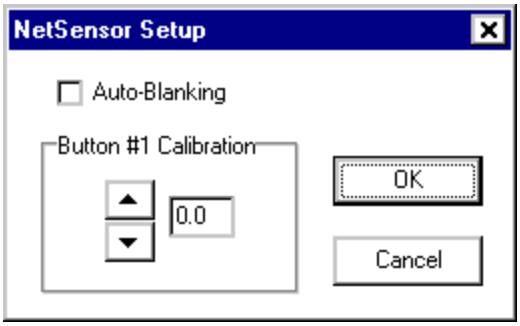
Unit	Action and display
°C	Displays temperature in degrees Celsius. Available only on Button 1. If °C is selected, Button 1 is assigned to the internal temperature sensor and must be associated with a variable.
°F	Displays temperature in degrees Fahrenheit. Available only on Button 1. If °F is selected, Button 1 is assigned to the internal temperature sensor and must be associated with a variable.
0	Sets the precision of the display to nearest whole number.
0.0	Sets the precision of the display to one place to the right of the decimal point.
0.00	Sets the precision of display to two places to the right of the decimal point.
Time	Sets the NetSensor to display a time format.
Off/Low/High	The NetSensor cycles through each word as arrow buttons are pressed and released. The analog point cycles from 0 to 2.
Off/On1/2/3	The NetSensor display cycles through each word as arrow buttons are pressed and released. The analog point cycles from 0 to 3.
System Time	Use to set time in a stand-alone controller when an operator workstation or other time master device is not available.
Day Of Week	(Not available on all models) Use to set the day of week in a stand-alone controller when an operator workstation or other time master device is not available.

Table 9–2 NetSensor binary display formats

Label	Action and display
On/Off	The NetSensor toggles between words as arrow buttons are pressed and released. The digital point toggles between 0 and 1.
Low/High	The NetSensor toggles between words as arrow buttons are pressed and released. The digital point toggles between 0 and 1.
Cool/Heat	The NetSensor toggles between words as arrow buttons are pressed and released. The digital point toggles between 0 and 1.

Setup Use to set Auto-Blanking and Button #1 Calibration.

Illustration 9–13 NetSensor Setup



Calibration displays the offset added to Button 1.

- For a low temperature reading enter a positive correction value.
- For a high temperature reading enter a negative correction value.
- The maximum calibration is 3.2 degrees Fahrenheit above or below the displayed value.

Auto-Blanking Select to clear the NetSensor display after approximately 15 seconds from the time the last button was pushed.

Note: Auto-Blanking is a feature found only in NetSensors with an LED display. Models with LCD displays do not include the auto-blanking feature.

NetSensor button assignments

The functions of the NetSensor buttons are listed in the following table.

Illustration 9–14 NetSensor button assignments

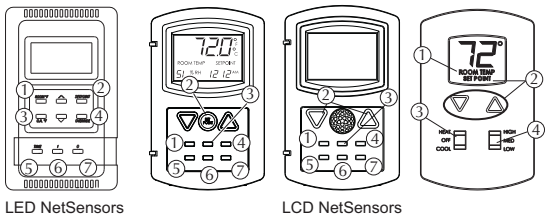


Table 9–3 NetSensor button descriptions

Button	Function
Up arrow	Increases analog values and toggles digital values
Down arrow	Decreases displayed values; toggles digital values

NetSensor button descriptions (continued)

Button	Function
Button 1	The default display value. Only Button 1 may be assigned to the internal temperature sensor.
Buttons 2-6	Can be defined as any point available on the Tier 2 network.
Button 7	On applicable models, assigned as the humidity sensor physically included on the NetSensor.
Aux	For use with auxiliary two-wire input on back of LED models. Use with dry contacts such as a switch. NetSensors with LCD displays do not have *auxiliary* wires. Press buttons 5 and 7 together and then press an up arrow or down arrow button to change *Aux* from *Off* to *On.*. On models with a motion sensor, detects motion in the room.

Programming for the NetSensor

The following examples are methods by which the NetSensor can be configured to display room temperature, humidity, a setpoint and time. See *Configuring the NetSensor* on page 88 for details about the NetSensor dialog box and button assignments.

Caution

When displaying the value from the internal temperature sensor, always associate Button 1 only with a variable. Associating Button 1 with an input or output will result in improper operation.

Button 1–internal temperature sensor Button 1 and the space temperature sensor inside of the NetSensor is usually associated with Variable 1.

- Under *Description* enter the name, description or mnemonic of the variable that will store temperature data.
- Set *Type* to *Analog*.
- Set *Range* to *°F* or *°C*
- Set *Display* to *Read Only*. Operators can then view the room temperature by touching Button 1 but cannot change the value.

Button 1–controller points To manage or display a point value from Button 1, configure as follows:

- Under *Description* enter the name, description or mnemonic of the point to associate with Button 1.
- Set *Type* to *Analog* or *Decimal.*
- Set *Range* to *0, 1* or *2 Decimal*. Do not set range to *°F* or *°C* unless controlling the internal temperature sensor.
- Set *Display* to *Read* or *Read/Write*.
  - If set to *Read*, operators can view the value associated with the Button but cannot change it.
  - If set to *Read/Write* operators can change the value of the point by first touching Button 1 and then pressing the up or down arrow buttons.

Setpoint Button 2 is usually associated with Variable 2.

- Under *Description* enter the name, description or mnemonic of the variable that will store the setpoint value.
- Set *Type* to *Analog.*
- Set *Range* to *0, 1* or *2 Decimal*.
- Set *Display* to *Read/Write*.
- Operators can view and change the setpoint by first touching Button 2 and then pressing an up or down arrow button.
- Write a Control Basic program to control equipment based on the conditions of the setpoint.

```
10 IF VAR2 < VAR1 THEN START OUT6
```

Humidity (Humidity equipped models only) Button 7—the humidity sensor— is usually associated with variable #7.

- Under *Description* enter the name, description or mnemonic of the variable that will store the humidity value.
- Set *Type* to *Analog.*
- Set *Range* to *0 Decimal*.
- Set *Display* to *Read/Write*.
- Operators can then view the room humidity by touching Button 7 but cannot change the value.

Displaying time Typically button 5 is assigned to display time.

- Under *Description* enter the name, description or mnemonic of the variable that will store the time data. Typically this is variable 5.
- Set *Type* to *Analog*.
- Set *Range* to *Time* which will automatically format the display with a colon (:).
- Add a Control Basic line as follows:

```
10 VAR5 = TIME
```

Day of Week Use to enter a day of the week from a NetSensor.

- Select *Allow DOW (Day Of Week) Range* at the bottom of the NetSensor dialog.
- Set *Type* to *Analog*.
- Set *Range* to *DOW*.
- Under *Description* enter the name, description or mnemonic of the variable that will store the day of week value.
- Add a Control Basic line as follows:

```
10 VAR5 = DOW
```

Note: In the Variables dialog box and in Control BASIC programming, the day of week value is represented by 0 thru 6 for Sunday (0) thru Saturday (6). In the NetSensor dialog box and on the NetSensor display the day of week value is represented by 1 thru 7 for Sunday (1) thru Saturday (7).

Setting system time System time sets the real-time clock in a stand-alone Tier 2 controller.

- Set *Type* to *Analog*.
- Set *Range* to *RTC Time* which will automatically format the display with a colon (:).
- Under *Description* enter the name, description or mnemonic of the variable that will store the time data.
- Add a Control Basic line as follows:

```
30 VAR4 = TIME
```

Verifying a functioning NetSensor To check if a functioning NetSensor is present, use the Control Basic function *NETSENSOR-STATUS* on page 161.

```
10 IF NOT NETSENSOR-STATUS THEN STOP OUT1
```

Auxiliary function The auxiliary function is triggered either from a pair of wires on the back of NetSensors with LED displays or simultaneously pushing buttons 5 and 7 on models with LCD displays. On some models, the auxiliary function also signals motion in the room.

- When connected together, the *Aux.* value in WinControlXL indicates *On*.
- Under *Description* enter the name, description or mnemonic of the variable that will store the *Aux.* value.
- *Type*, *Range* and *Display* are preprogrammed for a digital input and cannot be changed.

Note: NetSensors with LCD displays do not have auxiliary wires. Press buttons 5 and 7 together and then press an up arrow or down arrow button to change the auxiliary function from *Off* to *On*. NetSensor KMD-1162 does not include an auxiliary function.

Motion sensing (Motion sensing models only) Detects movement in the room.

- Under *Description* enter the name, description or mnemonic of the variable that will store the state of Aux. Typically this is variable VAR8 configured as an analog variable.
- Set *Type* to *Analog. Range* is automatically set to *0 Decimal*.
- Set *Display* to *Read/Write*.
- Use Control Basic to test the state of the variable assigned to Aux.
  - A value of -1 indicates motion
  - A value of -2 indicates no motion
  - A value of 0 or 1 indicates the auxiliary function is active.

The following Control Basic program detects motion and changes the state of variable VAR9.

```
10 IF+ VAR8 = -1 THEN START VAR9 , STOP A
20 IF VAR8 = -2 THEN START A
30 IF TIME-ON( A ) > 0:02:00 THEN STOP VAR9
```

InterProtocol Mapping

Use InterProtocol Mapping to associate a point in an attached MODBUS device with a variable in the KMD controller. Each line in the Interprotocol Map list transfers one value between the point listed in the Read Point column and the point listed in the Write Point column.

See also the Control Basic keyword *MODBUSTRANSFER* on page 160.

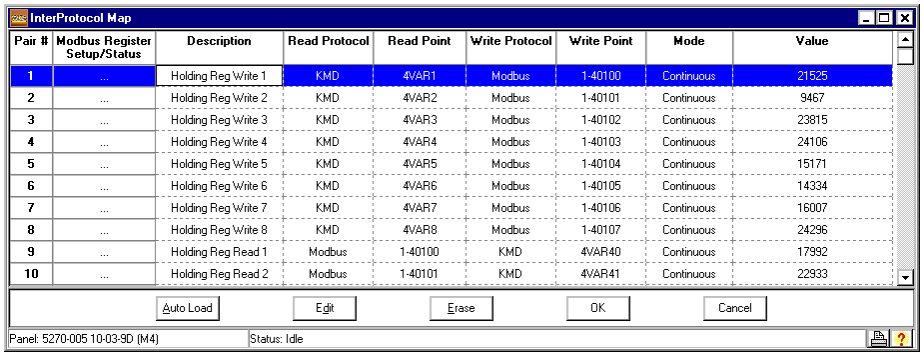
AutoLoad/EndAuto When in AutoLoad mode, continuously updates the Interprotocol Mapping dialog with the data in transferred between the controller and Modbus devices.

Edit/End Edit When WinControl XL Plus is in edit mode, the values and settings are not updated. When either *End Edit* or *Ok* is clicked, all of the values from the Interprotocol Mapping dialog are sent to the controller.

Erase Deletes all entries on the selected line.

Cancel Closes the dialog without making changes.

Illustration 9–15 InterProtocol Map dialog



InterProtocol Map

Pair #	Modbus Register Setup/Status	Description	Read Protocol	Read Point	Write Protocol	Write Point	Mode	Value
1	...	Holding Reg Write 1	KMD	4VAR1	Modbus	1-40100	Continuous	21525
2	...	Holding Reg Write 2	KMD	4VAR2	Modbus	1-40101	Continuous	9467
3	...	Holding Reg Write 3	KMD	4VAR3	Modbus	1-40102	Continuous	23815
4	...	Holding Reg Write 4	KMD	4VAR4	Modbus	1-40103	Continuous	24106
5	...	Holding Reg Write 5	KMD	4VAR5	Modbus	1-40104	Continuous	15171
6	...	Holding Reg Write 6	KMD	4VAR6	Modbus	1-40105	Continuous	14334
7	...	Holding Reg Write 7	KMD	4VAR7	Modbus	1-40106	Continuous	16007
8	...	Holding Reg Write 8	KMD	4VAR8	Modbus	1-40107	Continuous	24296
9	...	Holding Reg Read 1	Modbus	1-40100	KMD	4VAR40	Continuous	17992
10	...	Holding Reg Read 2	Modbus	1-40101	KMD	4VAR41	Continuous	22933

Auto Load | Edit | Erase | OK | Cancel

Panel: 5270-005 10-03-9D (M4) | Status: Idle

Modbus Register Setup/Status

The settings in the Modbus Register dialog set up the format of the data to be transferred between the KMD controller and the Modbus device. The settings must match the setting in the Modbus device.

To open the Modbus Register dialog, click the ellipsis (...) in the Modbus Register column.

Note: Set up Read Point and Write Point before setting up the Modbus Register dialog.

Data Type Data Type sets the type of data stored in the register.

- **Unsigned Integer**–For whole numbers between 0 and 65535.
- **Signed Integer**–For whole numbers between -32768 and 32767
- **Bit String**–Use for digital points and status registers.
- **Float**–Must use for 32-bit registers.

Number of Registers Choose 16 bit or 32 bit. If Float is selected in Data Type, 32 bit is automatically selected.

Data Format Data Format sets the order in which the parts of the data are sent first. This is also referred to as *byte ordering* and *word ordering*.

Integer data types have only byte ordering (LSB and MSB) to select. To set up Data Format for integers choose one of the following:

- Choose **MSB,LSB** to send the most significant or high byte first.
- Choose **LSB,MSB** to send and store the least significant or low byte first.

Float data types have both word ordering (MSW and LSW) and byte ordering (MSB and LSB) to set up. To set up Data Format for floating point values; choose one of the following:

- Choose **MSW, LSB** or **MSW, MSB** to send the most significant data word first followed by either the least significant (LSB) or most significant byte (MSB).
- Choose **LSW, LSB** or **LSW, MSB** to send the least significant data word first followed by either the least significant (LSB) or most significant byte (MSB).

Multiplier and Offset Values for Multiplier and Offset are used for scaling. Both are provided by the manufacturer of the Modbus equipment.

Description

Enter a description of the data passed between Modbus and KMD. Description is for notation only and is not required for operation.

Read Point and Read Protocol

The read point is the *origin* of the data transferred between the two protocols.

Read Protocol Set the protocol to either **KMD** or **Modbus**. The protocol must match the protocol of the point entered in Read Point.

Read Point Under **Read Point**, enter a KMD variable point or Modbus register.

- Enter KMD variable points using standard Control Basic mnemonics. See *Programming with mnemonics* on page 133.
- Enter Modbus registers as shown in the illustration *Modbus register format* on page 97. Function codes are listed in the table *Supported Modbus function codes* on page 97.

Note: Modbus manufacturers typically list the function code with the register number in equipment guides. Verify in the guide exactly how the register number is formatted.

Illustration 9–16 Modbus register format

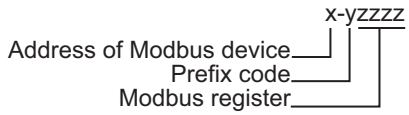


Table 9–4 Supported Modbus function codes

Function		Action	Description
1	01 hex	Read	Discrete output coils
2	02 hex	Read	Discrete input contacts
3	03 hex	Read	Analog output holding registers
4	04 hex	Read	Analog input registers
6	06 hex	Write single	Analog output holding register
15	0F hex	Write multiple	Discrete output coils

Write Protocol and Write Point

The write point is the point that is *receiving* the data that is being transferred between the two protocols.

Write Protocol Set the protocol to either **KMD** or **Modbus**. The protocol must match the protocol of the point entered in Write Point.

Write Point Under Write Point, enter a KMD variable point or Modus register.

- Enter KMD points using standard Control Basic mnemonics. See *Programming with mnemonics* on page 133.
- Enter a Modbus register as shown in the illustration *Modbus register format* on page 97. Function codes are listed in the table *Supported Modbus function codes* on page 97.

Mode

Sets the update mode for each read point and write point pair.

- **Disabled**–The pair will not be processed.
- **One Time**–The controller will update the pair only when End Edit is clicked. The value for the pair will not be processed after that.
- **Continuous**–The pair is processed approximately once every 10 seconds.

Value

The current level, quantity, or state of the point.

WCXL Scheduler

Available only in Tier 1 controllers.

Use the WCXL Scheduler to set up active periods for weekly and annual schedules in Tier 1 controllers.

- When the date on the computer running WinControl XL Plus is in the range set by the start and stop dates, WinControl sets the designated schedules to automatic. The manual check box in the weekly schedule dialog is cleared.
- When the date on the computer is outside the range of the start and stop dates, the designated schedules are set to manual. The manual check box in the weekly schedules is selected.
- The state of the schedules changes at midnight.

To set up a WCXL schedule, do the following:

1. From the **Control Menu** choose **WCXL Scheduler** and then choose **<New>** from the shortcut menu.
2. Enter a new name for the WCXL Schedule.
3. Expand the list of controllers in **Available Schedules** to locate the weekly or annual schedule within a controller.
4. Drag the weekly or annual schedule to the **Include Schedules** list.
5. Set a date range for the WCXL schedule with **Start** and **End Date**.
6. Click **OK** when finished.

WCXL Schedule Name Holds the name of the WCXL Schedule.

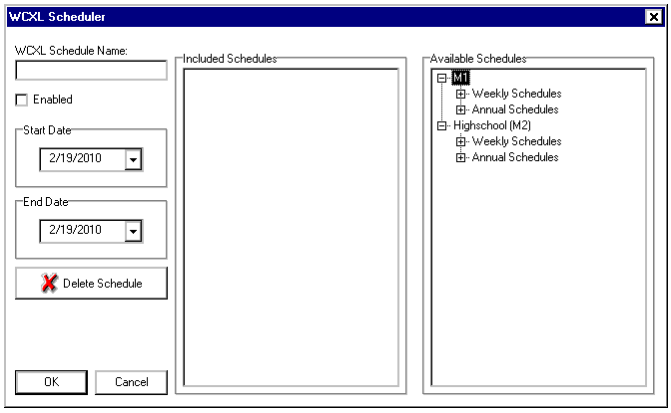
Start and End Date Sets the effective date for the WCXL Schedule based on the date in the computer on which WinControl XL Plus is running.

Delete Schedule Deletes the current WCXL schedule and closes the WCXL Schedule dialog.

Include Schedules A list of the weekly and annual schedules that are controlled by the WCXL Scheduler.

Available Schedules The schedules in the available Tier 1 controllers.

Illustration 9–17 WCXL Schedule dialog



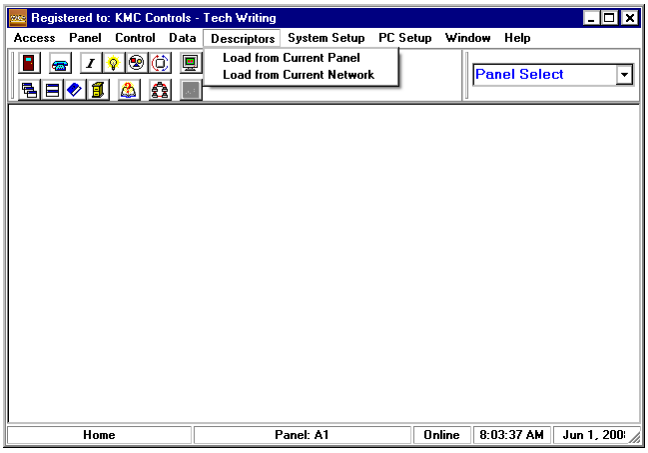
Section 10: The Descriptors menu

This section covers loading and saving descriptors from the current controller.

Use the Descriptors menu to access the following functions:

- *Load Descriptors From Panel* on page 102
- *Load Descriptors From Network* on page 102

Illustration 10–1 The Descriptors Menu



Load Descriptors From Panel

Use *Load Descriptors From Panel* to retrieve the descriptors from one controller on a network. The descriptors are loaded into computer memory for use during the current programming session.

Load Descriptors From Network

Use *Load Descriptors From Network* to retrieve the descriptors from all controllers on the Network. The descriptors are loaded into the computer memory for use during the current programming session.

About descriptors

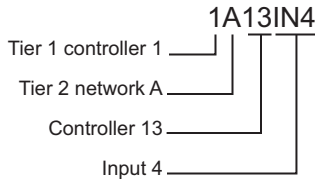
Descriptors are a set of names which identify the programmable items in a KMC Controls digital system. Descriptors aid in making controllers easier to program and may be in any of the following three forms.

- Mnemonic
- Label
- Descriptor

Mnemonics

A mnemonic is the computer method for naming a programmable item and address of the controller in which it resides. For example, the mnemonic *1A13IN4* represents the following input point:

Illustration 10–2 A system mnemonic



A mnemonic is part of the controller firmware and cannot be changed. System prefixes—the Tier 1 controller, Tier 2 network and controller numbers shown in Illustration 10–2—are only required to identify items in a controllers other than the controller to which you are connected.

Note: The Tier 1 controller to which a Tier 2 controller is connected is always controller 0.

For a list of mnemonics used in the KMC Controls controllers, see the table *Mnemonics*.

Table 10–1 Mnemonics

Mnemonic	Type	Example
IN	Input	IN1
OUT	Output	OUT6
VAR	Variable	VAR2
CON	PID Controller	CON1
PRG	Control Basic Program	PRG3
GRP	System Group	GRP2
TL	Trend Log	TL1
WS	Weekly Schedule	WS3
AS	Annual Schedule	AS1
AY	Array	AY2
TBL	Table	TBL1

Descriptions and labels

Descriptions and labels are a more user-friendly, human-readable method for naming items than identifying them with mnemonics. They are assigned to system groups, programs, points, variables and schedules in the *Control* menu.

Table 10–2 Descriptor examples

Type	Example	Length
Mnemonic	1A13IN4	As required
Label	OAT	8 characters
Description	Outside Air Temp	20 characters

When creating descriptors, consider the following:

- Descriptors in a like controller type are always identical.
- Descriptors which must be used by all controllers in a system must be unique.

Descriptors and controller type

When multiple controllers on a Tier 2 network are of the same type, all descriptors assigned to the controllers are identical. See *Network Status* on page 34. To avoid program and operation errors, use a different type number

for controllers which are programmed with system groups, points, schedules, variables or tables which must be used by other controllers.

For example, in a network with identical Tier 2 controllers managing temperature in identical rooms, the room controllers can be of the same controller type. Included also in the network is a Tier 2 controller that measures outside air temperature and humidity both of which are used by the room controllers. To prevent changes made in the room controllers from also changing the controller measuring outside temperature and humidity, the controller must be assigned a different controller type number.

