Adept T20 Pendant

User's Guide

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Table of Contents

Chapter 1: Introduction

This manual covers the setup, operation, and user maintenance for the Adept T20™ pendant.

1.1 Product Description

The Adept T20 pendant provides a user interface and teach pendant in an ergonomic and rugged package. The T20 pendant is designed for right-handed and left-handed use. All gripping and holding positions enable comfortable and fatigue-free operation.

The safety features include:

- Emergency stop switch (dual-channel circuit)
- Three position "enable" switch that prevents pendant input or robot motion when the switch is not engaged.

The software features include the ability to:

- Control the robot by enabling and disabling power and jogging the robot
- Teach locations
- Smart Locations, which allow you to work with locations through the Frame and Tool screens.
- Display robot position, system status, system identification, and error messages
- Display and change digital I/O

System Compatibility

The Adept T20 pendant is compatible with any robot that is controlled by the Adept SmartController EX™ motion controller.

1.2 Dangers, Warnings, Cautions, and Notes

There are six levels of special alert notation used in Adept manuals. In descending order of importance, they are:

DANGER: This indicates an imminently hazardous electrical situation which, if not avoided, will result in death or serious injury.

DANGER: This indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING: This indicates a potentially hazardous electrical situation which, if not avoided, could result in serious injury or major damage to the equipment.

WARNING: This indicates a potentially hazardous situation which, if not avoided, could result in serious injury or major damage to the equipment.

CAUTION: This indicates a situation which, if not avoided, could result in minor injury or damage to the equipment.

NOTE: This provides supplementary information, emphasizes a point or procedure, or gives a tip for easier operation.

1.3 Safety Precautions

DANGER: An Adept robot can cause serious injury or death, or damage to itself and other equipment, if the following safety precautions are not observed:

- All personnel who install, operate, teach, program, or maintain the system must read this guide, read the *Adept Robot Safety Guide*, and complete a training course for their responsibilities in regard to the robot.
- All personnel who design the robot system must read this guide, the *Adept Robot Safety Guide*, and the Adept robot user's guide that was supplied with the equipment. The system design must comply with all local and national safety regulations for the location in which the robot is installed.
- The robot system must not be used for purposes other than described in the Adept robot user's guide that was supplied with the equipment. Contact Adept if you are not sure of the suitability for your application.
- The user is responsible for providing safety barriers around the robot to prevent anyone from accidentally coming into contact with the robot when it is in motion.
- Power to the robot and its power supply must be locked out and tagged out before any maintenance is performed.

1.4 What to Do in an Emergency Situation

Press any E-Stop button (a red push-button on a yellow background/field) and then follow the internal procedures of your company or organization for an emergency situation. If a fire occurs, use CO_2 to extinguish the fire.

1.5 Additional Safety Information

Manufacturer's Declaration of Conformance (MDOC)

This lists all standards with which each robot complies. See Manufacturer's Declaration on page 9.

Adept Robot Safety Guide

The *Adept Robot Safety Guide* provides detailed information on safety for Adept robots. It also gives resources for more information on relevant standards.

It ships with each robot manual, and is also available from the Adept Document Library. See Adept Document Library on page 11.

1.6 Manufacturer's Declaration

The Manufacturer's Declaration of Incorporation and Conformity (MDOC) for Adept robot systems can be found on the Adept Web site, in the Download Center of the Support section.

http://www.adept.com/support/downloads/file-search

NOTE: The Download Center requires that you are logged in for access. If you are not logged in, you will be redirected to the Adept website Login page, and then automatically returned to the Download Center when you have completed the login process.

1. From the Download Types drop-down list, select Manufacturer Declarations
2. From the Product drop-down list, select your Adept robot product.
3. Click Begin Search. The list of available documents is shown in the Search Results area, which opens at the bottom of the page. You may need to scroll down to see it.
4. Use the Description column to locate the document for your Adept robot, and then click the corresponding Download ID number to access the Download Details page.
5. On the Download Details page, click Download to open or save the file.

1.7 Proper Handling of the Pendant

You have chosen a high-quality device that is equipped with highly-sensitive, state-of-the-art electronics. To avoid malfunctions or damage through improper handling, and possible voiding of the warranty, follow these instructions during operation.

- Never place the Adept T20 pendant with the display screen facing down, to avoid damaging the buttons or display.
- Never place the Adept T20 pendant on an unstable surface. It could fall to the ground and be damaged.
- Never place the Adept T20 pendant close to heat sources or in direct sunlight.
- Avoid exposing the Adept T20 pendant to mechanical vibrations, excessive dust, humidity, or to strong magnetic fields.
- Never clean the Adept T20 pendant display screen or other surfaces with solvents, abrasive cleaners, or scrubbing sponges.
- Make sure that no foreign objects or liquids can penetrate into the Adept T20 pendant.

WARNING: When the cable entrance cover is removed, the Adept T20 pendant is sensitive to electrostatic discharge.

1.8 How Can I Get Help?

Refer to the How to Get Help Resource Guide (Adept P/N 00961-00700) for details on getting assistance with your Adept software and hardware. Additionally, you can access information sources on Adept's corporate website:

http://www.adept.com

For details on getting assistance with your Adept software or hardware, you can access the following information sources on the Adept corporate website:

- For contact information: http://www.adept.com/contact/americas
- For product support information: http://www.adept.com/support/service-and-support/main
- For user discussions, support, and programming examples: http://www.adept.com/forum/
- For further information about Adept Technology, Inc.: http://www.adept.com

Related Manuals

This guide covers the installation, operation, and maintenance of the Adept T20 pendant. There are additional manuals that cover programming the system, reconfiguring installed components, and adding other optional components; see the table that follows. These manuals are available on the Adept Document Library CD-ROM shipped with each system.

Table 1-1. Related Manuals

Manual Title	Description
Adept Robot Safety Guide	Contains safety information for Adept robots.
Adept SmartController EX User's Guide	Contains complete information on the installation and operation of the Adept SmartController and the optional sDIO product.
Adept ACE User's Guide	Describes the Adept ACE software environment and use with an Adept control system. This documentation is included in the Adept ACE software installation. It can also be accessed in the Adept Document Library.

Adept Document Library

The Adept Document Library (ADL) contains documentation for Adept products. You can access the ADL from:

- the Adept Software CD shipped with your system

  or

- the Adept website. Select Document Library from the Adept home page. To go directly to the Adept Document Library, either click on or type the following URL into your browser:

  http://www.adept.com/Main/KE/DATA/adept_search.htm

To locate information on a specific topic, use the Document Library search engine on the ADL main page. To view a list of available product documentation, select the Document Titles option.

Chapter 2: Installation and Setup

This chapter covers the installation and setup of the Adept T20 pendant.

2.1 Transport and Storage

The Adept T20 pendant must be shipped and stored in a temperature-controlled environment, within the range –20° to +70° C (-4° to 158° F). The recommended humidity range is 5 to 95 percent, non-condensing. It should be shipped and stored in the Adept-supplied packaging, which is designed to prevent damage from normal shock and vibration. You should protect the packaging from excessive shock and vibration.The pendant must always be stored and shipped in a clean, dry area that is free from condensation.

The Adept T20 pendant weighs 480 g (1.1 lb) without the adapter cable installed.

2.2 Before Unpacking the Pendant

Carefully inspect the shipping packages for evidence of damage during transit. If any damage is indicated, request that the carrier's agent be present at the time the container is unpacked.

2.3 Upon Unpacking the Pendant

Before signing the carrier's delivery sheet, compare the actual items received (not just the packing slip) with your equipment purchase order. Verify that all items are present and that the shipment is correct and free of visible damage.

- If the items received do not match the packing slip, or are damaged, do not sign the receipt. Contact Adept as soon as possible.
- If the items received do not match your order, please contact Adept immediately.
- Retain all containers and packaging materials. These items may be necessary to settle claims or, at a later date, to relocate the equipment.

2.4 Unpacking

Remove the pendant from its box and place it on a flat surface.

2.5 Repacking for Relocation

If the pendant or other equipment needs to be relocated, reverse the steps in the installation procedures in this chapter. Reuse all original packing containers and materials and follow all safety notes used for installation. Improper packaging for shipment will void your warranty.

2.6 Operating Environment

The Adept T20 pendant is designed to operate in the following environment:

- Temperature: 0° to +45° C (32° to 113° F)
- Humidity: 0 - 95%, non-condensing

The Adept T20 pendant is not intended for use in hazardous environments (explosive gas, water, dust, oil, or mist). It has an IP rating of IP-65.

2.7 Installation

This section describes how to install the Adept T20 pendant on a SmartController EX. The following installation options are described:

- Installing the pendant and an Adept Front panel

About Jumper Plugs

There are two jumper, or bypass, plugs available for a T20 pendant system. One is a D-Sub plug (P/N 10052-000) for the XMCP connector on the Adept SmartController EX. The second is a screw-to-lock plug (P/N 10048-000) for the pendant adapter cable.

The pendant emergency stop switch and the enabling switch are wired into the system emergency stop circuitry. Therefore, if either the pendant cable or the adapter cable is unplugged, the corresponding jumper plug must be installed. If neither one is connected, you cannot enable high power. If the E-Stop circuit is opened by removing one of the cables, or a jumper plug, then high power is turned OFF.

