9800

Operator Interface Terminal
for
Omron C-Series
with
Host Link Adapter

PM9800A9-Omron C-Series
Revision 0

QUARTECH
Corporation

The product described in this document can have a variety of uses, the user and those responsible for applying this equipment must satisfy themselves as to the acceptability of each application and the use of the unit. Under no circumstances will QUARTECH CORPORATION be responsible or liable for any damage, including indirect or consequential losses resulting from the use, misuse, or application of the unit.

The text, illustrations, charts, and examples included in this document are intended solely to help explain applications of the product. Due to the many variables associated with specific uses or applications, QUARTECH CORPORATION cannot assume responsibility or liability for actual use based upon the data provided in this document.

No patent liability is assumed by QUARTECH CORPORATION with respect to the use of circuits, information, equipment, or software described in this document.

This document is printed in the U.S.A. and is subject to change without notice.

Quartech Corporation
15923 Angelo Drive
Macomb Twp, MI 48042

Phone: (586) 781-0373
Fax: (586) 781-0378
QuartechCorp.com

TABLE OF CONTENTS

Subject	Page
Section 1: Introduction	3
1.1 Manual Writing Conventions	3
1.2 Product Overview	4
1.3 Initial Power Up	6
Section 2: Edit Mode	7
2.1 Edit Screen Flags	8
2.2 Static Field Example	10
2.3 Dynamic Field Example	12
2.3.1 Window Field Example	13
2.3.2 Bit Status Field Example	13
2.3.3 PLC Data Field Example	16
2.3.4 Data Set Example	17
2.3.5 Bar Chart Example	18
2.4 Control Codes	19
Section 3: Setup System	20
3.1 COM1 Data Port	20
3.2 Date/Time	21
3.3 PLC Port	22
3.4 System	22
3.4.1 Edit Lock	22
3.4.2 Combination Lock	23
3.4.3 Powerup State	23
3.5 User Keys/LEDs	24
Section 4: Utilities	25
Section 5: Run Mode	26
5.1 Dialogue File	26
5.2 Command Register	27
5.2.1 Lock Edit Keys (Bit 0)	27
5.2.2 Lock User Keys (Bit 1)	27
5.2.3 Lock Window Field (Bit 2)	28
5.2.4 Combination Lock (Bits 3, 4, 5, 6)	28
5.2.5 Screen Stack (Bits 7, 8, 9, 10, 13)	29
5.2.6 Help Key (Bit 11)	30
5.2.7 Value Modified (Bit 12)	30
5.2.8 Dim Display (Bit 14)	30
5.2.9 Communication Active Flag (Bit 15)	30
5.3 Tri-Color LED control	31
5.4 User Keys	32
5.5 Screen Triggering	33
5.5.1 Integer Trigger	33
5.5.2 Bit Trigger	35
5.6 Programmers Tool	37
5.7 Date/time	37
Appendix A: Communication Basics	38
Appendix B: 9800 Access Plate	39
Appendix C: Error Codes	41
Appendix D: Special Graphic Set	41
Appendix E: Legend Cards	43
Appendix F: Installation	44
Quick Reference	46

Section 1: Introduction

The Model 9800 Operator Interface Terminal combines an 80 character vacuum fluorescent display, sixteen element pushbutton station with tri-color LEDs, and a numeric keyboard into one integrated unit. The 9800 is a series of products, each designed to communicate directly with various Programmable controllers. The 9800 described in this manual is designed specifically for Omron C Series PLC's, with the Host Link Adapter (RS-232 interface). It does not require any PLC programming, or Input/Output Modules to establish communication.

Once communication has been established the 9800 can access all addresses in the PLC's data table. The 9800 can also write to almost all addresses, however, it does not allow modification to the I/O image addresses.

1.1 Manual Writing Conventions

The 9800 has an eighty character display window, sixteen tri-color LEDs, two red LEDs, sixteen user keys, and sixteen numeric/editing keys. An AT style full keyboard may also be connected directly to the 9800 during both program and run mode. Throughout this manual many references will be made to these entities, therefore, the following conventions have been established.

- Characters that would appear in the eighty character display window will be shown in bold print and within quotation marks. The entire display window may be shown. It will appear as a rectangular box with the characters displayed in the relative position in which they would appear.

  Example of characters: "**Edit screen**"

Example of entire display window:

```
Edit screen    Setup System     Run Mode
Utilities
```

- Labels that refer to one of the two red LEDs will be shown in bold print and always in capital letters.
  Example: **SHIFTED** or **LOCKED**

- The numeric/editing key names (including AT keyboard) will always be shown in bold print inside brackets. Most keys have a primary function that appears black on the keypad. Most keys also have a secondary function that appears red on the keypad. The secondary function is selected by first pressing the **[SHIFT]** key, then the desired function. The **SHIFTED** LED will light to indicate the secondary key designation will be used. Throughout this manual, when a secondary key is referenced it is assumed the **[SHIFT]** key is first pressed.

  Example: **[ENT]**, **[Enter]** or **[LOCK]**

1.2 Product Overview

The 9800 is customized for a particular application by creating screens. A screen is similar to a canned message; however, screens may include variable information from the PLC which may be modified through the 9800's keyboard. Screens may be triggered, i.e., displayed, by two methods. Either the PLC can trigger a screen or the 9800 can trigger a screen. The method by which screens are triggered will be explained in detail in section 5.5 of this manual. A screen may use all or only part of the eighty character display window. This allows more than one screen to be displayed simultaneously. In addition, screens may be overlaid atop one another providing a "windows" type environment. A screen is comprised of up to ten fields. A field can be thought of as a type of information, a method of displaying information, or a defined process. There are ten unique field types. A brief explanation of each is given below.

Text This field allows fixed character strings to be displayed within a screen. The field size and position are user defined.

Scroll This field allows fixed character strings to scroll right to left within a defined window. The window size and position are user defined.

Page This field allows fixed character strings to scroll bottom to top within a defined window. The window size and position are user defined.

Date This field allows the current date to be displayed as: Month/Day/Year

Time This field allows the current time to be displayed as: Hours/Minutes/Seconds

Window This field appears as fixed text within a screen. Moving the cursor to this field and pressing the **[ENT]** key will trigger another screen that is specified by the user when the *window* field is created.

Data Set This field appears as fixed text within a screen. Moving the cursor to this field and pressing the **[ENT]** key will cause a value to be written to an address within the PLC. The address and value are specified by the user when the *Data Set* field is created.

Bit Status This field will display one of two character strings depending on the status of a group of bits within an address inside the PLC. The address and bit definition are specified by the user when the *Bit Status* field is created.

PLC Data This field will display variable information from within the PLC. The address from which data will be retrieved is specified when the *PLC Data* field is created. The data can be displayed in Hex, Binary, Decimal, ASCII, or floating point formats. Modification to the value may be enabled or disabled. Individual data value limits are also set for each PLC *Data field* created. If enabled, values are entered by first moving the cursor to this field then pressing the **[ENT]** key; a new value is then keyed in and the **[ENT]** key pressed.

Bar Chart This field is displayed as a conventional bar chart expanding from left to right relative to the value of an assigned address within the PLC. During field creation the address is specified, a scale value that is applied to the raw data prior to display, and the character that will be use in the bar.

Section 1: Introduction

A five pin circular DIN connector is located at the bottom of the 9800. A standard IBM compatible AT keyboard can be connected directly into this connector. This keyboard is then used to configure the 9800 and program screens. This is possible because the 9800 includes a resident screen editor. This editor is menu driven, i.e., the programmer is prompted through various screens to select or enter parameters.

The various menus that make up the resident editor are actually screens that are very much like the user screens that will be created. The resident editor screens utilize five field types, which are: *Word Fields, Entry Fields, Menu Fields, Task Fields,* and *Choice Fields*. These fields allow the user to enter screen text and make various parameter assignments.

The fields that make up the editor screens can be separated into two categories, information fields and action fields. A *Word Field* is an information field. It is made of characters that will never move, flash, or change. If an editor screen includes an action field it will flash when the cursor is on it to indicate some action is possible. This action includes the entering of data, multiple choice selection, selection of another menu, or initiation of a task such as printing or deleting. If more than one action field is present the arrow keys are used to move between them.

The following is a description of the action fields used in the resident editor:

Entry Field To initiate action within this field the **[Enter]** key is pressed. If the field allows data entry a block cursor "▒" will appear in the left most entry position. The original data will remain but will stop flashing. This is typeover entry mode. Data can be keyed in then the **[Enter]** key pressed to complete the operation.

If **[Shift] [Enter]** is used to select the field the block cursor will appear, however, the original data will disappear. This is new entry mode. As before, data can be keyed in then the **[Enter]** key pressed to complete the operation.

Menu Field To initiate action in this field the **[Enter]** key is pressed which will produce a new screen.

Task Field To initiate action in this field the **[Enter]** key is pressed which will cause a pre-defined task to be performed. These tasks include printing, deleting, and saving data. In some cases a word such as "**BUSY**", "**SAVING**", "**DELETING**", or "**ONLINE**" to appear at the top right position on the display indicating the task is being performed.

Choice Field The **[Enter]** key is used to scroll through the available choices. Screens that utilize this type of field often include a *Task Field* labeled "**Save setup**". Before leaving these screens the "**Save setup**" task must be executed to save any changes that were made.

It is important to understand what these fields are and how data is modified in each one since it will be assumed this is known information throughout the rest of this manual. As a general rule the **[Enter]** key allows access into and out of a field. The **[Esc]** key will back out of or discontinue an operation.

1.3 Initial Power Up

When the 9800 is first powered an initialization process is started that performs diagnostic tests on both the hardware and software. An initialization screen will appear in the display window and indicate the software version number and target PLC of the application program currently residing in memory.

The screen will look like this:

```
Operator Interface    Model 9800  V1.50
Omron C-Series
```

After the initialization process is complete, screen number zero will be displayed if it has been programmed. Screen number zero is a user identification screen and may be used to show a job number or company name. It cannot be displayed during normal operation of the unit.

After screen zero has been displayed, or in the absence of screen zero, the following screen will appear:

```
Edit screen    Setup System     Run Mode
Utilities
```

This is the primary selection screen or root directory. A brief description of the four sub-directories is given below. A separate section is assigned to each of these sub-directories within this manual.

- Edit screen - This allows individual screens to be created, modified, deleted, and printed.
- Setup System - This allows several operating parameters to be configured which include COM1 serial communication setup, date/time setting, security, PLC communication port setup, function key and tri-color LED configuration.
- Run Mode - This will direct the 9800 to attempt a communication link up with the programmable controller. If successful the 9800 will leave the editing mode and begin normal run operation.
- Utilities - This allows a group of screens to be printed or deleted. Also all parameters for such things as communication port configuration and function key configuration may be printed. Uploading and downloading of files created using the 9229 offline software package is initiated from the utilities screen.

Section 2: Edit Mode

Selecting the Edit Screen field from the root directory will cause the following screen to be displayed:

```
Edit screen number:000
Edit  Print  Delete
```

This screen will be used more often than any other. It allows a new screen to be created or an existing screen to be modified. This screen also allows a single screen to be printed or deleted. When multiple screens are to be printed or deleted the Utilities feature from the root directory is used.

The Edit screen number will be flashing to indicate the current cursor position. Prior to selecting any of the three functions on the second line a screen number must be entered. The legal address range is zero through 719. If the number that is flashing is the screen of choice it will not be necessary to re-enter it.

The first time the edit screen function is selected the screen number appearing will be "**000**". For example purposes assume screen number 15 is to be created. The first step is to enter the number fifteen as the "**Edit screen number:**" parameter. Press **[Shift] [Enter] [1] [5] [Enter]**. Next move the cursor to "**Edit**" by pressing the **[→]** key. The word "**Edit**" will begin to flash indicating the cursor is at that position. Select the "**Edit**" function by pressing the **[Enter]** key. The word "BUSY" will appear at the top right of the display for a moment, then assuming this screen has not been previously created the following screen will display:

```
Edit screen number:015
Screen does not exist!   Create? No Yes
```

The word "**No**" will be flashing. To select "**Yes**" press the **[→]** key followed by the **[Enter]** key. The screen will blank except for a block cursor "▒" at the top left position of the display. This is the cursor home position. Pressing the **[Home]** key will always return the cursor to this position. Pressing the **[End]** key will in some cases move the cursor to the bottom right position of the display.

Before describing the functionality of the screen editor a brief description of the function keys may be helpful. Function keys **[F1]** through **[F10]** are used to create and modify screens.

[F1] **Flash:** Pressing this key will cause the field in which the cursor currently resides to either begin flashing or stop flashing. This key actually modifies an attribute flag that is saved in memory with the field. Each time the **[F1]** key is pressed this flag is toggled, i.e., on-to-off, or off-to-on.

[F2] **Edit Screen Flags:** Pressing this key produces another screen which allows several screen related attribute flags to be modified. This setup must be completed for each screen that does not utilize the default attributes. The various flags will be discussed in detail later in this section.

Section 2: Edit Mode

[F3] **Edit Text:** Pressing this key allows re-entry into a previously created field for the purpose of editing. This key is only active when the cursor is placed on a field that contains text.

[F4] **Edit Field Parameters:** Pressing this key will display a setup screen unique to the field type the cursor is currently positioned on. This key is only active when the cursor is placed on a field that has modifiable parameters.

[F5] **Move Field:** To reposition a field the cursor must first be moved to that field. **[F5]** is then pressed which will cause the entire field to become blocks. The arrow keys are used to reposition and the **[Enter]** key is used to complete the move.

[F6] **Resize Field:** To re-size a field the cursor must first be moved to that field. **[F6]** is then pressed which will cause a flashing block cursor to appear over the entire field. The arrow keys are used to increase or decrease the field size. The **[Enter]** key is used to complete the re-sizing.

[F7] **Add Field:** Pressing this key will display a screen showing each of the ten possible field types. The arrow keys are used to move the cursor to the desired field type. The **[Enter]** key is then used to complete the selection.

[F8] **Remove Field:** To remove a field the cursor must first be moved to that field. **[F8]** is then pressed which will cause flashing "**X**" characters to appear over the entire field. The **[Enter]** key is used to complete the removal.

[F9] **Graphic Set:** If text is currently being entered into a field this key is active. Pressing this key will display eighty special graphic characters which may be included with a field's text. To select a graphic character from the set simply move the cursor to the desired character and press the **[Enter]** key.

[F10] **Transmit Control Codes:** In addition to displaying screens the 9800 can also transmit screens out an auxiliary communication port. This information may be directed to a printer or computer. Sometimes these devices require special code for proper reception of data. The feature associated with **[F10]** allows special code to be embedded within a screen. These codes do not affect the display of the screen, only the transmission of it. Detailed information on this topic will be presented in another part of this manual.

2.1 Edit Screen Flags

Several flags determine the characteristics of an individual screen. Pressing the **[F2]** key while in the screen editor will produce the following screen:

```
Screen:015  Display:Y  Stack:N  Print:N
Clear :Y    Cover  :N  Auto close:N
```

This screen allows the programmer to determine where a screen will be directed and how it will display. A description of each flag follows on the next page.

Section 2: Edit Mode

Display: When set to "**Yes**" the screen will be immediately sent to the 9800's display. When set to "**No**" the screen will not be sent to the 9800's display.

Stack: When set to "**Yes**" the screen will be placed in the 9800's display stack. When set to "**No**" the screen will not be sent to the 9800's display stack. Screens that are placed in the stack can later be displayed. The method to display stacked screens is discussed in section 5.2.5.

Print: When set to "**Yes**" the screen will be immediately sent to serial communication port COM1. If set to "**No**" the screen will not be sent to COM1. The serial communication must be configured and connected to a receiving device such as a printer or computer.

Clear: If this flag is set to "**Yes**" the entire display will be cleared before this screen is displayed. This effectively makes this the only screen on the display even if other screens have been triggered. If this flag is set to "**No**" the display will not be cleared before this screen is displayed. If this screen does not use the entire display then characters from previous screens will remain. This allows a windows type environment to exist on the display.

Cover: If this flag is set to "**Yes**" then the Clear flag must be set to "**No**". In fact the 9800 will automatically set the clear flag to "**No**" when the Cover flag is set to "**Yes**". The opposite is also true. If set to "**Yes**" any modifiable field that may be exposed from previously displayed screens will be disabled, i.e., only modifiable fields in this screen will be accessible. When this flag is set to "**No**" any modifiable field from previously displayed screens may be selected and modified or activated. For a previously displayed field to be selected, the entire field must be shown, if only part of it is shown it can not be selected.

Auto Close: This flag is only relevant when the screen is triggered by the *Window Field* of another screen. Selecting a *Window Field* will always cause another screen to be opened. To close this new screen from the display the **[ESC]** key may be pressed. If the *Auto Close* flag is set to "**Yes**" for this new screen then a second method of closing the new field is available. This second method (*Auto Close*) also requires a dynamic field be part of the new screen. Selecting a dynamic field in the new screen and activating its process will cause the new field to be automatically closed. If *Auto Close* is set to "**No**" then the only way to close the screen from the display is with the **[ESC]** key.

It is possible to "clone" or copy an existing screen to another screen number. This is useful when a new screen to be created is very similar to an existing screen. To use the "clone" feature the screen to be copied must be brought to the display. The **[F2]** key (Edit Screen Flags) is pressed, then the screen number is changed to the desired number. The current screen being edited is now the new screen. The screen that was copied is still safe in EEPROM memory.

Section 2: Edit Mode

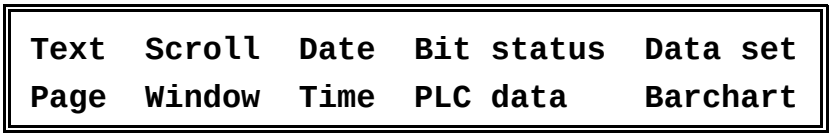
2.2 Static Field Example

The use of function keys greatly simplifies the creation of screens. Rather than try to describe in detail each function key and each field type, several examples will be presented that utilize all function keys and all field types. Fields can be separated into two basic categories, Static fields and Dynamic fields. Static fields present information that may be fixed, flashing, scrolling, or changing; however, this information can not be modified by the operator or PLC. Dynamic fields present information that may be modified by the operator, the PLC, or both.

The Static Fields are: Text, Scroll, Page, Date, and Time.

As previously described the **[F7]** key provides access to the field selection screen. Assuming that screen 15, previously created on page 7, is still blank the first step in creating a field within this screen is to move the cursor to the position where the field should begin. It is not necessary to choose the exact position because it is very simple to move a field once created. This example will create a Text field.

- Move the cursor to the sixth character position on the top line by pressing the **[→]** key five times. Next press the **[F7]** (Add Field) key. The field menu screen will appear as shown.



The word "**Text**" will be flashing to indicate the cursor is currently at that position. Since this is the field type we want, select it by pressing the **[Enter]** key. The display will blank except for an alternating star/block character in the sixth position on the top line.

- The next step is to establish the size the field should be. This is done with the arrow keys. Assume we want to display the word "**Quartech**". This requires a field size of eight. Press the **[→]** seven times then the **[Enter]** key to complete field sizing.

The display will now look like this:

- The word "Quartech" can now be keyed into the field followed by the **[Enter]** key to complete the process.

Section 2: Edit Mode

The block cursor will return and may be moved anywhere within the screen to create another field; however, before creating other fields let's modify the field just created.

- Use the arrow keys to position the cursor somewhere within the "**Quartech**" field then press the **[F6]** (Resize Field) key. Press the **[→]** key five times to increase the field size by five characters. Notice that the star character "★" is used to indicate reserved but unused character positions. Next press the **[Enter]** key to complete the re-sizing. The star characters disappear leaving only the word "**Quartech**".

Append the text field to read "**Quartech 9800**".

- Press the **[F3]** (Edit Text) key. The star characters will again appear in the reserved character positions. Also, a flashing underline cursor will appear.

Before proceeding press the **[Ins]** key. Notice the flashing underline cursor changes to a flashing block cursor. The block cursor indicates the text editor is in typeover mode. The underline cursor indicates the text editor is in insert mode. To append text to an existing field either mode will work.

- Use the arrow keys to position the cursor immediately to the right of the "**h**". Press the space bar then **[9] [8] [0] [0] [Enter]**. The modification is complete and the field should read "**Quartech 9800**".

Move the field.

- With the cursor somewhere within the text field press the **[F5]** key. The field will fill with non-flashing blocks. The field may be moved using the arrow keys, **[Home]** key, or **[End]** key. When the field appears in the desired position press the **[Enter]** key to complete the move.

Add flashing.

- Any field can be made to flash. Move the cursor into the text field then press the **[F1]** key. The field will begin to flash. Press the **[F1]** key again and notice the flashing stops. The **[F1]** key toggles a field attribute flag that will enable or disable flashing.

Saving the screen in memory.

Fields are created within the RAM memory of the 9800. This type of memory is suitable for temporary storage only. If power is removed all the data in RAM memory is lost. To permanently protect the created fields they must be moved into EEPROM memory. It is not necessary to save each field as it is created. It is best to save the entire screen after all fields have been created. To initiate the save process press the **[Esc]** key. Assuming we are still working on screen 15 the following will display:

```
Edit screen number:015
Save screen changes before exit? Yes No
```

The word "**Yes**" will be flashing indicating this is the current choice. Pressing the **[→]** key will toggle the choice selection between "**Yes**" and "**No**". With the word "**Yes**" flashing press the **[Enter]** key. As the data from RAM memory is being transferred to EEPROM memory the word "**SAVING**" will appear at the top right of the display to indicate the process is occurring. This process should take a few seconds to complete at which time the following will display:

```
Edit screen number:015
Edit  Print  Delete
```

This is the Edit Screen menu as seen previously. Pressing the **[Esc]** key would return us to the root directory but let's press **[Enter]** to resume editing screen 15. Screen 15 will be copied from EEPROM memory back to RAM memory. The previously created screen will appear with the text field "**Quartech 9800**".

Remove the Text Field.

- Position the cursor somewhere within the Text Field then press the **[F8]** key. The field will fill with the flashing "**X**" character. To complete the removal press the **[Enter]** key. The field will be removed from RAM memory only. To make the deletion permanent the entire screen must be again saved in EEPROM memory.

This example has demonstrated the use of the Add Field, Resize, Edit Text, Move Field, Flash Field, and Remove Field function keys. Saving a screen in EEPROM memory then returning to re-edit was also demonstrated. This Static Field example used only the Text Field; however, Scroll fields and page fields are basically identical to the text field with respect to entry, sizing, and moving. Scroll and page fields are normally used in place of text fields when the amount of text to be presented exceeds the space available for display. Scroll and page fields both move text through the field window. The scroll field moves text one character position at a time from right to left. The page field moves a group of text, equal to the number of character positions in the page window, from bottom to top.

The Date Field and Time Field are also created in a similar manner to the Text Field with the exception that no text is actually keyed in. It is only necessary to position and size these fields. To display a complete Date or Time field requires eight character positions in the screen. When these fields are reduced below eight characters, the characters are removed from the right.

As a final note, when creating a new field it is not important to set the field position or size exactly since changing these two parameters is so simple. It is easier to get the text onto the screen then position and size it.

2.3 Dynamic Field Examples:

The Dynamic Fields are: Window, Bit Status, Data set, PLC data, and Barchart.

Each dynamic field functions and is created differently. An example will be given for each. All dynamic fields except the Bar Graph field may allow operator interaction. An invisible cursor exists within the display window. If a screen is displayed that includes an interactive dynamic field, that field will be flashing to indicate the cursor is at that position allowing operator input. If multiple interactive dynamic fields exist the arrow keys may be used by the operator to select a field for input. When the desired field is selected the **[ENT]** key must be pressed to initiate the input process.

Section 2: Edit Mode

2.3.1 Window Field Example

The Window field is essentially a screen trigger. Another screen may be displayed by selecting this field. The Window Field is created the same (and appears the same) as a Text Field; however, a secondary function must be performed. Assuming the Window Field has been created, position the cursor within that field and press the **[F4]** (Edit Field Parameter) key. The following screen will appear:

```
Entry:Yes  Screen:000
```

The "**Entry**" parameter may be toggled between yes and no by pressing the **[Enter]** key. Selecting "**Yes**" will enable the Window feature; selecting "**No**" will disable it. Selecting "**No**" will cause this field to essentially become a static text field. If a system is being designed for future expansion it may be desirable to program additional window fields but keep them disabled until a future date. The screen number which is to be displayed when the Window Field is selected is programmed into the "**Screen**" parameter. The **[Esc]** key is used to return to the editing screen. The parameters will automatically be saved with the Window Field text. Refer to section 2.1 "Auto Close" for additional information regarding the Window Field.

2.3.2 Bit Status Field Example

The Bit status field allows the PLC to toggle between two character strings. If enabled the operator may also initiate the toggle which effectively produces a bit set function. The Bit Status Field is created in a manner similar to a text field.

- Assume the field will display "**Motor Off**" or "**Motor On**". Since "**Motor Off**" is the larger string and requires nine character spaces the field size must be nine. Position the cursor and create a Bit Status field having nine character positions. Key in the string "**Motor OffMotor On**" and press **[Enter]**. To view the text as it will appear, enter edit text mode (F3) then use the up and down arrow keys to alternate between the two strings.

The **[F4]** (Edit Field Parameter) function must be selected to complete the creation of the Bit Status Field. When the **[F4]** key is pressed the following screen will display:

```
Entry:No              Msk:0000000000000000
Addrs:??000/U         Val:0000000000000001
```

Section 2: Edit Mode

The "**Addrs**" parameter allows a word address to be specified. The word address may be any address within the Data Table including the I/O Image Table. All sixteen bits of the word address are always included in the MASK and VALUE parameters. The solving of this function may utilize a single bit or up to all 16. The 9800 will read 16 bits from the selected address, logical AND them with the mask value then compare the result to the specified value. If the values are not equal the first character group will be displayed. If the values are equal the second character group will be displayed. Examine the following examples.

Assume:

Entry:No	**Msk:0000000000000001**
Addrs:??000/U	**Val:0000000000000001**

If the value in the PLC has bit 0 equal to a one (bit 0 is on the far right), the function will solve true and the second character group "**Motor On**" will be displayed. Bits 1 through 15 do not affect the status.

Value in PLC	01010101 01010101	
AND with Mask	00000000 00000001	
Result	00000000 00000001	
Compare result to specified Value	00000000 00000001	Equal so display "Motor On"

Assume:

Entry:No	**Msk:0000000000000111**
Addrs:??000/U	**Val:0000000000000010**

If the value in the PLC has bit 1 on and bits 0 and 2 off, the function will solve true and the second character group "**Motor On**" will be displayed. Bits 3 through 15 do not affect the status.

Value in PLC	10101010 10101010	
AND with Mask	00000000 00000111	
Result	00000000 00000010	
Compare result to specified Value	00000000 00000010	Equal so display "Motor On"

Section 2: Edit Mode

Using the Bit Set feature.....

This feature is not allowed if the word address lies within the I/O Image Table. If enabled the Bit Status function may be used as a bit modify function, i.e., the 9800 can control the bit at the specified word address. To enable this feature the "**Entry**" parameter must be set to "**Yes**". When the cursor is moved to this field and the **[Enter]** key is pressed the specified bit or bits at the specified word address will be toggled. The following example will explain this function.

Assume:

Entry:Yes	**Msk:0000000000000001**
Addrs:??000/U	**Val:0000000000000001**

When the field is selected the 9800 will read 16 bits from the given PLC address, logical AND them with the "mask" data then compare the result to the specified value.

- If the result and the specified value match, then the 16 bits of data and the compliment of the mask are logically ANDed; this result is written to the PLC. This will clear the bit to a zero state.
- If the result and the specified value do not match then the 16 bits of data and the specified value are logically ORed; this result is written to the PLC. This will set the bit to a one state.

Example 1:

Value in PLC	01010101 01010101	
AND with Mask	00000000 00000001	
Result	00000000 00000001	
Compare result to specified Value	00000000 00000001	Equal so do the following:
Value in PLC	01010101 01010101	
AND with compliment of Mask	11111111 11111110	
Write this value to PLC	01010101 01010100	

Example 2:

Value in PLC	10101010 10101010	
AND with Mask	00000000 00000001	
Result	00000000 00000000	
Compare result to specified Value	00000000 00000001	Not equal so do the following:
Value in PLC	10101010 10101010	
OR with specified Value	00000000 00000001	
Write this value to PLC	10101010 10101011	

Section 2: Edit Mode

2.3.3 PLC Data Field Example

The PLC Data Field allows a value from a specified address to be dynamically displayed. The data may be displayed in any of the following formats.

- Hexadecimal, up to four digits
- Binary, up to sixteen digits
- ASCII, up to two characters
- Decimal, up to five digits
- Decimal, up to five digits with fixed decimal point

The PLC Data field is created by moving the cursor to the desired position, pressing **[F7]**, selecting "**PLC Data**" from the menu then sizing the field. Text can not be entered into this field type. To complete the creation the **[F4]** (Edit Field Parameter) key must be pressed which will result in the following display.

```
Entry:No   Format:HEX  Hi :0000
Addrs:??000/U          Low:0000
```

- The "**Entry**" parameter determines if the operator will be allowed to write data to the specified address in the PLC.

- The "**Addrs**" parameter allows an address to be specified. The address may be any available address in the PLC data table; However, if the word address lies within the I/O Image Table entry will not be allowed.

  The "/U" at the end of the address is the "Source Data Type" specification. The Source Data Type will determine how the 9800 will interprets the PLC's data. It can take one of the following values:
  U - Unsigned Binary - - Signed Binary integer B - Binary Coded Decimal (BCD)

- The "**Format**" parameter determines how the data will be displayed. Moving the cursor to this position and pressing the **[Enter]** key will cause the format types to be displayed. Each time the **[Enter]** key is pressed another format type will be shown.

- The "**Hi**" and "**Low**" parameters allow data value limits to be set for the field. These are the highest and lowest numbers the operator may enter into this field. These parameters are ignored if the "**Entry**" parameter is set to "**No**" which prevents all entry to this field. These limits are only utilized if the specified address is not an I/O Image Table address and the "**Entry**" parameter is set to "**Yes**".

When all the parameters appear as desired the **[Esc]** key is pressed to save the parameters and return to the current screen.

Section 2: Edit Mode

2.3.4 Data Set Example

The Data Set field allows a specified value to be written to a specified address within the PLC. The specified address must not be an I/O Image Table address. The Data Set field appears as a character string. When the cursor is moved to this field and the **[Enter]** pressed, the specified data value will be written to the specified address.

The Data Set field is created by moving the cursor to the desired position, pressing **[F7]**, selecting "**Data Set**" from the menu then sizing the field. The desired text can then be entered into this field . To complete the creation the **[F4]** (Edit Field Parameter) key must be pressed which will result in the following display.

```
Entry:Yes          Format:HEX
Addrs:??000/U      Data  :0000
```

- The "**Entry**" parameter determines if the data will be written to the PLC. This parameter would be set to "**No**" only if the field is being created for use at some future time.

- The "**Addrs**" parameter allows a word address to be specified. This is the address that the data will be written to. This address must not be an I/O Image Table address.

  The "/U" at the end of the address is the "Source Data Type" specification. The Source Data Type will determine how the 9800 will write the PLC's data. It can take one of the following values:
  U - Unsigned Binary - - Signed Binary integer B - Binary Coded Decimal (BCD)

- The "**Format**" parameter allows the data value to be expressed several ways. Moving the cursor to this position and pressing the **[Enter]** key will cause the format types below to be displayed.

  - Hexadecimal, up to four digits
  - ASCII, one or two characters
  - Decimal, up to five digits
  - Decimal, up to five digits with fixed decimal point

  Each time the **[Enter]** key is pressed another format type will be shown. The format parameter is associated only with the display of the data. The actual data written to the PLC will always be in the proper format for the given address.

- The "**Data**" parameter allows the data value that will be written to the PLC to be entered. This parameters is ignored if the "**Entry**" parameter is set to "**No**" which disables this field.

When all the parameters appear as desired the **[Esc]** key is pressed to save the parameters and return to the current screen.

2.3.5 Bar Chart Example

The Bar chart field allows the value from a specified word address within the PLC to be displayed as a proportional bar chart.

The Bar chart field is created by moving the cursor to the desired position, pressing **[F7]**, selecting "**Barchart**" from the menu then sizing the field. Text can not be entered into this field type . To complete the creation the **[F4]** (Edit Field Parameter) key must be pressed which will result in the following display.

- The "**Char**" parameter allows the graphic character that will be displayed to be chosen. The graphic character is shown next to the colon followed by the Hexadecimal code for that character. The character may be selected by directly entering the character or entering the hexadecimal code for the desired character. Any character from the special graphic set (Function key F9, Appendix D) may also be used.

- The "**Addrs**" parameter allows any Data Table word address (including I/O Image Table) to be specified. This is the address from where the raw data is read.

- The "**Format**" parameter sets the data format for the scale value. Moving the cursor to this position and pressing the **[Enter]** key will cause the format types to be displayed. Each time the **[Enter]** key is pressed another format type will be shown. This parameter affects viewing only. It does not modify the actual raw data. The following formats are available:

Hexadecimal, up to four digits
Decimal, up to four digits
Decimal, up to four digits with fixed decimal point

- The "**Scale**" parameter determines the numeric value of each character position in the field. The following formula can be used to calculate the required "**Scale**" value.

$$\frac{\textit{Raw Data Full Scale Value}}{\textit{Desired Number Of Character Positions}} = \text{"}\mathbf{Scale}\text{"}$$

When all the parameters appear as desired the **[Esc]** key is pressed to save the parameters and return to the current screen.

Section 2: Edit Mode

2.4 Control Codes

As a general rule for screen logging, when a screen is printed all eighty character are sent to the serial communication port. If the 9800 is connected to a computer or certain printers this is not sufficient for proper operation. For example, most printers require a *Carriage Return* or *Line Feed* character at the end of a transmission. The 9800 includes a Control Code feature which allows these extra characters to be added to the screen text. In fact, special characters may be included ahead of the screen text, within the screen text, or after the screen text.

To access this feature the 9800 must be in the edit screen mode. If the **[F10]** key (Edit Ctrl Codes) is pressed the display will blank except for a flashing block cursor in the HOME position. Before entering the Control Code screen it is important to determine where and what control codes must be included. A control code is entered by specifying a position and the control code.

- The position is a decimal value from 0 to 80. The display characters are numbered from 0 to 79 starting at the top left character position and ending at the bottom right character position. Specifying a position of zero will cause the control code to be sent prior to the start of the screen text. Specifying a position of eighty will cause the control code to be sent after the screen text. When a character position within the screen text is specified the control code will always be sent prior to the screen character. The control code can be any hexadecimal value from 01 to FF.

The syntax for entering control codes is: *@ Position : Control Code*. For example, to send a *Carriage Return* (CR 0Dhex) after the first forty characters (0 through 39) of screen text have been sent the following would be entered: **@40:0D**. Note the position was set to forty which will cause the control code to be sent prior to screen character forty which is actually the forty first character.

- Up to 120 characters of control code information may be entered in to the control code screen. A space character must be included between each control code that is entered and is included in the 120 character boundary.

When more than one control code is to be sent in a row it is not necessary to enter the position for each control code. For example, if after the entire screen text is sent a *Carriage Return* (CR 0Dhex) and a *Line Feed* (LF 0Ahex) are to be sent, the following would be entered: **@80:0D 0A**.

Two control codes are reserved and have predefined functions. Control code 04 is used to terminate serial transmission at the position where the code is specified. Control code 01 is used to multiple transmit a particular code. The syntax for this is: *@ Position : 01 Space Repetitions Space Code*. For example, to transmit five Line Feeds at the end of a screen enter: **@80:01 05 0A** . All values are hexadecimal except the position value which is decimal.

Example using several codes:

- Start of Text character (STX 02hex) is to be sent prior to any screen text.
- After the first forty characters a Carriage Return and Line Feed are to be sent.
- After all eighty characters have been sent an End of Text character (ETX 03hex) is to be sent.

- Enter this: **@00:02 @40:0D 0A @80:03**

Note: When cloning a screen the control codes are also cloned.

Section 3: Setup System

When Setup System is selected from the root directory the following screen will display:

```
COM1 data port  Date/Time  PLC port
User keys/LED   System
```

This screen allows access to several unit configuration parameters. Each screen selection provides access to a particular configuration parameter or a group of similar parameters.

3.1 COM1 Data Port

When the "**COM1 data port**" field is selected from the setup system screen the following screen will display:

```
Baud rate:1200   Data bits:8  Type:RS232
Parity   :Off    Stop bits:1  Save setup
```

This screen allows the auxiliary serial communication port, COM1, to be configured to match an external device such as a printer. This port is used for screen logging, documentation, and 9229 offline program loading. The individual parameters are modified by moving the cursor to the desired field then pressing the **[Enter]** key until the desired parameter state appears. If any parameters are modified they must be saved to EEPROM memory prior to exiting this screen. This is accomplished by moving the cursor to the "**Save setup**" field and pressing the **[Enter]** key. When the "**Enter**" key is pressed the word "**BUSY**" will appear at the top right of the display for a very short period of time. Once the parameters have been saved the **[Esc]** key may be pressed to return to the Setup system screen.

The possible choices for the five COM1 parameters are listed below.

- Baud rate: 300, 600, 1200, 2400, 4800, 9600, 19200
- Data bits: 7 or 8
- Stop bits: 1 or 2
- Parity: Even, Odd, Off
- Type: RS232 or RS485

Section 3: Setup System

3.2 Date/Time

When the "**Date/Time**" field is selected from the setup system screen the following screen will display:

```
Date:03/11/92  Calibrate: 00
Time:08:00:00  Save setup
```

This screen allows the real time clock/calendar (Timekeeper) to be set and the quartz crystal oscillator frequency to be calibrated. Each component of the date and time, i.e., day, month, etc., is modified separately. To modify a particular component move the cursor to that position, press the **[Enter]** key, key in the new value then press the **[Enter]** key again. The change will not be loaded into the Timekeeper until the "**Save setup**" parameter is selected.

Calibration

The Timekeeper is driven by a quartz crystal controlled oscillator with a normal frequency of 32768 Hz. The Timekeeper is typically accurate within ±1 minute per month at 25°C without calibration. The timekeeper is tested by the component manufacture not to exceed ±35 ppm (Parts Per Million) oscillator frequency error at 25°C, which comes to about ±1.53 minutes per month. The oscillation rate of any crystal changes with temperature.

The Timekeeper used in the 9800 provides a calibration technique that employs periodic counter correction. The calibration circuit adds or subtracts counts from the oscillator divider circuit at predefined intervals which will either increase or decrease the oscillator speed. The "**Calibrate**" parameter may be set to any value from -31 to +31. Each unit of change provides 2.034 ppm of adjustment providing a total adjustment range of ±63.07 ppm. Assuming the crystal frequency is exactly 32768 Hz, each of the 31 units would represent 5.35 seconds per month.

The "**Calibrate**" parameter is modified by moving the cursor to this field, pressing the **[Enter]** key, keying in the desired value then pressing the **[Enter]** key again. The change will not be stored in the Timekeeper until the "**Save setup**" parameter is selected .

Section 3: Setup System

3.3 PLC Port

When the "**PLC port**" field is selected from the setup system screen the following screen will display:

```
Dfile:HR 0000 Size:01  Unit:00 Link:S/232
Mode :ASC/O  Baud:9600  Clk:N  Save setup
```

This screen allows the *Dialogue file* address and size to be specified. It also allows the Link Adapter and Baud rate parameters to be specified. Below is a listing of the possible choices for setting the link. The *Dialogue file* will be described in section 5.1 of this manual. The "**Save setup**" field must be selected prior to exiting this field to save any changes that were made.

The following choices are for setting the Link Adapter parameters on the 9800 to match the PLC.

Link:S/232 (Single,RS232 interface)
M/232 (Multiple,RS232 interface)
S/422 (Single,RS422 interface)
M/422 (multiple,RS422 interface)

Mode :ASC/O (ASCII, Odd parity)
JIS/O (JIS, Odd parity)
ASC/E (ASCII, Even parity)
JIS/E (JIS, