

Crestron TPS-6
Isys™ 5.7" Tilt Touchpanel

Operations Guide



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Regulatory Compliance

As of the date of manufacture, the TPS-6 has been tested and found to comply with specifications for CE marking and standards per EMC and Radiocommunications Compliance Labelling.



Federal Communications Commission (FCC) Compliance Statement

This device complies with part 15 of the FCC rules. Operation is subject to the following conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

CAUTION: Changes or modifications not expressly approved by the manufacturer responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase separation between the equipment and the receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help

Industry Canada (IC) Compliance Statement

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

Contents

Isys™ 5.7" Tilt Touchpanel: TPS-6	1
Introduction	1
Features and Functions	2
Specifications	4
Physical Description	7
Setup	10
Network Wiring	10
Identity Code	10
Configuring the Touchpanel	11
Hardware Hookup	27
Recommended Cleaning	28
Programming Software	30
Earliest Version Software Requirements for the PC	30
Programming with Crestron SystemBuilder	30
Programming with SIMPL Windows	31
Programming with VisionTools Pro-e	33
Uploading and Upgrading	38
Establishing Communication	38
Programs, Projects and Firmware	39
Program Checks	39
Problem Solving	40
Troubleshooting	40
Check Network Wiring	41
Reference Documents	42
Further Inquiries	42
Future Updates	42
Software License Agreement	43
Return and Warranty Policies	45
Merchandise Returns / Repair Service	45
CRESTRON Limited Warranty	45

Isys™ 5.7" Tilt Touchpanel: TPS-6

Introduction

The Crestron Isys® TPS-6 Tilt Touchpanel delivers high-end style and performance in a striking tabletop design. Sleek and compact, the TPS-6 does away with piles of remotes and cryptic control panels, affording true "one-touch" control over a broad range of complex devices and systems. Featuring a bright, beautiful, high-contrast color touchscreen, the TPS-6 offers an ideal user-interface for controlling multimedia presentations, home automation, and a host of other uses, providing a wide open canvas for the creation of custom control screens tailored to each unique application.

The TPS-6 is available in three different models.

Models

MODEL NUMBER	COLOR
TPS-6	High Gloss Black
TPS-6-B-T	Matte Black
TPS-6-W-S	High Gloss White

Features and Functions

- Sleek, contoured design for tabletop use
- Full-time wired touchpanel operation
- Elegant high gloss black or white, or matte black finishes
- Illuminated buttons and engravable backlit text*
- 5.7" active matrix color touchscreen display
- 16-bit Isys graphics | 640 x 480 resolution
- Dynamic graphics & text capability
- Synapse™ image rendering algorithm
- Full-motion video display
- High-speed Ethernet and Cresnet® communications
- Crestron Home® CAT5 video connectivity
- Up to 45 degree tilt adjustment
- Low-profile single-wire connection
- No-button front bezel option included

Isys™ Color Touchscreen

Its brilliant 5.7" active-matrix display and powerful Isys engine combine to produce stunning 16-bit color graphics with extreme versatility and lightning-fast performance. Dynamic graphics and text capability enable the display of all kinds of useful data, from audio settings, TV channels, and lighting levels, to changing icons, photos, and logos, to digital media playlists complete with album cover art.

Crestron® exclusive Synapse™ image rendering algorithm enables system programmers to produce amazing graphics faster and easier, featuring advanced antialiasing for crisper, sharper objects and text, plus 3D effects for enhanced depth and style. Additional capabilities like animations, multimode objects, PNG translucency, and full-motion video enhance the palette for creating GUI's that are both eye-catching and easy to use.

Tactile Pushbuttons

In addition to its touchscreen, the TPS-6 features illuminated tactile pushbuttons for quick access to volume adjustment, channel selection, and on-screen menu navigation functions. Eight additional pushbuttons, elegantly trimmed by illuminated button dividers, flank the edges of the touchscreen to support additional programmable functions.

High-quality backlit laser-engraving lends a crisp, legible appearance to button text in both darkened and fully lit rooms*. The pushbuttons come pre-engraved with labeling suited to a typical home theater or multimedia presentation application. If needed, customized engraving can be attained simply using Crestron Engraver software. A no-button front bezel is also included with the TPS-6, which may be installed in place of the button bezel for a very clean appearance with no front panel pushbuttons.

Two additional "trigger" style buttons are positioned on top of the TPS-6 for easy control of the display brightness and other programmable functions.

* Text engraving on the TPS-6-W-S white model is not backlit.

Full Motion Video

The TPS-6 displays full-motion video, providing the ability to monitor a security camera, or preview a DVD or television channel, right on the touchscreen display. The video image is fully scalable for viewing in any size window or full screen. The choice of balanced or unbalanced composite inputs allows compatibility with both conventional coaxial and Crestron Home® Balanced AV distribution systems.

TableTop Tilt Base

With its sleek and innovative tilting base, the TPS-6 functions as a stylish tabletop tilt touchpanel, providing full-time wired communications and video capability. Both high-speed Ethernet and Cresnet connectivity are available. The screen tilt can be freely adjusted or locked down at up to a 45 degree angle for optimal viewing and operation. A single cable exits the rear of the base, extending to a wall or surface mounted TPS-6X-IMCW Interface Module (included). The cable can also be repositioned to exit from the bottom for a very clean, cordless appearance. A swivel mount kit is also available for fixed-mount applications that require the ability to rotate the touchpanel during use.

Specifications

Specifications for the TPS-6 are listed in the following table.

TPS-6 Specifications

SPECIFICATION	DETAILS
Touchscreen Display	
Display Type	TFT Active matrix color LCD
Size	5.7 inch (145 mm) diagonal
Aspect Ratio	4:3 VGA
Resolution	640 x 480 pixels
Brightness	350 nits
Contrast	400:1
Color Depth	18-bit, 256 k colors
Illumination	Backlit fluorescent
Viewing Angle	±80° horizontal, +80°/-70° vertical
Touchscreen	Resistive membrane
Processor	
CPU	32-bit Freescale ColdFire® Microprocessor
Memory	
SDRAM	32 MB
Flash	32 MB
Maximum Project Size	28 MB
Graphic Engine	Isys engine; 16-bit non-palette graphics; 65,536 colors; Synapse image rendering algorithm; multi-mode objects, dynamic graphics, PNG translucency, full-motion (60 fps) animation, color key video windowing
Ethernet	10BASE-T/100BASE-TX, auto-switching, auto-negotiating, auto-discovery, full/half duplex, TCP/IP, UDP/IP, CIP, DHCP, IEEE 802.3U compliant
Video	
Signal Types	Composite
Formats	NTSC 480i or PAL 576i
Color Depth	18-bit, 262,144 colors
Windowing	Single window, deinterlaced and scalable up to full screen
Audio	Internal transducer for key click sound
Power Requirements ¹	
24 VDC Power Consumption	0.75 Amps @ 24 Volts DC including interface module Power connection is via TPS-6X-IMCW interface module ²
Cresnet Power Usage	16 Watts (0.67 Amps @ 24 Volts DC) including interface module Power connection is via TPS-6X-IMCW interface module ²

(Continued on following page)

TPS-6 Specifications (Continued)

SPECIFICATION	DETAILS
Default Net ID	03
Minimum 2-Series Control System Update File ^{3,4}	Version 3.155.1240 or later
Environmental	
Temperature	32° to 112°F (0° to 45°C) 50° to 104°F (10° to 40°C) while charging
Humidity	10% to 90% RH (non-condensing)
Heat Dissipation	30 BTU/Hr
Enclosure	
Construction	Plastic, 45° to 90° adjustable friction clutch tilt mechanism, low-profile base, integral cable assembly, swivel mount kit available separately
Front Bezels	Button and no-button bezels included; button bezel includes white translucent illuminated Up/Down and Thumbpad buttons and eight hardkey buttons with illuminated dividers and default backlit ⁵ text engraving, optional custom backlit ⁵ text engraving sold separately
Dimensions	
Height	6.21 in (158 mm) maximum
Width	8.08 in (206 mm)
Depth	7.02 in (179 mm), 6.53 in (166 mm) without grommet
Weight	2.9 lbs (1.3 kg)
Available Models	
TPS-6	Isys 5.7" Tilt Touchpanel, High Gloss Black
TPS-6-B-T	Isys 5.7" Tilt Touchpanel, Matte Black
TPs-6-W-S	Isys 5.7" Tilt Touchpanel, High Gloss White
Included Accessories	
Power Pack	24 Volt Power Pack
TPS-6X-FP	Button Bezel with Default Engraving (specify color)
TPS-6X-FP-NB	No Button Bezel (specify color)
TPS-6X-IMCW	Interface Module
Available Accessories	
SMK-6X	Swivel Mount Kit
TPS-6X-FP	Button Bezel w/Custom Engraving (specify color)

1. May be powered by 24 Volts DC or Cresnet network power but not both.
2. Item is included with the TPS-6; refer to individual product specifications for additional information.
3. The latest software versions can be obtained from the Crestron® website. Refer to the NOTE following these footnotes.
4. Crestron 2-Series control systems include the AV2 and PRO2. Consult the latest Crestron Product Catalog for a complete list of 2-Series control systems.
5. Text engraving on the TPS-6-W-S white model is not backlit.

NOTE: Crestron software and any files on the website are for authorized Crestron dealers and Crestron Authorized Independent Programmers (CAIP) only. New users may be required to register to obtain access to certain areas of the site (including the FTP site).