Descriptor management

Descriptor definitions are always stored in the memory of the controllers on a network. As the list of descriptors grow, so does the time it takes to retrieve descriptors from the controllers. To keep transfer time to a minimum, WinControl XL Plus also stores the descriptors on the computer. If the system is programmed from more than one computer then the descriptor list may become out of date. To retrieve the current descriptors, use *Load Descriptors From Network* to refresh the computer files.

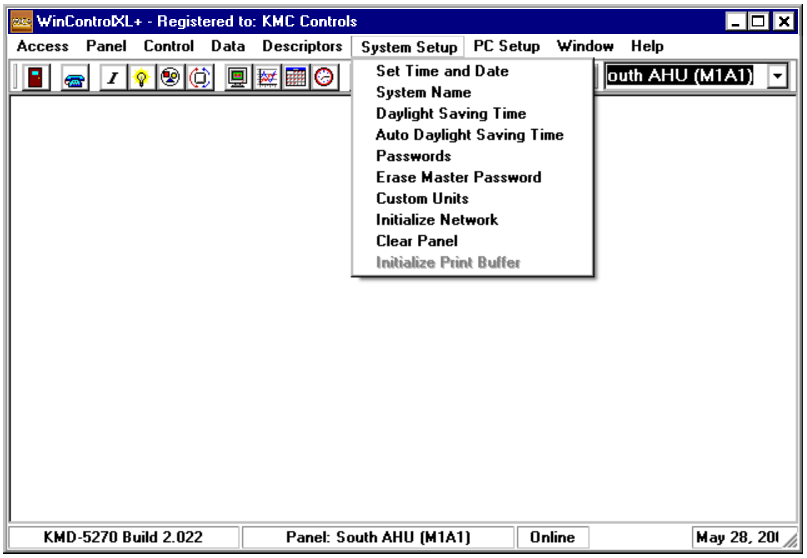
Section 11: The System Setup menu

This menu provides many of the fundamental options to modify a KMC digital network. The settings controlled in *System Setup* set parameters in all controllers on the network

---

Use the System Setup menu for the following functions:

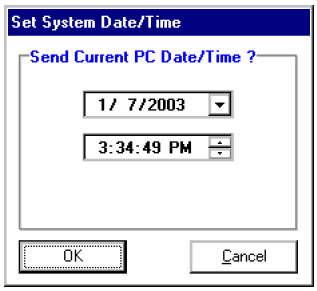
Illustration 11–1 The System Setup menu



Set Time and Date

Use the Set Time and Date dialog to change the system time and date.

Illustration 11–2 Set Time and Date dialog



Time keeping - Tier 1 controller If a Tier 1 controller is on the network, it maintains the time for the entire network.

If more than one Tier 1 controller is on the network, the unit addressed as number 1 keeps the time for the network.

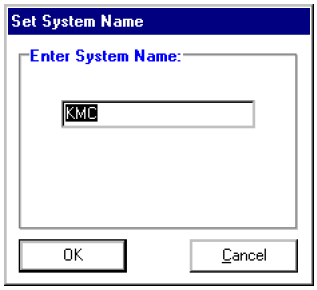
Time keeping - Tier 2 network If there is no Tier 1 controller on the network, the lowest numbered Tier 2 controller with a real-time clock maintains the network time.

If accurate time keeping is required for starting and stopping schedules, stand-alone controllers must include the real-time clock option.

System Name

System Name is system-wide description of the entire KMC control system. *System Name* is loaded when first connecting to the network and is used to determine where to store and retrieve files, descriptors and graphics, by associating a directory in the system list. See *System List* on page 26. *System Name* can be up to 20 characters and is stored in every controller on the network.

Illustration 11–3 Set System Name dialog

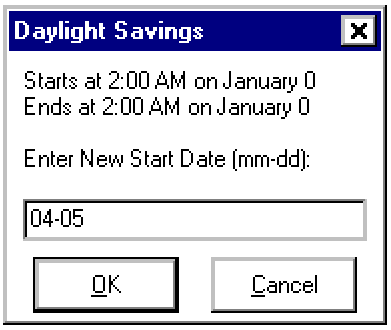


Daylight Savings Time

For models that do not fully support rules based auto daylight saving time, the controller clock moves ahead one hour at 2:00 AM on the start day and moves back one hour at 2:00 AM on the end day.

- See *Set Time and Date* on page 106 for details about system timekeeping.
- See *Auto Daylight Saving Time* on page 107 for setting daylight saving time in newer models.

Illustration 11–4 Daylight saving time

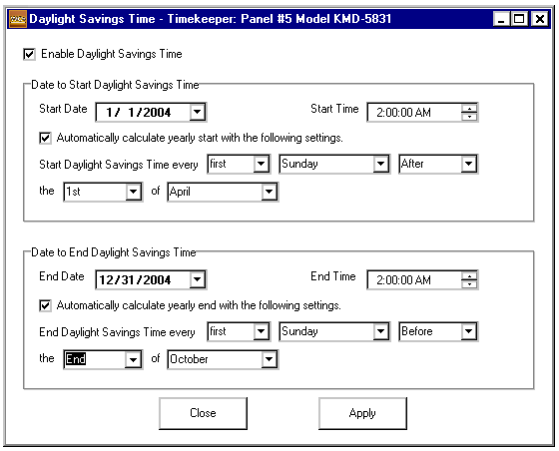


Auto Daylight Saving Time

Use to set a start and end of daylight saving time. Only selected models with newer firmware support the rules based auto daylight saving time features.

- See *Set Time and Date* on page 106 for details about system timekeeping.
- See *Daylight Savings Time* on page 107 for setting daylight saving time on older models.

Illustration 11–5 Daylight Savings Time dialog

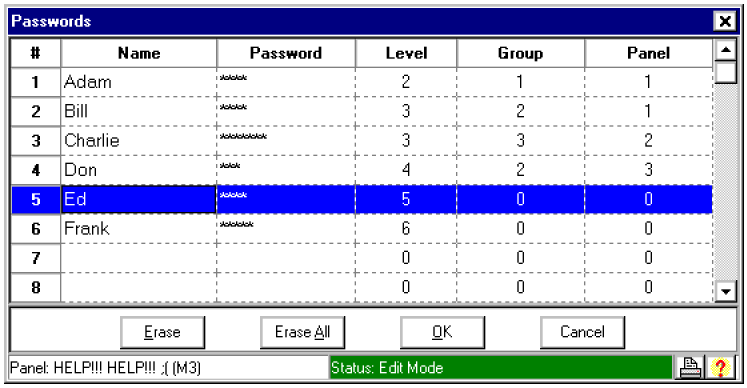


User security and passwords

The WinControl XL Plus program and the KMC digital network is a security-restricted system. Passwords are used to customize access to each user's responsibilities, to simplify system operation, and protect equipment. User-defined passwords and security levels stored within each controller on the network control all operator access. In addition to access and security restrictions, these passwords may automatically direct users to custom menu selection, to use graphically oriented displays or default to predefined controllers in the system.

- Tier 1 controllers may store up to 128 separate user-defined passwords and their associated security/access restrictions.
- Tier 2 controllers store 27 user-defined password combinations. When Tier 2 controllers are networked with a Tier 1 controller, the first two user-defined passwords are the same as the first two passwords in the Tier 1 controller.

Illustration 11–6 Password list



#	Name	Password	Level	Group	Panel
1	Adam	******	2	1	1
2	Bill	******	3	2	1
3	Charlie	********	3	3	2
4	Don	*****	4	2	3
5	Ed	******	5	0	0
6	Frank	******	6	0	0
7			0	0	0
8			0	0	0

When a Tier 1 controller is on the network, all passwords should be assigned in the Tier 1 controller, not from the Tier 2 controller. The first two passwords will be sent down to the Tier 2 network. Password changes are not sent from Tier 2 controllers to the Tier 1 controllers.

The following fields define passwords and security levels:

Name This is an 8-character name to be entered by the user at the sign-on prompt when starting WinControl XL Plus.

Password An 8-character password assigned to each user for private access to the system. Once the password is entered it cannot be retrieved. An asterisk (*) is substituted for characters in the *Passwords* list and while entering a password.

Level This selection defines a general security access level for each operator as defined in the table *Security levels*.

Table 11–1 Security levels

Security level	Description	Operator Permission
0	None	No access allowed. Use *Level 0* to place names in the password list of operators that no longer have permission to use the system.
1	View only	Operator is not allowed to make changes, but can look at system operation.
2	Minimum operator	Operator can only change point status and values either manual or automatic. Operator cannot exit WinControl or change Control Basic programs.
3	General operator	Operator can carry out all operations required for normal operation.
4	Setup operator	Operator can carry out normal operations and access all menus and commands with the exception of some found in the System Setup menu. See the appropriate section for the security level required.
5	Chief operator	Operators can carry out normal operations and access all menus and commands with the exception of Passwords, Erase Master Password, Port Configuration and Clear Panel.
6	Master Operator/Administrator	Operators can carry out all operations.

Group Opens a system group window. See *System Groups* on page 58.

Panel Designates a controller a user would most frequently connect to at start up. If *Panel* is set to 0 or 1, WinControl XL Plus will access the system and make the target controller address 1. Setting the value to a number other than 0 will connect to that address. When connecting to a Tier 1 controller, the controller to which the controller is connected is the default controller number.

To change this selection, the operator must have a current access level greater than or equal to the current security requirement.

This customizing feature allows operators to create their own security requirements for various fields in the software.

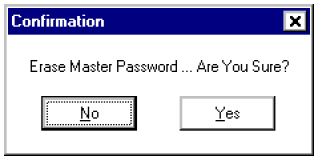
Erase Master Password— Removes the master password from the network. The master password enables communication with controllers prior to

assigning the user passwords.

Caution

The master password cannot be restored unless all programming is erased from the controller with the HCM configuration program. Before disabling the master password, verify that all user defined passwords are known and recorded and that at least one user defined password has level 6 access.

Illustration 11–7 Erase Master Password

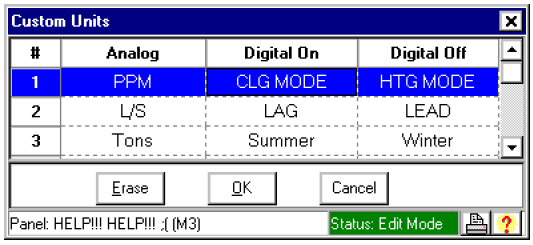


Custom Units

Use Custom Units to create user defined units of measure for use with inputs, outputs, variables, arrays and tables.

Custom units are stored in each controller on the network and are considered common to all controllers on that network. Define up to eight analog custom units and eight digital units in Tier 1 controllers. In Tier 2 controllers only three analog or three digital custom units can be defined. In a Tier 2 network, only the first three analog and first three digital units defined in a Tier 1 controller are used.

Illustration 11–8 Custom Units Window



Tip: The degree symbol "°" can be entered from the keyboard. With the *Num Lock* on, hold down *Alt* and press *248* on the numeric keypad.

Custom units can be defined as follows:

Analog Enter a 5-character name for custom units of measure relating to analog points.

Digital On Enter up to 11-characters per point when it is *On* (closed contact, 1, Start etc.).

Digital Off Enter a term to indicate when a point is in the opposite state of *Digital On*.

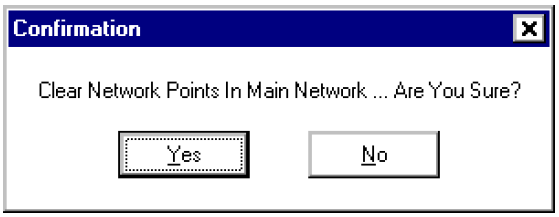
Initialize Network

Clears all want-points from the controllers on the network. Use *Initialize Network* when a controller has exceeded its maximum number of points.

When a KMC controller requests data from another controller on the network, the source of the data is stored in a want-point list. The want-point list, once created by a controller, remains even if data from the point is no longer required. After using *Initialize Network*, controllers will regenerate the list only as new data requests are processed.

Note: If the number of want-points in a controller exceeds the number of points allowed for that controller, changing the programming is the only way to correct the want-point list. See *Transferring values between controllers* on page 135 for additional information about transferring points.

Illustration 11–9 Clear want-points dialog



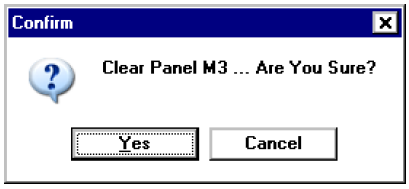
Clear Panel

Erases all programming, point configuration and descriptors from the connected controller.

Note: For Tier 2 controllers only.

Restoring the controller with a saved program file is the only way to restore controller information. If there is any information that you wish to keep in the controller, use the Panel File command in the Panel menu and save the controller information before using Clear Panel. Using Clear Panel in controllers containing canned programs will restore factory default settings.

Illustration 11–10 Clear panel



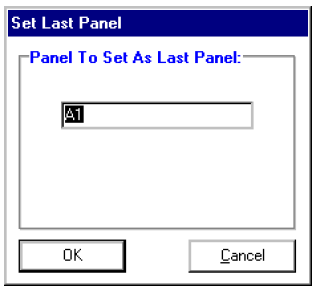
Note: Using Clear Panel does not change settings made in HCM. Panel address, baud and last panel settings remain unchanged.

Set Last Panel

A system configuration command which sets the highest numbered controller on the network as the end of the communication loop. When it is done talking on the network, the controller designated as *Last Panel* passes the token to controller 1. Controllers without a *Last Panel* designation pass the token to next higher numbered controller.

Note: For Tier 2 controllers only.

Illustration 11–11 Set Last Panel

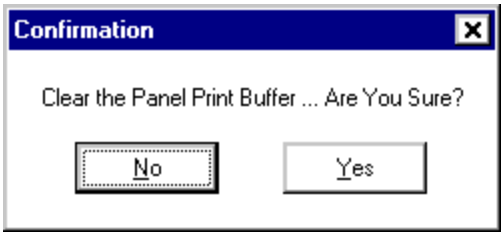


Initialize Print Buffer

Deletes all print jobs in the KMD–5110 print buffer.

Note: For KMD–5110 MultiNet controllers only.

Illustration 11–12 Clear Print Buffer



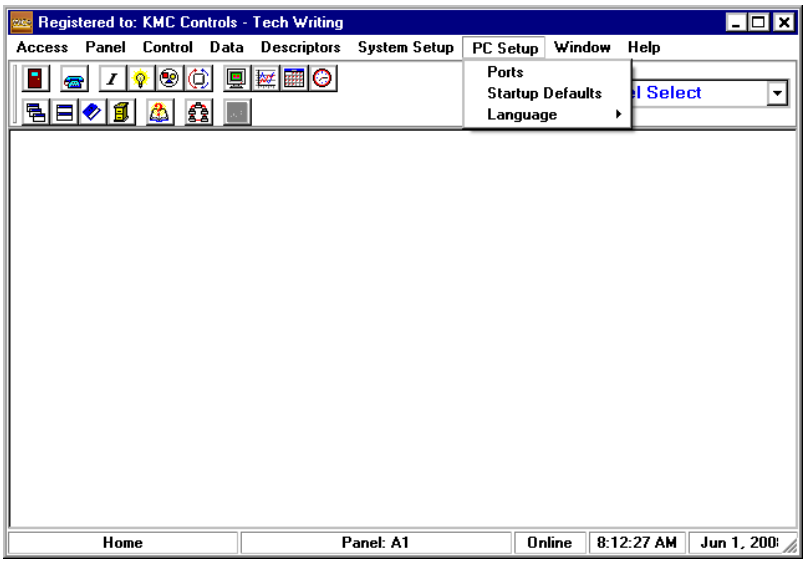
Section 12: The PC Setup menu

Use the PC Setup menu to configure ports, set startup defaults and select the language for WinControl XL Plus.

Use the PC Setup menu for the following functions:

- *The Ports dialog* on page 116
- *Startup Defaults* on page 117
- *Sending e-mail alarms* on page 119
- *Sending alarms as voice messages* on page 120

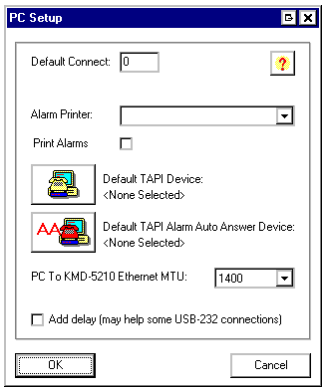
Illustration 12–1 The PC Setup Menu



The Ports dialog

Use the Ports dialog to set parameters for printers, connections to modems, or network configuration.

Illustration 12–2 Ports dialog



Default Connect Enter the system list number of the site to which you want to connect at start up. Most users will want to disable this feature by putting a 0 in the box. This enables WinControl XL Plus to use the shortcut entered in the icon property dialog box. See *Creating site shortcuts* on page 29.

Alarm Printer Selects the printer to which WinControl XL Plus prints alarms directed to a printer.

Print Alarms If checked, WinControl XL Plus prints alarms from the KMC network to the specified alarm printer.

Default TAPI Device The port to which a data modem is connected.

Default TAPI Alarm Auto Answer Device The port to which a voice modem is connected.

Add delay Select *Add delay* to improve performance when using a USB-to-serial adaptor for a serial port connection.

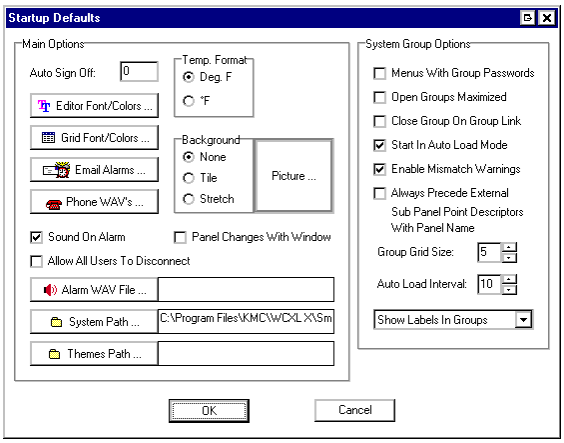
Note: The *Add delay* function does not work with KMD-5210 firmware earlier than version 4.0.

PC to KMD-5210 Ethernet MTU Sets the size of the Maximum Transfer Unit for network communications. The default setting is 1400. Change this only on instructions from an IT department or KMC Controls Technical Support.

Startup Defaults

The items in the Startup Defaults dialog control how WinControl XL Plus starts.

Illustration 12–3 Startup Defaults dialog



Main Group options

Auto Sign Off Enter the number of minutes of inactivity that will result in an automatic sign-off of the current user. Use to protect the system from unauthorized entry if a user fails to log out. To disable *Auto Sign Off*, enter 0.

Editor Font/Colors Use to modify the Control Basic text style and color.

Grid Font/Colors Use to modify the text style and color in windows other than Control Basic.

Email Alarm Setup e-mail addresses to receive system alarms. See *Sending e-mail alarms* on page 119.

Phone WAVs Setup phone numbers to receive `WAV` messages based on system alarms. See *Sending alarms as voice messages* on page 120.

Sound On Alarm When checked, a new alarm will be annunciated at the computer. A sound card and an alarm `WAV` file is required.

Alarm WAV File Selects a WAV file for a custom alarm sound. The folder in which this file is located is also the folder in which WAV files are placed for the voice message WAV files. See *Sending alarms as voice messages* on page 120.

System Path Sets the path to the WinControl XL Plus job folder. See *WinControl job files and folders* on page 181 for the location of the job folder.

Themes Path Sets the path to the themes used for the animated controls.

Temp. Format Select the display format for temperature.

- °C or °F
- Deg.C or Deg.F

Panel Changes with Window When this option is checked, clicking on an open window changes the targeted controller. Otherwise, the connection remains on the current controller.

Allow All Users To Disconnect When selected, users at any security level can disconnect WinControl XL Plus from the network. When the Allow All Users To Disconnect check box is clear, users with Level 1 or Level 2 security cannot disconnect WinControl XL Plus. See *User security and passwords* on page 108 for details on security levels.

Background Select the background picture for WinControl XL Plus background. The file format must be file type BMP or JPG.

System Group options

Menus w/Group Passwords Sets the option to enable or disable menus when signing on with a password the opens a system group.

Open Group Maximized Opens system groups at the maximum screen size. This will distort the background graphic if it was not designed for maximum screen size.

Start In Auto Load Mode When selected, a system group when it is opened, will automatically begin updating data from the referenced points.

Close Group on Group Link When a system group is linked to another system group, the previous system group will close when the linked system group is opened.

Always Precede External Point Descriptors with Panel Name When selected, adds the controller number and Tier 2 network letter to the descriptor of text based items in a system group.

Enable Mismatch Warnings When selected, enables WinControl to detect problems with system groups that occur when system groups are edited on more than one computer.

See *Highlight Mismatches/Hide Mismatches* on page 62 and *Restore From File* on page 66.

Group Grid Size The grid size is measured in pixels. This sets up the grid size in system groups to align points.

Auto Load Interval Sets the period—in seconds—for refreshing the data displayed in a system group.

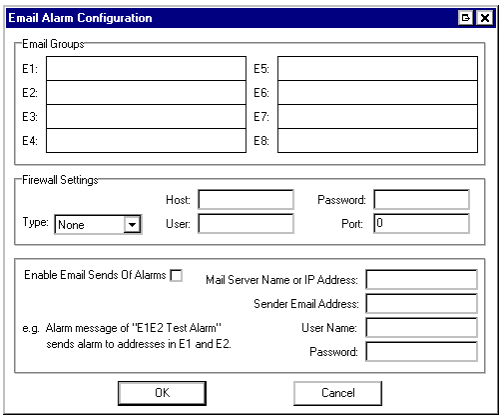
Show Labels in Groups/Show Descriptions in Groups Sets the option to display either labels or descriptions of a input, output, variable, control loop, system group or schedule inserted as a link on a System Group.

Sending e-mail alarms

Alarms can be sent by e-mail to any computer, pager or cellular phone with an e-mail address.

See the topic *Alarms* on page 37 for additional alarm information.

Illustration 12–4 Setting e-mail addresses



Email Groups Enter the e-mail address of the recipient of the alarm. Multiple addresses may be entered in the same group and separated by a semicolon (;).

Firewall Settings If e-mail messages are sent through a dial-up account, set type to *None*. For network e-mails, contact the network system administrator for the firewall settings.

Mail Server Name or IP Address Enter the name or address of the SMTP mail server.