See the sections that follow for installation instructions.

Installing the Pendant and an Adept Front Panel

Refer to the drawing that follows for information on connecting a Front Panel to a SmartController EX, in addition to the Adept T20 pendant. See the *Adept SmartController User's Guide* for additional information.

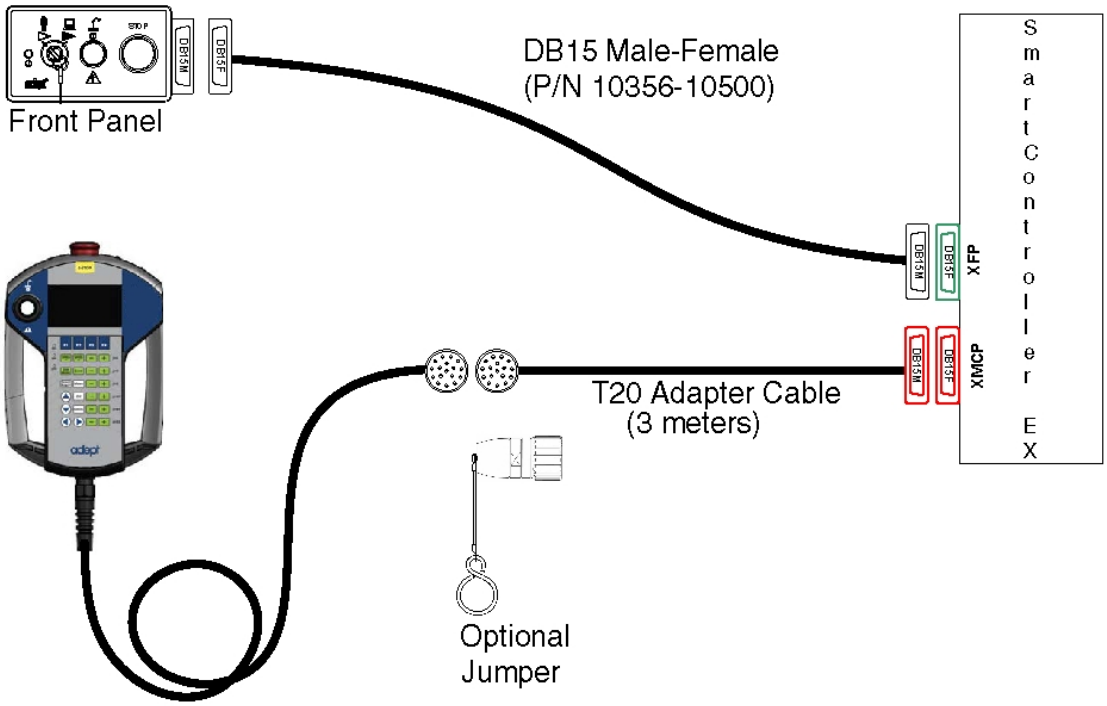


Figure 2-1. Pendant and Front Panel Installation

Auto/Manual Mode with Both Front Panel and T20 Pendant Installed

The Adept T20 pendant must be used with an Adept Front Panel. Note the following points:

- The E-Stop buttons on the Front Panel and T20 pendant both function and are individually detected by the Adept SmartController EX.
- The high-power-enable buttons on both devices function independently; the button on either device can enable/disable power on the system.

Chapter 3: Operation

This chapter describes how to operate the Adept T20 pendant. Before proceeding, you need to perform the steps covered in the Installation and Setup chapter.

3.1 Using the Pendant Controls and Indicators

Figure 3-1. T20 Pendant Controls and LEDs

Table 3-1. Adept T20 Pendant Controls and LEDs

Control	Description
Buttons/Switches	
E-Stop Button	Press to stop program execution and turn off high power immediately. If the robot is equipped with brakes, activates the brakes.
Robot Power Button and Light	Press to toggle between high power ON and OFF. Unlike the emergency stop switch, when turning OFF high power, a controlled stop is initiated, where the robot is decelerated under software control. After the robot has stopped, power is turned OFF. When robot power is ON, this button is lit.
F1 - F4 Function Buttons	When using the display screen, press the function key (F1 to F4) that appears under the soft key you want to select. For example, from the Home screen, press F1 to select the Disp (Display) function.
Speed +/ Speed - Buttons	Press to increase or decrease, respectively, the robot speed as a percentage of the maximum monitor speed. The current robot speed is displayed in the Speed indicator on the right side of the display screen.
Jog Mode Button	Press to cycle through COMP, Joint, World, Tool or Free modes, and then return to COMP mode. The currently selected mode is displayed in the Jog Mode indicator on the left side of the display screen.
Slow Button	Press to toggle between slow speed and normal speed. While slow speed is active, press Speed + and Speed - to select a robot speed within the slow speed range, which is from 0 to 25% of the normal robot speed. Press the Slow button again to return to normal speed.
Joint/Axis Control Buttons	Press a "+" button to move a joint or a Cartesian coordinate in the positive direction. Press a "-" button to move in the negative direction.These buttons work all the time while power is on and a jog mode is selected. Multiple joints or Cartesian coordinates can be moved simultaneously by pressing multiple buttons.
Select Robot Button	When more than one robot is connected to the Adept SmartController EX, press to cycle through the available robots. The currently selected robot is displayed in the selected robot indicator on the display screen.
Menu Button	Press to display the Home screen on the display screen.
OK Button	Press to select a setting to be changed or to implement a change.
Cancel Button	Press to return to the previous screen.
Arrow Keys	Press to make selections or to scroll through lists.
LEDs	
ACE	When lit, indicates that the pendant is communicating with Adept ACE.
ERR	(Error) When lit, indicates that an error has occurred.
JOG	When lit, indicates that the Joint/Axis control buttons are available to move the robot. Also indicates that the system is not in COMP mode.

3.2 Enable Switch

The pendant is equipped with a 3-position enable switch. The enable switch is located on the back of the pendant, as shown in the following figure.

Figure 3-2. 3-Position Enable Switch

The switch is a 3-position type, where the full-out and full-in positions disable all outputs, as shown in the following table. In order to enable high power in Manual mode, the switch must be activated. For details, see Turning Robot Power ON on page 20.

Table 3-2. Enable Switch Positions on Pendant

Position	Function	Enable Switch	Contacts
1	home position	not pressed (open)	enabling outputs are open
2	enabling	partially pressed (half way or in middle position)	outputs are closed
3	panic	fully pressed (closed)	enabling outputs are open

3.3 Turning Power ON and OFF

This section discusses how to turn the power on and off in both auto and manual modes, as well as after an E-stop is pressed.

NOTE: When power is disabled, the pendant automatically changes back to COMP mode. Note that:

- When power is off, the pendant cannot change out of COMP mode.
- The Power button is functional even when the screen saver is on (pressing

any key, except the Power button, only clears the screen saver).

Turning Robot Power ON

The Robot Power light reflects the same blinking as the Front Panel: Fast blink when “enable” released in manual mode; slow blink when the “Power button must be pushed after an ENABLE POWER command” feature is enabled in the controller configuration.

> **NOTE:** The controller feature is not currently supported when the pendant is being used as the Front Panel.

In Auto Mode

1. Make sure the Auto/Manual mode key switch on the Front Panel (if present) is set to Auto mode.
2. Press Robot Power on the pendant. After a few seconds, high power to the robot turns on, and the Robot Power button on the pendant lights.

In Manual Mode

> **NOTE:** When enabling power in manual mode, the pendant will display a notification screen that requests that user push and hold the “enable” switch. For details on the enable switch location, see Enable Switch on page 19.

1. Make sure that the Auto/Manual key switch on the Front Panel (if present) is set to Manual mode. If any errors occur, the ERR LED lights. Press Clear on the display screen to clear errors.
2. Press Robot Power on the pendant.
3. Press the pendant enable switch to the middle position. After a few seconds, high power to the robot turns on, and the Robot Power button on the pendant lights.

After an E-Stop

To turn ON high power after pressing the pendant emergency stop switch, perform the following procedure:

1. Turn the emergency stop switch to the right (clockwise). The switch is spring loaded and will return to its normal position. If any errors occur, the ERR LED lights. Press Clear on the display screen to clear errors.
2. Press the pendant enable switch to turn ON high power.

After Enable Switch Is Released

When the system is set to Manual mode and you release the enable switch (or select the "panic" position), the system turns off in a controlled manner. This puts the system in a different state than when the E-Stop button is pressed.

To turn ON high power in this situation, perform the following procedure:

1. Press the enable switch. If any errors occur, the ERR LED lights. Press Clear on the display screen to clear errors.
2. Press Robot Power to turn ON high power.

Turning OFF Power from the T20 Pendant

You have three options for turning OFF power from the pendant:

- Press Robot Power
- Press the E-Stop button
- Release the enable switch (this option is only available when the system is in Manual mode)

3.4 User Interface Operation

This section describes how to use the T20 user interface to control the pendant.