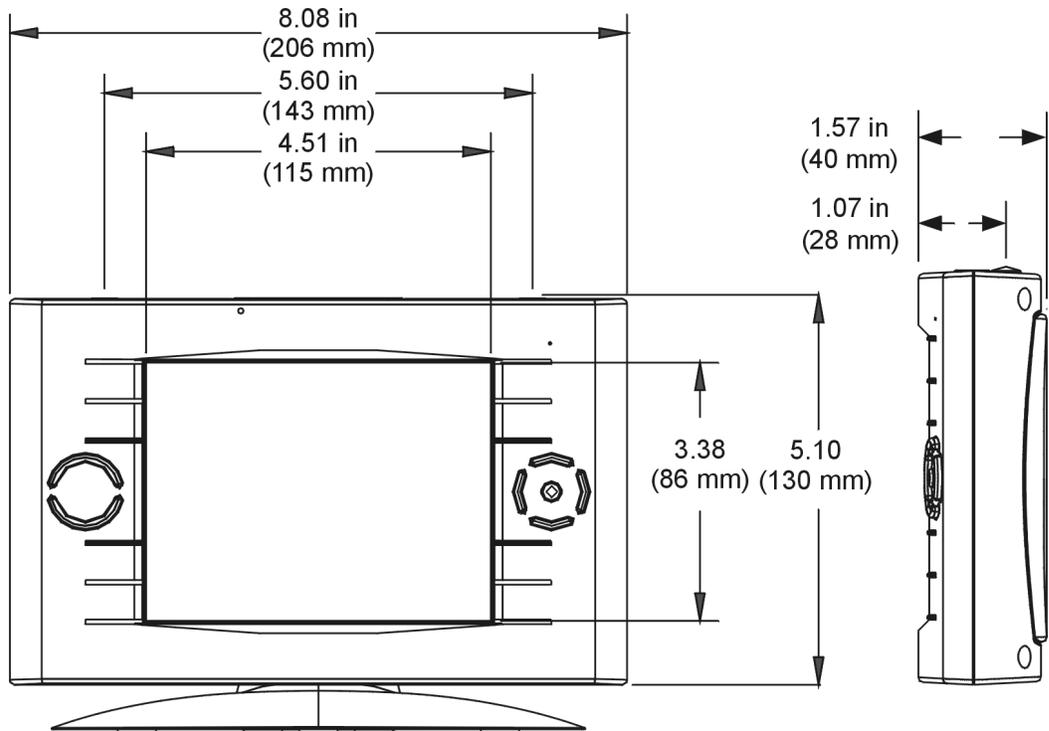
Physical Description

This section provides information on the connections, controls and indicators available on your TPS-6.

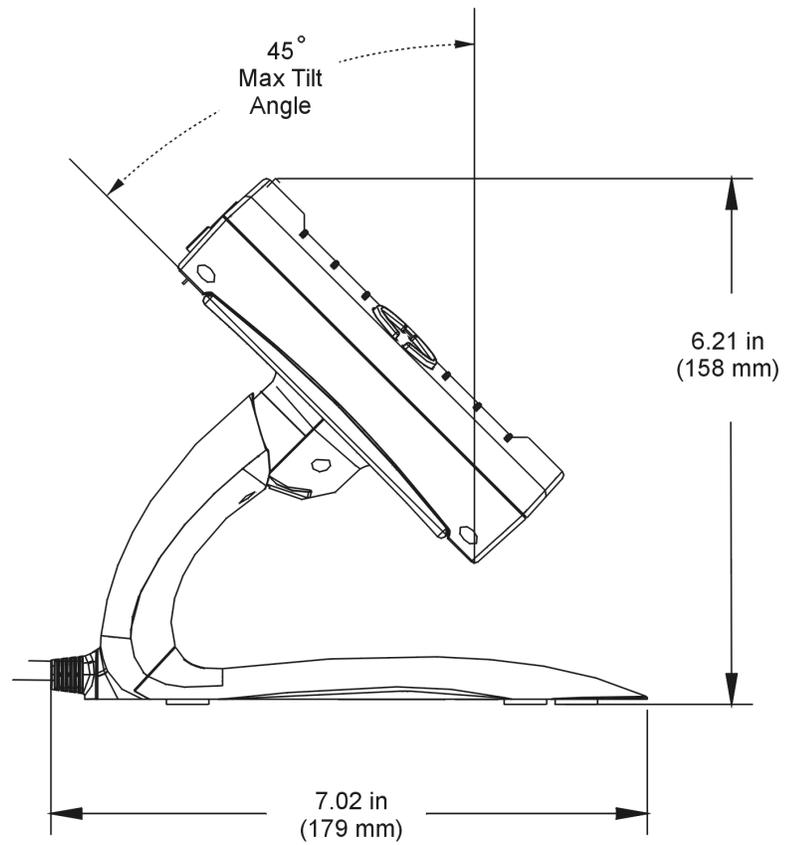
TPS-6 Physical View (Front)



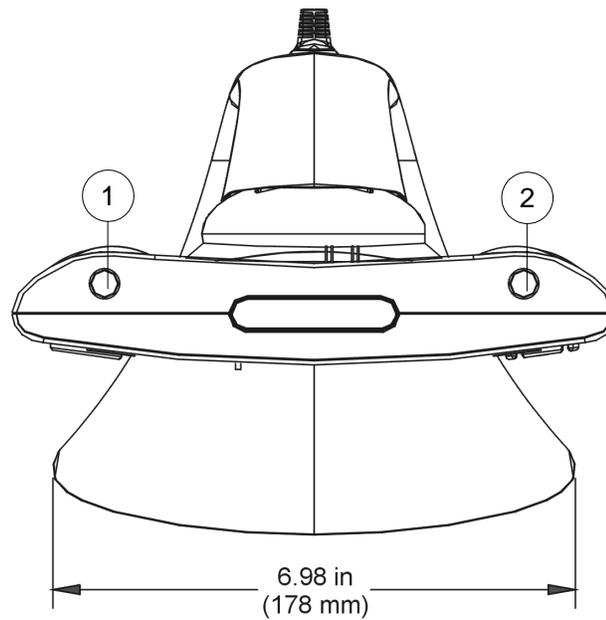
TPS-6 Overall Dimensions (Front and Side Views)



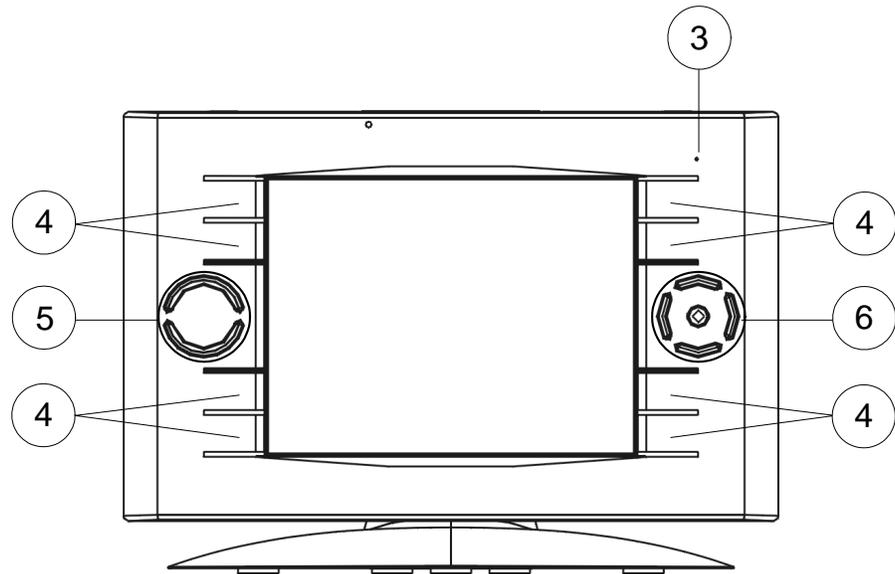
TPS-6 Overall Dimensions (Tilt View)



TPS-6 Overall Dimensions (Top View)



TPS-6 (Front View)



Connectors, Controls & Indicators

#	CONNECTORS, CONTROLS & INDICATORS	DESCRIPTION
1	SLEEP	(1) Programmable top-mounted pushbutton (left "trigger" key), initiates <i>Sleep</i> mode, also resets touchpanel if held for five seconds, starting up at first page of the installed project
2	BRIGHTNESS	(1) Programmable top-mounted pushbutton (right "trigger" key), normally sets display brightness level. Toggles between high, medium, low and standby. Toggling can be enabled/disabled from setup menu (refer to "BACKLIGHT" which starts on page 24 for details)
3	POWER LED	(1) Green LED, indicates DC power supplied from Cresnet network or 24 volt DC power supply
4	HARD KEYS	(8) Optional programmable pushbuttons; engravable backlit* text (sold separately); default engraving included
5	UP/DOWN	(2) Optional programmable "up/down" pushbuttons, backlit, engravable backlit* text on bezel (sold separately); default engraving included
6	THUMBPAD	(5) Optional programmable pushbuttons for 4-way directional navigation and "enter", backlit

* Text engraving on the TPS-6-W-S white model is not backlit.

Setup

Network Wiring

When wiring the Cresnet or Ethernet network, consider the following:

- Use Crestron Certified Wire.
- Use Crestron power supplies for Crestron equipment.
- Provide sufficient power to the system.

CAUTION: Insufficient power can lead to unpredictable results or damage to the equipment. Please use the Crestron Power Calculator to help calculate how much power is needed for the system (www.crestron.com/calculators).

Cresnet

For larger networks, use a Cresnet Hub/Repeater (CNXHUB) to maintain signal quality.

For more details, refer to “Check Network Wiring” which starts on page 41.

Ethernet

The TPS-6 can also use high-speed Ethernet for communications between the device and a control system, computer, digital media server and other IP-based devices.

For information on connecting Ethernet devices in a Crestron system, refer to the latest version of the Crestron e-Control® Reference Guide (Doc. 6052), which is available from the Crestron website (www.crestron.com/manuals).

Identity Code

Net ID

The Net ID of the TPS-6 has been factory set to **03**. The Net IDs of multiple TPS-6 devices in the same system must be unique. The Net ID is set using the internal setup menu (refer to “CRESNET” on page 17). Net ID may also be set from a personal computer (PC) via Crestron Toolbox™ (refer to “Establishing Communication” which starts on page 38).

When setting the Net ID, consider the following:

- The Net ID of each unit must match an ID code specified in the SIMPL™ Windows program.
- Each network device must have a unique Net ID.

For more details, refer to the Crestron Toolbox help file.

IP ID

The IP ID is set within the TPS-6’s table using the internal setup menu (refer to “ETHERNET” which starts on page 18). The IP ID may also be set from a personal computer (PC) using Crestron Toolbox. For information on setting an IP table, refer to the Crestron Toolbox help file. The IP IDs of multiple TPS-6 devices in the same system must be unique.

When setting the IP ID, consider the following:

- The IP ID of each unit must match an IP ID specified in the SIMPL Windows program.
- Each device using IP to communicate with a control system must have a unique IP ID.

Configuring the Touchpanel

NOTE: The only connection required to configure the touchpanel is power. Refer to “Hardware Hookup” which starts on page 27 for details.

To configure the TPS-6 it may be necessary to access a series of setup menus prior to viewing run-time screens that are loaded into the touchpanel for normal operation. The MAIN MENU is the starting point for configuring the touchpanel.

NOTE: If no project has been loaded or if an invalid project has been loaded, the touchpanel displays an error message and asks the user to touch the screen to enter setup, which defaults to the MAIN MENU.

NOTE: Trigger key functionality is not available in the setup menus.

If a project is running, the MAIN MENU can be accessed using one of two methods: via the trigger keys on the top of the touchpanel or via Crestron Toolbox.