Sender Email Address This is the *From* address in the e-mail message. This is usually the address to which reply mail would be directed.

User Name and Password Enter the name and password for the e-mail account.

Programming with Control Basic In Control Basic, enter the e-mail group into the alarm message. In the following examples, the alarm on line 10 mails the message to the address in Group 1. In line 20 the alarm is sent to the addresses in both Groups 1 and 2.

```
10 DALARM OUT1 , 5 , E1 Chiller has not started
20 DALARM VAR30 , 30 , E1E2 Exhaust fan is off!
```

Note: The computer must have WinControl XL Plus running to send e-mail messages.

See also the topics for the following Control Basic keywords.

- *ALARM* on page 139
- *DALARM* on page 146

Sending alarms as voice messages

Alarms can be sent to any voice capable modem, telephone, or public announcement card. Up to 400 different numbers can be entered to receive any system alarm. Click the phone to select the `WAV` file that will be played when the alarm is received and the TAPI device answers the call.

See the topic *Alarms* on page 37 for additional alarm information.

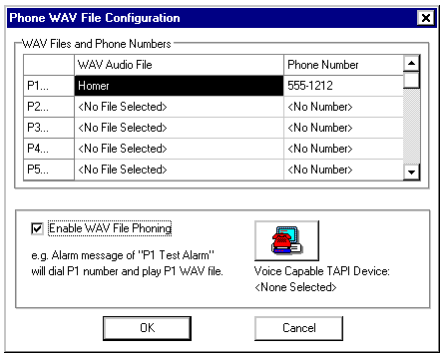
How to program for voice messages

In Control Basic, enter the group number into the alarm message.

```
10 DALARM IN1 > 85 , 60 , P1 Space temp is too high
20 DALARM VAR55 , 0 , P1P2P3 RTU Has not started!
```

The first example calls only the number entered on line P1. The second example calls the numbers entered on P1, P2 and P3.

Illustration 12–5 Send alarms as audible messages



WAV files for voice messages

Place the `.WAV` file for the voice message in the same folder as the `.WAV` file for the custom alarm sound. See *Alarm WAV File* on page 117.

The message `.WAV` files must be recorded with the following settings:

- Bit rate: 128 kbs
- Audio samples size: 16 bits
- Channesl: 1 (mono)
- Audo sample rate: 8kHz
- Audio format: PCM

Section 13: About Control Basic programs

Control Basic is the process that creates the automation in KMC controllers. Topics in this section cover the rules for writing Control Basic programs.

Every KMC controller includes space for Control Basic programs. Within each controller a program continuously evaluates input data from the building automation system. Then, based upon the instructions in the program, the controller takes action to keep one or more pieces of equipment operating within required parameters.

The instructions within the program object are written in Control Basic, a programming language that is similar to BASIC (Beginner's All-purpose Symbolic Instruction Code). In addition to standard BASIC programming functions, it includes specialized functions specific for the building automation controls industry.

Each of the following topics cover a key aspect of Control Basic.

The Control Basic program list

Use the Control Basic program list dialog to enter program descriptions, labels and manage program execution. Choosing the program are number opens the Control Basic Editor window.

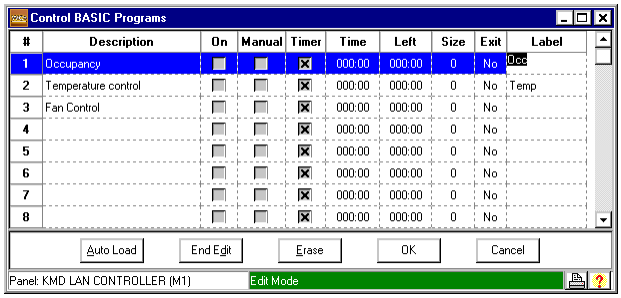
Start Control Basic by choosing *Control* > *Control BASIC* from the pick bar. The Control Basic program list opens. The list will be different between types of controllers.

- *Tier 1 Control Basic program list* on page 124
- *Tier 2 Control Basic program list* on page 125

Tier 1 Control Basic program list

To open a program area for editing, click the program number in the number sign (#) column.

Illustration 13–1 Tier 1 Control Basic program list



Description The long name of the program.

On Select the On check box to run the program.

Manual When selected, the program cannot be started by another program.

Timer Select Timer to run the program at the interval specified in Time.

Note: Do not select Timer if the program includes a NPAGE, TPAGE, or WAIT statement.

Time Sets the interval for Timer.

Left Time remaining before a program will start.

Size Amount of memory the program is using.

Exit Control Basic forced the program to stop running.

Label A short name for the program.

Auto Load Automatically refreshes the information in the dialog.

Edit or End Edit Click Edit to change information in the dialog. When finished, click End Edit.

Erase Removes all settings from the program list dialog. To restore to the original settings, click **Cancel**.

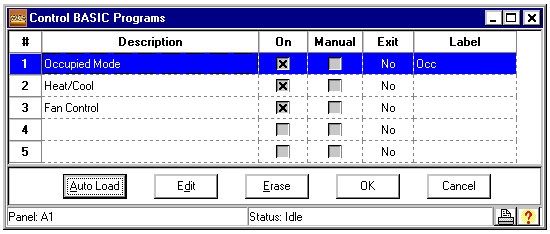
OK Click **OK** to save changes and close the program list dialog.

Cancel Click **Cancel** to close the program list dialog without saving changes.

Tier 2 Control Basic program list

To open a program area for editing, click the program number in the number sign (#) column.

Illustration 13–2 Tier 2 Control Basic program list



Description The long name of the program.

On Select the On check box to run the program.

Manual When selected, the program cannot be started by another program.

Exit Control Basic forced the program to stop running.

Label A short name for the program.

Auto Load Automatically refreshes the information in the dialog.

Edit or End Edit Click Edit to change information in the dialog. When finished, click End Edit.

Erase Removes all settings from the program list dialog. To restore to the original settings, click **Cancel**.

OK Click **OK** to save changes and close the program list dialog.

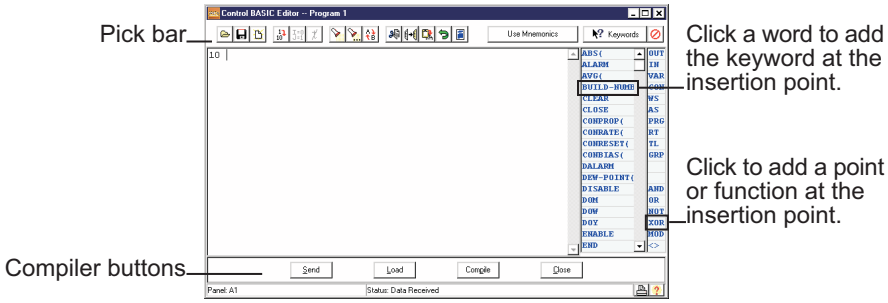
Cancel Click **Cancel** to close the program list dialog without saving changes.

Entering and editing programs

When you enter Control Basic Editor dialog, WinControl XL Plus will open an empty screen with a flashing cursor. To enter a line, type a line number followed by a space and then a statement.

```
10 START OUT1
```

Illustration 13–3 Control Basic Editor dialog



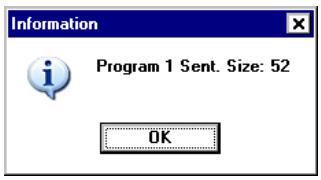
Note: Program lines are not checked for errors until you choose either *Send* or *Compile*. If errors are detected, WinControl XL cannot send the program to the controller until the error is corrected.

Table 13–1 Compiler buttons

Button	Action
Send	Send the program for proper syntax and then, if it is correct, sends it to the controller.
Load	Retrieves and displays the program from the current controller. Use load to refresh the program trace flags or to update the program list after using the alternate descriptors button.
Compile	Tests the program for proper syntax but does not send it to the controller.

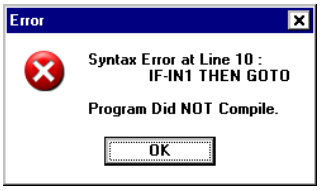
After the program is sent to the controller, it is stored in the controller's non-volatile memory. A message appears each time the program is sent telling you the size of the program and to which program area it was sent.

Illustration 13–4 Control Basic sent without errors



Only programs with correct syntax are sent to the controller. If errors are detected, a message opens:

Illustration 13–5 Control Basic errors detected



Pick bar buttons

Entering a Control Basic program is similar to using a text editor. Pick Bar buttons assist with file opening and closing and cutting, copying and pasting text.

Table 13–2 Pick bar buttons

Functions	Icon	Description
Open File		Opens a Control Basic file stored on disk.
Save to File		Saves the Control Bzasic file to disk
New Program		Clears the Control Basic program area.
Renumber		Renumbers the program starting with the first line and incrementing each line number by 10.
Local Variables		Displays all local variables used in the current program. In Tier 2 controllers, only local variables on lines that have been executed will appear in the dialog.
Clear Trace		Clears all trace flags in the current program. See also the following topic *Using program trace* on page 128.
Find and Find Next		Use to find a word or phrase.

Pick bar buttons (continued)

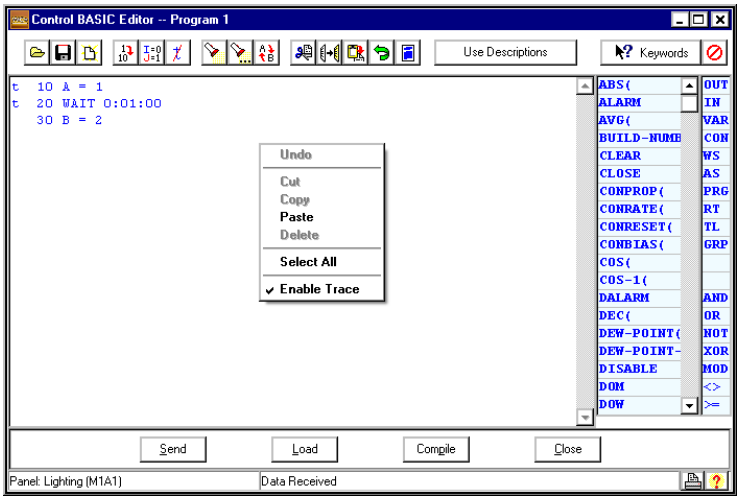
Functions	Icon	Description
Replace		Searches for a word or phrase and replaces it with another word or phrase.
Cut		(ctrl-x) Permanently removes the selected text.
Copy		(ctrl-c) Copies the selected text to the clipboard for pasting in another location.
Paste		(ctrl-v) Moves text from the clipboard to the selected location.
Undo		Reverses last action.
Select All		Selects all text in the program area.
Alternate descriptors button	Use Descriptions Use Labels Use Mnemonics	The alternate descriptors button steps through a three choices for descriptor use. The choices are *Use Labels*, *Use Mnemonics* and *Use Descriptions*.

Using program trace

Use program trace to monitor Control Basic program execution within a controller. When program trace is enabled, each program line that is executed is flagged with a lower case *t*. The flag appears to the left of the line number in the program editor dialog box.

- In Tier 2 controllers, program trace is disabled by default. To enable program trace, right-click over the program list and choose *Enable Trace*.
- If the trace is disabled all trace flags are cleared.
- When a program is downloaded to the controller all trace flags are cleared.
- The program trace configuration is stored in FLASH memory.
- Trace flags are cleared at start up.

Illustration 13–6 Program trace



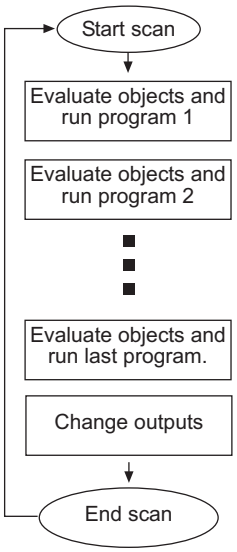
About Control Basic scans

Control Basic is the process that creates the automation in a KMC controller. Each controller has several program areas for storing and executing Control Basic instructions. When running Control Basic programs, the microprocessor in the controller does the following:

1. Evaluates the state of each object.
2. Executes the Control Basic programs.
3. Changes the state of all outputs when all programs have been executed.

This process—referred to as a scan—is normally performed several times a second. See the illustration *The scan process* on page 130 for an example of the scanning process.

Illustration 13–7 The scan process



The processor evaluates all program areas before making changes. For example, if programs 1, 3 and the last program includes instructions for Lights ON, and programs 2 and 4 had instructions Lights OFF, the lights will not flash, they will only be set to ON at the end of the scan.

Tip: Program the most important events in the highest numbered program area. This prevents programs with less importance from overriding critical actions.

Writing Control Basic statements

Control Basic programs are entered with the WinControl Control Basic editor. See the topic *The Control Basic program list* on page 124 for details on using the editor.

Multiple statements

Multiple statements can be used on the same program line, but must be separated by a colon.

```
10 A=B:F=C+D
```

Functions

A function is a keyword that—when evaluated by Control Basic—returns a value. This returned value is the result computed by the function. Functions save time for complex calculations such as calculating square roots. They may also be used to retrieve common system data such as time.

Expressions

A Control Basic expression describes a symbol or combination of symbols which represent a numeric value. Expressions may take the form of a simple equality such as A=7 or a comparison between symbols such as X < Y. Expressions can be derived also from a function such as *TIME*, a controller point such as AI2 (analog input 2), or by the result of a series of calculations such as A * B - AI2 - 2 / 9.

An expression must evaluate to a real number.

Table 13–3 Examples of expressions

Expression	Example
Functions	Time, DOW, DOY, etc.
Local Variables	A through Z
KMD Controller Points	OUT1, IN3, VAR16, etc.

Line numbers

When writing Control Basic programs, enter a line number at the beginning of each line. Each Control Basic program line must include a line number and at least one function or statement.

```
10 A = B
20 P = PI
```

Using arithmetic operators

Operators are listed in their order of priority. The formats for using operators are listed in the table *Arithmetic order of precedence* on page 132.

Table 13–4 Arithmetic order of precedence

Symbol	Operation	Example
*	Multiplication	2*4=8
/	Division	10/4 =2.5
\	The integer portion of a division	13\5= 2
MOD	The remainder of a division	13 MOD 5=3
+	Addition	2+2=4
-	Subtraction	4-3=1
^	Exponentiation Raises a value to a power	A = AI1 ^ AV1

Related topics

- *Relational operators* on page 135
- *Using Boolean logic* on page 132
- *Hierarchy of operators* on page 133

Using Boolean logic

Control Basic recognizes four logical operators. The operators are listed in their order of precedence.

NOT NOT is a Boolean operator that performs a logical NOT operation on an expression. If the expression is 0, the result is 1. If the expression is non-zero, the result is 0.

For additional details on this operator, see the keyword *NOT* on page 161.

AND AND performs the logical *AND* of the two expressions. The result is *true* if both expressions are non-zero; otherwise, the result is *false* .

For additional details on this operator, see the keyword *AND* on page 141.

OR OR performs the logical *OR* of the two expressions. The result is *true* if either expression is *true*. The result is *false* if both expressions are *false*.

For additional details on this operator, see the keyword *OR* on page 164.

XOR XOR performs the logical *exclusive or* of the two expressions. The result is *true* if the two expressions are different; otherwise, the result is *false* .

For additional details on this operator, see the keyword *XOR* on page 179.

Related topics

- *Using arithmetic operators* on page 132
- *Relational operators* on page 135
- *Hierarchy of operators* on page 133

Hierarchy of operators

Control Basic arithmetic operators have an order of precedence. When several operation take place in the same program statement, some operations are performed before others. Control Basic uses the operator-precedence shown in the illustration *Order of operator precedence* on page 133 when performing operations on an expression. Operations at the same level of precedence are evaluated from left to right.

Illustration 13–8 Order of operator precedence

Operator	Type	Precedence
( )	Expression in parenthesis	Highest (performed first)
NOT	Logical NOT	
^	Exponentiation	
*, /	Multiplication and division	
\	Integer division	
MOD	Modulus (remainder)	
+, -		
<, >, <=, >=	Relational	
=, <>		
AND	Logical	
OR		
XOR		Lowest (performed last)

Related topics

- *Using arithmetic operators* on page 132
- *Relational operators* on page 135
- *Using Boolean logic* on page 132

Programming with mnemonics

Mnemonics are a short, easy to remember abbreviations to use when writing Control Basic programs to refer to various parts of a controller. For example, a physical input is entered as *IN1* in KMD controllers instead of typing *Input1*.

Control Basic mnemonics for KMD points are listed in the table *Control Basic mnemonics for KMD points* on page 134. The following line of Control Basic is an example of using mnemonics to refer to an analog input point and a digital output point.

```
10 If IN1 < 70 then start out2
```

Table 13–5 Control Basic mnemonics for KMD points

Point Type	Mnemonic	Read Field	Write Field
Outputs	OUT #	Value	Value
Inputs	IN #	Value	Value
Variables	VAR #	Value	Value
PID Controllers	CON #	Output Value	Setpoint Value
Weekly Schedules	WS #	Status	N/A
Annual Schedules	AS #	Status	N/A
Programs	PRG#		Status
Control Groups	GRP #	N/A	N/A
Runtime Logs	RT #	ON TIME*	N/A
Trend Logs	TL #	Status	Status
Array Elements	AY #	Value	Value

*Runtime totals rounded to whole hours automatically.

The Read Field describes what can be read from that point type, such as its value or status.

The Write Field describes what may be changed on a point type through programming or by direct access, such as its value or status.

Programming format and notation

Control Basic programs consist of a series of numbered lines. On each line there are one or more statements.

Throughout these instructions the following notations are used to describe formats:

Table 13–6 Typographic conventions

CAPS	Words in capital letters are key words and must be entered as shown.
lowercase	Items in lowercase letters represent information such as expressions that you supply.
…	An ellipsis (…) indicates that an item may be repeated as many times as necessary.
spaces (_)	Required spaces in syntax are illustrated with an underline (_).

Typographic conventions (continued)

:	A colon (:) separates statements on the same line.
[ ]	Optional items are shown in brackets [ ].
	All other punctuation, including commas, are part of the syntax and must be included as shown in each example.

Real numbers

Real numbers are any logical number between $-3.4 * 10^{38}$ and $3.4 * 10^{38}$. Notation of the number is recognized in any of the following formats:

- Whole numbers (100)
- Decimal format (.0000123)
- Engineering notation (7.879 E-12)

Relational operators

Relational operators are used to compare two values. The result is *true* if the comparison is *true*; otherwise, the result equals *false*. This result can then be used to make a decision regarding program flow. All relational operators have the same level of precedence.

Table 13–7 Relational operators

Operator	Relation Tested	Example	Result
=	Equality	5 = 2	False
<>	Inequality	5 <> 2	True
<	Less than	5 < 2	False
>	Greater than	5 > 2	True
<=	Less than or equal to	5 <= 2	False
>=	Greater than or equal to	5 >= 2	True

Related topics

- *Using arithmetic operators* on page 132
- *Using Boolean logic* on page 132
- *Hierarchy of operators* on page 133

Transferring values between controllers

KMC direct digital controllers can be programmed to share common information across a network. The information is shared when a program in a controller makes a reference to a point in a controller on the same network.

This creates a want-point list that is filled and refreshed as each controller puts data on the network. There are, however, restrictions on the number of points which can be transferred.

- *Tier-to-Tier transfer limitations*
- *Total want-points transferred*
- *Tier 2 extended points*
- *Tier 1 want-point transfer time*
- *Tier 2 want-point transfer time*

Tier-to-Tier transfer limitations

The following table lists the number of want-points that may be transferred between any two controllers.

Note: Extended points may not be transferred from tier-to-tier. See *Tier 2 extended points* on page 137 for additional information about points transferred between Tier 1 and Tier 2 controllers.

Table 13–8 Maximum single controller tier to tier want-points

Point Type	Tier 2 to Tier 1	Tier 1 to Tier 2
Outputs	8	64
Inputs	8	64
Variables	32	64
Weekly Schedules	4	32
Annual Schedules	2	8
Runtime Logs Total Hours	8	64
PID Control loops	8	64
System Groups	4	64

Total want-points transferred

The total number of want-points from all sources that can be transferred into or out of a single Tier 1 controller.

Total Tier 1 controller want-points

Tier	In	Out
Tier 1	127	127
Tier 2	512	64

The following table lists the total number of want-points from all sources that can be transferred into or out of a single Tier 2 controller.

Table 13–9 Total Tier 2 controller want-points

Controller	In	Out
KMD-55xx	32	32
KMD-6000	32	32
KMD-5801/02	124	32
KMD-5821	124	32
KMD-5831	124	63
KMD-7xxx	32	32

Tier 2 extended points

The KMD–5800 series of controllers have points not found in the original generation of KMC controllers. These additional points are referred to as *extended points* and can only be transferred as follows:

- Extended points *can* be shared across the network with other KMD–5800 or KMD–7000 series controllers.
- Extended points *cannot* be shared with KMD–5500 or KMD–6000 series controllers.
- Extended points *cannot* be shared with attached Tier 1 controllers.

The table *KMD–5800 Series extended points* on page 137 summarizes the extended points found in the KMD–5800 series controllers.

Table 13–10 KMD–5800 Series extended points

Controller	Input	Output	Variables	PID Control Loops	System Groups	Weekly Schedules	Annual Schedules
KMD-5801			33-64				
KMD-5802			33-64				
KMD-5821			33-64				
KMD-5831	9-16	9-12	33-128	9-16	5-8	5-8	3-4

Tip: To transfer an extended point to a Tier 1 controller (either a KMD-5100 or KMD-5200 series controller), assign the value to a variable within the source controller and then share the variable with the Tier 1 controller.

Tier 1 want-point transfer time

Tier 1 controllers send want-points at regular intervals. The interval depends upon the version of firmware in the controller.

Firmware build 1.213 and later Want-points are transferred every 20-25 seconds.

Prior to firmware build 1.213 Want-point transfer time is calculated as follows:

Want-points = Number of controllers x 3

Tier 2 want-point transfer time

A Tier 2 want-point list is not immediately filled or refreshed. Each time the token is passed to a controller, the protocol permits the controller to transmit up to eight points. A full controller, with 32 points to put onto the network, will have all of its information passed only every fourth time the token passes by.

Special conditions

The following conditions apply to want-points.

- A want-point initial value is set to zero.
- A controller will hold the last know value of a want-point even if the controller that is sending the point is off-line.