User Interface Controls

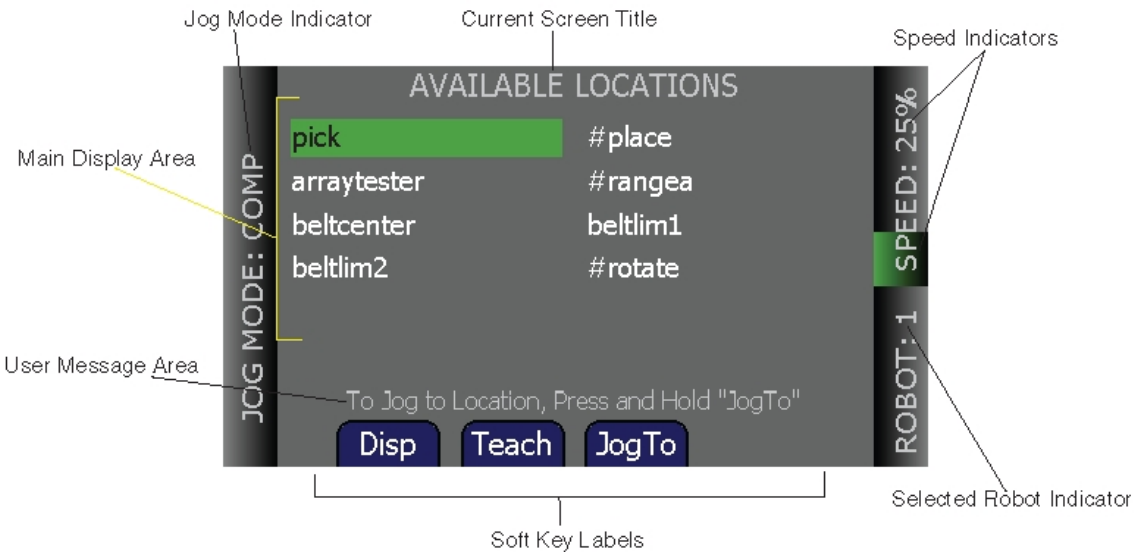


Figure 3-3. T20 Pendant Indicators

Table 3-3. T20 Pendant Indicators

Indicator	Description
Jog Mode Indicator	Displays the currently selected Jog Mode: COMP (computer), Joint, World, Tool, or Free. **NOTE:** This indicator flashes when the jog mode changes.
Current Screen Title	Displays the name of the currently displayed screen.
Speed Indicator	Displays the current robot speed as a percentage of maximum pendant speed. Also, the green speed gauge increases or decreases in size to indicate higher or lower robot speed, respectively. **NOTE:** While slow speed is active, maximum slow-mode speed is 20% of maximum pendant speed. The slow speed control is non-linear.
Main Display Area	Displays information about the robot and errors.
User Message Area	Displays user messages, such as operating instructions.
Soft Key Labels	Displays the labels of the soft keys associated with the currently displayed screen.
Selected Robot Indicator	Displays the currently selected robot. The currently selected robot is the robot that can be moved and monitored by the software. (This indicator is only applicable when more than one robot is connected to the Adept SmartController EX.) **NOTE:** This indicator flashes when the robot number changes.

User Interface Flow Diagram

The following diagram shows the flow of the T20 pendant user interface. Please note the following:

- The Home button always returns you to the T20 pendant user interface Home screen. For details, see the next section.
- The Cancel button always takes you "back" one screen (up one level in the diagram). Additionally, in the case of the “Expanded Array” screens, these continue to repeat, if there are arrays within arrays. At each level, pressing the Cancel button will back up exactly one level.
- The software incorporates a "key blocking" feature, which ignores continued key inputs while the pendant is processing the current input. This is most notable during the “Power On” sequence, which may take a few seconds during which the pendant will not respond.This prevents the pendant from suddenly executing a series of queued-up inputs, if you have moved on to a different command screen.

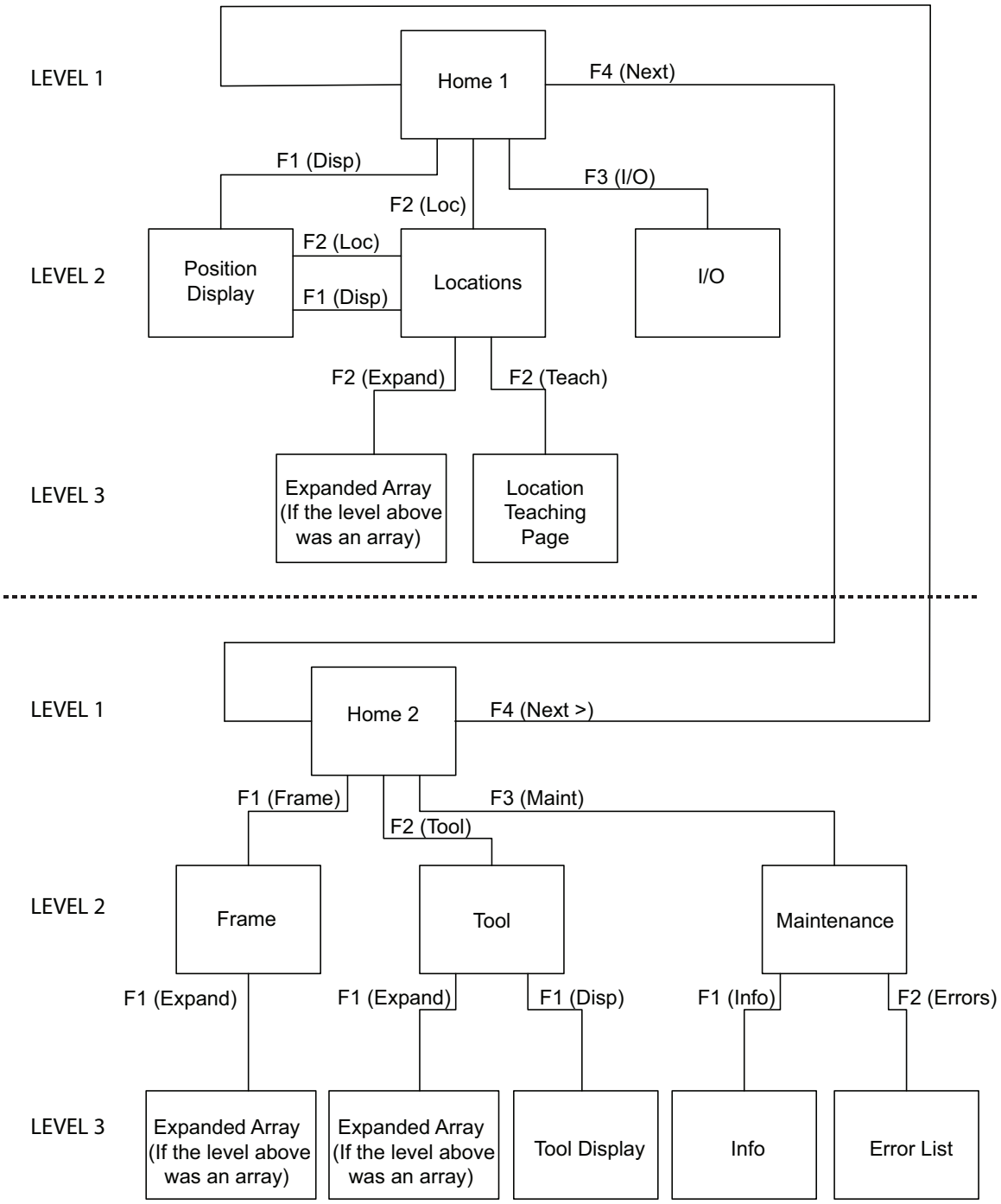


Figure 3-4. User Interface Flow Diagram

Displaying the Home Screen

Pressing the Menu button on the Adept T20 pendant, displays the Home screen as shown below.

Figure 3-5. Home Screen

The table below describes the soft keys shown on the Home screen. The soft keys are used for quick access to the different screens and functions on the Adept T20 pendant.

Soft Key	Description
Disp	Accesses the current World or Joint position screens. It also allows you to open and close the gripper.
Loc	Accesses the available locations and associated commands (such as a pick or place), Teach, JogTo, Align and New functions.
I/O	Accesses the Type and Toggle functions, which allow you to select the type of I/O and toggle the selected signal on or off.

Press **Next>** to access the second Home screen, which displays additional soft keys.

Figure 3-6. Home Screen 2

The table below describes the soft keys shown on the second Home screen.

Soft Key	Description
Frame	Allows displaying available frames and selecting a frame for movement.
Tool	Allows displaying available tools and displaying and setting the current tool.
Maint	Accesses the system maintenance, Smart Locations, firmware update and error functions on the pendant.
Next >	Returns to the main Home screen.

3.5 Using the Jog Controls

The jog control allows you to position the selected robot. The following jog control modes are available in the following order: COMP (computer), Joint, World, Tool, and Free. When high power is enabled and the robot is calibrated, press Jog Mode to step through these modes in sequential order. The selected mode is displayed in the Jog Mode indicator. When any of these modes (except COMP) is active, the Jog LED lights. You can use the jog control feature while any of the software screens are displayed.

COMP Mode

In COMP mode, an executing program or the system terminal has control of the robot. To select COMP mode, press the Jog Mode button until COMP is displayed in the Jog Mode indicator.

NOTE: You cannot use jog control to move a robot while in COMP mode.

Joint Mode

When Joint mode is selected, movement is about the axis of the specified joint. The following figure shows an Adept SCARA robot with three rotational joints (Joints 1, 2, and 4) and one translational joint (Joint 3). Positive rotation of Joints 1 and 2 is counterclockwise as viewed from above. Positive rotation of Joint 4 is clockwise as viewed from above. Positive movement of Joint 3 is downward.

Different robots or motion devices will have different joint numbers assigned to their joints. When you first move an unfamiliar robot using Joint mode, set the monitor speed to 10 or lower, put the robot in a safe area, and carefully move the robot using the different joint numbers to verify how the pendant moves the robot. See the documentation for the motion devices you are using for details on their joint assignments.

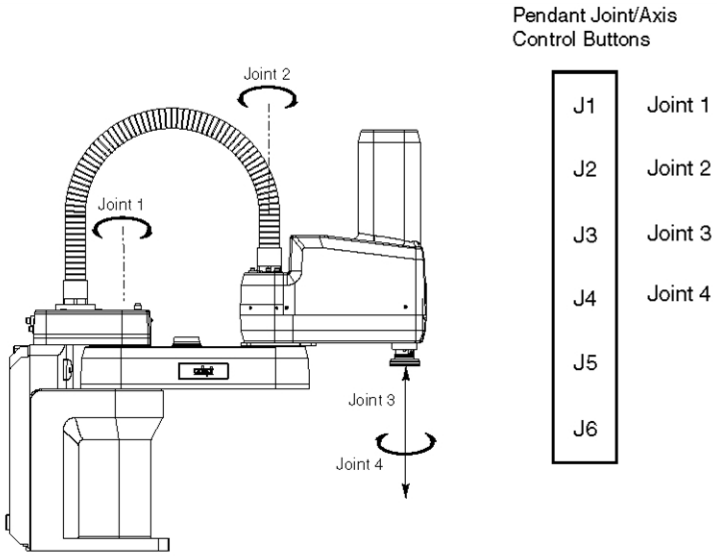


Figure 3-7. Joint Mode (Four-Axis Adept Cobra Robot Shown)

To position the robot while in Joint mode:

1. Press the Jog Mode button until Joint is displayed in the Jog Mode indicator.
2. Press and hold the “+” button to move the robot joint in the positive direction; press and hold the “–” button to move the robot joint in the negative direction.

World Mode

When World mode is selected, movement in the X, Y, or Z direction is parallel to an axis of the World coordinate system.

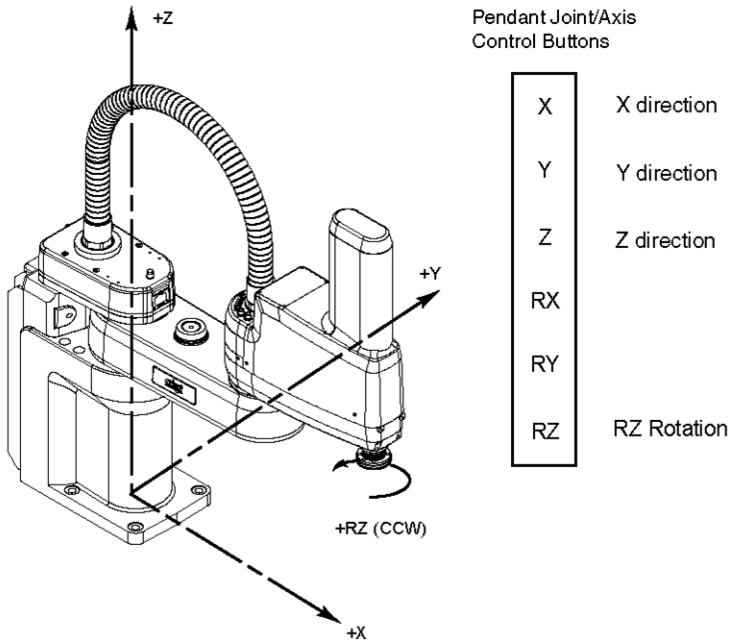


Figure 3-8. World Mode (Four-Axis Adept Cobra Robot Shown)

To position the robot while in World mode:

1. Press the Jog Mode button until World is displayed in the Jog Mode indicator.
2. Press and hold the "+" button to move the robot tool flange in the positive direction; press and hold the "–" button to move the flange in the negative direction

Tool Mode

When Tool mode is selected, movement in the X, Y, or Z direction is along an axis of the Tool coordinate system. The Tool coordinate system is centered at the robot tool flange with the Z-axis pointing away from the flange. On most robots, the positive X-axis is aligned with the center of the tool flange key way.

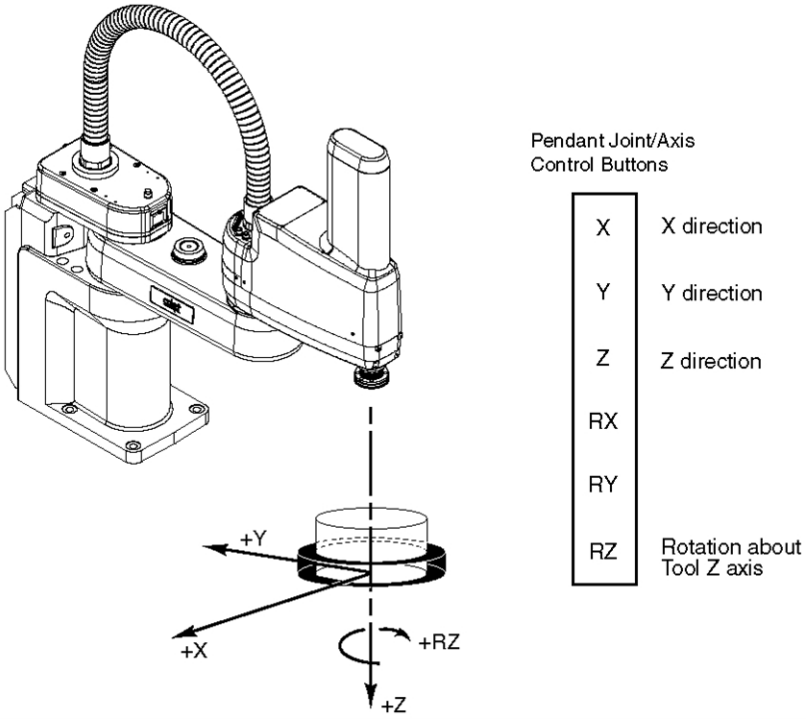


Figure 3-9. Tool Mode (Four-Axis Adept Cobra Robot Shown)

NOTE: The above drawing assumes that the tool transformation is set to null (all values are 0). If a tool transformation is in effect, the tool coordinate system will be offset and rotated by the value of the tool transformation. Any motion in Tool mode will now be relative to the offset coordinate system, and not the center of the tool flange.

To position the robot while in Tool mode:

1. Press the Jog Mode button until Tool is displayed in the Jog Mode indicator.
2. Press and hold the "+" button to move the robot tool flange in the positive direction; press and hold the "–" button to move the flange in the negative direction. In a four-axis robot, positive rotation of the gripper (RZ) is clockwise as viewed from above.

Free Mode

When Free mode is selected, the motor torque will be zeroed and the brake (if any) for the selected joint will be released. You can make multiple selections with the Joint/Axis control buttons to release as many joints as required.

To select Free mode, press the Jog Mode button until Free is displayed in the Jog Mode indicator. As soon as another jog control mode is selected, all joints are returned to servo control and will not move freely.

On some robots, Free mode is disabled for some of the joints.

The joint assignments in Free mode are the same as the joint assignments in Joint mode. See the preceding figure.

WARNING: When a joint is selected using the Joint/Axis control buttons while in Free mode, the corresponding joint is released and moves freely (in some mechanisms, multiple joints may be released). In many cases, the weight on the joint will be sufficient to move the joint and cause equipment damage or injury to personnel in the workspace.

3.6 Speed Control

You can change the robot speed using the Speed +, Speed -, and Slow buttons. The selected speed will be applied when you use the jog controls to move the robot.

While Slow speed is active, a red horizontal line and hash marks are displayed in the part of the speed indicator above 20%, showing that you cannot increase the speed beyond 20%.

NOTE: The slow speed control is non-linear.

Figure 3-10. Speed Indicator (Slow Mode)

3.7 Position Display

To display coordinate information about the robot's current position, press Disp. The coordinates for the robot's current location are displayed.