Via the Trigger Keys

1. Press and hold the right trigger key on the top of the touchpanel and at the same time, touch the upper right corner of the screen.
2. Continue holding the right trigger key and touching the upper right corner of the screen. At the same time, press and hold the left trigger key on the top of the touchpanel. After four seconds, the panel will reset.
3. Once the screen turns black, release the left trigger key and the panel will enter the MAIN MENU, as shown in the illustration on the following page.
4. Release the right trigger key and the touch screen.

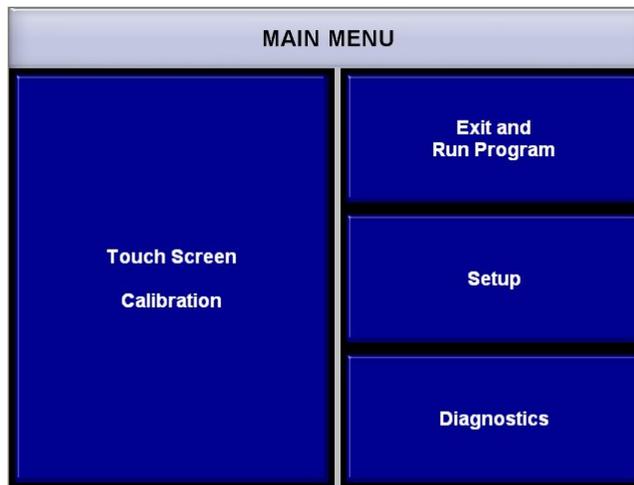
Via Crestron Toolbox

1. Establish communication with the touchpanel (refer to “Establishing Communication” which starts on page 38 for details).
2. Right-click on the device and select **Functions | Setup Mode....**
3. Select **Enter Setup Mode**. The MAIN MENU will be displayed, as shown in the illustration on the following page.

NOTE: Select **Exit Setup Mode** to exit the setup menu.

The MAIN MENU displays four large buttons: **Touch Screen Calibration**, **Exit and Run Program**, **Setup** and **Diagnostics**, as shown in the following illustration.

MAIN MENU

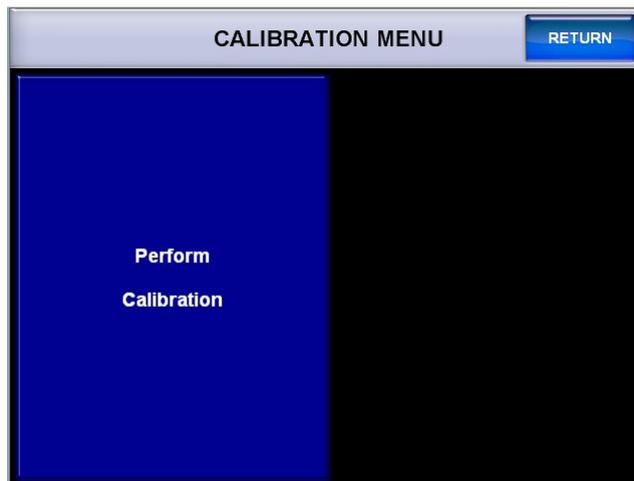


The **Exit and Run Program** button verifies that all of the setup information has been saved to the EEPROM and displays the main page that has been programmed into your system. The remaining buttons on the MAIN MENU open other menus and displays which are discussed in subsequent paragraphs.

CALIBRATION MENU

Touch the **Touch Screen Calibration** button to enter the CALIBRATION MENU.

CALIBRATION MENU



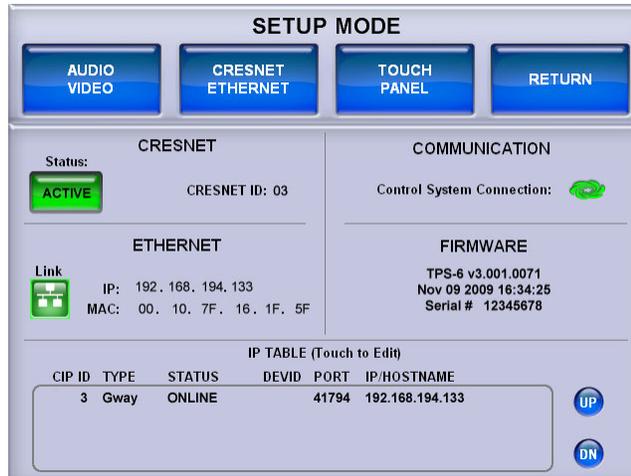
Touch **Perform Calibration**. The message “Touch Upper Left +” appears centered on the panel with a crosshair in the upper left corner. Touch the center of the crosshair in the corner of the screen to initiate calibration. Another message, “Touch Upper Right +”, appears with a crosshair in the correct corner. Touch the center of the crosshair in the corner of the screen. A final message, “Touch Lower Right +”, appears with the crosshair in the correct corner. Touch the center of the crosshair in the corner of the screen to conclude calibration and return to the MAIN MENU.

NOTE: When touching the screen during calibration, be as accurate as possible. Use the tip of a capped pen or the eraser end of a pencil. To cancel calibration and return to the MAIN MENU without saving calibration data, create a calibration error by touching the screen in the same spot two times. If calibration has not been started, you can return to the MAIN MENU by touching **RETURN**.

SETUP

To enter the SETUP MODE menu, touch **Setup** on the MAIN MENU.

SETUP MODE Menu



The SETUP MODE menu offers a series of buttons which open additional menus and displays that are detailed in subsequent paragraphs. After setup parameters have been selected, touch **RETURN** to go to the previous menu. When all setup parameters have been selected, touch **RETURN** repeatedly to go back to the MAIN MENU.

NOTE: All touchpanel settings are automatically saved in non-volatile memory.

The *CRESNET* section displays Cresnet connection status and ID.

The *ETHERNET* section displays Ethernet Link status, along with the IP and MAC address.

The *COMMUNICATION* section displays the Crestron Swirl logo , which illuminates to indicate the status of your connection to the control system(s):

- Green Connected (via Ethernet or Cresnet)
- Blue Connected to some but not all of the control systems listed in IP table (Ethernet only)
- Yellow Network trouble (no CIP communication with a control system, or no Cresnet packets addressed to panel)
- Red Not connected to any control system (via Ethernet or Cresnet)

The *FIRMWARE* section displays the firmware version, date and time of the firmware build and the touchpanel serial number.

The *IP TABLE* section at the bottom of the SETUP MODE menu will show all current IP Table entries and provide **UP** and **DN** buttons which allow you to scroll through the list.

To create a new IP table entry or to edit an existing one, touch the rectangle within the *IP TABLE* section of the menu to enter the IP TABLE EDITOR.

IP TABLE EDITOR (IP ADDRESS)



The IP TABLE EDITOR offers the option of entering the information as an IP address (as shown in the illustration above) or as a hostname (as shown in the following illustration). Simply touch **IP ADDRESS** or **HOSTNAME** to switch between the two methods.

IP TABLE EDITOR (HOSTNAME)



To add an IP address (or hostname), use the **DN** and **UP** buttons to select the *CIP ID*. Then use the numeric keypad on the screen for IP address entry or touch **HOSTNAME** to switch to the alphanumeric keypad. When both the *CIP ID* and IP address (or hostname) have been entered, touch **ADD IP** to add the entry to the list.

To remove an IP address (or hostname), select the appropriate *CIP ID* and type in the IP address (or hostname), then touch **REMOVE IP**.

To clear the entry area just above the keypad on the screen, touch **Clear IP/Host**.

The IP TABLE EDITOR also has **DN** and **UP** buttons for the optional *DEV ID* and *PORT* settings. Touch the **Default Port** button to reset the *PORT* to its factory default setting.

To verify the latest status of connections listed in the IP table, touch **Update IP Table**.

AUDIO

From the SETUP MODE menu, touch **AUDIO VIDEO** to enter the AUDIO SETUP menu.

AUDIO SETUP Menu



The AUDIO SETUP menu offers a pair of buttons that allow muting of the key click sound for either the *Soft Keys* (on screen buttons) or the *Hard Keys* (buttons on the front of the touchpanel).

Refer to the following table for additional AUDIO SETUP menu details.

Audio Setup Details

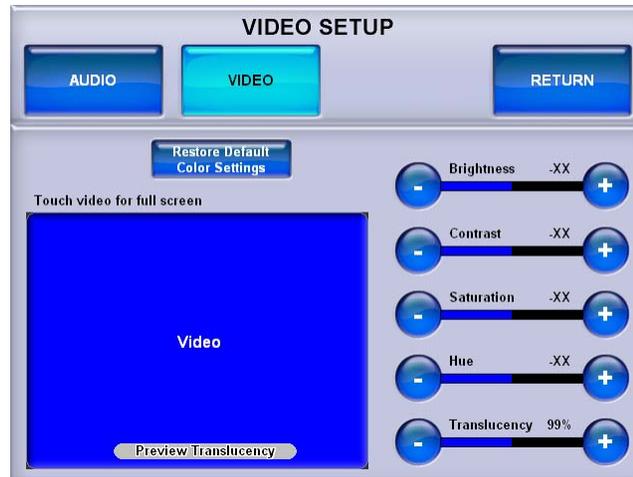
AUDIO SETUP SCREEN CONTROL	DESCRIPTION
Soft Keys Mute	Toggles the key click sound for on screen soft key presses.
Hard Keys Mute	Toggles the key click sound for touchpanel hard key presses.

After audio parameters have been set, touch **RETURN** to go back to the SETUP MODE menu or MAIN MENU.

VIDEO

From the SETUP MODE menu, touch **AUDIO VIDEO** to enter the AUDIO SETUP menu. Touch **VIDEO** to enter the VIDEO SETUP menu.

VIDEO SETUP Menu



The VIDEO SETUP menu offers a series of buttons that adjust video *Brightness*, *Contrast*, *Saturation*, *Hue* and *Translucency*. The **Restore Default Color Settings** button will return all of these controls to their factory defaults.

Refer to the following table for additional VIDEO SETUP menu details.