Programming with variables

Variables are place holders for information such as setpoints, time delays, and operating modes. .Control Basic uses two types of variables, program variables and local variables.

Variables in KMD controllers

Variable points in KMD controllers are place holders for information such as set points, time delays, and modes.

Program variables are entered in the Setpoints/Variables window.

Local variables

Local variables can only be used within the Control Basic program that refers to them. The values they represent cannot be directly transferred to other Control Basic programs. Local variables are useful for counters or to store the results of local calculations.

Section 14: Keywords for Control Basic

This section covers the keywords for the Control Basic programming language.

The Control Basic keywords for operators, commands and functions are reserved for Control Basic. They may not be used for descriptors, labels or names of points, variables, or procedures.

Syntax for commands and functions

Required spaces are shown with underscore marks (_) and indicate that a space must be included for proper syntax. Optional items are shown in brackets [ ].

Using example programs from help

You can use example programs from the help system. Highlight the example and then copy the example and paste it into a Control Basic program.

ABS

This function returns the absolute value of the expression. The expression can be a single number or the result of a calculation.

Syntax: *ABS(_expression_)*

KMD example

Returns *2.3*, the absolute value of -2.3.

```
10 A = ABS( -2.3 )
```

Returns the absolute value of the result of the calculation.

```
10 C = ABS( SETPOINT - SPACETMP )
```

ALARM

The ALARM statement initiates an alarm notification from a KMD controller. It may also initiate a dial-out sequence to a modem connected directly to the controller in which the alarm notification is created.

Syntax: *ALARM_limit_,_differential_,_MessageString*

The *limit* parameter defines a condition that triggers the alarm. It is expressed as a conditional such as X_<_Y or X_>_Y or X_=_Y. The values for X and Y can be any number, variable, input, or output in any controller.

The *differential* parameter defines a dead band. The alarm returns to normal after the condition is outside of the dead band. Using *differential* minimizes rapidly changing between *on* and *off* alarm conditions.

MessageString is the alarm message and may be up to 69 characters long.

```
10 ALARM IN1 < 34 , 3 , Air temperature is close to
freezing.
```

The example Control Basic statement creates an alarm when the temperature measured at Input IN1 drops below 34. Once triggered, the alarm will not clear until the air temperature rises to or above 37 (34+3) degrees. The differential value eliminates multiple alarms if the temperature cycles rapidly between 33.9 and 34.0.

For WinControl XL e-mail routing

To duplicate the WinControl XL Plus e-mail feature, create one or more alarm classes named *E1-E8*.

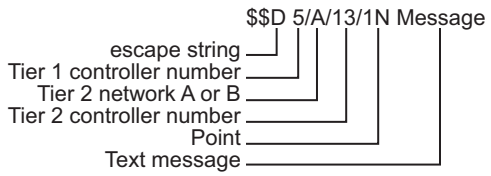
Add the alarm class to the alarm message string as shown in the following example:

```
10 ALARM IN4 > 85 , 3 , E1 Area temp too high
```

To set up routing for TotalControl alarms

TotalControl will display an alarm message but will only display the alarm in the alarm list of Design Studio or the web portal. To use TotalControl alarm routing, you must add to the message information about the point that originated the alarm. The format is shown in the illustration, *ALARM*

Illustration 14–1 Alarm routing message string for KMD controllers




```
10 ALARM VAR15 < 68 , 0 , $$D1/A/13/VAR15 Gym below
setpoint!
```

For pager notification

By adding the CALL, NPAGE, or TPAGE options to the text string, the controller will initiate a dial-out sequence to pagers or another computer running WinControl XL. The KMD Tier 1 controller that initiates the alarm must have a modem connected to it for pager notification.

Table 14–1 Pager message string options

Alarm device	String option
Numeric pager	NPAGE(_1234567_)_5555555
Text pager	TPAGE(_1234567-1234_)_Message

```
10 ALARM AIR/TP < 34 , 3 , NPAGE( 1234567 ) 5555555
20 ALARM AIR/TP < 34 , 3 , TPAGE( 1234567 1234 ) Message
```

Related topics

- *DALARM* on page 146
- *NPAGE* on page 161
- *TPAGE* on page 177
- *PHONE* on page 165

ALARM-AT

This statement specifies which controllers in a network receives the alarm message. This enables specific controllers to print the alarm while other controllers ignore the alarm. *ALARM-AT_ALL* sends an alarm message to all controllers in the system.

Syntax: *ALARM-AT_controller#_controller#_... or ALARM-AT_ALL*

Note: For KMD–5100 series only.

In the following example, an alarm is sent to controllers 2 and 8 only.

```
10 ALARM-AT 2 8
```

AND

AND is a Boolean operator that performs the logical *AND* of two expressions. The result is *true* if both expressions are non-zero; otherwise, the result is *false*.

Syntax: *result = expression1 AND expression2*

In the following example, local variable *C* will always equal 1 as long as both local variables *A* and *B* = 1

```
10 A = 1 : B = 1 : C = A AND B
```

See the related topic *Using Boolean logic* on page 132.

AVG

This statement returns the average value of the items enclosed in parenthesis. In the following example, local variable *D* equals the average of analog inputs 1, 3 and 6.

Syntax: *AVG(_expression_,_expression_...)*

KMD example

```
10 D = AVG( IN1 , IN3 , IN6 )
```

BAC-GET

Returns the present value from an object in a BACnet device. The BACnet *device instance* number must be in the range from 1 to 4,194,303. The BACnet *object* is composed of the object type and the object number.

Syntax: *BAC-GET (_device number_,_object_)*

Note: BACnet Licensed KMD Tier 1 controllers only.

Table 14–2 Supported BACnet object types

Object type	Mnemonic to use
Analog Input	AI
Analog Output	AO
Binary Input	BI
Binary Output	BO
Analog Value	AV
Binary Value	BV

Note: The WAIT statement in the following example may be required for controllers with an older firmware version that does not include WAIT within the *BAC-GET* statements.

In the following example, ON-ERROR redirects the program if a BACnet error occurs. *WAIT* on line 40 halts program execution while the BACnet device responds to the program.

```
10 A = BAC-GET( 1 , AV01 )
```

```
20 ON-ERROR 40
30 VAR10 = A
40 WAIT 0:00:30
```

BAC-RLQ

BAC-RLQ relinquishes control to the specified priority to the object in the BACnet device. The BACnet *device instance* number must be in the range from 1 to 4,194,303. The BACnet *object* is composed of the object type (see the table *Supported BACnet object types* on page 142) and the object number. The priority number must be in the range of P1 to P16. See the table *Standard BACnet priorities* on page 143 for the BACnet standard priority levels.

Syntax: *BAC-RLQ(device instance , object , priority)*

Note: For BACnet licensed KMD Tier 1 controllers only.

Table 14–3 Standard BACnet priorities

Priority Level	BACnet Standard Priority
P1	Manual-Life Safety
P2	Automatic-Live Safety
P3	
P4	
P5	Critical Equipment Control
P6	Reserved for minimum On/Off time
P7	
P8	Manual Operator
P9	Default for Control Basic
P10–P16	

Note: The WAIT statement in the following example may be required for controllers with an older firmware version that does not include WAIT within the BAC-RLQ statement.

In the following example, ON-ERROR redirects the program if a BACnet error occurs. The WAIT statement halts program execution while waiting on a response from the BACnet device.

```
10 BAC-RLQ( 54321 , AO14 , P12 )
20 ON-ERROR 40
30 WAIT 0:00:30
40 REM Program continues
```

BAC-SET

This command sends a value at the specified priority, to a point in a BACnet device. The BACnet *device instance* number must be in the range from 1 to 4, 194,303. The BACnet *object* is composed of the object type (see the table *Supported BACnet object types* on page 142) and the object number.

Syntax: *BAC-SET (device instance , object , priority , value)*

Note: BACnet licensed KMD Tier 1 controllers only.

Note: The WAIT statement in the following example may be required for controllers with older with an older firmware version that does not include WAIT within the BAC-SET statement.

In the following example, ON-ERROR redirects the program if a BACnet error occurs. WAIT on line 30 halts program execution while the BACnet device responds to the program.

```
10 BAC-SET( 5 , BO14 , P9 , VAR10 )
20 ON-ERROR 40
30 WAIT 0:00:30
40 REM Continue program here at Line 40
```

BUILD-NUMBER

This function returns the firmware version number stored in the controller.

```
10 VAR10 = BUILD-NUMBER
```

CALL

Used in conjunction with the DECLARE statement to branch to a subroutine program. Call passes data to be processed in a list of arguments to be used in that program. Arguments can be any point, local variable or expression. Up to 40 arguments may be passed.

Syntax: *CALL_program_=_Argument1_,_Argument2_...*

Note: For KMD-5100, Multi-Net controllers only.

Programs may be nested up to ten levels using CALL and DECLARE.

```
10 CALL PRG1 = IN3 , 21 ,VAR7 , D
20 CALL 2-PRG1 = 2-VAR3
```

The values of these points are transferred to program #1. PRG1 will use these values in its program sequence and may change them assuming they are not constants.

CLEAR

Resets the value of all local variables—variables labeled A-Z and declared variables—to zero.

```
10 CLEAR
```

CLEAR-COUNT

Resets the error count in a KMD Tier 2 controller to zero.

```
10 A = CLEAR-COUNT
```

See the related topic *ERROR-COUNT* on page 154.

CLOSE

Sets the value of a named point, KMD variable, binary output or value object to *off*.

Syntax: *CLOSE_point*

KMD example

```
10 CLOSE VAR1
20 CLOSE A
```

Related topics

- *OPEN* on page 164
- *START* on page 173
- *STOP* on page 174

CONBIAS

CONBIAS sets the bias property of a PID control loop. The *PIDcontroller* is the number of the PID control loop within the controller while *expression* is the new bias value within the range of 0–100. The value for *expression* can also be a variable or a computation.s

Syntax: *CONBIAS(_PIDcontroller_,_expression_)*

```
10 CONBIAS( 1 , 1.1 )
```

CONPROP

CONPROP sets the proportional band of a PID control loop. The *PIDcontroller* is the PID control loop number while *expression* is the new proportional band value within the range of 0-4000. The expression can also be a variable or a computation.

Syntax: *CONPROP(_PIDcontroller_,_expression_)*

In the following example, if VAR1 is less than 3, the proportional band on controller #1 will be set to 10 otherwise the proportional band will be set to 50.

```
10 IF VAR1 < 3 THEN CONPROP( 1 , 10 ) ELSE CONPROP( 1 , 50 )
```

CONRATE

Used to change the rate (derivative component) of a PID control loop. *PIDcontroller* is any controller in the network, while *expression* is the new rate to set within the range of 0–2.00. The value for *expression* can also be a variable or a computation.

Syntax: *CONRATE(_PIDcontroller_,_expression_)*

```
10 IF VAR1 < 3 THEN CONRATE( 1 , 1.3 ) ELSE CONRATE( 1 , 0.7
)
```

CONRESET

Used to change the reset rate (integral component) of a PID control loop. *Controller#* is any PID control loop in the network, while *expression* is the number of allowable resets per hour within the range of 0–255. The *expression* can also be a variable or a computation.

Syntax: *CONRESET(_controller#_,_expression_)*

```
30 IF VAR1 < 3 THEN CONRESET( 1 , 25 ) ELSE CONRESET( 1 , 20
)
```

Reset for controller #1 is 20 unless variable VAR1 is less than 3; then *reset* will be set to 25.

COS-1

Returns the arccosine of the specified angle. *Angle* is expressed in radians.

Syntax: *COS-1(_angle_)*

```
10 A = COS-1( VAR10 )
```

COS

Returns the cosine value of a specified angle. *Angle* is expressed in radians.

Syntax: *COS(_angle_)*

KMD example

```
10 A = COS( VAR10 )
```

DALARM

The DALARM statement creates a visual alert and places an entry in the alarm log. It may also initiate a call-out sequence over a telephone connection to either a pager or a computer running WinControl.

Syntax: *DALARM_limit_,_delay_,string*

The parameter *limit* defines the condition which triggers the alarm. It is expressed as a conditional such as X_<_Y or X_>_Y or X_=_Y. X and Y can be any number, variable, input, or output in any controller.

Note: Spaces before and after <, >, or = are required.

- The value for *delay* is time expressed in whole numbers.
- The value for *string* is the alarm text message and may be up to 69 characters long.

```
10 DALARM IN1 > 72 , 7 , Room temperature is above 72
degrees!
```

This example will create an alarm condition if the input *IN1* is greater than 72 for 7 seconds or longer. The delay parameter eliminates unnecessary alarms if input *IN1* briefly exceeds 72.

For WinControl XL e-mail routing

To duplicate the WinControl XL Plus e-mail feature, create one or more alarm classes named *E1-E8*.

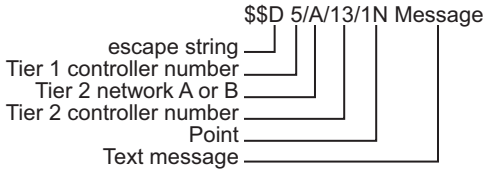
Add the alarm class to the alarm message string as shown in the following example:

```
10 ALARM IN4 > 85 , 3 , E1 Area temp too high
```

To set up routing for TotalControl alarms

TotalControl will display an alarm message but, it will only display the alarm in the alarm list of Design Studio or the web portal. To use TotalControl alarm routing, you must add to the message information about the point that originated the alarm. The format is shown in the illustration *Routing message string for DALARM* on page 147.

Illustration 14–2 Routing message string for DALARM




```
10 DALARM IN1 > 72 , 7 , $$D1/A/13/IN1 Room temperature is
above 72 degrees!
```

For pager notification

By adding *CALL*, *NPAGE*, or *TPAGE* options to the text string, the controller will initiate a dials-out sequence to either pagers or a computer running WinControl XL. The KMD Tier 1 controller that initiates the alarm must have a modem connected to it for pager notification.

Table 14–4 Pager message string options

Alarm device	String option
Numeric pager	NPAGE(_1234567_)_5555555
Text pager	TPAGE(_1234567-1234_)_Message

```
DALARM IN1 > 72 , 7 , NPAGE( 1234567 ) 5555555
DALARM IN1 > 72 , 7 , TPAGE( 1234567 1234 ) Message
```

Related keywords

- *ALARM* on page 139
- *NPAGE* on page 161
- *TPAGE* on page 177
- *PHONE* on page 165

DEC

Decrements the value of *point* by the value of *step*. If *step* is omitted, the *step* value is 1.

Syntax: *DEC(_point_,_step_) DEC(_point_)*

See the related topic *INC* on page 157.

KMD example

```
10 DEC( VAR1 , A + B )
10 DEC( VAR2 )
```

DECLARE

Used in conjunction with a CALL statement to receive a list of arguments (ARG) into a program. DECLARE must be used on the first line in the program. Using DECLARE makes the program a subroutine and should only be run from a CALL statement.

Syntax: *DECLARE_variable_variable...*

Note: For KMD-5100, Multi Net controllers only.

The variables are set to the value of the corresponding arguments employed in the CALL statement.

A subroutine called by DECLARE must use the END statement to stop the program.

The values of the variables will be transferred to the arguments in the CALL statement when END is executed.

The "timer" available on the Control Basic Program screen must be disabled so the program will only run when the CALL-DECLARE statement is executed.

Most often used when a long, complicated control routine needs to be repeated for many different points.

```
10 DECLARE VAR44 VAR56
```

See also *CALL* on page 144.

DECOM

Returns *true* if the decommission flag for a point is set and *false* if not.

Syntax: *DECOM(_point_)*

```
10 A = DECOM( IN1 )
```

DEW-POINT

Returns the dew point in degrees Fahrenheit based on Outside Air Humidity (OAH) and Outside Air Temperature (OAT). OAT is in degrees Fahrenheit.

Syntax: *DEW-POINT(_OAH_,_OAT_)*

```
10 D = DEW-POINT( VAR1 , VAR2 )
```

DEW-POINT-SI

Returns the dew point in degrees Celsius based on Outside Air Humidity (OAH) and Temperature (OAT). OAT is in degrees Celsius.

Syntax: *DEW-POINT-SI(_OAH_,_OAT_)*

```
10 D = DEW-POINT-SI( VAR1 , VAR2 )
```

DISABLE

DISABLE sets the value of a point, which can be the present value of an input, output or value object, to *off*.

Syntax: *DISABLE_point*

KMD example

```
10 DISABLE OUT1
20 DISABLE FAN
30 DISABLE PRG1
```

Related topics

- *ENABLE* on page 153
- *START* on page 173
- *STOP* on page 174

DOM

Returns the current day of the month.

KMD example

```
10 IF+ DOM = 15 THEN 20 ELSE END
20 REM Continue program execution
```

DOW

Returns a numerical value for the day of the week.

KMD example

In KMD controllers the days of the week are numbered 0-6.

- Sunday is day 0.
- Saturday is day 6.
- The day can also be identified by the first three letters (SUN, MON, etc.).

```
10 IF DOW = MON THEN START OUT1
```

DOY

Returns the day of the year.

- The year always begins on January 1.
- December 31st is day 366.
- February is always counted as having 29 days which means March 1 is always day 61.
- On non-leap years, February 29 (day 60) is skipped.

The day of the year may be expressed as either a number or the first three letters of the month and the day of the month.

KMD example

```
10 IF DOY = 92 THEN START OUT1
20 IF DOY = APR 1 THEN START
```

EMAILD

Sends an e-mail with the value of system points as data in the contents of the e-mail. Data from up to eight points may be included in one message.

Note: KMD web enabled products only.

Syntax: *EMAILD_to address_,_reply address_,_subject_,_data points*

In the following example the 15 second WAIT statement at line 20 halts program execution until the message is sent.

```
10 EMAILD joedoe@anonymous.com , webLite@jobsite.com , Air
Handler Data , IN1 IN, VAR2 OUT2
20 WAIT 0:00:15
```

Related topics

- *EMAILL* on page 151
- *EMAILM* on page 152
- *EMAILR* on page 152

EMAILL

Sends an e-mail message with data from either a trend log or runtime log as the contents of the message. Only one log may be sent in the same message. The log data in the body of the message is separated by commas (,).

Note: KMD web enabled products only.

Syntax: *EMAILL_to address_,_reply address_,_subject_,_log*

In the following example, the 15 second WAIT statement at line 20 halts program execution until the message is sent.

```
10 EMAILL joedoe@anonymous.com , webLite@jobsite.com , Roof
top unit , TL1
20 WAIT 0:00:15
```

Related topics

- *EMAILD* on page 151
- *EMAILM* on page 152
- *EMAILR* on page 152

EMAILM

Sends an e-mail message with *text* as the message contents.

Note: KMD web enabled products only.

Syntax: *EMAILM_to address_,_reply address_,_subject_,_text*

In the following example, the 15 second WAIT statement at line 20 halts program execution until the message is sent.

```
10 EMAILM joedoe@anonymous.com , WebLite@jobsite.com ,
Refrigeration Alarm , Temperature in cooler is high!
20 WAIT 0:00:15
```

Related topics

- *EMAILD* on page 151
- *EMAILL* on page 151
- *EMAILR* on page 152

EMAILR

Sends an e-mail message with data from either a trend log or runtime log as the contents of the message. Only one log may be sent in the same message. The log data in the body of the message is formated in columns.

Note: KMD web enabled products only.

Syntax: *EMAILR_to address_,_reply address_,_subject_,_log*

In the following example, the 15 second WAIT statement at line 20 halts program execution until the message is sent.

```
10 EMAILR joedoe@anonymous.com , WebLite@jobsite.com , Roof
top unit , TL1
20 WAIT 0:00:15
```

Related topics

- *EMAILD* on page 151
- *EMAILL* on page 151
- *EMAILM* on page 152

ENABLE

ENABLE sets the value of an input point, output point, variable or program to 1 or *on*.

Syntax: *ENABLE_point*

KMD example

```
10 ENABLE OUT1
20 ENABLE A
30 ENABLE PRG1
```

Related topics

- *DISABLE* on page 149
- *START* on page 173
- *STOP* on page 174

END

Terminates the execution of a program. When the END statement is encountered, the program stops reading lines and exits the program. All programs lines that follow an encountered END statement are *not* executed.

In the following example, the last line is ignored and the analog output will always equal 10.

ENTHALPY

Calculates enthalpy based on Outside Air Temperature (OAT) and Outside Air Humidity (OAH). The value returned is expressed as BTUs per pound of air. OAT is in degrees Fahrenheit.

Syntax: *ENTHALPY(_OAH_,_OAT_)*

For KMD controllers, see the topic *ENTHALPY-SI* on page 153 to enter OAT in degrees Celsius.

KMD example

```
10 E = ENTHALPY( VAR10 , VAR20 )
20 OAE = ENTHALPY-SI( OAH, OAT )
```

ENTHALPY-SI

Calculates enthalpy based on Outside Air Temperature (OAT) and Outside Air Humidity (OAH). The value returned is expressed as joules per kilogram of air. OAT is in degrees Celsius.

Syntax: *ENTHALPY-SI(_OAH_,_OAT_)*

```
10 E = ENTHALPY-SI( VAR10 , VAR20 )
20 E = ENTHALPY-SI( OAH , OAT )
```

ERROR-COUNT

Returns the number of network errors detected by the controller since the last start-up cycle or executed a CLEAR-COUNT statement.

Note: KMD Tier 1 controllers only.

```
10 VAR1 = ERROR-COUNT
```

The following statements return a count of the errors detected for a specific network on connections in Tier 1 controllers:

```
ERROR-COUNT-SUBA
ERROR-COUNT-SUBB
ERROR-COUNT-MAIN
ERROR-COUNT-ETHERNET
ERROR-COUNT-PCA
ERROR-COUNT-PCB
```

See the related topic *CLEAR-COUNT* on page 145.

FOR TO NEXT

The FOR TO NEXT loop repeats a set of instructions a specific number of times.

Syntax: *FOR_ConrtrolVariable_=_StartValue_to_EndValue(_Step_Increment_)*

- *ControlVariable* is the variable that *FOR* increments each time the loop repeats. It controls whether or not Control Basic repeats the loop. *ControlVariable* must be local to the controller in which the Control Basic program is running.
- *StartValue* is the initial value that Control Basic assigns to *ControlVariable*.
- *EndValue* is the value that the *ControlVariable* must equal before the loop ends.
- *Increment* is the amount that Control Basic adds to *ControlVariable* with each iteration of the loop. *Increment* can be a positive or negative value. If *STEP* and *Increment* are omitted, the default value is 1.
- NEXT ends FOR TO statements. It directs Control Basic to increment *ControlVariable* and to test whether it is greater than *EndValue*. If it is not, the loop continues at the first statement within the loop; if not, the program continues at the first statement following NEXT.