Figure 3-11. Position Display, World Coordinates

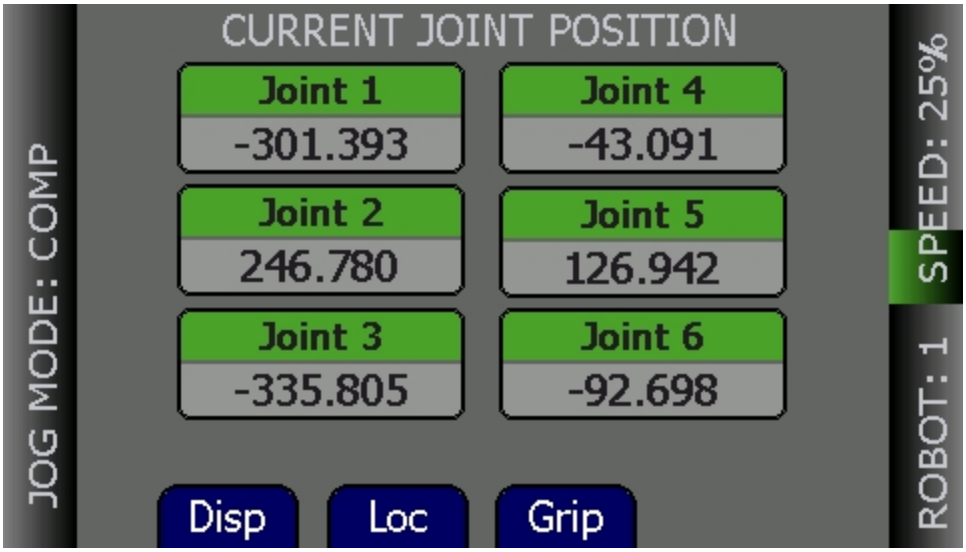


Figure 3-12. Position Display, Joint Coordinates

- Press Disp to toggle the display between the World and Joint coordinate systems.
- Press Grip to open and close a gripper installed on the tool flange. The signals for the gripper are configured in the Adept ACE software Gripper object signals. (For details on

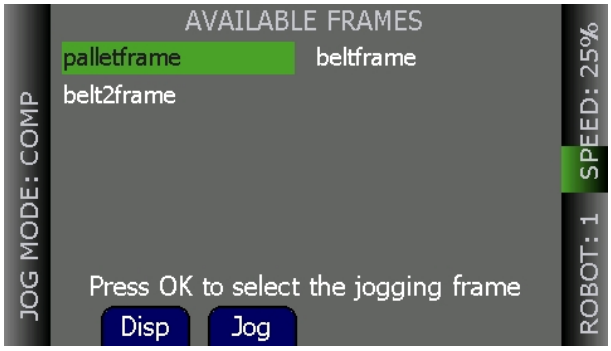
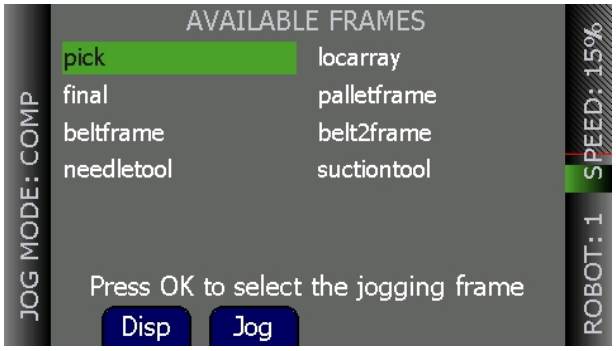
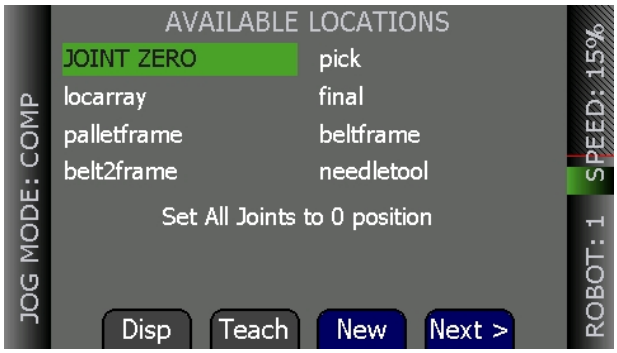
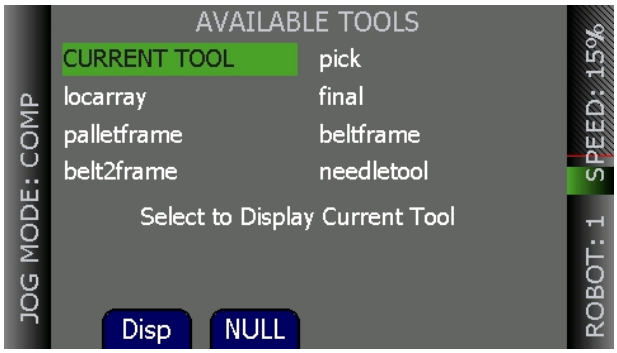
the Gripper object, see the corresponding topic in *Adept ACE User's Guide*.)

- Press Loc to display the Available Locations screen.

3.8 Smart Locations

A pendant option, called "Smart Locations" (which is available on the Maintenance screen), shows all locations that have the string "tool" in them on the Available Tools screen, all locations that have the string "frame" in them in the Available Frames screen, and all locations that don't match "tool" or "frame" in the Available Locations screen. If the option is disabled, all locations are shown on all three screens. See the examples in the following table.

Table 3-4. Smart Locations Enabled versus Disabled

Smart Locations Enabled	Smart Locations Disabled
	
	
	

3.9 Available Frames

The Available Frames screen is used to set the jog mode relative to the selected frame. This is the only way to enter the "frame" jog mode. When this is done, the jog controls will move the robot in relation to the selected frame, rather than the World coordinates (robot base).

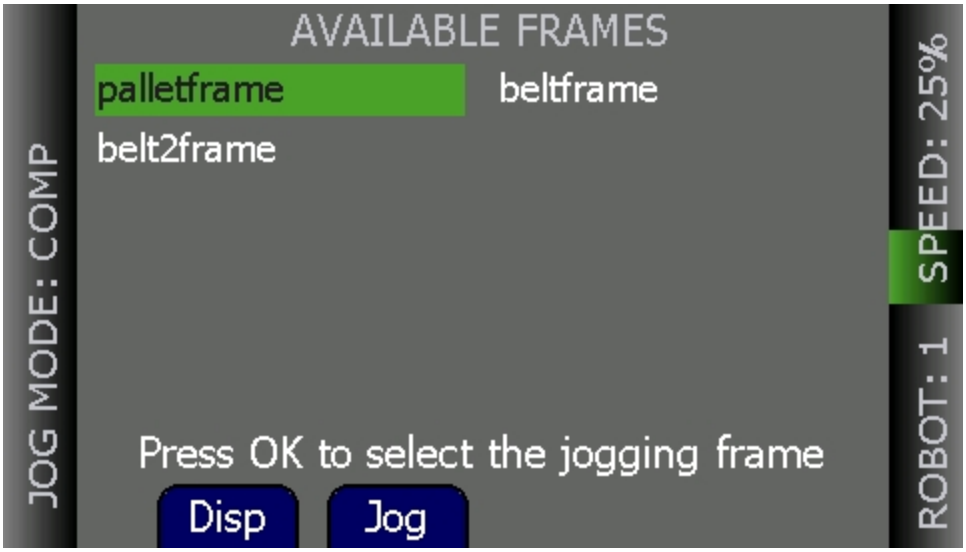


Figure 3-13. Available Frames Screen

NOTE: Once you use "Jog Mode" to cycle to another jog mode, you cannot return to "Frame" mode again without going back to this screen.

To enable jogging based on an available frame:

1. From the Home 2 screen, press Frame (F1). The Available Frames screen opens.
2. Use the arrow keys to select the desired frame.
3. Press the Jog (F2) key to enable jogging along the selected frame.

The system will now jog in "frame" mode (this is displayed as JOG REL: <FrameName>).

A Note about Frame-mode Jogging

When locations are "taught" while in frame-jogging mode (see the previous section), they are taught relative to the selected frame. When locations are "jogged to" while in frame-jogging mode, they are jogged relative to the currently-selected frame.

This feature was designed to allow you to teach, and then jog to locations relative to another frame, such as a "palette", all from the pendant. However, it does provide the opportunity for confusion: The most likely user error here would be to teach a position in "JOG REL: XXX", then change jog modes, and later try to jog to the new position while in world mode – this would produce either no movement (if the position is unreachable) or, possibly, movement to an arbitrary location, because the relative frame is no longer involved.

3.10 Available Tools

The Available Tools screen provides the ability to view and set a tool transformation (or offset).

Figure 3-14. Available Tools Screen

While on this screen, you can:

- Press Disp (F1) to display the value of the selected tool transformation (you can select CURRENT TOOL to display the current tool transformation). After you display a tool (other than current tool), pressing Disp (F1) will then toggle between that tool and the current tool, which allows you to see if it is the selected tool.
- Set a tool—select the desired tool from the list and press OK to set it.
- Press Null (F2) to set the current tool transformation (or offset) to null tool (no tool offset frame in use).

3.11 Location Teaching

Press the Loc soft key from the pendant Home screen to display the Available Locations screen shown below.