Video Setup Details

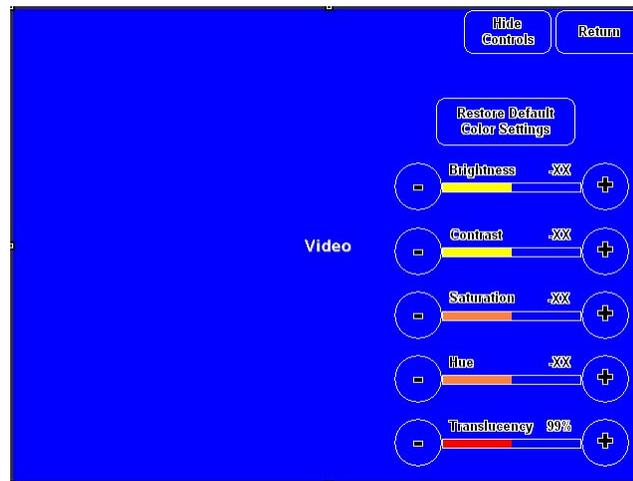
VIDEO SETUP SCREEN CONTROL	DESCRIPTION
Restore Default Color Settings	Returns video settings to their factory defaults.
Brightness	Adjusts video image brightness with the – and + buttons.
Contrast	Adjusts video image contrast with the – and + buttons.
Saturation	Adjusts video image saturation with the – and + buttons.
Hue	Adjusts video image hue with the – and + buttons.
Translucency	Adjusts video image translucency with the – and + buttons.

The *Preview Translucency* area of the video screen within the VIDEO SETUP menu will show the effects of different settings of the *Translucency* controls.

NOTE: *Preview Translucency* requires an actual video signal input to the touchpanel in order to show the effects of the *Translucency* controls.

Touching the video screen within the VIDEO SETUP menu provides a full screen view, as shown in the following illustration.

Full Screen View



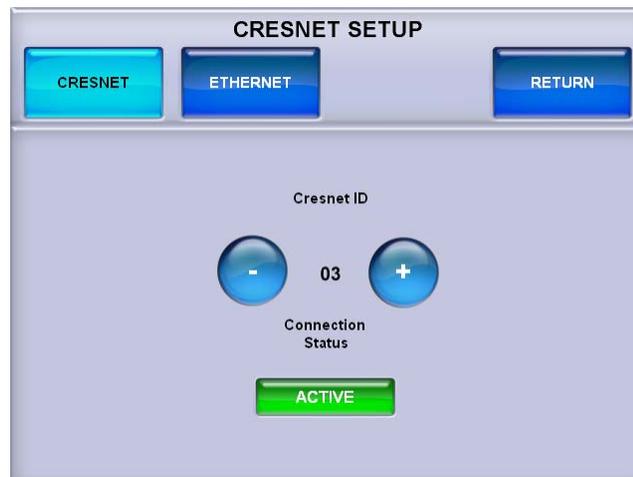
The **Hide Controls** button removes the **Restore Default Color Settings** button and the *Brightness*, *Contrast*, *Saturation*, *Hue* and *Translucency* controls from the screen.

Touch **Return** to go back to the VIDEO SETUP menu. After video parameters have been set, touch **RETURN** to go back to the SETUP MODE menu or MAIN MENU.

CRESNET

From the SETUP MODE menu, touch **CRESNET ETHERNET** to enter the CRESNET SETUP menu.

CRESNET SETUP Menu



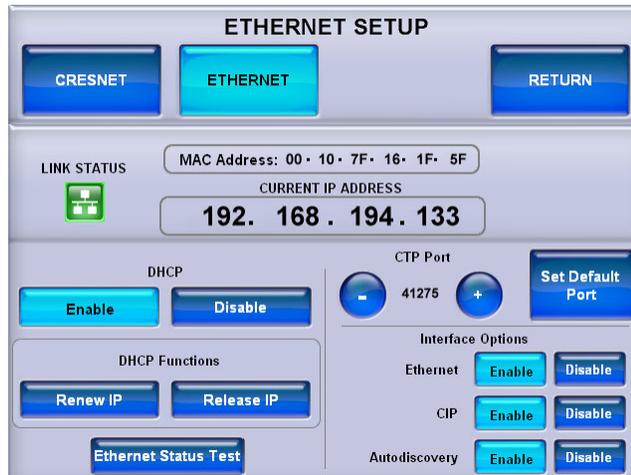
The CRENSET SETUP menu has – and + controls to set the *Cresnet ID* and a *Connection Status* indicator to show when the Cresnet connection is active.

After communications parameters have been set, touch **RETURN** to go back to the SETUP MODE menu or MAIN MENU.

ETHERNET

From the SETUP MODE menu, touch **CRESNET ETHERNET** to enter the CRESNET SETUP menu. Touch **ETHERNET** to enter the ETHERNET SETUP menu.

ETHERNET SETUP Menu

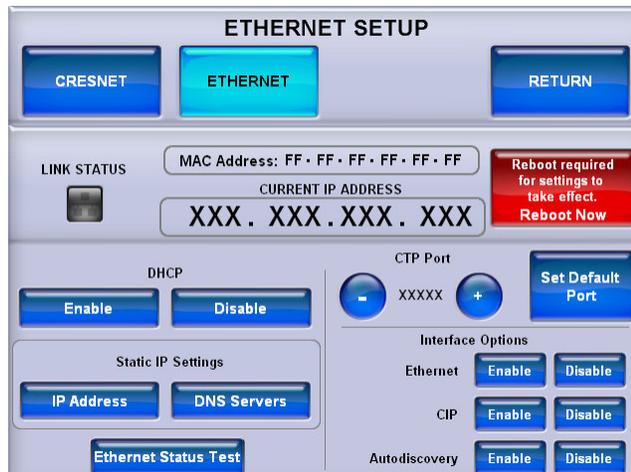


The ETHERNET SETUP menu offers a series of buttons which open additional menus and displays that are detailed in subsequent paragraphs. After Ethernet parameters have been selected, touch **RETURN** to go to the previous menu. When all parameters have been selected, touch **RETURN** repeatedly to go back to the SETUP MODE menu or the MAIN MENU.

The ETHERNET SETUP menu also provides information on Ethernet link status, MAC and IP addresses, - and + controls to set the *CTP Port*, a **Set Default Port** button to return the CTP Port setting to its factory default and buttons to **Enable** or **Disable Ethernet**, *CIP* and *Autodiscovery*.

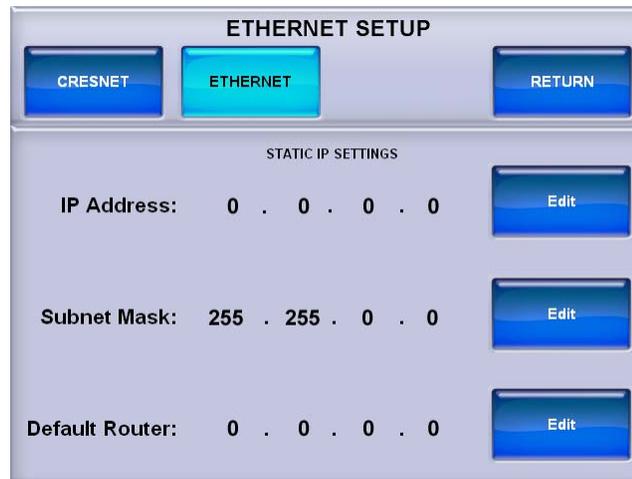
By default, DHCP is enabled. To use a static IP address, touch the **Disable** button under *DHCP*. The *DHCP Functions* section of the menu, with the **Renew IP** and **Release IP** buttons, will change to a *Static IP Settings* section, with **IP Address** and **DNS Servers** buttons. A new **Reboot required for settings to take effect. Reboot Now** button will appear, as shown in the following illustration.

ETHERNET SETUP Menu (DHCP Disable)



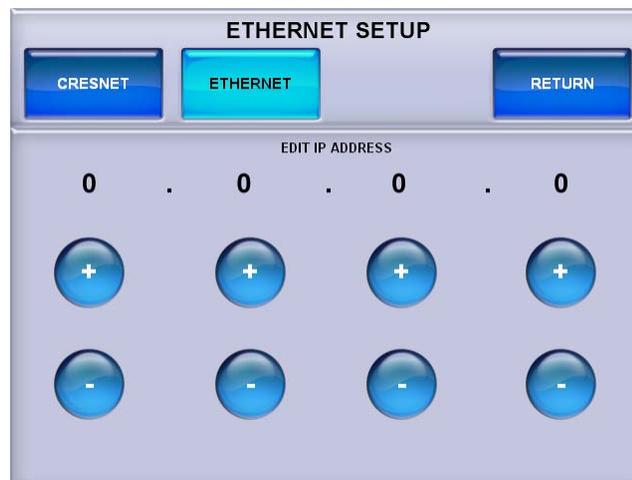
Touch **IP Address** to enter the STATIC IP SETTINGS menu, as shown in the following illustration.

ETHERNET SETUP (STATIC IP SETTINGS Menu)



From the STATIC IP SETTINGS menu, touch the **Edit** buttons to enter the menus that allow you to set the *IP Address*, *Subnet Mask* and *Default Router*, as shown in the following illustrations. + and – buttons on each menu are provided for setting the numbers. In each case, touch **RETURN** to go back to the previous menu.

ETHERNET SETUP (EDIT IP ADDRESS Menu)



ETHERNET SETUP (EDIT SUBNET MASK Menu)

ETHERNET SETUP

CRESNET ETHERNET RETURN

EDIT SUBNET MASK

255 . 255 . 0 . 0

+ + + +

- - - -

ETHERNET SETUP (EDIT DEFAULT ROUTER Menu)

ETHERNET SETUP

CRESNET ETHERNET RETURN

EDIT DEFAULT ROUTER

0 . 0 . 0 . 0

+ + + +

- - - -

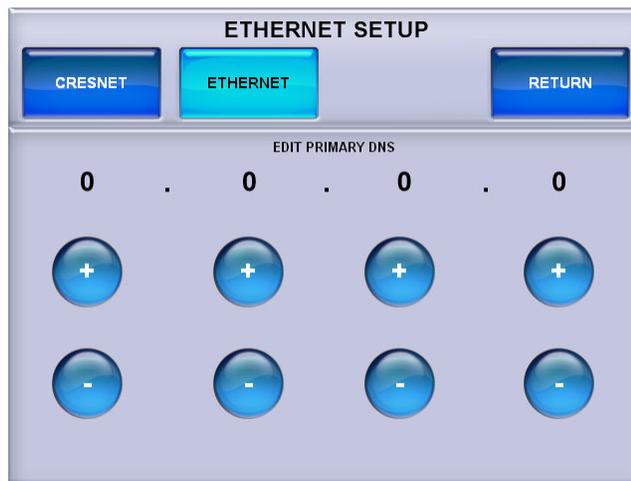
From the main ETHERNET SETUP menu, in the *Static IP Settings* section, touch **DNS Servers** to enter the STATIC DNS SETTINGS menu, as shown in the following illustration.