In the following example, the value of *A* increases from 0 to the value of *CON1* in 0.1 increments, pausing 10 seconds between steps.

KMD example

```
10 FOR A = 0 TO CON1 STEP 0.1
20 OUT1 = A
30 WAIT 0:00:10
40 NEXT A
```

GOSUB

GOSUB is the preferred way of branching to a subroutine in a program and then returning to the original point and continuing execution. When Control Basic encounters a GOSUB statement, the program jumps to the location specified and continues reading program lines until a RETURN statement is encountered. At that point the program returns to the line following the GOSUB statement.

Syntax: *GOSUB_line#*

In the following examples, the program reads the first line, jumps to the third line and then to the fourth line. The RETURN statement on the fourth line sends the program back to the second line and the program ends.

See the related topics *GOTO* on page 155 and *RETURN* on page 169.

KMD example

```
10 GOSUB 30
20 END
30 REM
40 RETURN
```

GOTO

This function redirects the program to a new location in the program. In the following examples, the program does not run the second line and output 1 is never changed.

See the related topic *GOSUB* on page 155.

Syntax: *GOTO_line#*

KMD example

```
10 GOTO 30
20 START OUT1
30 REM Line 30
40 END
```

HANGUP

Use HANGUP to end a telephone call placed through a modem connected to the KMD network. When Control Basic runs this statement, the controller

drops the modem off-line to end the call.

This example program will dial the number and after connecting, will wait 10 seconds before hanging up.

```
10 PHONE ATDT 555-1234
20 IF INTERVAL( 0:00:10 ) THEN 30 ELSE END
30 HANGUP
```

See the related keyword topic *PHONE* on page 165.

HAVE-TOKEN

Returns *true* if the controller has the network token and *false* if not.

```
10 IF HAVE-TOKEN THEN START OUT1
```

HSEL

Selects the highest (second highest, etc.) value of the expressions listed. The value for *N* defines whether it selects the highest (1) or the second highest (2) etc. The expressions can be variables, inputs, outputs, calculations, etc.

Syntax: *HSEL(_N_,_expression_,_expression...)*

This example returns the local variable *A* equal to the second highest value of the items listed.

KMD example

```
10 A = HSEL( 2 , IN1 , IN2 , IN3 , VAR1 )
```

IF- THEN

IF- is similar to IF THEN except that it detects the first time a condition changes from *true* to *false*. In this case the THEN clause would only be executed if the expression is *false* and on the previous scan it was *true*.

Syntax: *IF-_expression_THEN_clause(_ELSE_clause)*

Note: The *ELSE* and associated clause is optional.

See the related topic *IF THEN* on page 157 and *IF+ THEN* on page 156.

IF+ THEN

IF+ is similar to IF THEN, except that it detects the first time a condition changes from *false* to *true*. If the expression is true and on the previous scan it was not true, the THEN clause will be executed.

Syntax: *IF+_expression_THEN_clause(_ELSE_clause)*

The ELSE statement and associated clause are optional. If they are not included the program reads and executes the next program line.

When a button closes the circuit in the sensor analog input 1 to which it is connected, the program will branch down to line 30, which increases the setpoint (AV13 or VAR13) by one degree. This will happen only once for each time the button is pressed and released. Even if the button is held for several minutes it will only increment the setpoint by one degree.

See the related topic *IF THEN* on page 157 and *IF- THEN* on page 156.

KMD example

```
10 IF+ SENSOR-ON( IN1 ) THEN GOSUB 30
20 END
30 VAR13 = VAR13 + 1
40 RETURN
```

IF THEN

IF THEN is a decision making statement. The *expression* parameter can be any expression capable of being true or false (high or low, on or off, etc.) If *expression* is *true* the THEN statement will be executed. If the expression is *false* (not true) the ELSE statement will be executed. The ELSE statement and associated clause are optional. If they are not included the program reads and executes the next program line.

Syntax: *IF_expression_THEN_clause(_ELSE_clause)*

KMD example

```
10 IF IN1 < IN2 THEN STOP OUT5 ELSE START OUT5
END
```

In this example, the program stops output #5 if input #1 is less than input #2. If input #1 is not less than input #2, output #5 will be turned on (started). If the *ELSE START OUT5* statement was not included, the program will stop output #5 if input #1 is less than input #2. Otherwise, it will do nothing and end the program.

Note: Use commas to separate multiple commands in an IF statement.

```
10 IF IN1 > VAR1 THEN START OUT2 , STOP OUT1
20 IF IN1 > VAR1 THEN START OUT2 , STOP OUT1 , OUT3 = 0 ELSE
STOP OUT1 , OUT3 = CON1
```

INC

Increments the value of the argument *point* by the value of the argument *step*. If *step* is omitted, the step value is 1. *Point* may be the present value of any analog object.

Syntax: *INC(_point_, step_) INC(_point_)*

See the related topic *DEC* on page 148.

KMD example

```
10 INC( VAR1 , A + B )
20 INC( VAR2 )
```

INT

INT returns the integer portion of the numeric value *expression*. The value returned is the greatest integer that is less than or equal to the value of *expression*.

Syntax: *INT(_expression_)*

The following examples calculate the hour of the day (0-23) without minutes or seconds. The result is stored in variable VAR1.

KMD example

```
10 VAR1 = INT( TIME / 100 )
```

INTERVAL

The INTERVAL command performs an operation at a regular time interval. The statement is *true* at each expression time; otherwise it is *false*. The time format is in *hh:mm:ss* format.

Syntax: *INTERVAL(_expression_)*

The program sequence in this example increases the setpoint temperature—stored in variable VAR2—by 0.1° every 45 seconds.

KMD example

```
10 IF INTERVAL( 00:00:45 ) THEN VAR2 = VAR2 + .1
20 END
```

LET

The LET function assigns *expression1* to equal *expression2*. Use this function assign initial values to inputs, outputs, variables, PID control loops or schedule.

Syntax: *LET_expression1_=_expression2*

```
10 LET OUT1 = CON1
20 LET A = OUT1
```

The LET function is optional. Both of the following examples will produce the same results.

```
30 VAR3 = IN2 - 23
40 LET VAR3 = IN2 - 23
```

LN-1

LN-1 returns the inverse natural logarithm of the numeric expression.

Syntax: *LN-1(_expression_)*

```
10 B = LN-1( IN4 * 125 )
```

LN

The function *LN( )* returns the natural logarithm of the numeric expression.

Syntax: *LN(_expression_)*

```
10 A = LN( IN1 )
```

LSEL

LSEL returns the lowest, second lowest, etc. value of the expression listed. The value *N* defines whether it selects the lowest (1) or second lowest (2) etc. Expressions can be variables, inputs, outputs, calculations, etc.

Syntax: *LSEL(_N_,_expression_,_expression_...)*

In the examples local variable *A* will be set equal the second lowest value of the items listed.

KMD example

```
10 A = LSEL( 2 , IN1 , IN2 , IN3 , VAR1 )
```

MAX

MAX returns the maximum value of the expression listed. Expressions can be the present value of an input, output, or variable, or the result of a calculation.

Syntax: *MAX(_expression_,_expression_...)*

KMD example

```
10 A = MAX( IN1 , IN2 , IN3 , VAR1 )
```

MIN

MIN returns the minimum value of those expression listed. Expressions can be the present value of an input, output, or variable, or the result of a calculation.

Syntax: *MIN(_expression_,_expression_...)*

KMD example

```
10 B = MIN( IN1 , IN2 , IN3 , VAR1 )
```

MOD

MOD is an arithmetic operator that returns *true* if the division operation returns a remainder equal to *remainder*in the expression; returns *false* if the remainder of the division is not equal to *remainder* in the expression.

Syntax: *Dividend MOD Divisor_=_remainder*

KMD example

```
10 IF VAR1 MOD 5 = 0 THEN START OUT1 ELSE STOP OUT1
```

The following example uses MOD to calculate leap year. If the year in the controllers's internal clock is a leap year, local variable *L* is set to *true*. For other years the variable *L* is set to *false*.

```
10 IF YEAR MOD 4 = 0 AND YEAR MOD 100 <> 0 OR YEAR MOD 400 =
0 THEN L = 1 ELSE L = 0
```

See the related topic *Using arithmetic operators* on page 132.

MODBUSTRANSFER

Use this command to control the transfer of data between pairs of points and registers set up with interprotocol points.

Syntax: *MODBUSTRANSFER(point , action)*

- *Point* designates the interprotocol point.
- *Action* controls the transfer. See the following table for a list of permissible actions.

Note: Only for KMD models with Modbus license.

```
10 MODBUSTRANSFER( 1 , DISABLED )
20 MODBUSTRANSFER( 2 , ONCE )
30 MODBUSTRANSFER( 3 , ALWAYS )
```

Table 14–5 Actions

Action	Description
DISABLED	Disables the transfer of data from the read point to the write point.
ONCE	Initiates a one-time transfer of data between the read point and the write point. When the transfer is complete, the mode of the point pair is set to DISABLED.
ALWAYS	Initiates a continuous transfer of data between the read point and the write point.

MODEL-NUMBER

Returns the numerical portion of the model number of the controller.

```
10 VAR1 = MODEL-NUMBER
```

MONTH

Returns the current month of the year.

KMD example

```
10 M = MONTH
```

NETSENSOR-STATUS

Returns the connection status of a NetSensor so the program can take appropriate action. The function returns *true* if a functional NetSensor is connected to the controller and *false* if the controller does not detect a NetSensor.

```
20 DALARM NETSENSOR-STATUS = 0 , 10 , NetSensor in lobby not
responding!
```

NOT

NOT is a Boolean operator that performs a logical negation operation on an expression. If the expression is 0, the result is 1. If the expression is non-zero, the result is 0.

Syntax: *result = NOT expression*

```
10 IF NOT OUT1 THEN STOP OUT2
```

See the related topic *Using Boolean logic* on page 132.

NPAGE

Control Basic initiates a telephone call to a numeric pager.

Syntax: *NPAGE telephone number , numeric message*

- Use NPAGE only in programs running in Tier 1 controllers that are connected to a modem.
- *Telephone number* cannot contain spaces, hyphens or other punctuation except commas. Each comma adds a two second pause.

```
10 DALARM VAR51 , 1 , VAR 51 is in alarm!
20 ON-ALARM 40
30 GOTO 60
40 NPAGE 18005551212,,,,51
50 WAIT 0:00:15
60 END
```

See the related topics *TPAGE* on page 177 and *PHONE* on page 165.

ON-ALARM

ON-ALARM is a control statement that redirects the program when alarms are detected. When an alarm condition is detected, ON-ALARM redirects the program to the line number listed. This redirection occurs only once when the alarm is first detected. This statement only evaluates the ALARM statement immediately prior to it.

Syntax: *ON-ALARM_line#*

The following program runs the first three lines if alarms are not detected. However, if the alarm is activated on the first line, when ON-ALARM runs, the program jumps to the fourth line (Line 40). In this example, if no alarm is detected the program does nothing. If an alarm is detected Output *OUT1* is turned on.

```
10 ALARM IN1 < 34 , 1 , Temp is near freezing
20 ON-ALARM 40
30 END
40 START OUT1 : REM Activates warning device
50 END
```

ON-ERROR

ON-ERROR is a control statement. The program branches to the line specified by *location* when the previous Control Basic line detects an error.

Syntax: *ON-ERROR location*

The example prints an error message if line 10 is unsuccessful while executing the *PHONE* statement. *ON-ERROR* may also be used to branch to a subroutine where a second telephone phone number is called when an error may be received on the first attempt. Use *ON-ERROR* with the following commands.

- BAC-GET
- BAC-SET
- BAC-RLQ
- NPAGE
- PHONE
- REMOTE-GET
- REMOTE-SET
- RUN-MACRO
- TPAGE

```
10 PHONE 555-1234
20 ON-ERROR 40
30 END
40 REM Line 40 handles the error
```

```
50 END
```

ON GOSUB

ON GOSUB is a control statement. The program branches to the location from the list passed by the statement. The value of *expression* determines the location in the list to which Control Basic will continue. *Expression* is rounded to an integer. For example, if *expression* = 3 the program will branch to the location in the list. If the value of *expression* is greater than the number of locations listed or if *expression* is less than 1, no branch will occur.

Syntax: *ON_expression_GOSUB_location1[_location2_location3_...]*

See the related topic *RETURN* on page 169.

KMD example

In this example Variable *VAR1* is equal to *3* which will cause the program to branch to Line *80*. If *VAR1* equals *2*, the program will branch to Line *60*, etc

```
10 VAR1 = 3
20 ON VAR1 GOSUB 40 , 50 , 60
30 END
40 RETURN
50 RETURN
60 RETURN
```

ON GOTO

ON GOTO is a control statement. The program branches to the locations from the list passed by the statement. The value of *expression* determines the location in the list to which the program will branch. *Expression* is rounded to an integer. For example, if *expression* = 3 the program will branch to the third location in the list. If the value of *expression* is greater than the number of locations listed or if *expression* is less than 1, no branch will occur.

Syntax: *ON_expression_GOTO_location1[_location2_location3_...]*

KMD example

In this example VAR1 = 3 which will cause the program to branch to line 60. If VAR1 were equal to 2, the program would branch to line 50, etc.

```
10 VAR1 = 3
20 ON VAR1 GOTO 40 , 50 , 60
30 END
40 REM Program continues here
50 REM Program continues here
60 REM Program continues here
```

OPEN

Use OPEN to set the present value of a point to *on* or *true*.

Syntax: *OPEN_point*

KMD example

```
10 OPEN OUT1
20 OPEN A
30 OPEN VAR1
```

Related topics

- *CLOSE* on page 145
- *START* on page 173
- *STOP* on page 174

OR

OR is a Boolean operator that performs the logical *OR* of the two expressions. The result is *true* if either expression is *true*. The result is *false* if both expressions are *false*.

Syntax: *result = expression1 OR expression2*

In the following example, local variable *C* will equal 1 if either of the variables *A* and *B* are equal to 1.

```
10 A = 1 : B = 0 : C = A OR B
```

See the related topic *Using Boolean logic* on page 132.

OUTPUT-OVERRIDE

Returns the switch position of an optional HPO-6700 series output board installed in the controller in which Control Basic is running.

Syntax: *OUTPUT-OVERRIDE(_expression_)*

The argument *output* is returned *false* if the switch is in *AUTO* and *true* if the switch is set to either the *OFF* or *HAND* position. *Output* can be expressed as either of the following:

- The point number of the output.
- A local variable whose value represents the number of an output object.

```
10 DALARM OUTPUT-OVERRIDE( 1 ) , 300 , OUTPUT1 1 SWITCH IS
NOT IN AUTO
20 IF OUTPUT-OVERRIDE( 2 ) THEN STOP OUT2
```

PANEL-ADDRESS

Returns the KMD network address of the controller on which Control Basic is running.

```
10 P = PANEL-ADDRESS
```

PHONE

Use PHONE to establish a modem connection from a controller to a remote computer running WinControlXL Plus.

Syntax: *PHONE_ATDT_telephone number*

- The *ATDT* option is a standard modem structure clause to configure the modem to dial out in a tone format.
- *Telephone number* cannot contain spaces, hyphens or other punctuation except commas. Each comma adds a two second pause.

When Control Basic runs the *Phone* statement, the processor suspends operation for up to 45 seconds as it waits for the modem to return a connection string.

Caution

The Wait statements in the following examples are critical to reliable program execution. Do not delete them.

Examle programs

Tier 1 controller example

The sequence in the following example dials the number, waits up to 45 seconds for the remote modem to answer and then after connecting to it, waits 1 minute before hanging up. HANGUP is required at the end of the sequence.

```
10 DALARM 1-VAR51 , 1 , VAR 51 is in alarm!
20 ON-ALARM 40
30 GOTO 80
40 PHONE 18005551212,,,,51
50 WAIT 0:00:45 : ON-ERROR 40
60 HANGUP
70 WAIT 0:01:00
80 END
```

Tier 2 controller example

In the following example, a Tier 2 controller dials a pager and leaves the message 1234. Each comma adds a 1 second pause.

```
10 IF+ IN1 THEN 20 ELSE END
20 PHONE ATDT 5551212,,,,,,1234
30 HANGUP
```

Related topics

- *NPAGE* on page 161
- *TPAGE* on page 177
- *HANGUP* on page 155

PI

Inserts the value of pi. The following example converts angle *D* from degrees to radians.

KMC example

```
10 A = PI * ( D / 180 )
```

POWER-LOSS

Use POWER-LOSS to detect loss of power to the controller or any condition that forced the controller to reset. This function returns *true* on the first scan of all Control Basic programs after power is restored. After the first scan, it returns as *false*.

The following example is useful for monitoring intermittent power failures at a controller. The variable *VAR32* increments by 1 each time power is restored. *POWER-LOSS* may also be used to detect any other condition that causes the controller to perform its restart sequence.

```
10 IF POWER-LOSS THEN VAR32 = VAR32 + 1
20 END
```

PRINT

Sends a string of up to 69 characters to the selected print device. String must be enclosed in quotation marks unless it is one of the following key words: DATE, TIME, USER-A or USER-B.

Syntax: *PRINT_"string"(;)*

Note: Available only with the KMD-5100 series controllers.

A semicolon (;) at the end of the print statement is optional. Use it to continue printing on the same line. If no semicolon is included.printing will start on a new line.

A PRINT-AT statement must be used before using a PRINT statement to direct the system to the correct print device.

```
10 PRINT-AT 25
20 IF+ USER-A THEN PRINT USER-A; “Has signed on”
30  END
100 REM***FIRE INSTRUCTIONS***
110 PRINT
120 PRINT “Step 1, ... Step 2, ..." etc.
130 RETURN
```

On Main LAN controllers with firmware version 4.14 or later the print statement can also be used to send ASCII character codes to the specified port.

```
10 PRINT $41;
20 PRINT $0D:
```

In the example an “A” (41 HEX) is printed followed by a carriage return (0D HEX).

The following example prints the value of output 1 followed by the message.

```
20  PRINT OUT1 [ “TIME TO CHANGE FILTER” ]
```

See also *PRINT-AT* on page 167.

PRINT-AT

Use before a PRINT statement to specify which controller or controllers will receive the print message. List individual panel numbers or ALL to send the message to every panel in the system.

Syntax: *PRINT-AT_panel(_panel_panel...) or PRINT-AT ALL*

Note: For KMD-5210 controllers only.

```
10 PRINT-AT 1 3 7
20 PRINT “Sends message to panels 1, 3, and 7"
30 30 PRINT-AT ALL
40 PRINT “Sends message to all panels in system”
50 END
```

See also *PRINT* on page 166.

READ-CONBIAS

Returns the bias value of a PID control loop. The value range is 0–100.

Syntax: *READ-CONBIAS(_expression_)*

```
10 B = READ-CONBIAS( 1 )
```

READ-CONPROP

Returns the proportional band value of PID control loop. The value range is 0–4000.

Syntax: *READ-CONPROP(_expression_)*

```
10 P = READ-CONPROP( 1 )
```

READ-CONRATE

Returns rate (derivative) value of PID controller. The value range is 0–2.00.

Syntax: *READ-CONRATE(_expression_)*

```
10 R = READ-CONRATE( 1 )
```

READ-CONRESET

Returns the reset (integral) value of a PID control loop. The value range is 0–255.

Syntax: *READ-CONRESET(_expression_)*

```
10 S = READ-CONRESET( 1 )
```

REM

Place a REM statement at the beginning of a program line to insert explanatory comments or remarks. REM is a method to document the use of a subroutine or to explain a formula used in a calculation.

Syntax: *REM_string*

KMD example

```
50 REM ** Step temperature every minute by 1 degree **
60 IF INTERVAL( 0:01:00 ) THEN VAR1 = VAR1 + 1
70 REM **calculation for velocity (FPM)**
80 VAR1 = 4004.4 * SQR( IN1 )
90 END
```

REMOTE-SET

Use REMOTE-SET to assign a value to a point in a remote system. The remote point is any accessible point in the remote system. The value of variable “x” will be assigned to the point in the remote system.

Syntax: *REMOTE-SET_remote point_=_x*

Note: For KMD-5100 MultiNet controllers only. Deprecated for all KMD Tier 1 and Tier 2 controllers.

```
10 PHONE 555-1234
20 REMOTE-SET 2-OUT1 = 50
30 HANGUP
40 END
```

REMOTE-GET

Use REMOTE-GET to retrieve the value of a point in a remote system. In the following example A is returned with the value of IN5 (input 5).

Syntax: *REMOTE-GET_variable_=_remote point*

Note: For KMD-5100 MultiNet controllers only. Deprecated for all KMD Tier 1 and Tier 2 controllers.

```
10 PHONE 555-1234
20 REMOTE-GET A = IN5
30 HANGUP
40 END
```

RETURN

This command returns control from a subroutine to a calling procedure. RETURN is always used in conjunction with GOSUB or ONGOSUB statements to RETURN from a subroutine.

See the related topics *GOSUB* on page 155 and *ON GOSUB* on page 163.

RND

RND is a numeric function which returns a random number between 0 and *expression*-1. It is useful for applications such as security lighting.

Syntax: *RND(_expression_)*

KMD example

```
10 IF TIME = 20:00:00 + RND( 10:00:00 ) THEN START OUT1
```

RUN-MACRO

This statement starts a macro in a PC connected to the system. The macro number (#) is the assigned number of the MACRO you wish to run (1 - 16). The macro may be in either the local computer or via a modem using PHONE statement. .

Syntax: *RUN-MACRO #*

Note: For KMD LAN Controllers only.

```
10 IF+ TIME 4:00 THEN PHONE 555-1234 ELSE 110
20 ON-ERROR 100
30 RUN-MACRO 6
40 WAIT 0:10 : REM Wait while program runs
50 HANGUP
60 END
100 REM connection not made
110 END
```

SCANS

SCANS returns the rate a controller is processing all Control Basic programs. The value returned is expressed in scans per second. As the complexity or length of a program increases it takes longer to process and the number of scans per second decreases.

A useful application for SCANS is to create a time-based counter similar to those used for time-proportioning relays. If you use the INTERVAL or WAIT statements you are limited to a time division no smaller than one second. By programming a counter based on SCANS, the smallest time increment can range between 1/5 of a second to 1/50 of a second depending on how busy the controller is.

If a time proportioning relay sequence is based on a 5 second cycle for example, having time increments in only 1 second divisions would likely not be sufficient.

See the related topic *About Control Basic scans* on page 130.

KMD example

```
10 A = 1 / SCANS
20 B = A + B : REM B Will inc. by 1 every sec.(based on scan
rate)
30 IF B > 10 THEN B = 0 : REM B counts 0-10 in 10 seconds
40 END
```

SENSOR-OFF

Use SENSOR-OFF to detect an open-circuit condition on an input that is configured as an analog input. A typical application is a two-wire thermistor sensor with *Up* and *Down* pushbuttons. SENSOR-ON detects 0 volts (closed contact) while SENSOR-OFF detects 5 volts (open-circuit) condition.

Syntax: *SENSOR-OFF(_IN#_)*

When used with *SENSOR-ON* on page 171 and *IF THEN* on page 1570, *IF+ THEN* on page 156, or *IF- THEN* on page 156 you can determine three separate conditions from one input:

- A temperature or other analog reading.
- A sensor with open contacts (Sensor-Off).
- A sensor with closed contacts (Sensor-On).

These statements can also be used with inputs using a table if the minimum value in the table is set to a value greater than zero and its maximum value is less than 5.00 volts.

Table 14–6 Input conditions for SENSOR-OFF in KMD Controllers

Input Voltage	Detected condition
0	Closed circuit
0.1	Temperature-55 degrees
4.9	Temperature-95 degrees
5.0 or greater	Open circuit

In the example table, under normal temperature conditions, the input voltage would never fall below 0.1 volts. When a sensor is shorted to ground, the input voltage will fall to zero, which is a condition SENSOR-ON can detect. Similarly, if the circuit is opened, the controller will read 5.00 volts, which is higher than the maximum 4.9 volts in the table which will be detected by SENSOR-OFF.

See the keyword topic *DECOM* on page 149 for additional information about decommissioned inputs.

```
10 IF- SENSOR-OFF( IN1 ) THEN GOSUB 30
20 END
30 VAR13 = VAR13 + 1
40 RETURN
```

SENSOR-ON

Use SENSOR-ON to detect 0 volts (closed-circuit) condition on an input that is configured as an analog input. A typical application is to detect momentary conditions such as a pressed button. If the opened contact condition lasts longer than two minutes the function will be disabled. After three minutes, the object will change *Out Of Service* to *true* but the commands will still execute.

Syntax: *SENSOR-ON(_IN#_)*

When used with *SENSOR-OFF* on page 170 and *IF THEN* on page 157, *IF+ THEN* on page 156, or *IF- THEN* on page 156 you can determine three separate conditions from one input:

- A temperature or other analog reading.
- A sensor with open contacts (Sensor-Off).
- A sensor with closed contacts (Sensor-On).

These statements can also be used with inputs using a table if the minimum value in the table is set to a value greater than zero and its maximum value is less than 5.00 volts.

Table 14–7 Example table for SENSOR-ON for KMD controllers

Input Voltage	Detected condition
0	Closed circuit
0.1	Temperature-55 degrees
4.9	Temperature-95 degrees
5.0	Open circuit

In the table, *Example table for SENSOR-ON for KMD controllers*, the input voltage under normal temperature conditions would never fall below 0.1 volts. When a sensor is shorted to ground, the input voltage will fall to zero, which is a condition that SENSOR-ON can detect. Similarly, if the circuit is opened, the controller will read 5.00 volts, which is higher than the maximum 4.9 volts in the table which will be detected by SENSOR-OFF.

```
10 IF+ SENSOR-ON( IN1 ) THEN VAR11 = 02:00:00
```

Note: Use *SENSOR-ON* to detect momentary, unusual conditions such as a pressed button. The opened or closed contact condition should last no longer than two minutes or the functions will be disabled. After three minutes the inputs will change to a decommissioned status but the commands will still execute.

See the keyword topic *DECOM* on page 149 for additional information about decommissioned inputs.

SET-PRINTER

This statement informs the panel a serial printer is connected in the system. The following “codes” define to which port the printer is connected to. To get ASCII out specified port SET PRINTER a (lowercase), only prints data (no

alarms) from print statement (alarms still directed by other print statements) capital "A".

Note: For KMD-5210 controllers only.

Syntax: *SET-PRINTER_code*

```
10 Code "A", "B", or "0"
```

SIN-1

Returns the arcsine of the specified angle. The value *angle* is expressed in radians.

Syntax: *SIN-1(_angle_)*

```
10 A = SIN-1( VAR1 )
```

SIN

Returns the sine of the specified angle. *Angle* is expressed in radians.

Syntax: *SIN(_angle_)*

KMD example

```
10 A = SIN( VAR10 )
```

SQR

The SQR function returns a value equal to the square-root of the value *expression*.

Syntax: *SQR(_expression_)*

KMD example

```
10 A = SQR( IN1 )
```

START

START sets the value of a point to *on*.

Syntax: *START_point*

KMD example

```
10 START OUT1
20 START VAR5
30 START A
40 START PRG1
```

Related topics

- *STOP* on page 174
- *DISABLE* on page 149
- *ENABLE* on page 153

STATUS

This function returns the network status of a KMD controller. The status codes are listed in the table *Status conditions* on page 174.

Syntax: *STATUS(_expression_)*

Table 14–8 Status conditions

Value	Status
0	Loss of communication; Not on-line
1	Controller is functioning properly
2	Controller has no program but is communicating

```
10 REM Take special action if controller is not functioning
20 IF STATUS( 2 ) = 0 THEN GOSUB 40
30 END
40 START OUT1 : STOP OUT2 : RETURN
```

STOP

STOP sets the value of a *point* to *Off*.

Syntax: *STOP_point*

KMD example

```
10 STOP OUT1
20 STOP VAR10
30 STOP PRG7
40 STOP RT1
```

Related topics

- *START* on page 173
- *DISABLE* on page 149
- *ENABLE* on page 153

TAN-1

A function that Rreturns the arctangent of the specified angle.The value of *angle* is expressed in radians.

Syntax: *TAN-1(_angle_)*

```
10 A = TAN-1( VAR12 )
```

TAN

A function that returns the tangent of the specified angle. The value *angle* is expressed in radians.

Syntax: *TAN(_angle_)*

KMD example

```
10 A = TAN( VAR10 )
```

TBL

Use TBL to look up the value of an expression such as a variable in a custom created table. Use look-up tables when the value of the expression is nonlinear or requires a complicated calculation to arrive at the proper value. Use ON-ERROR after TBL to recover from problems within the table.

Syntax: *TBL(_expression_,_table#_)*

When referencing a table within Control Basic, use the form TBL (x , N) where “N” is the table number and “x” is the value within the table. The function returns the interpolated y coordinate-ordinate of the table. N must be a whole number, x can be an integer.

KMD example

```
10 VAR1 = TBL( IN3 , 2 )
20 VAR2 = TBL( VAR7 , 1 )
```

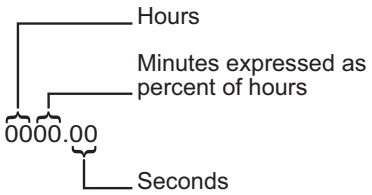
TIME-OFF

Use TIME-OFF to determine if a point has been in an *off* state for a specific period of time.

Syntax: *TIME-OFF(_point_)*

- If *point* is a variable, it must be configured as a unit of time.
- If *point* is a local variable, it will be returned as a number in the 24-hour format.

Illustration 14–3 Time format



Caution Time-Off responds to the time a point was *off* as seen by the controller executing the program. This time may not be the same as the actual time if the point is a from another controller.s

```
10 IF TIME-ON( OUT1 ) > 0:10 THEN START OUT2
```

See the related topic *TIME-ON* on page 176 and *Variables in KMD controllers* on page 138.

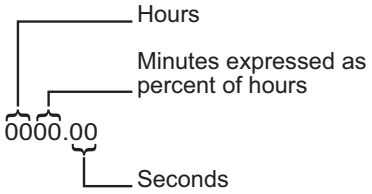
TIME-ON

Use this statements to determine if the present value in a point t has been *on* for a specific period of time.

Syntax: *TIME-ON(_point_)*

- If *point* is a variable, it must be configured as a unit of time.
- If *point* is a local variable, it will be returned as a number in the 24-hour format.

Illustration 14–4 Time format



Caution *Time-On* responds to the time a point was *on* as maintained by the controller running the program. This time may not be the same as the actual time if the point is a from another controller.

```
10 IF TIME-ON( OUT1 ) > 0:10 THEN START OUT2
```

See the related topic *TIME-OFF* on page 175.

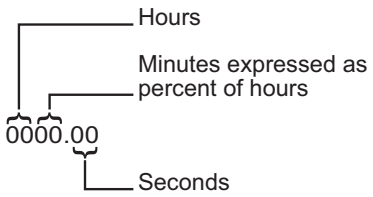
TIME

A function that returns a value based on the time as maintained in the controller running Control Basic.

KMD example

The TIME function in KMD controllers returns a number in the 24-hour format.

Illustration 14–5 TIME function format in KMD controllers



TIME can also be entered in the traditional hours:minutes:seconds format.

```
10 IF TIME = 12:30:00 THEN GOTO 20 ELSE END
20 REM it is after lunchtime
```

Time in 00:00:00 format can be evaluated to a real number by using the following formula:

TIME = hour * 100 + (60 * min + sec) / 36

```
10 14:30:30 = 1450.833
20 2:15 = 225
```

TPAGE

Control Basic initiates a telephone call to a text pager. *Telephone number* cannot contain spaces, hyphens or other punctuation except commas. Each comma adds a two second pause.

Syntax: *TPAGE telephone number , text message*

Note: KMC controllers do not support older TAPI protocols or speeds below 1200 baud.

```
10 DALARM VAR51 , 1 , VAR51 is in alarm!
20 ON-ALARM 40
30 GOTO 60
40 TPAGE 18005551212-5551212 , VAR 51 is in alarm!
50 WAIT 0:00:15 : ON-ERROR 40
```

```
60 END
```

Note: Use TPAGE only in programs running in KMD Tier 1 controllers or stand-alone Tier 2 networks with a KMD-5559.

See the related topics *NPAGE* on page 161 and *PHONE* on page 165.

UNACK

Use to determine if there are alarms in the system which have not been acknowledged. The function returns *true* when an unacknowledged alarm exists or *false* if alarms have been acknowledged.

Note: Use in KMD Tier 1 controllers only.

```
10 IF UNACK THEN START VAR31 ELSE STOP VAR31
```

USER-A and USER-B

These statements return the user number of any user logged on at local serial Port A. The functions return as *false* if an operator is not logged on.

Note: KMD Tier 1 controllers only.

```
10 IF+ USER-A > 0 THEN GOSUB 30
20 END
30 Handles a user on Port A
40 RETURN
```

WAIT

Use WAIT to control timed events. The program waits for the time period specified before reading the next program line. Other programs in the controller will not be affected as WAIT applies only to the program in which it is listed.

Syntax: *WAIT_period*

Tip: The value for *period* can be expressed in 24-hour format (14:15) or converted to decimal format (1425). See the related topic *TIME* on page 177.

Note: Plan carefully when using WAIT before a conditional branch such as with IF-THEN. Conditions within a controller may change the value of points or properties during the waiting period.

KMD example

```
10 START OUT2
```

```
20 WAIT 0:10
30 REM * * Waits 10 Minutes at line 20 * *
40 WAIT 00:00:10
50 REM * * Waits 10 seconds at line 40 * *
60 END
```

WRITE-TO-FLASH

Writes data to the non-volatile flash memory in the controller.

Note: Firmware in the controller limits *WRITE-TO-FLASH* execution to once every 15 minutes. This limitation prevents *WRITE-TO-FLASH* commands from superseding other programming in the controller.

```
10 IF+ TIME > 17:00:00 THEN WRITE-TO-FLASH
20 IF ABS( VAR1 - VAR2 ) = 100 THEN WRITE-TO-FLASH
```

WS-OFF

Use this function to determine the time of day that a weekly schedule will change to *off*. The parameter *schedule#* designates the weekly schedule and *time#slot* is the selected *Off* time, in earlier-to-later sequence.

Syntax: *WS-OFF(_schedule#_,_time#slot_)*

The following example sets variable VAR2 equal to the time that the schedule changes to *Off* for the third time on the day that Control Basic runs the statement.

```
10 VAR2 = WS-OFF( 1 , 3 )
```

WS-ON

Use this function to determine the time of day that a weekly schedule will change to *On* . The parameter *schedule#* designates the weekly schedule and *time#slot* is the selected *On* time, in earlier-to-later sequence.

Syntax: *WS-ON(_routine#_,_time#slot_)*

The following example sets variable VAR1 equal to the time that the schedule changes to *On* for the third time on the day that Control Basic runs the statement.

```
10 VAR1 = WS-ON( 1 , 3 )
```

XOR

XOR performs a logical exclusion on two Boolean expressions. The result is *true* if the two expressions are different; otherwise, the result is *false*.

Syntax: *result_=_expression1_XOR_expression2*

In the following example, local variable *C* will equal 1 as long as variables *A* and *B* are not equal to each other.

```
10 A = 1 : B = 0 : C = A XOR B
```

See the related topic *Using Boolean logic* on page 132.

YEAR

Returns the four-place value of the current year.

```
10 Y = YEAR
```

Appendix A: WinControl job files and folders

This section describes the location and contents of the WinControl XL job folders.

As systems are added to the system list, job folders are created in the WCXL folder. The name of the job folder is the same as *System Name* in the system list. The job folder includes other folders in which WinControl stores specific data and information about the job.

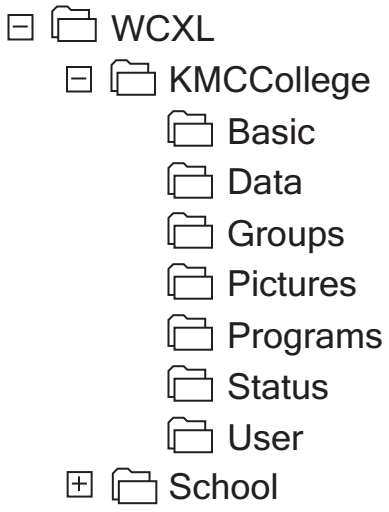
Windows XP job folder location:

```
C:\Documents and Settings\All Users\Application Data\KMC
Controls\WCXL
```

Windows Vista and Windows 7 job folder location:

```
C:\Program Data\KMC Controls\WCXL
```

Illustration A–1 WinControl XL Plus file structure

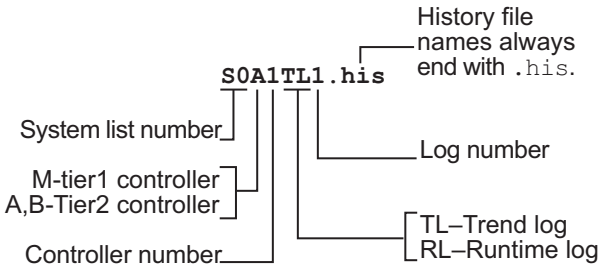


Control Basic folder The Basic folder is the default location for storing Control Basic files. The files are in text format and can be opened with Notepad or Wordpad.

Data folder Stores alarm history and trend log data.

- Alarm files use the extension *ALM*. Each file is a record of alarms for one month.
- The trend and runtime logs use the following illustration.

Illustration A–2 Trend log file name



Groups folder Stores the data for system group displays. Each system group has a file that includes the controller number and the group number within the controller.

Beginning with WinControl XL Plus version 2.04, the program version, file format, file version number and operator name is stored in the groups file.

Example log entry in system group file

```
WinControlXL=2.04

GroupFileFormat=2.04

FileVersion=1

FileVersion 1= by a Super Admin on 07/13/05 11:25:37
```

Pictures folder Stores the background and animated graphic files used with displays in System Groups.

Background graphic file formats for System Groups are:

- .JPG
- .BMP

Animation files must be in the animated GIF format.

Programs folder The default location for storing panel files.

Status folder Stores controller names and network status. These files are used only by WinControl.

User folder Stores the operator activity log in the jobs folder.

- The operator log is a time-stamped record of every operator login, logoff, and action performed.
- A new log file is created every day there is an operator login. The file name is the date created in month, day, year format.
- The operator activity log is a text file that can be opened with Microsoft Notepad, Wordpad or other text editing program.

Appendix B: Computer Connections to KMC controllers

This section describes methods to directly connect a computer to a KMC digital controller for use with HCM, TotalControl, or WinControl.

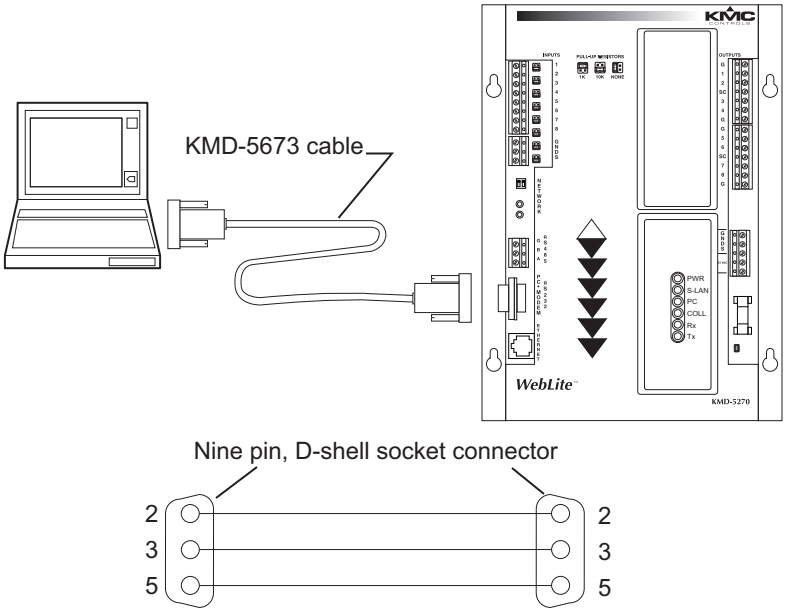
Each type of KMD controller has a specific connection requirements. Choose the method from the following list that is appropriate for the controller or building automation system.

- *Tier 1 with 9–pin connectors* on page 185
- *Tier 1 with terminal blocks* on page 186
- *Tier 2 to a computer serial port* on page 186
- *Tier 2 to a computer USB port* on page 187

Tier 1 with 9–pin connectors

To connect to a computer with a 9–pin serial connector, use a KMD–5673 cable between a serial port on the computer and the RS–232 port on the controller.

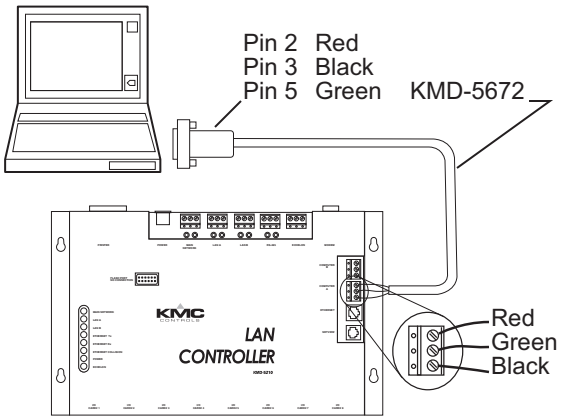
Illustration B–1 Tier 1 9–pin RS–232 connection



Tier 1 with terminal blocks

Connect a computer directly to the terminal marked *Computer A* on a KMC Tier 1 LAN controller.

Illustration B–2 Connecting to LAN controllers



Tier 2 to a computer serial port

Connect a computer to Tier 2 controllers at the RJ–12 PC port. Tier 2 controller connections require a KMD–5557, KMD–5558 or KMD–5559. Connection may be made through a NetSensor or directly to the controller. The following illustrations show details for several methods.

Illustration B–3 Connecting with KMD-5559

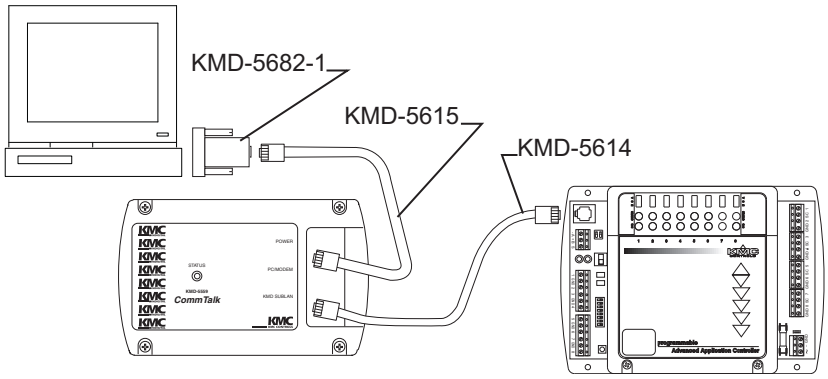


Illustration B–4 Service connection with a Connecting with KMD-5557 and NetSensor

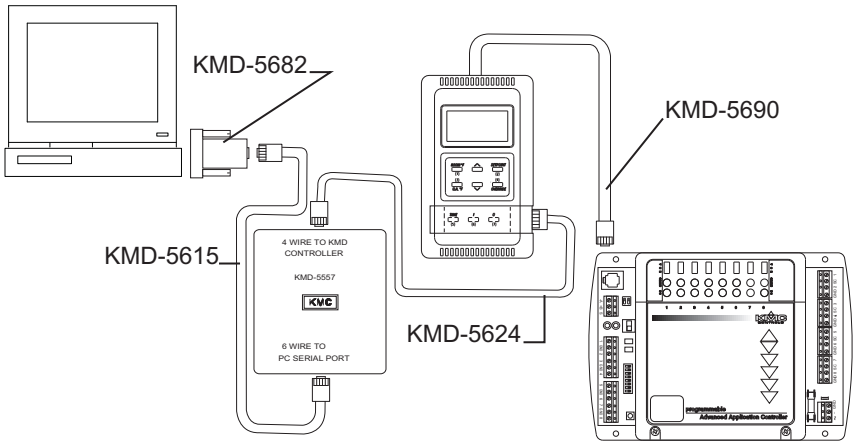
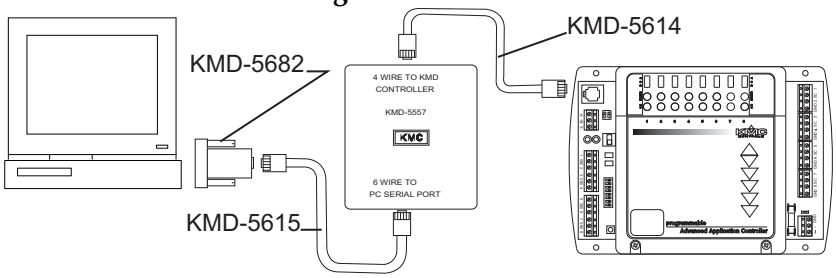


Illustration B–5 Connecting with KMD-5557



Tier 2 to a computer USB port

For computers with USB (Universal Serial Bus) ports, use the KMD–5576 USB adaptor to connect to a Tier 2 controller.

