PWS-700X PLC WORKSTATION

APPLICATION MANUAL

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About PWS-700X

A.1 Introduction

The PWS-700X is an intelligent operator panel that provides the same functionality as the PWS-700T, which is the most compact member of the PWS Series PLC Workstations family. The 700X differ from the 700T in the method of operator inputs. The 700X get operator inputs from a set of external key switches instead of a built-in touch panel that the 700T do. You can make your own keypad with up to 16 x 8 key switches for your application and connect it to the EXT port of the 700X. The 700X scan the keypad to get operator inputs and take action accordingly. If your application needs a keypad with unique appearance, prefers the good tactile feeling of mechanical switches, or requires very prompt maintenance for the keypad, PWS-700X is the choice. You can configure the 700X with ADP3, which is a powerfully Windows program that supports all its sister products.

This chapter describes how to configure and install your 700X.

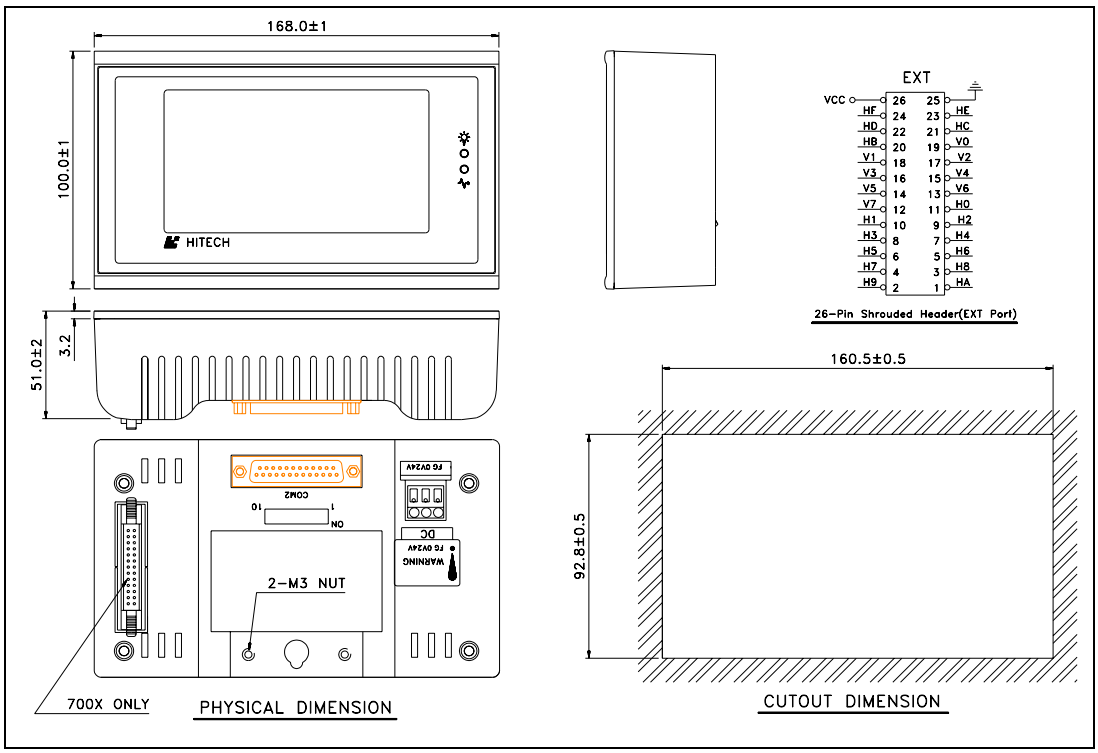
A.2 General Specification

Item	**Description**
Display Type	Blue mode STN LCD
Display Size	4.7" (diagonal)
Number of Pixels	240(H)x128(V)
Display Adjustment	Contrast adjustable by external keys
Back Light	CCFT; Life time is 20,000 hours under normal temperature and humidity
EXT Port	26-pin shrouded header; Connects up to 128 external key switches
Input Power	24VDC±10%; Under 10W
Flash Memory	640K bytes
RAM	128K bytes
Communication Port (COM2)	25-pin D Type; Supports RS232/RS422/RS485
Front Panel Seal	IP65 / NEMA 4
Operating Temperature	0~50°C
Storage Temperature	-20~60°C
Ambient Humidity	20-90% RH (non-condensing)
Vibration Endurance	0.5mm displacement, 10-55Hz, 2 hours per X, Y, and Z-axis directions
Shock Endurance	10g, 11ms three times in each

	direction of X, Y, and Z axes
RF Emissions	CISPR 22, Class A
Electrostatic Discharge	IEC 801-2 Level 3
RF Susceptibility	IEC 801-3 Level 3
High Frequency Transients	IEC 801-4 Level 3
Weight	0.55 Kg
Cooling	Natural cooling

A.3 Dimensions

This section illustrates the dimensions of the 700X as well as the cutout dimensions. The unit of dimensions is millimeter. You should allow 10 cm (4") of clearance behind the workstation for cable connectors and 5 cm (2") above and below for airflow. Method of installation: Unscrew the back cover of PWS, Mount the PWS to the preserved hole from the front side. Attach the back cover of PWS from behind, and fasten the four screws with a screwdriver. Don't tighten the screws with too much force or it may cause a damage of the panel.