ETHERNET SETUP (STATIC DNS SETTINGS Menu)

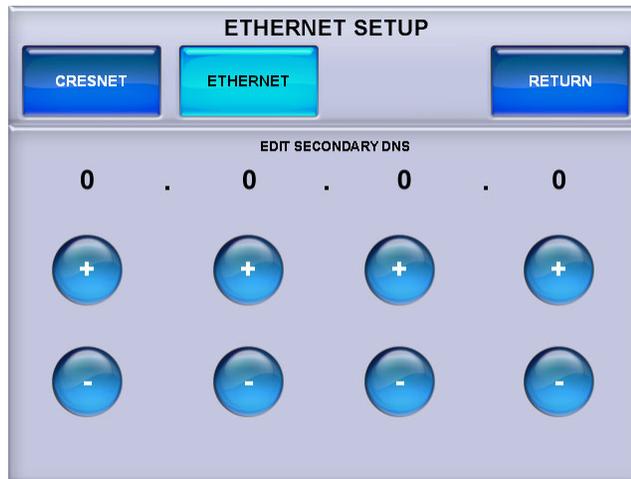


From the **STATIC DNS SETTINGS** menu, touch the **Edit** buttons to enter the menus that allow you to set the *Primary DNS*, *Secondary DNS*, *Primary WINS* and *Secondary WINS*, as shown in the following illustrations. + and – buttons on each menu are provided for setting the numbers. In each case, touch **RETURN** to go back to the previous menu.

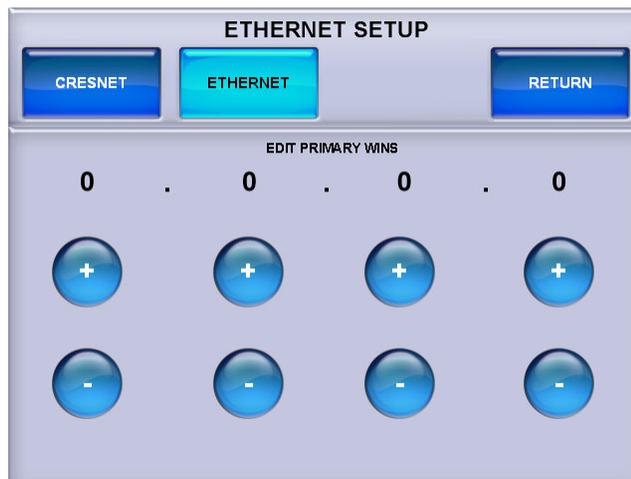
ETHERNET SETUP (EDIT PRIMARY DNS Menu)



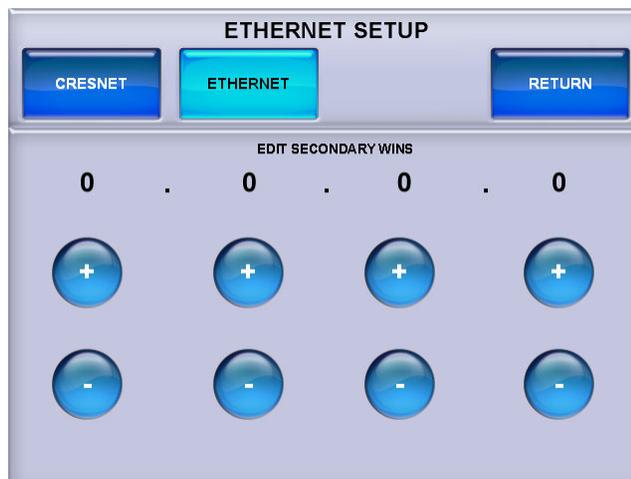
ETHERNET SETUP (EDIT SECONDARY DNS Menu)



ETHERNET SETUP (EDIT PRIMARY WINS Menu)



ETHERNET SETUP (EDIT SECONDARY WINS Menu)



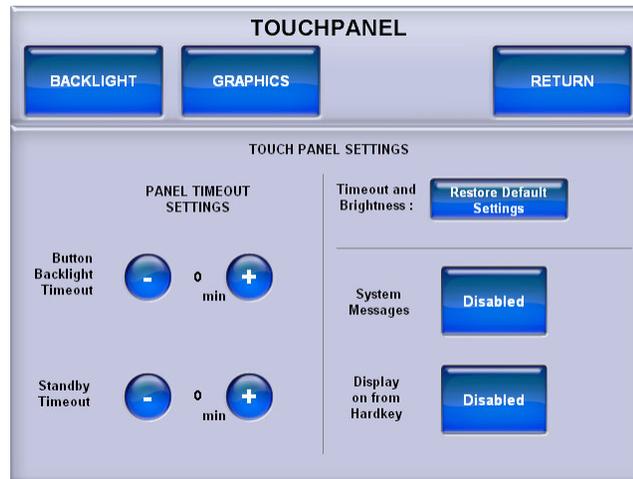
When all settings have been entered, touch **RETURN** to go back to the main ETHERNET SETUP menu and touch **Reboot required for setting to take effect. Reboot Now.**

After communications parameters have been set, touch **RETURN** to go back to the SETUP MODE menu or MAIN MENU.

TOUCH PANEL

From the SETUP MODE menu, touch the **TOUCH PANEL** button to enter the TOUCHPANEL menu.

TOUCHPANEL Menu



The TOUCHPANEL menu offers access to BACKLIGHT SETUP and GRAPHICS SETUP menus as well as pairs of – and + controls to set the *Button Backlight Timeout* and *Standby Timeout*.

The *Restore Default Settings* button will reset the Timeout and Brightness settings to their factory configuration.

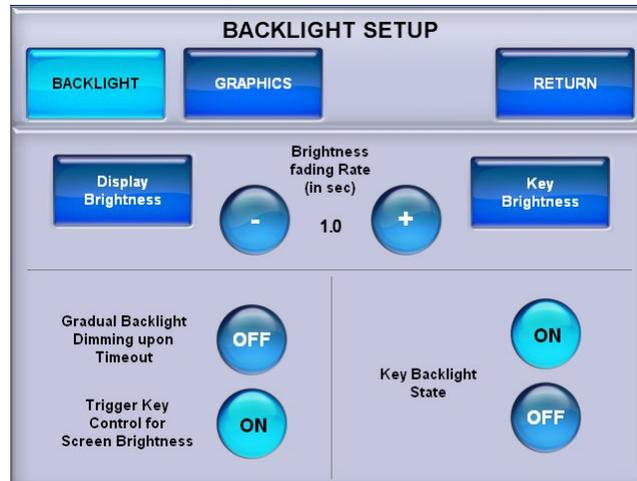
When enabled, *System Messages* will display gateway or control system disconnect warnings.

When enabled, *Display on from Hardkey* causes the display to turn on along with the touchpanel at the press of any key on the front of the touchpanel.

BACKLIGHT

From the TOUCHPANEL menu, touch **BACKLIGHT** to enter the BACKLIGHT SETUP menu, shown in the following illustration.

BACKLIGHT SETUP Menu



The BACKLIGHT SETUP menu offers access to the DISPLAY BRIGHTNESS and KEY BACKLIGHT BRIGHTNESS menus as well as – and + controls to set the *Brightness fading Rate* (i.e. how fast the screen brightness changes when the **HIGH**, **MEDIUM** or **LOW** buttons are touched or the right trigger key is used to control screen brightness). There are also **ON/OFF** controls for *Gradual Backlight Dimming upon Timeout*, *Trigger Key Control for Screen Brightness* and *Key Backlight State*.

Gradual Backlight Dimming upon Timeout sets the screen to fade to black when **ON** or to simply shut off when **OFF**. When set to **ON**, the fade rate is five seconds.

Trigger Key Control for Screen Brightness enables brightness toggling with the right trigger key (on top of the touchpanel). When **ON**, the right trigger key will toggle display brightness between high, medium, low and standby.

NOTE: The right trigger key can toggle screen brightness when the TPS-6 is displaying a project. It will not toggle screen brightness in the setup menus.

Key Backlight State turns the backlighting for the front panel keys **ON** or **OFF**.

Touch **Display Brightness** to enter the DISPLAY BRIGHTNESS menu, shown in the illustration on the following page.

DISPLAY BRIGHTNESS Menu



The DISPLAY BRIGHTNESS menu provides – and + controls to adjust *Current Display Brightness*, *High Backlight Level*, *Medium Backlight Level* and *Low Backlight Level*. These last three are the brightness levels the display will be set to as the right trigger key (on top of the touchpanel) is used to toggle between high, medium, and low screen brightness, provided *Trigger Key Control for Screen Brightness* is set to **ON** in the BACKLIGHT SETUP menu.

The *Press To Trigger Level Now* buttons allow for immediate setting of screen brightness level to **HIGH**, **MEDIUM** or **LOW**.

Touch **RETURN** to go back to the BACKLIGHT SETUP menu.

From the BACKLIGHT SETUP menu, touch **Key Brightness** to enter the KEY BACKLIGHT BRIGHTNESS menu, shown in the following illustration.

KEY BACKLIGHT BRIGHTNESS Menu



The KEY BACKLIGHT BRIGHTNESS menu provides – and + controls to adjust *Current Key Brightness*, *High Backlight Level*, *Medium Backlight Level* and *Low Backlight Level*.

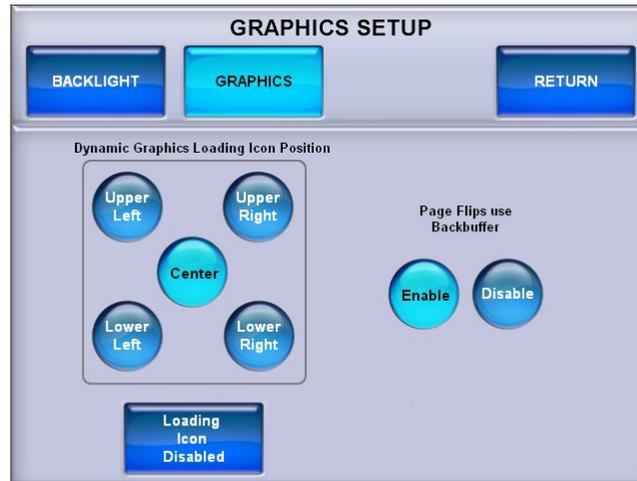
The *Press To Trigger Level Now* buttons allow for immediate setting of key brightness level to **HIGH**, **MEDIUM** or **LOW**.

Touch **RETURN** to go back to the BACKLIGHT SETUP menu.

Touch **RETURN** again to go back to the TOUCHPANEL menu or touch **GRAPHICS** to enter the GRAPHICS SETUP menu, shown in the following illustration.

GRAPHICS

GRAPHICS SETUP Menu



The GRAPHICS SETUP menu provides controls to set the *Dynamic Graphics Loading Icon Position* as well as a button to disable the loading icon(s), depending on user preference.

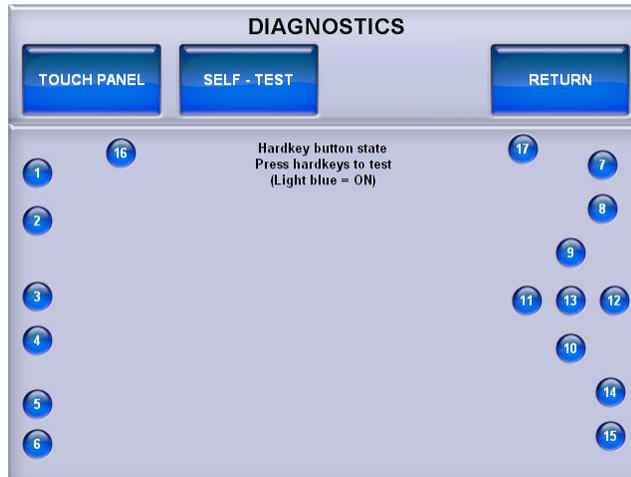
There are also *Page Flips use Backbuffer* **Enable** and **Disable** buttons. When enabled, new pages are drawn in the backbuffer and displayed when fully drawn. When disabled, new pages will be drawn on the screen from top to bottom.

Press **RETURN** to go back to the TOUCHPANEL menu. After touchpanel parameters have been set, touch **RETURN** to go back to the SETUP MODE menu or the MAIN MENU.

DIAGNOSTICS

The **Diagnostics** button on the MAIN MENU should only be used under the supervision of a Crestron customer service representative during telephone support. Many options available on the DIAGNOSTICS menu, shown in the following illustration, are numeric in nature and their interpretation is beyond the scope of this manual.

DIAGNOSTICS Menu



Hardware Hookup

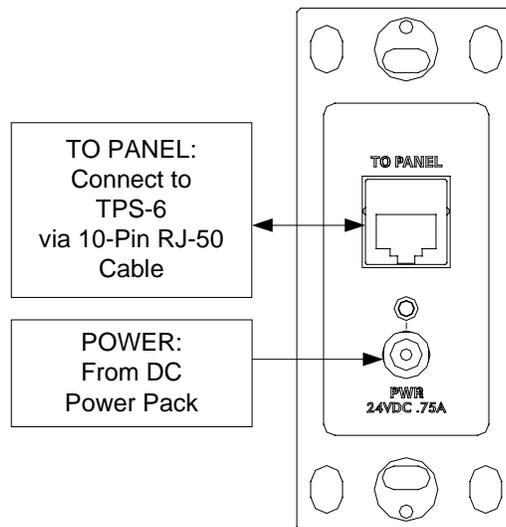
The TPS-6 comes in a soft felt bag to protect it during shipping.

For Cresnet or Ethernet connection or to upgrade touchpanel firmware, the TPS-6 must be connected to the TPS-6X IMCW Interface Module (included), which in turn must be connected to a control system via Cresnet or Ethernet. For details, refer to the latest version of the TPS-6X-IMCW Installation Guide (Doc. 6874).

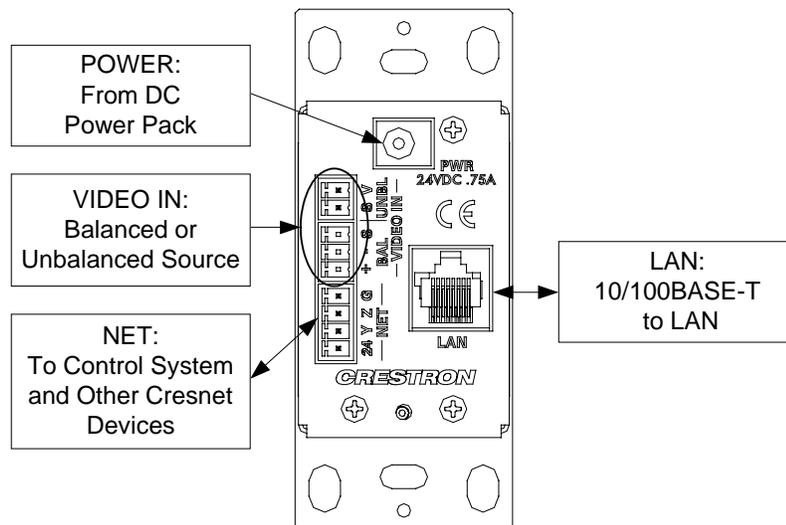
Make the necessary connections as called out in the illustrations that follow. Refer to “Network Wiring” on page 10 before attaching the 4-position terminal block connector. Apply power after all connections have been made.

When making connections to the TPS-6X-IMCW, use Crestron power supplies for Crestron equipment.

Hardware Connections for the TPS-6X-IMCW (Front)



Hardware Connections for the TPS-6X-IMCW (Rear)



NOTE: Ensure the TPS-6X-IMCW is properly grounded.

NOTE: The TPS-6X-IMCW can be powered via the **24 VDC** jack on either the front or the back of the unit if the **NET** port is not being used to power the module.

Recommended Cleaning

Touchscreen

Keep the surface of the touchscreen free of dirt, dust or other materials that could degrade optical properties. Long-term contact with abrasive materials can scratch the surface, which may detrimentally affect image quality.

For best cleaning results, use a clean, damp, non-abrasive cloth with any commercially available non-ammonia glass cleaner. Bezels may not provide a complete watertight seal. Therefore, apply cleaning solution to the cloth rather than

the surface of the touchscreen. Wipe touchscreen clean and avoid getting moisture beneath the bezels.

CAUTION: Do not apply excessive pressure to the touchscreen display during handling. Doing so can crack the screen and damage the touchpanel.

Enclosure

The soft felt bag the TPS-6 came shipped in can be used to clean the bezel and the rest of the touchpanel enclosure.

Programming Software

Have a question or comment about Crestron software?

Answers to frequently asked questions (FAQs) can be viewed in the Online Help section of the Crestron website. To post a question or view questions you have submitted to Crestron’s True Blue Support, log in at <http://support.crestron.com>. First-time users will need to establish a user account.

Earliest Version Software Requirements for the PC

NOTE: Crestron recommends that you use the latest software to take advantage of the most recently released features. The latest software is available from the Crestron website.

Crestron has developed an assortment of Windows®-based software tools to develop a controlled system. For the minimum recommended software versions, visit the Version Tracker page of the Crestron website (www.crestron.com/versiontracker).

Programming with Crestron SystemBuilder

Crestron SystemBuilder is the easiest method of programming but does not offer as much flexibility as SIMPL Windows. For additional details, download SystemBuilder from the Crestron website and examine the extensive help file.

Programming with SIMPL Windows

NOTE: While SIMPL Windows can be used to program the TPS-6, it is recommended to use SystemBuilder for configuring a system.

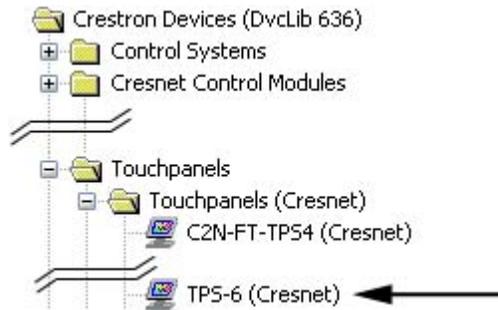
SIMPL Windows is Crestron's premier software for programming Crestron control systems. It is organized into two separate but equally important "Managers".

Configuration Manager

Configuration Manager is the view where programmers "build" a Crestron control system by selecting hardware from the *Device Library*.

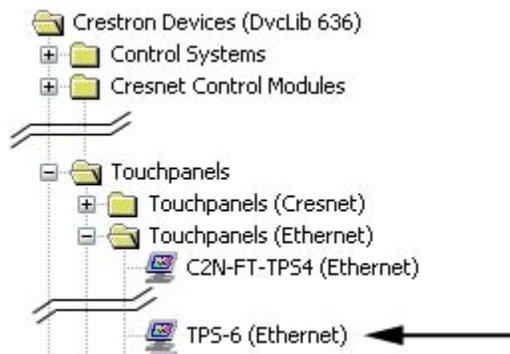
1. The TPS-6 must first be incorporated into the system.
 - a. To incorporate the TPS-6 (Cresnet) into the system, drag the TPS-6 from the Touchpanels | Touchpanels (Cresnet) folder of the *Device Library* and drop it in the *System Views*.

Locating the TPS-6 (Cresnet) in the Device Library



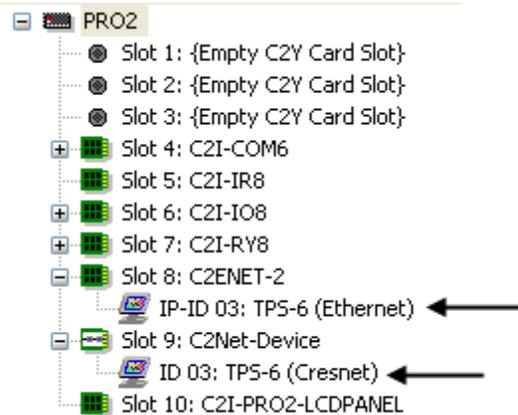
- b. To incorporate the TPS-6 (Ethernet) into the system, drag the TPS-6 from the Touchpanels | Touchpanels (Ethernet) folder of the *Device Library* and drop it in the *System Views*.

Locating the TPS-6 (Ethernet) in the Device Library



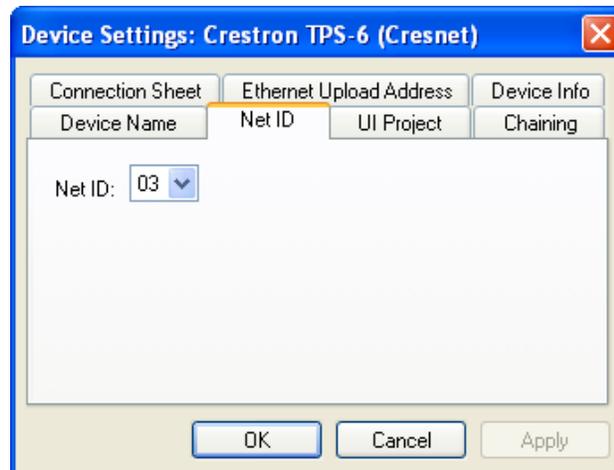
2. The system tree of the control system displays the device in the appropriate slot(s) with a default Net ID, or IP ID as shown in the following illustration.

C2Net Device, Slot 8 and 9 (Net ID and IP ID)

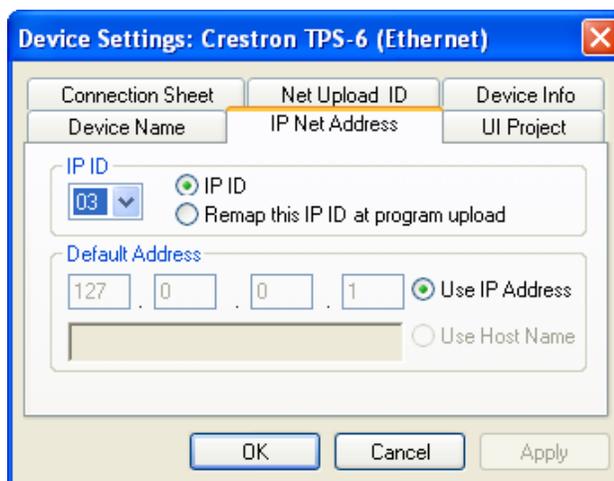


3. Additional TPS-6 devices are assigned different Net ID, or IP ID numbers as they are added.
4. If necessary, double click a device to open the “Device Settings” window and change the Net ID, or IP ID as shown in the following figure(s).

“TPS-6 (Cresnet) Device Settings” Window



“TPS-6 (Ethernet) Device Settings” Window



- The ID code specified in the SIMPL Windows program must match the Net ID, or IP ID of each unit. Refer to “Identity Code” which starts on page 10.

Program Manager

Program Manager is the view where programmers “program” a Crestron control system by assigning signals to symbols.

The symbol can be viewed by double clicking on the icon or dragging it into *Detail View*. Each signal in the symbol is described in the SIMPL Windows help file (F1).

Programming with VisionTools Pro-e

Touchpanel screens should be created in VisionTools® Pro-e (VT Pro-e) to allow switching of source signals to desired outputs as well as selection of the system mode. There are no special programming requirements to use the functions of the TPS-6 in a room control system.

Multi-Mode Objects

Multi-mode objects offer high-performance programming!

The single most advanced VT Pro-e high performance programming technique involving the TPS-6 is the concept of multi-mode objects. A multi-mode object (i.e. button, legend, etc.) is an object drawn on a VisionTools Pro-e page that can have one or more active and inactive visible settings (*modes*).

For examples, refer to www.crestron.com/exampleprograms and search for multi-mode object examples. This file contains the VT Pro-e touchpanel files and SIMPL Windows files that illustrate the high-performance capabilities of multi-mode objects.

Bit Depth and File Size

A balance of performance and quality can be achieved by using VT Pro-e to configure the size of graphics in a project. Read this section to learn about bit depth and how to maximize the quality and performance of a TPS-6 project.

Bit depth refers to the number of memory bits used to store color data for each pixel in a raster image. A touchpanel raster image consists of a rectangular grid of picture elements (pixels). Each pixel uses the same amount of memory to store its color data. The amount of memory is called the bit depth of the image.

Greater bit depths are required to represent finer gradations of color. Increasing bit depth necessarily increases file size. A black and white drawing requires only one bit per pixel to store all the available color information. Using a 32-bit per pixel bit depth for a black and white image increases the file size 32 times without adding anything to the black and white image quality.

In an 8-bit per pixel system, the associated 8-bits of video memory for every screen pixel contain a value referring to a location in an 8-bit color table. In this way, any one of the specific 256 color table locations is assigned to a pixel.

A 16-bit highcolor system is considered sufficient to provide life-like colors. It is encoded using 5-bits to represent red, 5-bits to represent blue and (since the human eye is more sensitive to the color green) 6-bits to represent 64 levels of green. These can therefore be combined to provide 65,536 mixed colors ($32 \times 32 \times 64 = 65,536$).

In a 24-bit graphics display, the video memory allocates 24 bits for each pixel on the screen enabling each pixel to take on any one of a possible 16.7 million colors. Each 24-bit value is composed of 8-bits for red, 8-bits for green and 8-bits for blue. These triplets of 8-bit values are also referred to as the red, green and blue color planes. A 24-bit image is actually composed of three component images which combine to create the truecolor picture. The reason this is called truecolor is that this is near the maximum number of colors the human eye is able to detect.

Truecolor images are sometimes represented by a 32-bit value. The extra 8-bits do not enhance the precision of the color representation but act as an alpha channel that represents pixel translucence. 32-bit truecolor has become popular on the computer desktop to provide effects such as translucent windows, fading menus and shadows.

In graphics intensive applications such as touchpanels, raising or lowering the color depth of the displayed graphics can achieve a balance of performance and quality. Lower color depths do not require as much frame buffer memory or display bandwidth, allowing them to be generated and displayed more quickly. Increasing color depth results in higher color quality at the expense of display speed and responsiveness. By using mostly 8-bit or 16-bit graphics and holding 32-bit graphics to a minimum (e.g. for a family photo, etc.), you can create a sophisticated project that will fit in the memory space provided and have the touchpanel remain very responsive.

Relationship of Bits to Colors

NUMBER OF BITS	NUMBER OF COLORS
1 bit	Black and White
2 bits	4 Colors
4 bits	16 Colors
8 bits	256 Colors
16 bits	65,536 Colors (Highcolor)
24 bits	16.7 million Colors (Truecolor)
32 bits	16.7 million Colors plus Transparency

When creating a VT Pro-e project you can elect to compress and reduce the image size in the “Page Properties” window for the entire page and/or perform the same function of reducing the image size using the “Image Properties” window. A reduction in image size will save a considerable amount of memory space for your project.

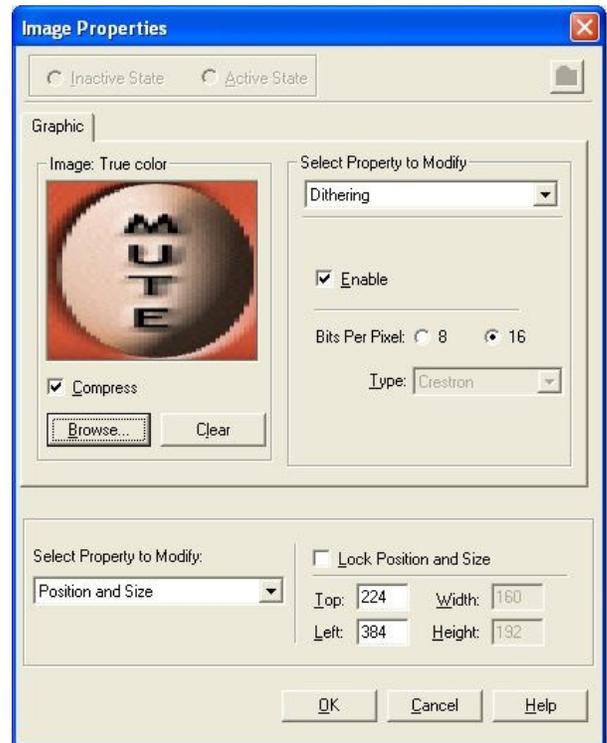
In VT Pro-e, the **Compress** checkbox permits the image to be compressed when compiling. This conversion may cause the loss of some subtle shading. To compensate for this, use the dithering to simulate the original shading. Check your image with each of the available dithering types to determine which will deliver the best quality image.

Dithering type selection can be accessed from the “Page Properties” or “Image Properties” windows in VT-Pro-e. Refer to the following illustrations.

VT Pro-e “Page Properties” Window – Bit Depth Selection



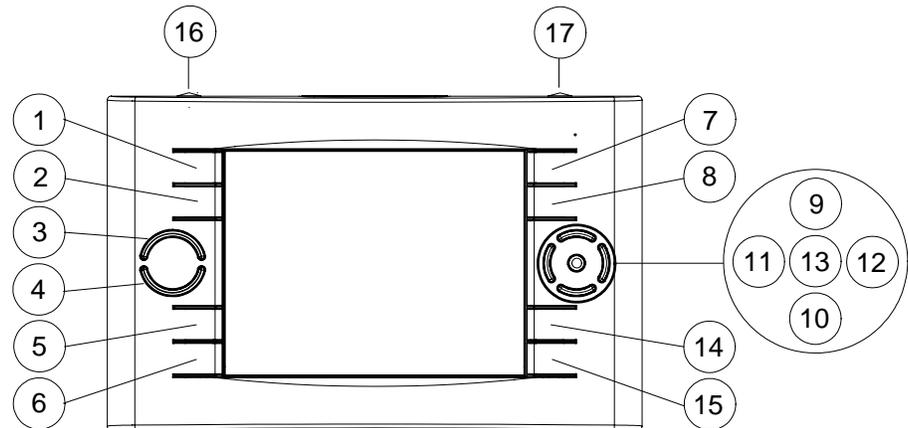
VT Pro-e “Image Properties” Window – Bit Depth Selection



Pushbutton Programming

Any of the buttons can be programmed to access any frequently used command. Each button has a permanently fixed digital join number. Refer to the following illustration for their assigned join numbers. A description for each button signal is described in the SIMPL Windows help file (F1).

Pushbutton Layout and Join Number Assignment



NOTE: Join numbers 16 and 17 are fixed for the two “trigger” keys, the top-mounted pushbuttons on the TPS-6. The left trigger key toggles power when the unit is undocked and initiates *Sleep* mode when docked. In addition, when held for five seconds, it initiates a touchpanel reset. The right trigger key toggles screen brightness, unless it is disabled with the on-screen button in the BACKLIGHT SETUP menu (refer to “BACKLIGHT” which starts on page 24).

While both of these join numbers can be programmed to perform other functions, their main functions as outlined above will still be in effect, i.e. each button will perform both its default and its newly programmed operation.

MultiByte International Characters

Most languages use a single byte of eight bits to represent a character, e.g. English, French, German, Hebrew, Russian, Thai, etc.

Multibyte character fonts require more than the usual eight bits to specify a character. This occurs when a language has more than 256 characters (2^8) in a font. For example, Chinese fonts contain several thousand characters. Other multibyte languages include Japanese and Korean.

There are two separate applications with multibyte characters – static text on buttons and indirect text on buttons. No Isys touchpanel firmware changes are required in either case.

Indirect text on a button is entered in VTPro-e and the actual string to be displayed is entered in SIMPL Windows. As of this publication date only completely single byte or completely multibyte strings may be entered or they will not be compiled correctly in SIMPL Windows. In other words, you cannot enter Chinese characters interspersed with numbers. You can enter Chinese characters or numbers in separate strings or you can pad each number with “\x00” to make it multibyte and then combine it with Chinese characters in the same string.

Of course, you can always use the workaround of showing a graphic that displays the string but it is not dynamic. To compile and use multibyte characters it is essential that the operating system understand the language. Windows XP, Vista and 7 are available in many international languages and add-on software is available for other versions of Windows.

Uploading and Upgrading

Crestron recommends using the latest programming software and that each device contains the latest firmware to take advantage of the most recently released features. However, before attempting to upload or upgrade it is necessary to establish communication. Once communication has been established, files (for example, programs, projects or firmware) can be transferred to the control system (and/or device). Finally, program checks can be performed (such as changing the device ID or creating an IP table) to ensure proper functioning.

Establishing Communication

Use Crestron Toolbox for communicating with the TPS-6; refer to the Crestron Toolbox help file for details. There are two methods of communication.

Indirect

Indirect Communication

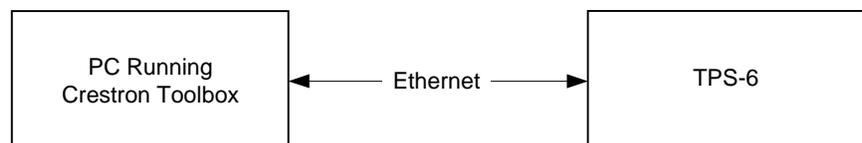


TPS-6 connects to control system via Cresnet:

1. Establish communication between the PC and the control system as described in the latest version of the 2-Series Control Systems Reference Guide (Doc. 6256).
2. Use the Address Book in Crestron Toolbox to create an entry for the TPS-6 using the expected communication protocol (Indirect). Select the Cresnet ID of the TPS-6 and the address book entry of the control system that is connected to the TPS-6.
3. Display the TPS-6's "System Info" window (click the  icon); communications are confirmed when the device information is displayed.

TCP/IP

Ethernet Communication



The TPS-6 connects to PC via Ethernet:

1. Enter the IP address, IP mask and default router of the TPS-6 via the Crestron Toolbox (**Functions | Ethernet Addressing**); otherwise enable DHCP.

NOTE: Use the Device Discovery Tool in Crestron Toolbox to detect all Ethernet devices on the network and their IP configuration. The tool is available in Toolbox version 1.15.143 or later.

2. Confirm Ethernet connections between TPS-6 and PC. If connecting through a hub or router, use CAT5 straight through cables with 8-pin RJ-45 connectors. Alternatively, use a CAT5 crossover cable to connect the two LAN ports directly without using a hub or router.
3. Use the Address Book in Crestron Toolbox to create an entry for the TPS-6 with the TPS-6's TCP/IP communication parameters.
4. Display the "System Info" window (click the  icon) and select the TPS-6 entry.

Programs, Projects and Firmware

Program, project or firmware files may be distributed from programmers to installers or from Crestron to dealers. Firmware upgrades are available from the Crestron website as new features are developed after product releases. One has the option to upload programs and projects via the programming software or to upload and upgrade via the Crestron Toolbox. For details on uploading and upgrading, refer to the SIMPL Windows help file, VisionTools Pro-e help file or the Crestron Toolbox help file.

SIMPL Windows

If a SIMPL Windows program is provided, it can be uploaded to the control system using SIMPL Windows or Crestron Toolbox.

VisionTools Pro-e

Upload the VisionTools Pro-e file to the touchpanel using VisionTools Pro-e or Crestron Toolbox.

Firmware

Check the Crestron website to find the latest firmware. (New users may be required to register to obtain access to certain areas of the site, including the FTP site.)

Upgrade TPS-6 firmware via Crestron Toolbox.

1. Establish communication with the TPS-6 and display the "System Info" window.
2. Select **Functions | Firmware...** to upgrade the TPS-6 firmware.

Program Checks

Actions that can be performed on the TPS-6 vary depending on whether it is connected via Cresnet or Ethernet.

Cresnet Connections

For Cresnet connections, using Crestron Toolbox, display the network device tree (**Tools | Network Device Tree**) to show all network devices connected to the control system. Right-click on the TPS-6 to display actions that can be performed on the TPS-6.

Ethernet Connections

For Ethernet connections, display the "System Info" window (click the  icon) and select the **Functions** menu to display actions that can be performed on the TPS-6.

Be sure to use the internal setup menu (refer to "ETHERNET" which starts on page 18) or Crestron Toolbox to create the TPS-6 IP table. In Toolbox:

1. Select **Functions | IP Table Setup**.
2. Add, modify or delete entries in the IP table.
3. A defined IP table can be saved to a file or sent to the device.

Edit the control system's IP table to include an entry for the TPS-6. The entry should list the TPS-6's IP ID (specified on the TPS-6's IP table) and the internal gateway IP address 127.0.0.1.

Problem Solving

Troubleshooting

The following table provides corrective action for possible trouble situations. If further assistance is required, please contact a Crestron customer service representative.

TPS-6 Troubleshooting

TROUBLE	POSSIBLE CAUSE(S)	CORRECTIVE ACTION
Device does not function.	TPS-6 is not receiving power.	Verify power to (included) TPS-6X-IMCW Interface Module.
	Device is not communicating with the network.	Use Crestron Toolbox to poll the network. Verify network connection to the device.
	Device is not receiving power from a Crestron power source.	Use the provided Crestron power source. Verify connections.
Touchpanel is not responding.	Device is not receiving sufficient power.	Use the Crestron Power Calculator to help calculate how much power is needed for the system.
	Touchpanel Net ID is not set to match the Net ID in the SIMPL program.	Use Crestron Toolbox to poll the network. Verify the Net ID for the touchpanel is properly set to match the Net ID in the SIMPL program.
	Touchpanel Net ID is not unique; two or more units share the same ID.	Use Crestron Toolbox to poll the network and verify that each ID is used only once.
	No IP address configured/obtained on the TPS-6.	Use the internal setup menu (refer to “ETHERNET” which starts on page 18) or Crestron Toolbox to create/verify Ethernet settings.
	Invalid control system IP address / IP ID set up on the TPS-6.	The IP address (or host name) for the control system is invalid or the IP ID does not match the one defined in the SIMPL program. Refer to “ETHERNET” which starts on page 18 to define IP addresses.
Touchpanel display is dark.	Standby timeout has elapsed.	Touch the screen to reactivate.

(Continued on following page)

TPS-6 Troubleshooting (Continued)

TROUBLE	POSSIBLE CAUSE(S)	CORRECTIVE ACTION
Unexpected response from touchpanel.	Touchpanel is incorrectly calibrated.	Recalibrate the touchscreen (refer to "Configuring the Touchpanel" which starts on page 11 and "CALIBRATION MENU" on page 12).
TPS-6 boots up with message saying "Your desired page was not found."	Invalid VT Pro-e project or no VT Pro-e project is loaded.	Load/reload VT Pro-e project using Crestron Toolbox.

Check Network Wiring

Use the Right Wire

In order to ensure optimum performance over the full range of your installation topology, Crestron Certified Wire and only Crestron Certified Wire may be used. Failure to do so may incur additional charges if support is required to identify performance deficiencies because of using improper wire.

Calculate Power

CAUTION: Use only Crestron power supplies for Crestron equipment. Failure to do so could cause equipment damage or void the Crestron warranty.

CAUTION: Provide sufficient power to the system. Insufficient power can lead to unpredictable results or damage to the equipment. Please use the Crestron Power Calculator to help calculate how much power is needed for the system (www.crestron.com/calculators).

When calculating the length of wire for a particular Cresnet run, the wire gauge and the Cresnet power usage of each network unit to be connected must be taken into consideration. Use Crestron Certified Wire only. If Cresnet units are to be daisy-chained on the run, the Cresnet power usage of each network unit to be daisy-chained must be added together to determine the Cresnet power usage of the entire chain. If the unit is home-run from a Crestron system power supply network port, the Cresnet power usage of that unit is the Cresnet power usage of the entire run. The wire gauge and the Cresnet power usage of the run should be used in the following equation to calculate the cable length value on the equation's left side.

Cable Length Equation

$$L < \frac{40,000}{R \times P}$$

Where: L = Length of run (or chain) in feet
 R = 6 Ohms (Crestron Certified Wire: 18 AWG (0.75 MM²))
 or 1.6 Ohms (Cresnet HP: 12 AWG (4 MM²))
 P = Cresnet power usage of entire run (or chain)

Make sure the cable length value is less than the value calculated on the right side of the equation. For example, a Cresnet run using 18 AWG Crestron Certified Wire and drawing 20 watts should not have a length of run more than 333 feet. If Cresnet HP is used for the same run, its length could extend to 1250 feet.

NOTE: All Crestron certified Cresnet wiring must consist of two twisted pairs. One twisted pair is the +24V conductor and the GND conductor and the other twisted pair is the Y conductor and the Z conductor.

Strip and Tin Wire

When daisy-chaining Cresnet units, strip the ends of the wires carefully to avoid nicking the conductors. Twist together the ends of the wires that share a pin on the network connector and tin the twisted connection. Apply solder only to the ends of the twisted wires. Avoid tinning too far up the wires or the end becomes brittle. Insert the tinned connection into the Cresnet connector and tighten the retaining screw. Repeat the procedure for the other three conductors.

Add Hubs

For larger networks (i.e., greater than 28 network devices), it may become necessary to add a Cresnet Hub/Repeater (CNXHUB) to maintain signal quality throughout the network. Also, for networks with lengthy cable runs it may be necessary to add a Hub/Repeater after only 20 devices.

Reference Documents

The latest version of all documents mentioned within the guide can be obtained from the Crestron website (www.crestron.com/manuals). This link will provide a list of product manuals arranged in alphabetical order by model number.

List of Related Reference Documents

DOCUMENT TITLE
2-Series Control Systems Reference Guide
Crestron e-Control Reference Guide
TPS-6X-IMCW Interface Module

Further Inquiries

If you cannot locate specific information or have questions after reviewing this guide, please take advantage of Crestron's award winning customer service team by calling Crestron at 1-888-CRESTRON [1-888-273-7876].

You can also log onto the online help section of the Crestron website (www.crestron.com/onlinehelp) to ask questions about Crestron products. First-time users will need to establish a user account to fully benefit from all available features.

Future Updates

As Crestron improves functions, adds new features and extends the capabilities of the TPS-6, additional information may be made available as manual updates. These updates are solely electronic and serve as intermediary supplements prior to the release of a complete technical documentation revision.

Check the Crestron website periodically for manual update availability and its relevance. Updates are identified as an “Addendum” in the Download column.

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(2026851)**

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