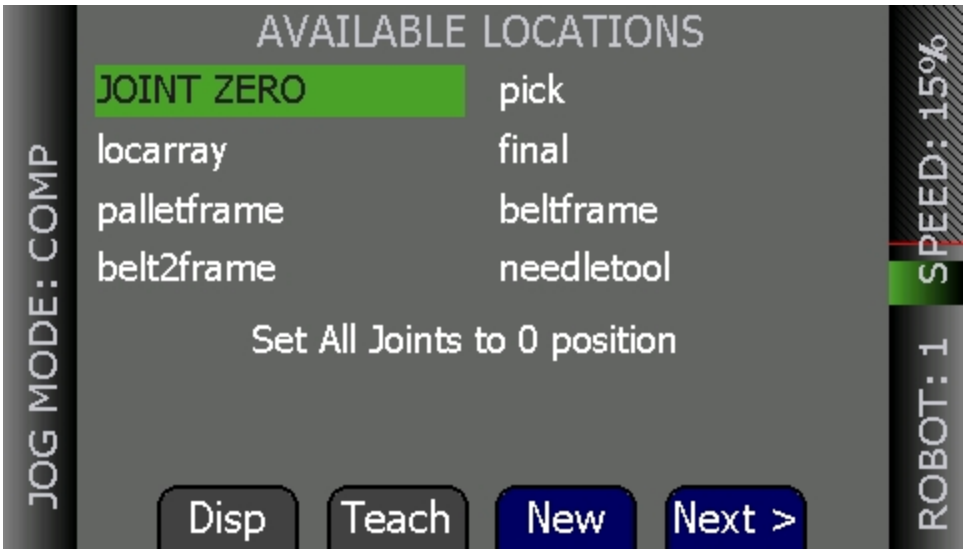


Figure 3-15. Available Locations Screen 1

Figure 3-16. Available Locations Screen 2

The table below describes the soft keys shown on the Available Locations screens.

Soft Key	Description
Disp	Shows the current position of the robot.
Teach	Teaches the current position to the selected location.
New	Creates a new location named pendant.loc[X] where X is the first available value (1,2,3...).

Soft Key	Description
JogTo	Press and hold to move (jog) the robot to the selected position.
Appro	Press to bring the robot to the approach position for the selected location. The approach position is the location less "A" mm along the Z-axis of the tool transformation (or offset), where "A" is the approach distance set on the Maintenance screen.
Align	Aligns the robot tool Z-axis with the nearest world axis.
Next >	Goes to the next Location screen.

To teach a location:

1. From the Available Locations screen, press the arrow keys to select the desired location from the list of locations.
2. Press Teach. The Teach screen opens for the selected location.
3. Use the jog controls to position the robot at the desired location.
4. When the robot is in the desired location, press OK to "teach" the position.

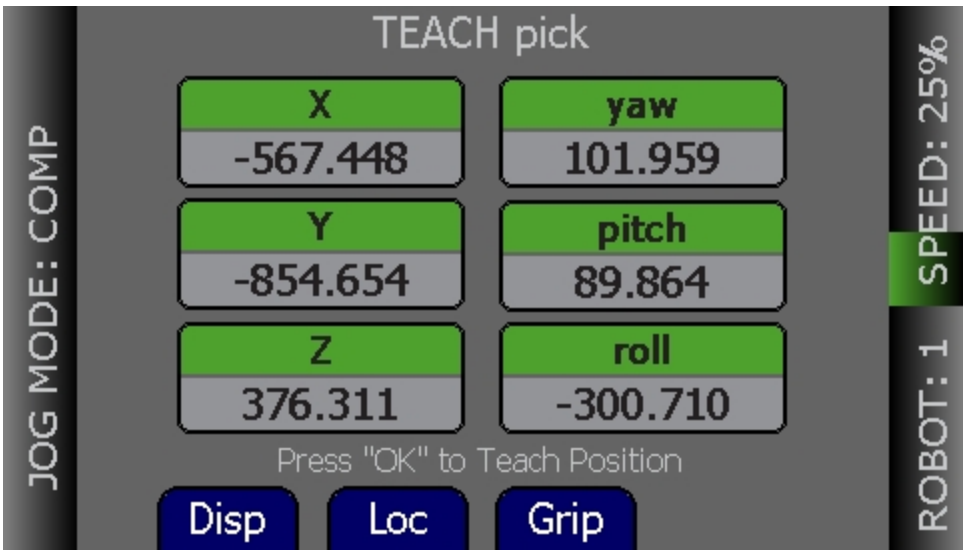


Figure 3-17. Teach Screen

To select an array:

1. From the Available Locations screen, press the up/down arrow buttons to select the desired array, and then press Expand. The valid members of the selected array are displayed.
2. Press the up/down arrow buttons to select the desired location. Press Cancel to return to the previous screen.

Adding Approach Distance

You can specify an approach distance through the Maintenance screen. For details, see Setting the Approach Distance on page 41.

After the approach distance is set, you can use the Appro soft key to bring the robot to the approach position for the selected location. The approach position is the location less "A" mm along the Z-axis of the tool transformation (or offset), where "A" is the approach distance set on the Maintenance screen.

Using Jog To

Use Jog To to move the robot to a selected location (stored in memory).

To jog the robot to a location:

1. Press Loc from the Home screen to display the Available Locations screen.
2. Press the arrow buttons to select the desired location.
3. Press and hold Jog To until the robot is at the desired location. Release the button.

NOTE: The predefined JOINT ZERO location, sets the robot to #PPOINT (0,0,0,0,0,0).

Align

Align works with Adept Viper robots. While the Available Locations screen is displayed, you can select a location and then press Align to align the nearest axis of the tool transformation (or offset) to the Z axis.

NOTE: Align is only available for six-axis robots, like the Adept Viper robots.

NOTE: In addition to the green Joint/Axis control buttons, the Jog To and Align functions are the only functions available for moving the robot.

3.12 I/O Signals

Press I/O on the Home screen to display the screens used to control I/O signals. The I/O signals feature allow users to toggle outputs ON (active, high) and OFF (inactive, low). Round icons represent input signals; square icons represent output signals. The available signal types are: digital output, digital input, soft, and robot.

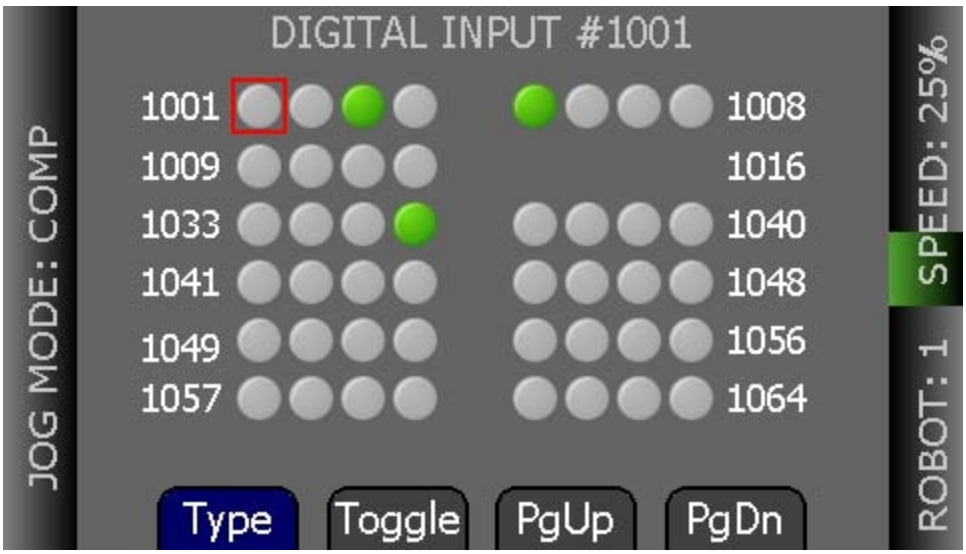


Figure 3-18. DIGITAL INPUT Screen

After pressing I/O, perform the following steps to control I/O signals.

1. Press Type to cycle through the available signal types until the desired signal type is displayed. The current signal type and the selected signal number are displayed at the top of the screen.
2. Press the arrow buttons to select the desired signal. The selected signal is identified by a red outline. If more than one row of signals is available, press the up/down arrow buttons to scroll through the rows of signals. If more than one screen full of signals is displayed, press PgUp (Page Up)/PgDn (Page Down) to scroll through the signals.
3. For output signals, press Toggle to turn the selected signal ON or OFF.

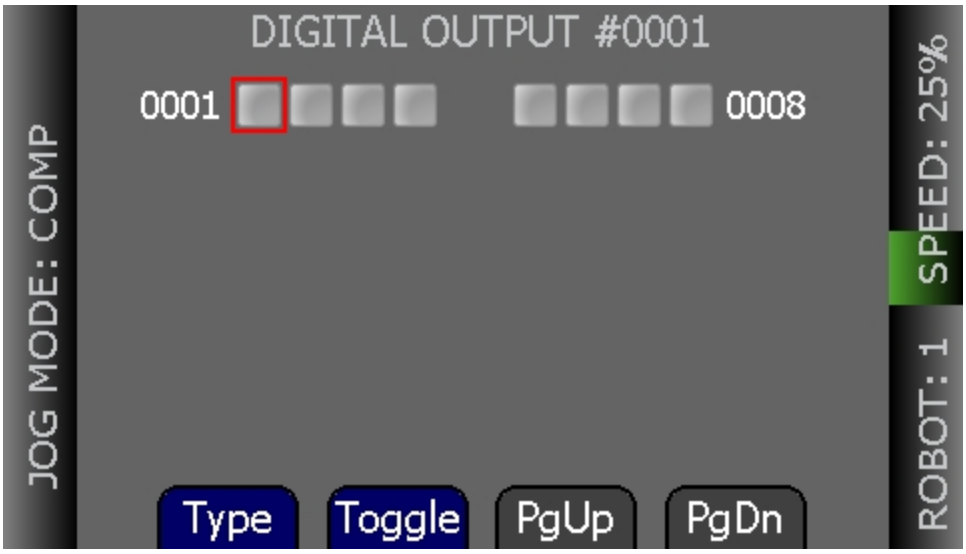


Figure 3-19. DIGITAL OUTPUT Screen

3.13 Displaying and Clearing Errors

When errors occur, the ERR LED lights and a screen describing the error is displayed. Press Clear to clear the error information.

While the error screen is displayed, all buttons other than Clear are disabled.

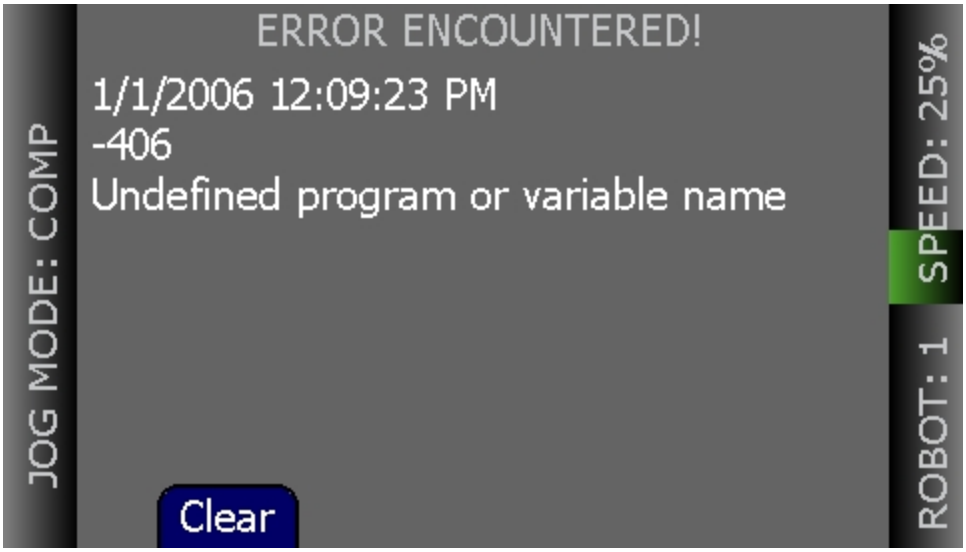


Figure 3-20. ERROR ENCOUNTERED Screen

NOTE: When the controller does not respond within a specified amount of time, a "Communication Timeout" will be displayed as a critical error, which requires a reboot.

Displaying Recent Errors

You can display a list of errors that have occurred since the pendant was last powered up. For details, see Displaying Recent Errors on page 43.

Chapter 4: Maintenance

This chapter describes how to use the screen saver, update the pendant's firmware, troubleshoot problems and maintain the pendant.

4.1 The System Maintenance Screen

The System Maintenance screen is used to set various pendant options, obtain information on the system, and view the errors log.

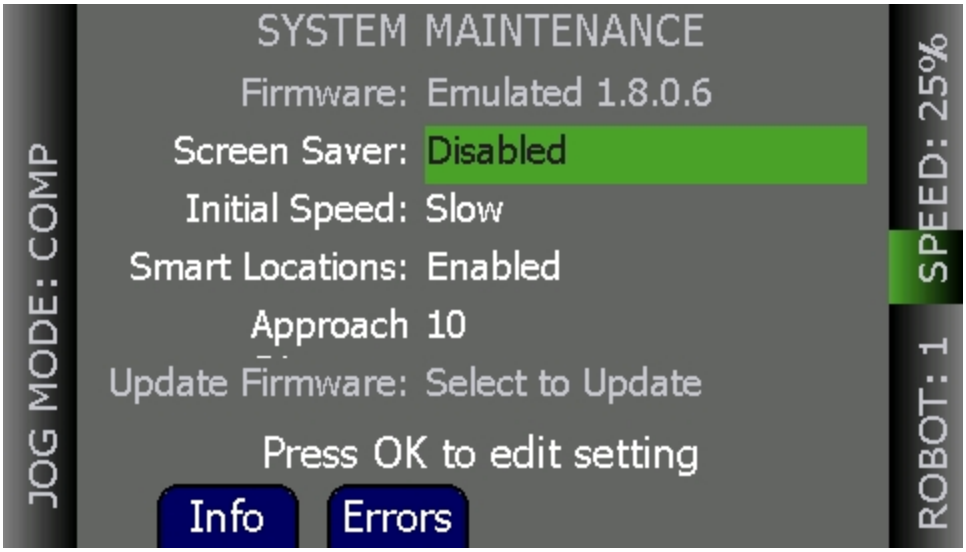


Figure 4-1. System Maintenance Screen

The table below describes the options shown on the System Maintenance screen.

Option	Description
Screen Saver	Enables/disables the screen saver and sets the screen-idle time (Disabled, One Minute, Two Minutes, Five Minutes, Ten Minutes, Twenty Minutes, One Hour). For details, see Using the Screen Saver on page 40.
Initial Speed	Sets the default speed used when the system starts up (Slow, Normal). For details, see Setting the Initial Speed on page 40.
Smart Locations	Enables/disables the Smart Locations feature, which organizes the locations by type. For details, see Enabling the Smart Locations on page 41.
Approach	Sets the approach distance (1 mm - 200 mm). For details, see Setting the Approach Distance on page 41.
Update Firmware	Updates the pendant firmware. For details, see Updating the

Option	Description
	Pendant Firmware on page 41.

The table below describes the soft keys shown on the System Maintenance screen.

Soft Key	Description
Info	Accesses a screen that displays the system information from the Adept controller. For details, see Displaying System Information on page 42.
Errors	Accesses the error log. For details, see Displaying Recent Errors on page 43.

4.2 Using the Screen Saver

You can enable a screen saver and specify the length of time without activity before the screen saver is activated.

To use the screen saver:

1. From the Home screen, press Next to display Home screen 2.
2. Press Maint. The System Maintenance screen opens.
3. If necessary, press the up/down arrow buttons to select the Screen Saver field. Press OK.
4. Press the up/down arrow buttons to select the length of time before the screen saver is activated. To turn OFF the Screen Saver, select Disabled.
5. Press OK to accept the change; press Cancel to revert to the previous setting.

NOTE: For maximum screen life, it is strongly recommended that you do not disable the screen saver.

4.3 Setting the Initial Speed

You can specify "Normal" or "Slow" as the default speed setting when the system starts up. "Normal" is the default setting. For more details, see Using the Pendant Controls and Indicators on page 17.

To select the initial speed:

1. From the Home screen, press Next to display Home screen 2.
2. Press Maint. The System Maintenance screen opens.
3. Press the up/down arrow buttons to select the Initial Speed field. Press OK.
4. Press the up/down arrow buttons to select either "Normal" or "Slow" for the initial speed.
5. Press OK to accept the change; press Cancel to revert to the previous setting.

4.4 Enabling the Smart Locations

The Smart Locations option allows you to view tool, frame and general locations on separate pages. For more details on this option, see Smart Locations on page 31.

To enable the Smart Locations option:

1. From the Home screen, press Next to display Home screen 2.
2. From the Home 2 screen, press Maint (F3). The System Maintenance screen opens.
3. From the Maintenance screen, use the arrow up/down keys to select the Smart Locations option. Press OK.
4. Use the arrow up/down keys to select Enabled.
5. Press OK to accept the change; press Cancel to revert to the previous setting.

4.5 Setting the Approach Distance

You can specify the approach distance, which is used by the robot when moving to a location. For details on teaching locations, see Location Teaching on page 33.

To select the approach distance:

1. From the Home screen, press Next to display Home screen 2.
2. Press Maint. The System Maintenance screen opens.
3. Press the up/down arrow buttons to select the Approach field. Press OK.
4. Press the up/down arrow buttons to select a value between 1 mm and 200 mm.
5. Press OK to accept the change; press Cancel to revert to the previous setting.

4.6 Updating the Pendant Firmware

To update the pendant firmware:

1. Turn OFF power to the Adept SmartController EX or disconnect the Adept T20 pendant from the Adept SmartController EX (see Installation on page 14).
2. Insert a Micro SD card containing the firmware update files and "T20UpdatePackage.dat" into the pendant. Make sure the files are located under the following path and folder name: "\T20Update".
3. Reapply power to the Adept SmartController EX, or reconnect the Adept T20 pendant to the Adept SmartController EX, depending on how you removed power.
4. After the pendant reboots, from the Home screen, press Next to display Home screen 2.
5. Press Maint. The System Maintenance screen opens.
6. Press the up/down arrow buttons to select the Update Firmware field.

Figure 4-2. Location for Inserting Micro SD Card in Pendant

7. Press OK. A screen displaying status messages about the update will be displayed. The messages will indicate that the system was able to detect the firmware update and that the firmware update was successfully verified.
8. Press OK. The firmware will be copied to the pendant.
9. After the update has completed, the pendant reboots automatically.

If you encounter any problems while updating the firmware, check the following:

- Make sure the Micro SD card is fully inserted in the pendant and that you reboot the pendant after inserting the Micro SD card.
- Make sure the firmware update files are stored in a folder named "T20Update" on the Micro SD card.
- The update package performs a checksum test to verify the contents of the update files. If any of the files are corrupted, the update package will fail to verify the contents. If this error occurs, obtain new update files from Adept and perform the firmware update again. See How Can I Get Help? on page 10.

NOTE: In the event a firmware update fails, you can operate the pendant using the factory-installed firmware, which is always present on the pendant.

4.7 Displaying System Information

The Information screen displays identity information about components of the system, as returned by the "ID" monitor command. See the *eV+ Operating System Reference Guide* for details.

Additionally, it displays the IP address of the connected controller.

To access the Information screen:

1. From the Home screen, press Next to display Home screen 2.
2. From the Home 2 screen, press Maint (F3). The System Maintenance screen opens.
3. From the Maintenance screen, press Info (F1). The following screen opens.

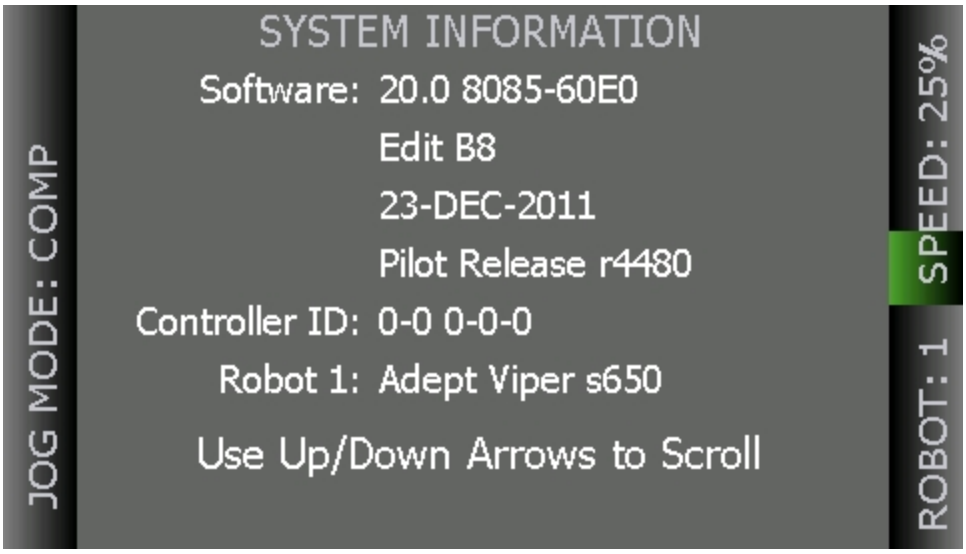


Figure 4-3. System Information Screen

4.8 Displaying Recent Errors

You can display a list of errors that have occurred since the pendant was last powered up.

To display recent errors:

1. From the Home screen, press Next to display Home screen 2.
2. Press the Maint soft key followed by Errors (F2). The Recent Errors screen opens.
3. If necessary, press the up/down arrow buttons to select the error of interest.
4. Press Detail to display details about the selected error.

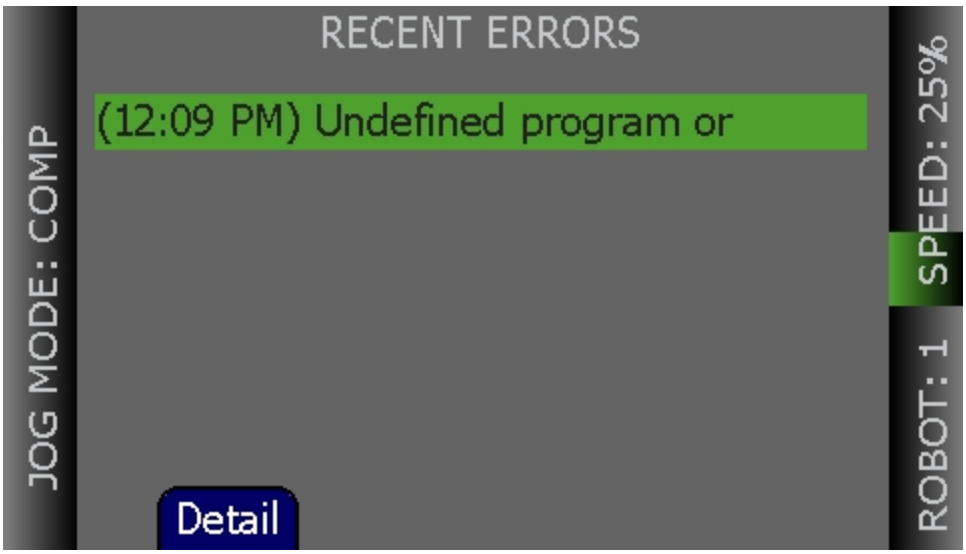


Figure 4-4. RECENT ERRORS Screen

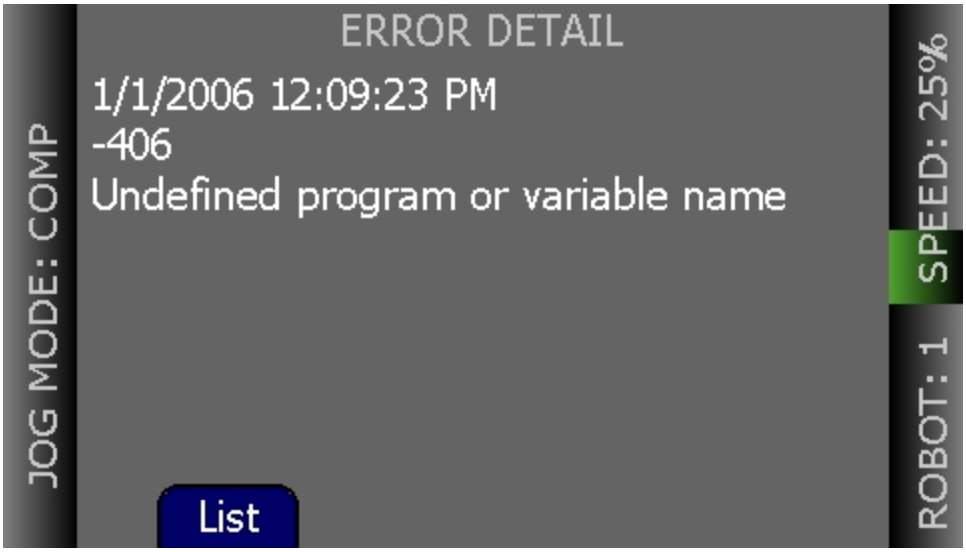


Figure 4-5. ERROR DETAIL Screen

5. Press List to return to the RECENT ERRORS screen.

4.9 Troubleshooting

This section provides information on how to correct problems encountered while using the Adept T20 pendant.

Critical Error

If you encounter a critical error, a message describing the error will be displayed. To correct the error, try rebooting the pendant by either power cycling the Adept SmartController EX, or by disconnecting the pendant from the Adept SmartController EX and then reconnecting it. If the error persists, contact Adept for assistance.

4.10 Cleaning

To clean the Adept T20 pendant, use a soft cloth dampened with a small amount of water or a mild cleaning agent..

CAUTION: Never clean the Adept T20 pendant display screen or other surfaces with solvents, abrasive cleaners, or scrubbing sponges.

4.11 Periodic Maintenance

Periodically check the protective covers of the Adept T20 pendant to ensure that all housing screws are firmly tightened, and that there is no damage to the cable entry area, sealing plug, or cable strain relief.

Chapter 5: Technical Specifications

5.1 Dimension Drawings

Figure 5-1. Adept T20 Pendant Dimensions

5.2 Pendant Specifications

Table 5-1. Adept T20 Pendant Specifications

Description	Specification
Physical	
Length	224 mm (8.8 in)
Width	162 mm (6.4 in)
Depth	45 mm (1.8 in)
Weight (w/o connector)	480 g (1 lb)
Pendant Cable Length	10 m (32.8 ft)
Adapter Cable Length	3 m (9.8 ft)
Safety Controls	1 Emergency Stop (E-Stop) switch 1 3-position enable switch
Construction/Rating	
Ingress Protection	IP-65
Shock Resistance (operating)	25 g / 11 ms (IEC 60068-2-27)
Display Type	High-resolution color OLED display
Construction	Steel panel housing, blue zinc-coated surface. With-stands grease, oil, alcohol, and lubricants.
Flammability Class	UL 94-V0
Environmental	
Operating Temperature	0° to 45° C (32° to 113° F)
Storage Temperature	-20° to 70° C (-4° to 158° F)
Relative Humidity (non-condensing)	5 to 95%

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