A.4 Power Supply and Electrical Grounding

The three-position power connector accepts 24VDC only. The unit's maximum power consumption is 10 watts at 24VDC. The

rating of fuse is 0.5A.

You must make sure that your 700X is properly connected to earth ground. You must properly ground your 700X to prevent it from radiating radio frequency noise.

If you connect a communications cable to your unit after static electricity has built up or when the 700X and the other device are on different grounds, the resulting discharge could damage the electronics in either device.

A.5 Connecting External Key Switches

The EXT port on the 700X is for the connection of external key switches. The type of connector is shrouded header. The pin assignment of the EXT port is shown in the following table.

EXT port

+5V*	26	25	GND*
HF	24	23	HE
HD	22	21	HC
HB	20	19	V0
V1	18	17	V2
V3	16	15	V4
V5	14	13	V6
V7	12	11	H0
H1	10	9	H2
H3	8	7	H4
H5	6	5	H6
H7	4	3	H8
H9	2	1	HA

* Consult the factory if you want to use these two pins

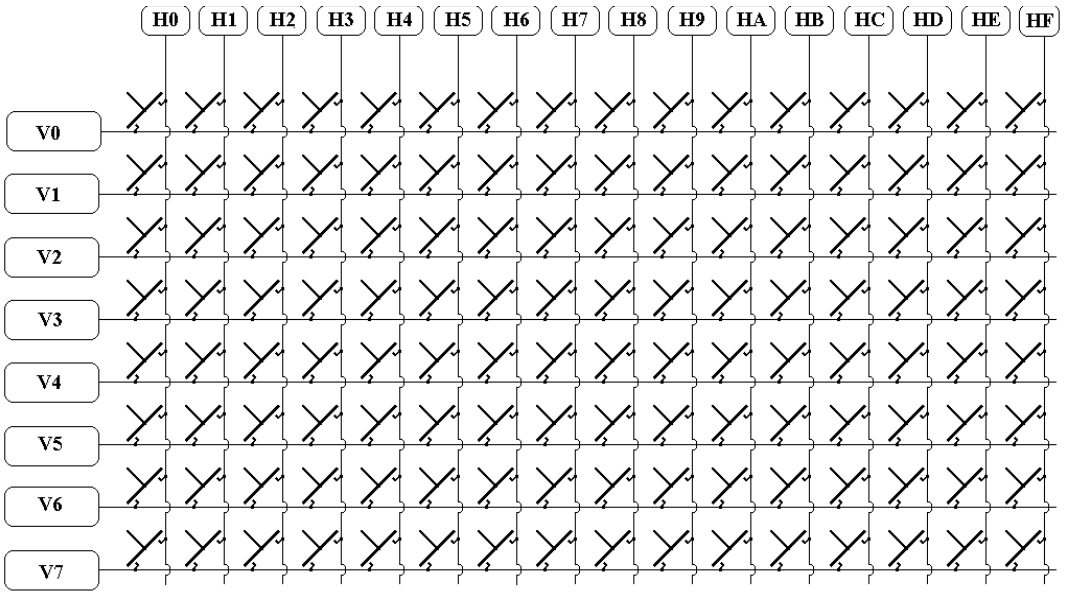


Figure A-1 Schematic diagram of a keypad with 128 key switches

The EXT port can connect up to 16 x 8 key switches as shown in the Figure A-1. The 700X scan external key switches by sending signals on pin V0-V7 and reading signals on H0-HF. For example, the 700X scan the switches on line V1 by lowering the voltage level of V1 while keeping the voltage level of V0 and V2-V7 high. If at this moment the switch

locates at the intersection of V1 and H5, which will be labeled as K51 in section A.6, is pressed to close lines V1 and H5, the 700X reads 1111101111111111B on the H0-HF that indicates K51 is pressed. Lines V0-V7 are driven by a 7406 open collector buffer and are pulled up to 5 volts by a 150K resistor when shorted to H0-HF.

Warning: As there is no protection circuitry built inside the 700X unit for the EXT port, you should take care of the problem of static discharge, noise coupling, leaking current from other devices, by yourself. It is also important to limit the trace distance between any switch and any pin of the EXT port within 60 cm.

A.5.1 Labels of External Key Switches

In order to identify external key switches of the 700X, we label each key as shown in Table A-1. Keys K00 through K35 and K80 through KA7 are user configurable keys and you can assign these keys as common keys of your application, auxiliary keys of application screens, or external keys of screen objects. The other keys are reserved for system use.

		H 0	***H 1***	***H 2***	***H 3***	***H 4***	***H 5***	***H 6***	***H 7***	***H 8***	***H 9***	***H A***	***H B***	***H C***	***H D***	***H E***	***H F***
	D 0	K E0	K F0														
		K 01	K 11	K 21	K 31	K 41	K 51	K 61	K 71	K 81	K 91	K A1	K B1	K C1	K D1	K E1	K F1
V2		K 02	K 12	K 22	K 32	K 42	K 52	K 62	K 72	K 82	K 92	K A2	K B2	K C2	K D2	K E2	K F2
V3		K 03	K 13	K 23	K 33	K 43	K 53	K 63	K 73	K 83	K 93	K A3	K B3	K C3	K D3	K E3	K F3
V4		K 04	K 14	K 24	K 34	K 44	K 54	K 64	K 74	K 84	K 94	K A4	K B4	K C4	K D4	K E4	K F4
V5		K 05	K 15	K 25	K 35	K 45	K 55	K 65	K 75	K 85	K 95	K A5	K B5	K C5	K D5	K E5	K F5
V6		K 06	K 16	K 26	K 36	K 46	K 56	K 66	K 76	K 86	K 96	K A6	K B6	K C6	K D6	K E6	K F6
V7		K 07	K 17	K 27	K 37	K 47	K 57	K 67	K 77	K 87	K 97	K A7	K B7	K C7	K D7	K E7	K F7

Table A-1 Labels of external key switches

A.5.2 Reserved Key Switches

The reserved keys K36 through K77 are shown in Table A-2 and their purposes are described in the following:

1) [Up], [Down], [Left], [Right]: select a Numeric Entry, a historical object, or an alarm object.

2) [0]-[9], [A]-[F], [.], [-]: enter a decimal value or hexadecimal value for the selected Numeric Entry.

3) [Enter]: change the PLC register associated with the selected Numeric Entry with the entered value or start to accept operator input if there is no value entered yet.

4) [BS]: erase the last entered character

5) [Esc]: cancel the entered value.

6) [Begin], [PgUp], [ScrollUp], [ScrollDn], [PgDn], [End]: scroll data in the selected historical object or alarm object.

7) [Pause]: stop updating the selected historical object.

8) [Clear]: clear the logging buffer associated with the selected historical object.

9) [Aux]+[Up] or [Down]: increase or decrease the contrast of the display.

10) [Aux]+[Enter]: save the current setting of the display contrast.

11) [Aux]+(any of [K00]-[K07]): A00-A07 are user definable

	H3	*H4*	*H5*	*H6*	*H7*
V0		K40 **7**	K50 **8**	K60 **9**	K70 **Begin**
V1		K41 **4**	K51 **5**	K61 **6**	K71 **PgUp**
V2		K42 **1**	K52 **2**	K62 **3**	K72 **ScrollUp**
V3		K43 **.**	K53 **0**	K63 **-**	K73 **ScrollDn**
V4		K44 **BS**	K54 **Up**	K64 **Enter**	K74 **PgDn**
V5		K45 **Left**	K55 **Down**	K65 **Right**	K75 **End**
V6	K36 **Esc**	K46 **A**	K56 **B**	K66 **C**	K76 **Pause**
V7	K37 **Aux**	K47 **D**	K57 **E**	K67 **F**	K77 **Clear**

Table A-2 Reserved key switches

A.5.3 Common Keys, Auxiliary Keys, and External

Keys

There are three kinds of keys you can configure for the 700X with the ADP3:

1) **Common Keys** - A common key is used to activate a designated function no matter what the current screen is. For example, you can press the key K01 to return to the screen 1 whenever you want if the key is configured as a common key that goes to screen 1. To configure common keys for your application, select Common Keys on the Application sub-menu of the ADP3 as shown in the Figure A-2.

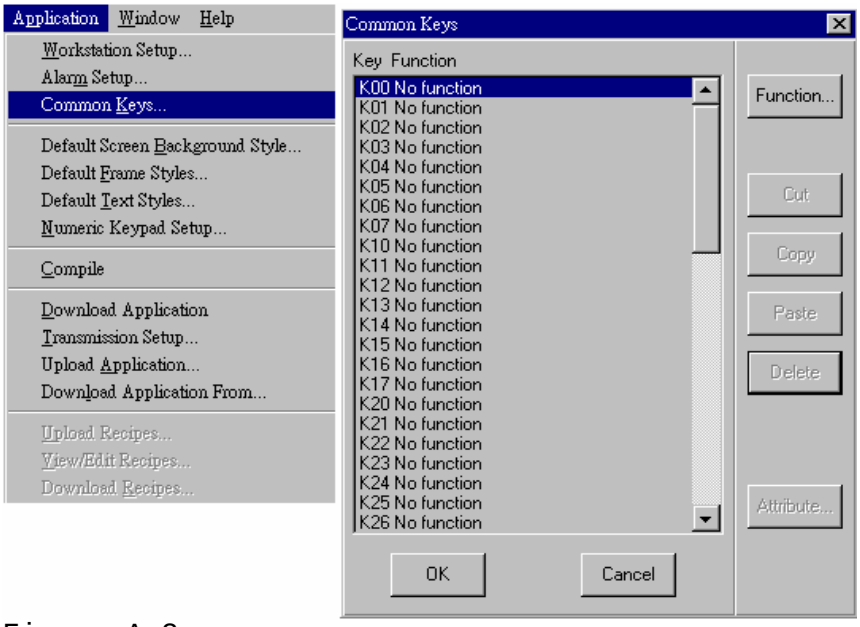
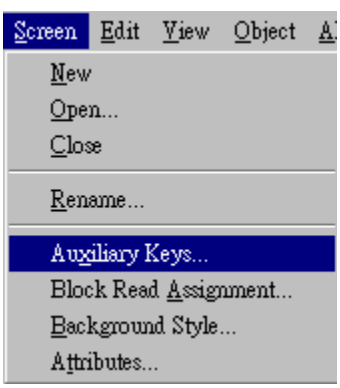
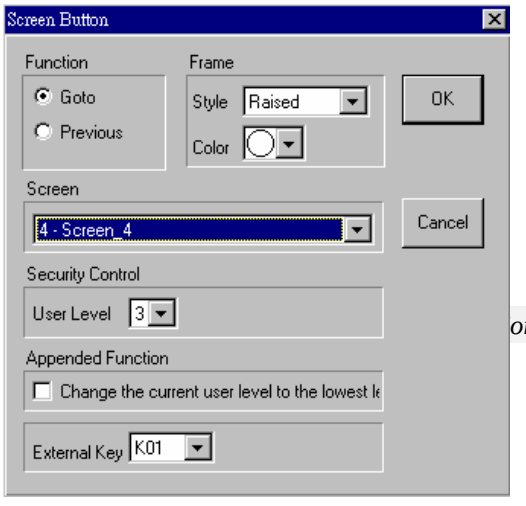


Figure A-2

2) **Auxiliary Keys** - A screen can have a number of auxiliary keys. The auxiliary keys of a screen are available for use only when that screen is the current screen. To configure auxiliary keys for a screen, select that screen first and then select Auxiliary Keys on the Screen sub-menu.





orp.

Figure A-3 Figure A-4

3) **External Keys** – For a screen object requiring a real key to activate its function, you need to assign an external key switch as its external key when you configure that object. However, it is optional to assign an external key for a Numeric Entry, because a Numeric Entry can also be selected by reserved arrow keys.

You can assign an external key switch as an external key even if it is already assigned as a common key or auxiliary key of the same screen. However it is not allowed to assign an external key switch for more than one screen object in a screen. In case that an external key switch plays more than one role at a time, the role of external key precedes the role of auxiliary key and the role of auxiliary key precedes the role of common key.

A.5.4 Two-key Operations

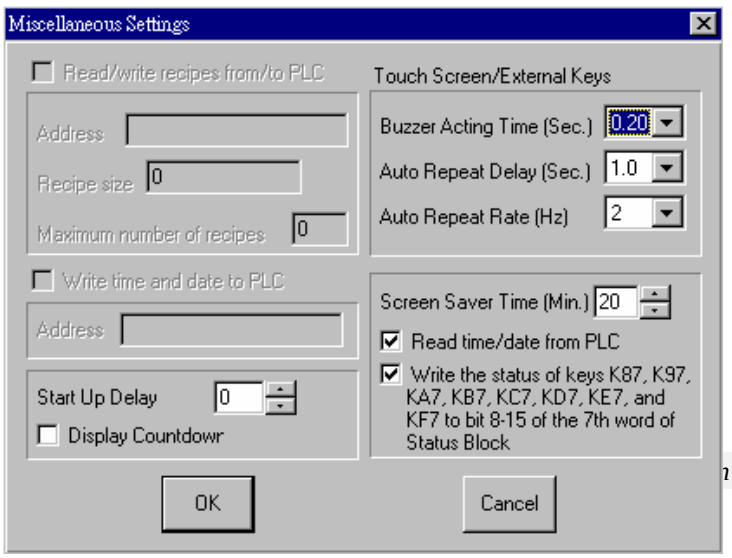
Some applications require the operator to press two buttons simultaneously to activate a function for safety consideration. The 700X support this type of application. You can assign keys A00-A07 for this purpose. A00 means K00 plus [Aux], A01 means K01 plus [Aux], and so on. The key [Aux] is K36 as described in section A.7. For example, if A05 is assigned as the external key for a push button, the operator should press [Aux] and [K05] at the same time to activate that push button.

There is another way that the 700X can support the two-key operations. The 700X can be configured to report the state of keys K87-KF7 by writing the state information to the 7th word in the Status Block. Your PLC can determine what to do with this information. The state information is encoded as the following:

Bit	15	14	13	12	11	10	9	8	7-0
State of	KF7	KE7	KD7	KC7	KB7	KA7	K97	K87	Reserved

Bit value = 1: pressed
Bit value = 0: not pressed

For example, if the Status Block locates at register W100, your PLC should read 9000H from register W106 when the KF7



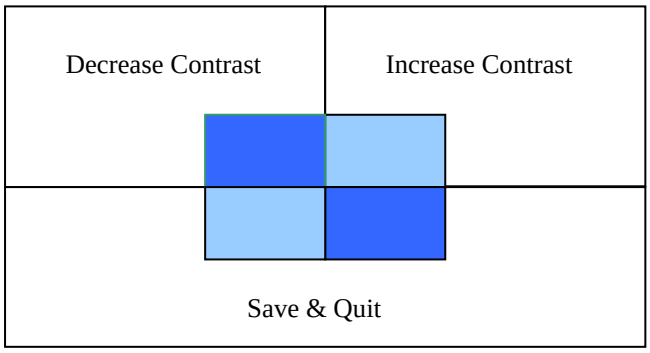
and KC7 are both pressed.

Figure A-5

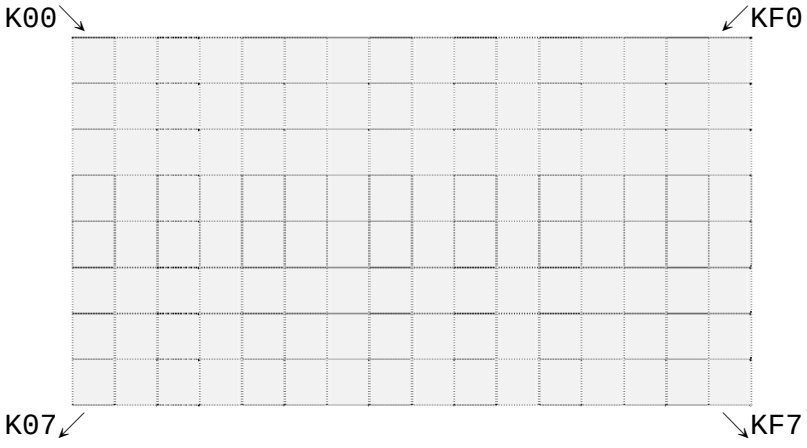
A.5.5 Verifying External Key Switches

To verify the external key switches are connected to the 700x properly, use the following procedures:

1) Set DIP switches SW3 and SW4 of the 700X to off. After power on, the 700X displays the following pattern.



2) Press any one of the keys that connect to line V4-V7. If the pressed key can work, the 700X displays 16x8 small rectangular cells to represent the possibly connected 128 external keys as shown below.



3) To verify an external key switch, press it and see if the corresponding cell on the 700X screen changes color. See Table A-1 for the corresponding position of each external key switch.

A.6 Setting of DIP Switches

There are ten DIP switches that you can access through the back cover. The purposes of these switches are stated in the following:

SW1	SW2	SW7	Menu/Run/Download
On	On	On	The 700X displays the System Menu after self-test
On	On	Off	The 700X starts running the user application immediately after self-test.
Off	x	x	The 700X starts to wait for a download after self-test.

SW3	SW4	Operation Mode
x	On	User application mode
On	Off	Burn-in test mode
Off	Off	Bench test mode

SW5	PLC Communication
On	If you want the Workstation to work without a PLC connected, set this switch to on; this allows you to view downloaded screens without a PLC.
Off	The Workstation uses the downloaded parameters for PLC communications.

SW6	Reserved switch
Off	Should be off

SW8	Default User Level
On	The default user level is 1 if the Workstation requires no password to start its operation.
Off	The default user level is 3 if the Workstation requires no password to start its operation.

SW9	Reserved switch
On	Should be on

SW10	COM2 Port
On	This setting is for most PLC drivers.
Off	This setting is only for the driver of Mitsubishi A Series CPU port.

A.7 Self Test

After power is applied, the Workstation runs a self-test that checks its hardware. After each test, the Workstation displays the result as shown in the following example. The version number of ROM BIOS refers to the EPROM chips, which will likely never change.

```
     Industrial Workstation
      ROM BIOS Version 1.0
(C) 98' Hitech Electronics Co.
 Display Type       Mono STN LCD
 System RAM Size          128 KB
 Video RAM Size            32 KB
 Firmware Memory Size     128 KB
 User Memory Size         640 KB
 Working RAM Test         Passed
 BIOS ROM Checksum        Passed
 Firmware Checksum        Passed
 Application Checksum     Passed
 Com. Port Test           Passed

 DIP SW Setting (8..1)=11001111
```

If you have interrupted a download to the 700X by switching off the power, disconnect the communication cable, or click cancel button in the ADP3 while a download is in progress, the self-test may report a problem in the Firmware Checksum or Application Checksum. You can ignore these errors and try to download again.

If there are any items of the self-test the 700X does not pass, the message “Error ! Press any keys to go on.” appears. The Workstations continues its operation after you press any keys.

A.8 System Menu

After the self-test, the 700X displays System Menu as shown in the following figure if the DIP switches SW1, SW2, and SW7 are all set to on.

```
        System Menu
0 : Download Application
1 : Run Application
2 : Copy
3 : Upload
4 : Adjust LCD contrast
5 : Exit

Press 0-5 or ↑ ↓ + Enter to
select
```

0:[0]/K53; 1:[1]/K42; 2:[2]/K52; 3:[3]/K62;

4:[4]/K41; 5:[5]/K51; ↑:[Up]/K54; ↓:[Down]/K55;

Enter:[Enter]/K64

The commands on the System Menu are summarized in the following:

Commands	Function	User Level
Download Application	Allows you to download an application to the 700X from a PC or another 700X.	1
Run Application	Starts running your application.	1-3
Copy Application	Allows you to copy the application in the 700X to another 700X.	1-3
Upload Application	Allows you to upload the application in the 700X to a PC.	1-3
Adjust LCD contrast	Allows you to set the contrast or brightness of the display.	1-3
Exit	Starts from the self-test again.	1-3

A.9 Downloading Application

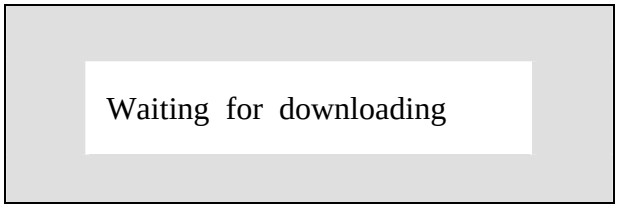
There are three ways to make the 700X ready for receiving your application data downloaded from a PC or another 700X:

1) Press [0]/K53 to select Download Application directly on System Menu

2) Press [Up]/K54 and [Down]/K55 to highlight Download Application and press [Enter]/K64 to select this command.

3) Set DIP switch SW1 to off and DIP switch SW2 to on. Turn on the power of the 700X. The 700X will wait for a download after the power-on self-test.

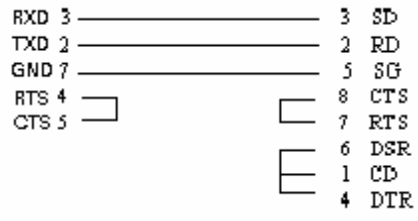
The 700X displays the message “Waiting for downloading...” when it is ready.



After downloading, the System Menu is active again.

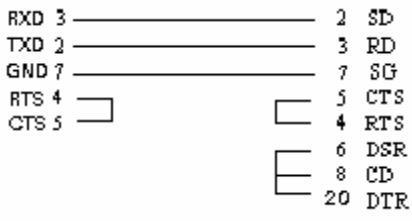
You should have a cable with the following connection for the download.

PWS-COM2 PC COM RS232C
25-pin female --CABLE--- 9-pin female



PWS to PC's 9-pin connector

PWS-COM2 PC COM RS232C
25-pin female --CABLE---25-pin female



PWS to PC's 25-pin connector

Warning: To avoid electric shock, be sure to switch off the power when connecting the communication/download cable to the PWS unit .

A.10 Setting Operating Parameters

You can use Communication Parameter dialog box of ADP3 to set the parameters for the communications between your 700X and PLC. The parameters set in ADP3 is transmitted to the Workstation along with all other data when you download an application.

To get Communication Parameters dialog box, click Communications button in Workstation Setup dialog box. The Communication Parameter dialog box appears with the following options:

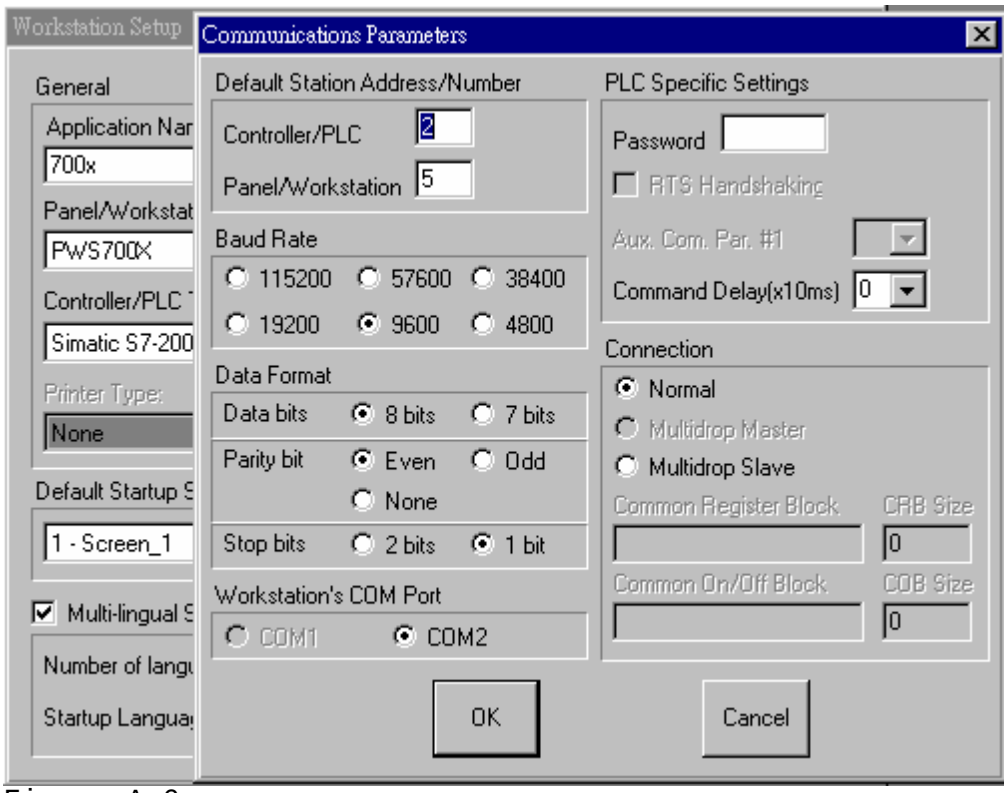


Figure A-6

Following are descriptions of each of these options:

Options	Description
Controller/PLC	Select a number to specify the address of PLC.
Panel/Workstation	Select a number to specify the address of your 700X. This parameter is only useful for some types of PLCs.
Baud Rate	Specify the baud rate for communications between the Workstation and the PLC.

Data Format	Specify the number of data bits, the number of stop bits, and the type of parity check bit for the communications between the 700X and the PLC.
Workstation's COM Port	Fixed at COM2 as there is no other selections.

RTS handshaking	Check this item to specify the 700X should wait to transmit until the CTS input on the communication port is asserted. This is sometimes called "hardware handshaking." This is available for only a number of PLCs.
Command delay (x10ms)	Enter a number between 0 and 255 to specify the amount of time that the 700X waits between sending commands to your PLC. The unit of time is 10 milliseconds and the default is 0. However, many PLCs consume additional scan time to service requests from the 700X, and if you find that your PLC's scan time is too long, you can increase the "Command delay" to slow down the Workstation. This is available for only a number of PLCs.
PLC Model Code	Select a number to specify the sub-type of your PLC. This parameter is only useful for some types of PLCs, such as Simatic S5.

You can use Miscellaneous Settings dialog box of ADP3 to set the screen saver time for your 700X. See Figure A-5. If you set the screen saver time to 0, the 700X never turns off the back light.

A.11 Serial Communication Port (COM2)

COM2 is a serial port that supports RS-232, RS-422, and RS-485 operation. The pin assignments of the port are listed in the following table:

Pin	Function	Pin	Function
1	Chassis ground	14	RS-422 TXD+ and RS-485 TXD/RXD+
2	RS-232 TXD	15	RS-422 TXD- and RS-485 TXD/RXD-
3	RS-232 RXD	16	RS-422 RXD+
4	RS-232 RTS	17	RS-422 RXD-
5	RS-232 CTS	18	(no function)
6	(no function)	19	(no function)
7	Signal ground	20	(no function)
8 *	(no function)/5V max 250mA output, when JB1-pin1-2 was shortted	21	RS-422 terminating resistor for RXD-; the other terminal of the resistor (120Ω, 1/2W) is already connected with the RXD+
9	(no function)	22	RS-422 terminating resistor for

			CTS-; the other terminal of the resistor (120Ω, 1/2W) is already connected with the CTS+
10	(no function)	23	RS-422 RTS+
11	(no function)	24	RS-422 RTS-
12	RS-422 CTS+	25*	(no function) /24V DC power input
13	RS-422 CTS-		

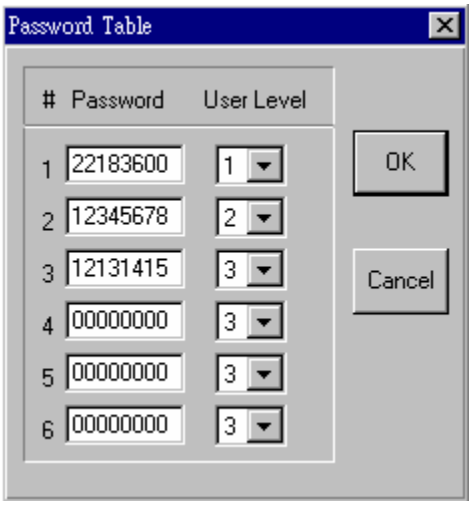
* Consult the factory if you want to use these two pins

A.12 Password and User Level

The 700X stores passwords in its Flash EPROM. A password has eight numeric characters. When you register a password, you must specify the user level associative with that password. The user level of a password determines the privilege of the user who enters that password to start the operation of the 700X. When a user wants to use the function of the System Menu, change to another screen, or make change to a PLC location, the 700X checks the user's user level. There are three user levels: level 1, level 2, and level 3. Level 1 users have the highest privilege and Level 3 users have the lowest privilege.

A.12.1 Registering Passwords

You can register up to six passwords for your application in ADP3. To register passwords and their associated user level, click Password button on the Workstation Setup dialog box. The ADP3 displays the Password Table as shown in the following figure. You can enter passwords as well as select the user level for them. The password data are part of the application data.



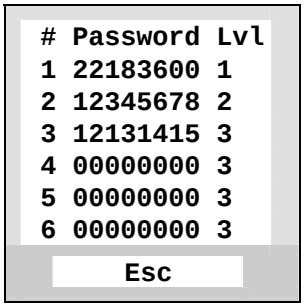
Therefore, remember to compile your application and download it to the 700X when you make any changes to the password table. The default passwords are 00000000, 00000000, 00000000, 00000000, 00000000, and 00000000. The default user level is level 1.

A.12.2 Setting the Lowest User Level

You are able to set the current user level of the 700X to level 3 by pressing an Action button that is assigned the function of “Set Lowest User Level.”

A.12.3 Displaying Passwords

To display the passwords of your application on the 700X, you have to create an Action button on a screen and assign the function "Display Password Table" to that button. The 700X displays the password table as the example shown below, when a level 1 user presses and releases an Action button that is assigned the function of "Display Password Table."



A.12.4 Reentering a Password

When the 700X is running the user application, you can enter a password to change the current user level by pressing an Action button that is assigned the function of “Reenter Password.” To cancel the input of a new password, press [Esc]/K36.

Note that the default user level is 1 after the power-on self-test if the DIP switch SW8 is set to on; the default user level is 3 if the SW8 is set to off.

When a screen object requiring a certain user level is activated and the current user level is higher than the specified user level with that screen object, the 700X automatically displays a box to let you enter a new password. This is a chance to change the current user level. The screen object proceeds to performs its function if a valid password with qualified user level is entered; otherwise, the 700X keeps on asking for a password or cancel the operation if [Esc]/K36 is pressed.

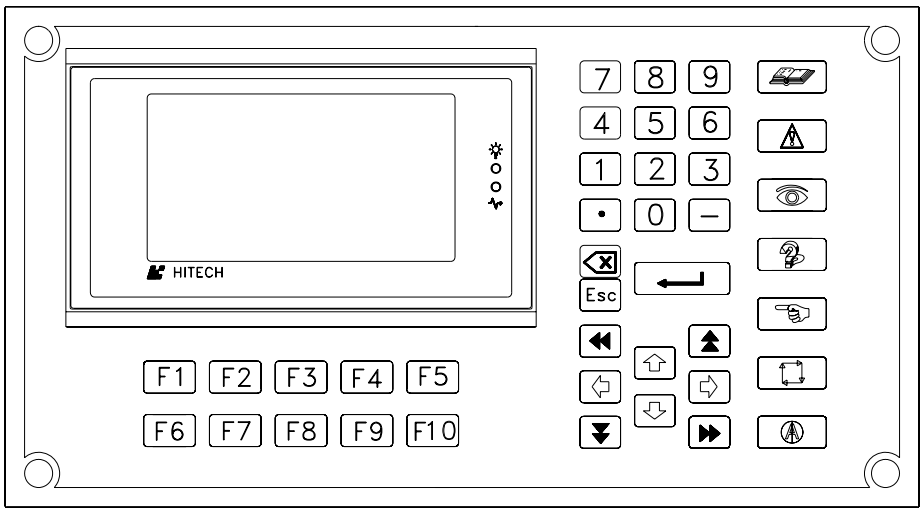
A.13 Adjusting Display Contrast

You can adjust the contrast of the display at any time when the 700X is running your application. To increase the

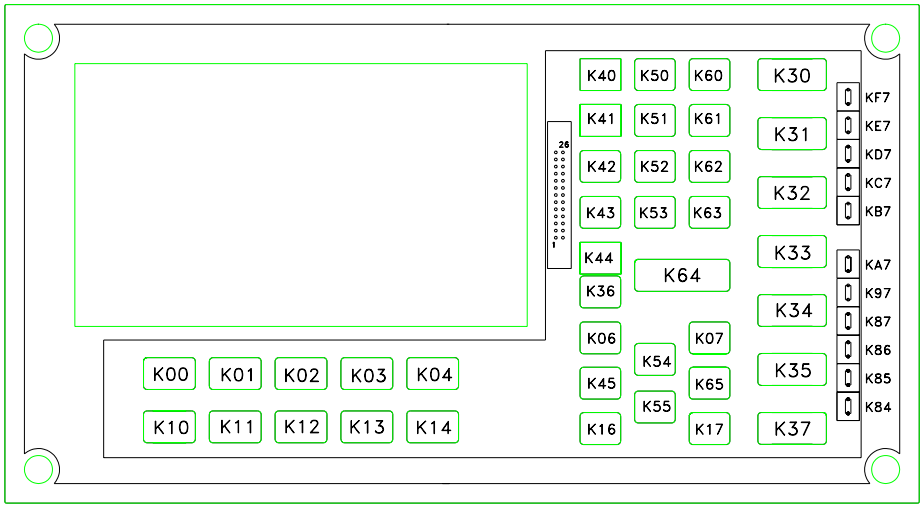
contrast, press [Aux]/K37 and [Up]/K54 at the same time or press an Action button that is assigned the function of “Contrast Up.” To decrease the contrast, press [Aux]/K37 and [Down]/K55 at the same time or press an Action button that is assigned the function of “Contrast Down.” To save the setting of the contrast, press [Aux]/K37 and [Enter]/K64 at the same time or press an Action button assigned the function of “Save Contrast.”

A.14 Design Example of External Key Switches

The following figure shows the mounting panel with a set of key switches that you can get from Hitech for PWS700X. You can mount a 700X on it and then mount the whole panel on your control box or machine. The part number of this mounting panel is PMEM700X-I21-CK01. It is very handy for those who don't want to build their own external keyboard. Originally it is designed to upgrade the applications of PWS1100 with the advanced PWS700X. Some applications need a keypad with the good tactile feeling of mechanical switches, or prompt maintenance for the keypad, PMEM700X-I21-CK01 as shown in the following figure is the choice.



The following figure shows the label of each key on the mounting panel.


K40
K50
K60
K30
K41
K51
K61
K31
K42
K52
K62
K32
K43
K53
K63
K44
K64
K33
K36
K34
K06
K07
K54
K45
K65
K35
K55
K16
K17
K37
K00
K01
K02
K03
K04
K10
K11
K12
K13
K14
KF7
KE7
KD7
KC7
KB7
KA7
K97
K87
K86
K85
K84
26
1