Illustration B–6 Connecting a KMD–5576 directly to a controller.

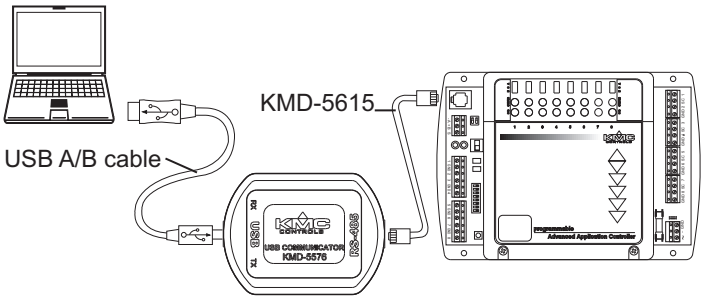
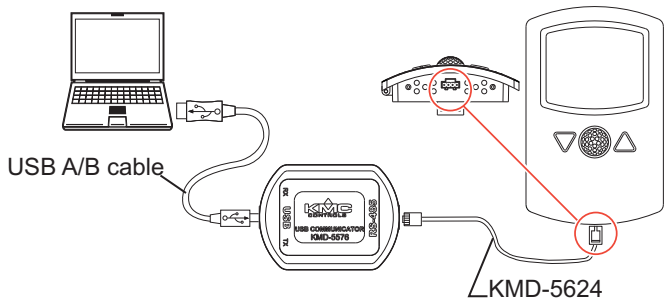


Illustration B–7 Connecting a KMD–5576 through a NetSensor



You may use also a third-party USB (Universal Serial Bus) connection by adding USB to EIA–485 converter.

Appendix C: KMD Tier 1 alarm messages

KMD Tier 1 controllers issue alarm notifications when an internal error is detected. This section is a list of the error messages.

Table C–1 Tier 1 alarm messages

Module	Alarm Text	Cause	Restor-able
Cbasic	Program Error: Prog	WS-ON: WS-OFF: An illegal routine# FOR TO NEXT: An off-panel point is used as value to increment INC: sub-opcode other than RD_A-RD_Z, or RD_PNT DEC: sub-opcode other than RD_A-RD_Z, or RD_PNT	No
Cbasic	Off Panel Write : Prog #, Line # , OpCode #!	STOP, DISABLE, CLOSE, LET: Argument is an off panel point.	No
Cbasic	Invalid Table: Prog #, Line # , OpCode #!	TBL: Invalid table#.	No
Cbasic	Array Table Invalid: Prog #, Line # , OpCode #!	Invalid array index used anywhere an array point is read or is assigned a value.	No
Cbasic	Invalid OpCode: Prog #, Line # , OpCode #!	Can be tested by using an email command on a LAN Controller	No
Cbasic	BACnet Not Licensed: Prog #	These errors arenít currently implemented in Control Basic.	No
Cbasic	BACnet Application Layer Not Configured: Prog #	These errors arenít currently implemented in Control Basic.	No
Cbasic	BACnet: Ethernet is not Running: Prog #	These errors arenít currently implemented in Control Basic.	No
Cbasic	Main Panel Does not Exist: Prog #, Line # , OpCode #!	STATUS: Illegal panel#	No
Cbasic	User Name not found: Prog #,	PRINT USER-A/B: There isnít a user	No

Tier 1 alarm messages (continued)

Module	Alarm Text	Cause	Restor-able
	Line # , OpCode #!	logged-on on port A/B.	
Cbasic	LSEL too many values: Prog #, Line # , OpCode #!	LSEL: The number of expressions are less than 2 or greater than 30	No
Cbasic	HSEL too many values: Prog #, Line # , OpCode #!	HSEL: The number of expressions are less than 2 or greater than 30	No
Cbasic	Probable Infinite Loop: Prog #, Line # , OpCode #!	More than 25,000 opcodes have been executed for one pass of the program	No
BACnet	BACnet Service Request Timeout on Device #, Object #	A BACnet read or write property request has timed out.	No
BACnet	BACnet Who-Is Timeout on Device #	A BACnet who-is request has timed out.	No
BACnet	BACnet MS/TP Sole Master	No other panels accepting the token	Yes
Main-Net	Too Many MainNet In Want Points! Point not added:	More than 64 In Want Points	No
Main-Net	Too Many MainNet Out Want Points! Point not added:	More than 64 In Want Points	No
Main-Net	MAIN PANEL IS OFFLINE-#	5 minutes has passed since this panel was heard from	Yes
Sub-NetA	Too Many SubNetA In Want Points! Point not added:	More than 512 In Want Points	No
Sub-NetA	Too Many SubNet A Out Want Points! Point not added:	More than 64 In Want Points	No
Sub-NetA	SUB-PANEL IS OFFLINE M#-SUBA-#	5 minutes has passed since this panel was heard from	Yes
Sub-NetB	Too Many SubNetB In Want Points! Point not added:	More than 512 In Want Points	No
Sub-NetB	Too Many SubNet B Out Want Points! Point not added:	More than 64 In Want Points	No
Sub-NetB	SUB-PANEL IS OFFLINE-SUBB-#	5 minutes has passed since this panel was heard from	Yes
Ethernet	Trying to send more packets than allowed by protocol!	User response message length greater than 255 bytes.	No

Tier 1 alarm messages (continued)

Module	Alarm Text	Cause	Restor-able
		Broadcast message length greater than 1500 bytes.	
Ethernet	Panel to Panel message from unknown panel : # port #	MSG_TOPANELS received from a panel not in the Netlist.	No
Ethernet	Broadcast message from unknown panel : # port #	MSG_TOBEHOST received by a panel thatís not a broadcast server. MSG_TOBEHOST received from a panel not in the Netlist.	No
Ethernet	PANEL IS OFFLINE-#	5 minutes has passed since this panel was heard from	Yes
Hourly Memory Check	Memory utilization has exceeded 95%! Memory utilization has exceeded 90%! Memory utilization has exceeded 85%! Memory utilization has exceeded 80%! Memory utilization has exceeded 75%!	May be able to hit one of these watermarks by loading the panel with programs, schedules, and system groups. A memory leak would also be detected by these alarms after running the panel for an extended period of time.	No

Appendix D: Thermistor values

The thermistor values shown in the tables correspond to temperature ranges in *Configure Inputs*.

Values shown in the table *Type III 10,000 ohm thermistors* on page 193 are associated with analog input temperature units for a Type III, 10,000 ohm thermistor. See *Units of measure list* on page 73.

This table was revised on July 1, 1999.

Table D–1 Type III 10,000 ohm thermistors

Resistance	Volts	Range 2 -40 to 150 Deg.C	Range 3 -40 to 250 Deg.F
369	0.18	134.38	273.89
589	0.28	112.19	233.95
818	0.38	99.97	211.94
1057	0.48	90.86	195.55
1307	0.58	83.63	182.54
1569	0.68	77.62	171.72
1843	0.78	72.44	162.40
2130	0.88	67.88	154.19
2432	0.98	63.84	146.90
2749	1.08	60.12	140.21
3082	1.18	56.75	134.15
3434	1.28	53.62	128.51
3805	1.38	50.69	123.23
4196	1.48	47.92	118.26
4611	1.58	45.30	113.53
5051	1.68	42.79	109.02
5518	1.78	40.37	104.67
6015	1.88	38.07	100.52
6545	1.98	35.86	96.54

Type III 10,000 ohm thermistors (continued)

Resistance	Volts	Range 2 -40 to 150 Deg.C	Range 3 -40 to 250 Deg.F
7112	2.08	33.70	92.65
7718	2.18	31.57	88.83
8369	2.28	29.47	85.05
9069	2.38	27.48	81.46
9826	2.48	25.48	77.87
10644	2.58	23.48	74.27
11533	2.68	21.52	70.74
12502	2.78	19.59	67.26
13563	2.88	17.63	63.73
14728	2.98	15.64	60.16
16015	3.08	13.72	56.70
17442	3.18	11.75	53.15
19036	3.28	9.72	49.50
20826	3.38	7.69	45.84
22852	3.48	5.63	42.14
25162	3.58	3.50	38.31
27821	3.68	1.29	34.32
30917	3.78	-1.00	30.19
34563	3.88	-3.36	25.95
38924	3.98	-5.84	21.49
44230	4.08	-8.48	16.74
50827	4.18	-11.31	11.65
59252	4.28	-14.38	6.11
70386	4.38	-17.79	-0.03
85785	4.48	-21.54	-6.77
108483	4.58	-25.98	-14.76
145280	4.68	-31.27	-24.29
215225	4.78	-37.53	-35.55
399836	4.88	-42.35	-44.22

Values shown in the table *Type II 10,000 ohm thermistors* are associated with analog input temperature units for a Type II, 10kW thermistor.

This table was revised on July 1, 1999.

Table D–2 Type II 10,000 ohm thermistors

Resistance	Volts	Range 4 -40 to 120 Deg.C	Range 5 -40 to 250 Deg.F
369	0.18	121.49	250.68
589	0.28	104.92	220.85
818	0.38	93.71	200.68
1057	0.48	85.40	185.72
1307	0.58	78.78	173.81
1569	0.68	73.25	163.86
1843	0.78	68.52	155.34
2130	0.88	64.38	147.88
2432	0.98	60.64	141.16
2749	1.08	57.24	135.03
3082	1.18	54.15	129.47
3434	1.28	51.28	124.30
3805	1.38	48.58	119.44
4196	1.48	46.03	114.85
4611	1.58	43.63	110.54
5051	1.68	41.36	106.45
5518	1.78	39.16	102.49
6015	1.88	37.03	98.66
6545	1.98	34.95	94.92
7112	2.08	32.99	91.37
7718	2.18	31.05	87.89
8369	2.28	29.13	84.43
9069	2.38	27.27	81.09
9826	2.48	25.45	77.81
10644	2.58	23.60	74.48

Type II 10,000 ohm thermistors (continued)

Resistance	Volts	Range 4 -40 to 120 Deg.C	Range 5 -40 to 250 Deg.F
11533	2.68	21.81	71.26
12502	2.78	20.03	68.06
13563	2.88	18.21	64.77
14728	2.98	16.44	61.59
16015	3.08	14.64	58.35
17442	3.18	12.78	55.00
19036	3.28	10.98	51.76
20826	3.38	9.10	48.38
22852	3.48	7.11	44.80
25162	3.58	4.41	39.94
27821	3.68	2.90	37.22
30917	3.78	1.11	34.00
34563	3.88	-1.11	30.00
38924	3.98	-3.38	25.92
44230	4.08	-5.79	21.58
50827	4.18	-8.39	16.90
59252	4.28	-11.21	11.83
70386	4.38	-14.33	6.21
85785	4.48	-17.86	-0.15
108483	4.58	-21.85	-7.33
145280	4.68	-26.75	-16.16
215225	4.78	-33.06	-27.50
399836	4.88	-42.30	-44.13

Values shown in the tables *Type 85 Platinum RTD Fahrenheit* on page 197, *Type 91 Platinum RTD Fahrenheit* on page 198, *Type 85 Platinum RTD Centigrade* on page 199 and *Type 91 Platinum RTD Centigrade* on page 200 are associated with Platinum RTD sensors.

Table D–3 Type 85 Platinum RTD Fahrenheit

Resistance	Volts	-40 to 300 Deg. F
842.59	2.29	-40
864.57	2.32	-30
886.51	2.35	-20
908.42	2.38	-10
930.29	2.41	0
952.11	2.44	10
973.90	2.47	20
995.65	2.49	30
1017.36	2.52	40
1039.04	2.55	50
1060.67	2.57	60
1082.27	2.60	70
1103.83	2.62	80
1125.36	2.65	90
1146.84	2.67	100
1168.29	2.69	110
1189.71	2.72	120
1211.09	2.74	130
1232.43	2.76	140
1253.73	2.78	150
1275.00	2.80	160
1296.23	2.82	170
1317.42	2.84	180
1338.58	2.86	190
1359.70	2.88	200
1380.79	2.90	210
1401.84	2.92	220
1422.85	2.94	230
1443.83	2.95	240

Type 85 Platinum RTD Fahrenheit (continued)

Resistance	Volts	-40 to 300 Deg. F
1452.63	2.96	250
1472.97	2.98	260
1493.27	2.99	270
1513.53	3.01	280
1533.76	3.03	290
1553.95	3.04	300

Table D–4 Type 91 Platinum RTD Fahrenheit

Resistance	Volts	-40 - to 240 Deg F
846.58	2.29	-40
868.01	2.32	-30
889.41	2.35	-20
910.76	2.38	-10
932.07	2.41	0
953.34	2.44	10
974.57	2.47	20
995.77	2.49	30
1016.92	2.52	40
1038.04	2.55	50
1059.12	2.57	60
1080.17	2.60	70
1101.18	2.62	80
1122.15	2.64	90
1143.08	2.67	100
1163.98	2.69	110
1184.84	2.71	120
1205.66	2.73	130
1226.45	2.75	140
1247.19	2.78	150

Type 91 Platinum RTD Fahrenheit (continued)

Resistance	Volts	-40 - to 240 Deg F
1267.90	2.80	160
1288.58	2.82	170
1309.21	2.83	180
1329.81	2.85	190
1350.37	2.87	200
1370.90	2.89	210
1391.39	2.91	220
1411.84	2.93	230
1432.25	2.94	240

Table D–5 Type 85 Platinum RTD Centigrade

Resistance	Volts	-40 to 260 Deg. C
842.59	2.29	-40
882.13	2.34	-30
921.60	2.40	-20
960.83	2.45	-10
1000.00	2.50	0
1039.04	2.55	10
1077.95	2.59	20
1116.75	2.64	30
1155.45	2.68	40
1193.99	2.72	50
1232.43	2.76	60
1270.75	2.80	70
1308.95	2.83	80
1347.03	2.87	90
1385.00	2.90	100
1422.85	2.94	110
1460.60	2.97	120

Type 85 Platinum RTD Centigrade (continued)

Resistance	Volts	-40 to 260 Deg. C
1498.20	3.00	130
1535.80	3.03	140
1573.08	3.06	150
1610.40	3.08	160
1647.50	3.11	170
1684.60	3.14	180
1721.46	3.16	190
1758.40	3.19	200
1794.96	3.21	210
1831.70	3.23	220
1868.00	3.26	230
1904.50	3.28	240
1940.58	3.30	250
1976.90	3.32	260

Table D–6 Type 91 Platinum RTD Centigrade

Resistance	Volts	-40 to 260 Deg. C
842.59	2.29	-40
882.13	2.34	-30
921.60	2.40	-20
960.83	2.45	-10
1000.00	2.50	0
1039.04	2.55	10
1077.95	2.59	20
1116.75	2.64	30
1155.45	2.68	40
1193.99	2.72	50
1232.43	2.76	60
1270.75	2.80	70

Type 91 Platinum RTD Centigrade (continued)

Resistance	Volts	-40 to 260 Deg. C
1308.95	2.83	80
1347.03	2.87	90
1385.00	2.90	100
1422.85	2.94	110
1460.60	2.97	120
1498.20	3.00	130
1535.80	3.03	140
1573.08	3.06	150
1610.40	3.08	160
1647.50	3.11	170
1684.60	3.14	180
1721.46	3.16	190
1758.40	3.19	200
1794.96	3.21	210
1831.70	3.23	220
1868.00	3.26	230
1904.50	3.28	240
1940.58	3.30	250
1976.90	3.32	260

Appendix E: Controller points

This appendix list total points for each KMC controller family.

Table E–1 KMD–5000 and KMD–6000 series

Type	KMD-5110	KMD-5500	KMD-6000
Alarms	32	n/a	1
Annual Schedule	16	2	-
Arrays	n/a	n/a	n/a
Control Basic	128	5	4/1
Inputs	128	8	4
Outputs	128	8	4
Passwords	128	2	2
PID Control loops	64	8	4
Runtime Logs	128	8	2
Sign On log	32	n/a	n/a
System groups	8	4	1/1
Tables	5	3	2/1
Trend Logs	16	8	2
Variables	256	32	32
Weekly Schedules	32	4	1

Table E–2 Tier 1 controllers

Type	KMD-5205	KMD-5210	KMD-5270
Alarms	192	192	192
Annual Schedule	4	16	4
Arrays	8	48	8
Control Basic	10	128	10

Tier 1 controllers (continued)

Type	KMD-5205	KMD-5210	KMD-5270
Inputs	8	128	8
Outputs	8	128	8
Passwords	256	256	256
PID Control loops	8	64	8
Runtime Logs	16	128	16
Sign On log	32	32	32
System groups	32	64	32
Tables	5	5	5
Trend Logs	16	96	16
Variables	128	256	128
Weekly Schedules	8	32	8

Table E–3 Tier 2 controllers

Type	KMD-5801	KMD-5821	KMD-5831	KMD-7000	KMD-7300
Alarms	10	10	10	10	10
Annual Schedule	2	2	4	0	0
Arrays	n/a	n/a	n/a	n/a	n/a
Control Basic	5	5	10	5	5
Inputs	8	8	12	4	4
Outputs	8	8	16	4	4
Passwords	27	27	27	27	27
PID Control loops	8	8	16	4	4
Runtime Logs	8	8	12	2	2
Sign On log	n/a	n/a	n/a	n/a	n/a
System groups	4	4	8	2	2
Tables	3	3	6	3	3
Trend Logs	8	8	12	2	2

Tier 2 controllers (continued)

Type	KMD-5801	KMD-5821	KMD-5831	KMD-7000	KMD-7300
Variables	64	64	128	32	32
Weekly Schedules	4	4	8	1	1

Appendix F: Designing System Group Graphics

With the system groups feature in WinControl, WinControl XL Plus, and WinControl XL Plus you can assemble graphical user interfaces to control building automation systems. This section covers techniques and resources required to create system group background graphics using the three-dimensional graphic library elements provided with WinControl XL Plus. Animated graphics are beyond the scope of this manual.

Overview of System Groups

System Groups are custom designed windows created for each project to provide quick access to the most often used parts of a system. A system group can be a few text-based controls or a complex graphical user interface that includes animated displays and site plans. With the library of graphics in WinControl XL Plus you can display all parts of a system such as temperature, setpoints and equipment settings. Links can be placed in system groups which open other system groups.

System groups use graphics for two different purposes:

- Background graphics display the overall view of the system or component.
- Animated graphics display motion and provide control.

Things you need to know

Before you begin, take some time to become familiar with the following items.

- The file formats JPG, GIF, and BMP. See the topic *Graphic file formats* on page 213.
- A paint or photo editing program. You will need to know how to cut, copy, paste, use the layers palette, and generate output files with *Save As...* or *Export*.
- Creating and modifying WinControl system groups.
- The building automation system for which you are creating graphics.

Most paint programs are supplied with a tutorial. Taking the time to work through the examples in the tutorial will often result in less time required to create background graphics.

Paint program requirements

To create custom system group backgrounds, use a paint or photo editing program. KMC Controls has tested the WinControl XL Plus graphic library elements and recommends any of the following programs. All recent versions of these programs are suitable for creating system group backgrounds.

- Adobe Photoshop Elements
- Adobe Photoshop
- Corel PaintShop Pro

If you choose to use a program that is not on the list, verify that the program meets the following minimum requirements.

- Graphic elements can be placed, moved and edited on separate layers.
- It can open, import or place a PNG, TIF or GIF file.
- It can save or export a graphic as a JPG or BMP file.

Organize the project

An effective and useful graphical user interface starts with good planning. In the planning process consider the following items.

- Are end users technical? Do they understand schematics or are picture and 3-D renderings preferred?
- What is the display capability? How big is the monitor? Is ambient light a problem?
- What is the complexity of the system? Is it a multi-building campus or a small system with just one or two controllers?
- What resources are allocated to create a system group?

Review the site plans

Site plans can serve as a visual index to individual components in system groups. The plans may be a simple, single floor plan or a complex set of plans that include campus, building, wing, floor and room drawings. Most CAD programs can export plans in a WinControl compatible format. If the CAD program does not export directly to JPG or BMP formats, export to a format your paint program can use and then save as a JPG or BMP file.

Develop a components list

After reviewing the site plans, make a list of the system components.

1. List all of the types of equipment in the system.
2. Use the equipment list to create a list of the required background images.
3. Determine how many unique background images.
4. Use this list of background images to select the individual graphic elements. Graphic elements can be from the KMC library or generated as required from a CAD, paint or illustration program.

Choose the library elements

KMC Controls provides five graphic libraries for constructing background graphics. These four libraries are supplied on the WinControl XL Plus CD in the following folders:

Table F–1 Library file location

Equipment Type	Folder
Air Handling Units Fan Coil Units	AHU and FCU Components
Rooftop Units	RTU Components
Chillers and Boilers	Chillers and Boilers Components
Variable Air Volume	VAV Components
Buttons and Icons	Icons

Within each library folder are building blocks for pieces of equipment from which you can construct a complete graphic. Each piece is stored in multiple sizes and file formats. KMC recommends using the PNG format.

Before starting a background, choose a scale that works best in your system group.

Tip: To aid organization, store all graphics work for each project in one folder. Before starting work, copy only the required library elements from the WinControl XL Plus CD into the graphics project folder.

Consider the animation elements

KMC Controls designed the animation elements to exactly match the background library elements. Only GIF files may be used as WinControl animation elements. Animation is added in WinControl XL Plus.

Caution Do not resize animation elements. Resizing, even with an animation editing program, will result in distorted edges on the moving objects.

Building a background graphic

Building a background graphic involves performing some or all of the following steps with a paint program:

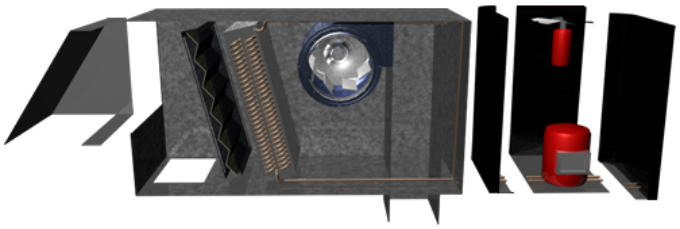
- Creating a work area
- Adding library elements
- Positioning elements within the work area
- Adding buttons or other graphic elements
- Generating the output file

Example graphics

Paint Shop Pro 8.0 was used to build the background graphic in the examples. The graphic of the roof top unit was assembled from the following library files:

- RTU-Hood-50.png
- RUU-Main-Exposed filter-50.png
- RTU-Compressor-50.png
- RUT-Compressor-LeftSide-50.png
- RTU-Compressor-RightSide-50.png

Illustration F–1 Roof top unit components



Animation files that compliment the above roof top unit are:

- RTU-burner-animation-50.gif
- RTU CompressFan-50.gif
- RTU fan-50.gif

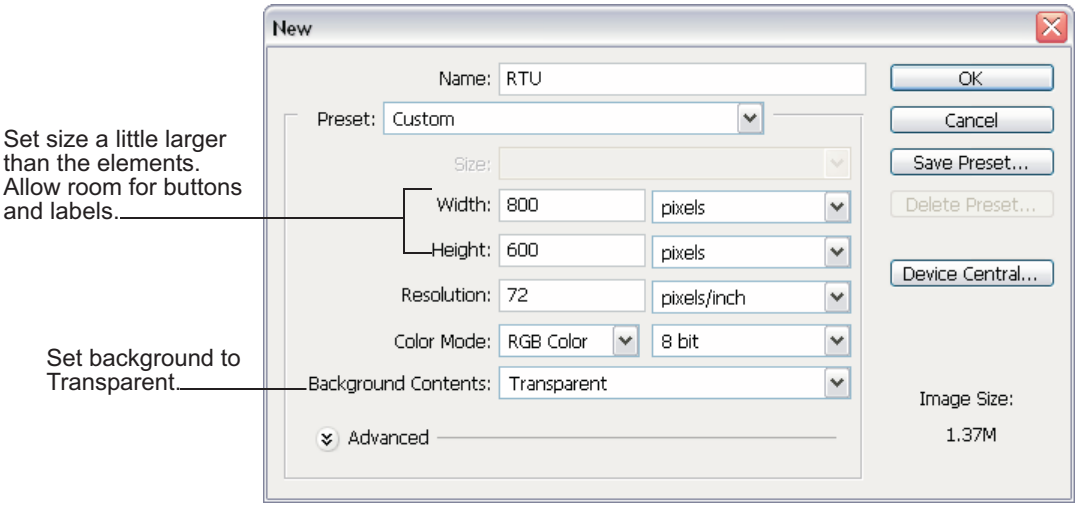
Creating a work area

When you start a new document in a paint program you must first open a new work area. The work area (or canvas) defines the background graphics dimensions. For example, 200 by 300 pixels or 5 by 3 inches.

The dimensions of the work area will set the dimensions of an unsized system group window in WinControl. Set the work area size a little larger than the graphic information but not so large as to force the operator to scroll either horizontal or vertical.

1. Start the paint program.
2. Choose *File* and then *New* to create a new document.
3. Make selections to define the work area.

Illustration F–2 New work area dialog

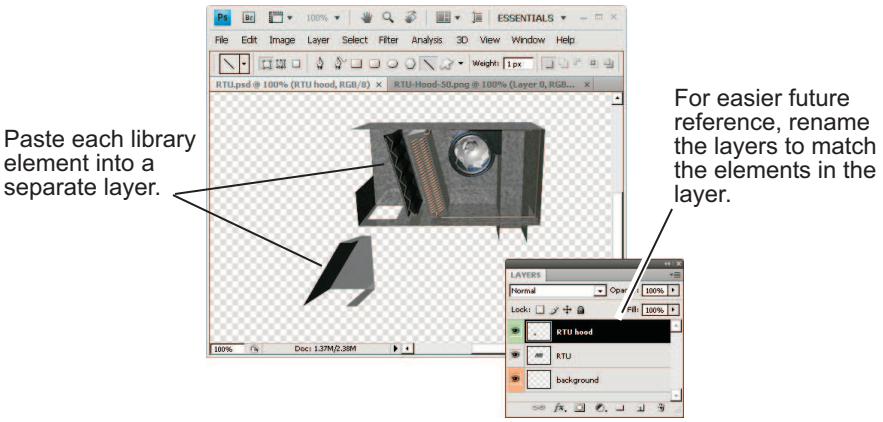


Adding the library elements

After you create a work area, add elements, one at time, until the background is complete. Paste each element into a separate layer.

1. Open a library element file. For example, the file *RTU-Main-Exposed filter-50.png* is the first element file used in the following example, *Background graphic under construction*.
2. Copy the entire contents of the library element file.
3. Make the work area active.
4. Paste the library element as a new layer into the work area.

Illustration F–3 Background graphic under construction



5. When all of the elements are in place, use the *Move Tool* to correctly position the elements.
6. Add additional elements and layers as required for logos, buttons or text items.

Note: Do not add animation items to the background graphic. Animation items are added in WinControl.

When the background graphic is complete, save the graphic in its native format. The native format preserves the individual layers for editing and reuse with other projects.

Generating the output file

When the new background graphic is complete, save the graphic in the program's native format.

To create the actual file that WinControl will use as a background, save or export the file as either a JPG or BMP file. Consider the following file type characteristics when choosing a background file format.

- JPG images save as small, highly compressed files which load faster than a BMP file but may blur detail. Set the compression or quality setting to about 75% of maximum quality. See "JPEG or JPG" on page 213
- BMP files preserve detail but the larger file size takes longer to load. See "BMP" on page 213

Move the JPG or BMP background file to the *Pictures* folder which is inside of the WinControl *Job Folder*.

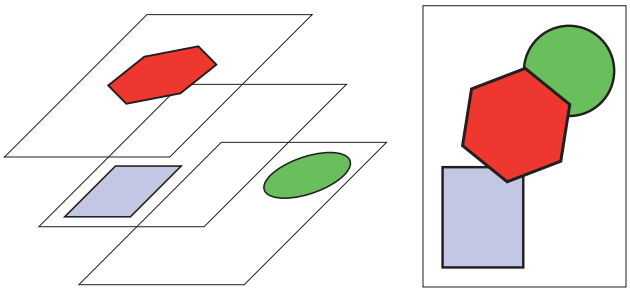
Revising and retouching

When making changes to the background graphic, make the changes in the original file and then generate a new output file. Revising a JPG file and then saving it will result in a loss of detail every time the file is compressed.

About using layers

Layers provide a way to manage all of the elements that make up a system group background. Managing a graphic with layers is similar to drawing on separate tracing paper overlays. Where there is no image on a layer, you can see through to the layers below. With separate layers you work on one element of an image without disturbing the others. You can change the composition of the finished graphic by changing the order of the layers and the location and appearance of the elements on each layer. The structure of layers in a graphic can be as simple or complex as required to build the background.

Illustration F–4 An image composed of three layers



Graphic file formats

JPEG or JPG

Short for *Joint Photographic Experts Group*, and pronounced jay-peg. The JPG format uses a lossy compression technique for color images. The information that is discarded in the compression is information that the human eye cannot detect. JPG images support 16 million colors and are best suited for photographs and complex graphics. Although it can reduce files sizes to about 5% of their normal size, some detail is lost in the compression. The JPG file format is one of the two formats supported by WinControl for background graphics in system groups.

BMP

BMP files are the standard, *Bit-Mapped* graphics format used by the Microsoft Windows operating systems. It is an uncompressed file format. The BMP file format is one of the two formats supported by WinControl for background graphics in system groups.

GIF

Short for *Graphics Interchange Format*. Unlike JPG, the GIF format is a lossless compression technique that supports only 256 colors. GIF is better than JPG for images with only a few distinct colors, such as line drawings, black and white images and small text that is only a few pixels high. With an animation editor, multiple GIF images can be assembled to create animated objects. GIF also supports transparency, where the background color can be set to transparent which allows the color on an underlying graphic to show through. WinControl uses GIF files to add animation to system groups. WinControl three-dimensional graphic library elements are distributed in the GIF format.

PNG

Short for *Portable Network Graphics*, and pronounced ping, a bit-mapped graphics format similar to GIF. Developed as a patent-free alternative to GIF files, the PNG format is a 24-bit, lossless file compression technique. A PNG file can be 5–25% more compressed than a GIF file of the same image. PNG techniques improved on the GIF background transparency properties to produce images without jagged edges. Saving, restoring and re-saving a PNG image will not degrade its quality. PNG does not support animation. WinControl three-dimensional graphic library elements are distributed in the PNG format.

TIFF or TIF

Acronym for *Tagged Image File Format*, one of the most widely supported file formats for storing bit-mapped images on both Windows based and Macintosh personal computers. TIFF is a flexible bitmap image format supported by virtually all paint, image-editing, and page-layout applications. Also, all desktop scanners can produce TIFF images. TIFF graphics can be any resolution, and they can be black and white, gray-scaled, or color. WinControl three-dimensional graphic library elements are distributed in the TIF format.

Native format

Referring to an original form. For example, many applications can work with files in a variety of formats, but an application's native file format is the one it uses internally. For all other formats, the application must first convert the file to its native format.

EPS

Abbreviation of *Encapsulated PostScript*. Pronounced as separate letters, EPS is the graphics file format used by the PostScript language. An EPS file format can contain both vector and bitmap graphics and is supported by virtually all graphic, illustration, and page-layout programs. When you open an EPS file containing vector graphics, paint programs rasterizes the image, converting

the vector graphics to pixels. KMC Controls distributes its logo files in EPS format.

Data compression

Refers to storing data in a format that requires less space than in its original format or size. Lossy compression technologies attempt to eliminate redundant or unnecessary information. Data compression is particularly useful in communications because it enables devices to transmit the same amount of data in fewer bits. The JPG and most video compression technologies, such as MPEG, use a lossy technique. Other types of compressed files are PNG and GIF files.

Appendix G: Glossary

This glossary is a list of the more common terms you may encounter when designing and installing a building automation system with KMD controllers and WinControl XL Plus.

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actuator
A component or assembly of components that contributes to the motive power of a device. Actuators from KMC Controls open and close valves and change the position of dampers in variable air volume units.

air handling unit
A fan system that conditions the air in one or more areas. Conditioning may include particle filtering, adding or removing heat and adding or removing moisture.

alarms
Audible or visual messages indicating a value is out of range or an abnormal condition is present. KMC digital controllers generate alarm messages.

analog
Analog describes any fluctuating, evolving, or continually changing process. Examples of analog units are temperatures, setpoints, percent, volts and amplifiers.

BACnet
Building Automation Control Network. A data communications protocol for building automation systems. Developed and maintained by ASHRAE, it is an American National Standards Institute standard (ASHRAE/ANSI 135-1995). BACnet defines how information is packaged for transportation between building automation system (BAS) vendors.

baud
Pronounced bawd, it is commonly a reference to the speed at which a modem or other serial device can transmit data. In KMC networks the speed at which a Tier 2 or BACnet network operates is referenced in baud.

The term is named after J.M.E. Baudot, the inventor of the Baudot telegraph code.

building automation system
An integration of digital, electronic, and pneumatic controls and devices to provide unattended and automatic operation of a buildings systems. Systems may include HVAC, elevators, fire suppression, and security, lighting, and other sub systems

communication status
Text displayed in the WinControl Information bar to indicate that one or more panels are online or offline.

communications
Sharing information with other controllers.

connected controller
The controller with which WinControl is in direct communication. The controller address is shown in the lower information bar to the right of the *System Name*.

Control Basic
A program embedded in KMC controllers that interprets a set of instructions. Control Basic programs are either written by the installer or supplied the manufacturer with the controller .

controller
A Direct Digital Controller (DDC). Current KMC controllers are:

- KMD–5200 Tier 1 controllers
- KMD–5800 Tier 2 general purpose
- KMD–70000 Tier 2 application specific controllers

descriptor files
A block of memory on a hard or floppy drive of on which a computer stores the descriptors for a KMC digital Network.

descriptors
Descriptors are a set of names that identify the programmable items in a KMC Controls digital system. The point description can be up to 20 characters and the label can be up to 8 characters.

device instance
A number that uniquely identifies the device on the internetwork. The device instance number is determined by the BACnet system designer. Valid instance number's range from 0 to 4,194,303 and are assigned to the controller

during configuration with BACstage. It is by reference to the device instance number that data is exchanged between BACnet devices.

digital
Any electronic technology that generates, stores, and processes data in terms of two states: positive and non-positive. Positive is expressed or represented by the number 1 and non-positive by the number 0. Valid ranges for digital points in KMC controllers include Off/On, Closed/Open, 1 / 0, and Unoccupied/Occupied.

direct digital control
A microprocessor based device or network of devices to control a system or process. The DDC device operates digitally and converts digital information into analog signals which control HVAC equipment such as hot water valves, heat pumps or air control devices.

direct expansion
A method of cooling air by passing it through a coil that contains refrigerant. The refrigerant expands prior to entering the coil allowing it to absorb heat from the warmer air passing through the coil.

display mode
An option in system groups windows to view live data sent from a controller. When a system group is in display mode, the display is updated every 5 seconds with new data from the controller.

end of line
A set of switches or jumpers that indicates the controller is the last physical panel at the end the network cable. This is not the same as the software *Last Panel* parameter.

enthalpy
Enthalpy is a measure of the heat content within a given sample of air and is expressed in BTUs per pound or as joules per kilogram of dry air. It is used to determine the amount of outside air to add for best economy.

fan coil unit
A packaged unit that conditions the air in a single room or zone. FCUs generally contain heating and cooling coils and have the ability to supply outside air to the space.

flash memory
A special type of EEPROM (electrically erasable programmable read-only memory) that can be erased and reprogrammed in blocks instead of one byte at a time. Flash memory gets its name because the microchip is organized so that a section of memory cells are erased in a single action or “flash.” Flash memory is a non-volatile memory device that retains its data after the power is removed.

heat pump
A unit that uses direct expansion to remove or add heat to a space. On a call for heat the heat pump pulls heat from a source such as outside air, pond or river water and puts it into a space. On a call for cooling, the process is reversed.

history
A long term storage feature in KMC panels. History files store information for trend log displays.

history files
A file of trend log data saved for long term use.

hub
A common connection point for devices in a network. A hub contains multiple ports. When a data packet arrives at one port, it is copied to the other ports so that all segments of the network can see all packets. Hubs are commonly used to connect segments of a network.

HVAC
Heating Ventilating and Air Conditioning. A term generally used to describe a building’s comfort system.

InControl
A Microsoft DOS program written by KMC Controls to view, program, and configure controllers on a KMC digital network. WinControl replaced InControl.

information bar
The text appearing at the bottom of the WinControl Screen.

Starting from the left, the System Name is shown, then the connected panel address, the communication status, time and date.

inputs
Physical values read by the controller. Inputs are temperatures, pressures, speed, or other measured values.

IP address
An identifier for a computer or device on a TCP/IP network. The format of an IP address is a 32–bit numeric address written as four numbers separated by periods. Each number can be zero to 255. For example, 1.160.10.240 could be an IP address.

Within an isolated network, you can assign IP addresses at random as long as each one is unique. Connecting a private network to the Internet requires using registered IP addresses (called Internet addresses) to avoid duplicates.

KSET
A KMC Controls program used to set addresses and baud in the original series of KMC direct digital controllers. It also configured ports in the KMD–5100. Hardware configuration manager (HCM) superseded KSET.

label
An eight-character description of a point. Labels aid in the identify the purpose of the point. By referring to an output point as OUT2, for the second output on a controller, we can name it FAN as shown in the following Control Basic example:

```
10 IF OCCUPIED THEN START FAN ELSE STOP FAN
```

last panel
The highest numbered panel on the network. A controller assigned as the last panel will pass the token back to the lowest numbered panel when it is done talking on the network. Last Panel is not the same as end-of-line termination.

links
In System Groups a link is a jump to another WinControl function.

local area network
A collection of interconnected equipment that can share data, applications, and resources. It may include computers, printers, data storage devices and industrial controllers and machines. A LAN device can send and receive signals from all other devices in the network. Networks use protocols, or rules, to exchange information through a single shared connection. These protocols prevent collisions of data caused by simultaneous transmission between two or more computers. Computers on most LANs use protocols known as Ethernet or Token Ring.

The physical connection between LAN devices can be a coaxial cable, pairs of copper wires, or optical fiber. Wireless connections also can be made using infrared or radio-frequency transmissions.

local controller
A control unit designed for use on a specific type of equipment or at the terminating point of the air system (installed locally, at or close to the controlled device). Local controllers are used to control VAV units, heat pumps, fan coils, and air handlers.

MAC address
An abbreviation for Media Access Control address, a unique hardware address that identifies each device on a network. For KMC digital controllers, the MAC address identifies the panel on Ethernet networks.

main Panel
See *Tier 1 controller* on page 225.

MicroTech
McQuay equipment interface available through the KMD–5100 controller or the KMD-5540-004.

Modbus
A protocol developed to establish master-slave/client-server communication between industrial devices. It is an open and widely used network protocol in the industrial manufacturing environment.

MultiNet®
The trademark of the first KMC Tier 1 controller. See *Tier 1 controller* on page 225.

network
One or more controllers connected together electrically to share data.

offline
WinControl is not able to communicate with the connected controller or network.

online
WinControl is able to communicate with the connected panel.

output
Control signals sent to external devices from a controller. Outputs may energize relays and contactors or drive motors, dampers, and valves.

PC
Personal Computer - Laptop or desktop computer running WinControl software.

peer-to-peer communications
The controllers in a network hierarchy which are considered to be at the same level. There are no host or master controllers. Each controller is at the same level as its peers.

phone delay compensation
Delay added to all controllers on a network to compensate for delays in telephone switching equipment.

PID controller
A Proportional Integral Derivative loop is an algorithm built into each KMC controller that calculates a value between 0 and 100 percent. The output of the loop can then be used to control the position of an actuator. The output value is based on the sensed value and the required setpoint.

point
Any hardware or software object configured in a KMC digital controller. A point can be an input, output, variable, schedule, log or a PID controller loop.

print buffer
A temporary storage area for data waiting to be sent to a printer.

protocol
A definition or rules of communication for a computer network. A formal set of conventions governing the format and relative timing of message exchange between two communications terminals.

range
Assigned units of a measure of an input, output or variable.

real numbers
Real numbers are any logical number between $-3.4 * 10^{38}$ and $3.4 * 10^{38}$. Notation of the number is recognized in any of the following formats:

- Whole numbers (100)

- Decimal format (.0000123)
- Engineering notation (7.879 E-12)

recool
The cooling of air that has been previously heated by HVAC systems serving the same building.

reheat
The heating of air that has been previously cooled either by mechanical refrigeration or economizer cooling systems.

repeater
A network device used to regenerate analog or digital signals distorted by transmission loss. A repeater cannot do the intelligent routing performed by bridges and routers.

reset
An alarm condition indicating the monitored point has returned to normal but has not been acknowledged.

Changing a setpoint based on an external variable. For example, the outside air temperature may be used to reset the setpoint temperature of a boiler. The space temperature may be used to reset the discharge setpoint temperature of an air-handling unit.

roof rop unit
An air-handling unit that is typically supplied as a packaged and installed outside of a building. Often these units contain one or more stages of direct expansion cooling.

router
A network device that connects any number of LANs to aid LANs and WANs achieve interoperability and connectivity. Routers can link LANs that have different network topologies such as Ethernet and Token Ring. Routers match packet headers to a LAN segment and choose the best path for the packet, optimizing network performance. Very little filtering of data is done through routers.

setpoint
The desired temperature of a space.

scan
The process in a panel which reads inputs, executes Control Basic programs and sets outputs. The period of time required for the processor to perform all

of its instructions and programs.

simulator
A mode in WinControl that mimics the operation a controller without physically being connected to it. Points can be configured and program files can be saved. Control Basic programs can be edited, compiled, and saved but will not run.

startup defaults
The initial conditions to which WinControl is set when it is started.

subnet panel
See *Tier 2 controller* on page 226.

switch
In networks, a device that filters and forwards packets between LAN segments. LANs that use switches to join segments are called switched LANs or, in the case of Ethernet networks, switched Ethernet LANs.

system
All of the components that combine to control a building. This may include controllers, repeaters, modems, and computers.

system name
A description given to the entire network of controllers.

tables
Charts for converting an input from one value to another or for converting a non-linear input value into a linear one.

terminal unit
A piece of equipment that operates at the room or space, as opposed to operating at a central location. It performs the final conditioning of the air at the space.

Tier 1 controller
An upper level controller in the KMC digital network hierarchy. The Tier 1 controller can have one or more Tier 2 networks connected to it. A Tier 1 controller may also have ports for connection to computers, a network, buffered modem communications, a dedicated system printer and OEM equipment interfacing.

The Tier 1 controller has many other advantages for large networks such as large areas of memory for system groups, Control Basic programs, schedules,

and passwords. Tier 1 controllers have additional commands and statements available to allow complex programs to be easily written .

Also referred to as a LAN controller, MultiNet® or main panel.

Tier 2 controller
A KMC controller with built-in peer-to-peer, RS-485 network communications. Also referred to as a Subnet controller or sub-panel.

token
A virtual symbol of authority that is passed along a network. When a controller receives the token, it has permission to place data onto the network. The token is not needed to listen. A controller can receive data from network at any time.

universal serial bus
An external bus standard that supports data transfer rates of 12 Mbps. A single USB port can be used to connect up to 127 peripheral devices such as mice, modems and keyboards.

variable air volume
A method of temperature control in which the volume of constant temperature air is modulated to maintain a temperature setpoint in an individual space.

variables
Virtual points that can represent temperatures, setpoints, offsets, multipliers, or digital values.

want-points
Points that are being requested from the network. A list of want-points is created in each panel when a point in another panel is referenced in a Control Basic program, system group, or trend log.

WinControl
KMC Controls operating software. Enables users to view, program, and configure controllers on a KMC digital network.

Index

E

O

P

R

S

T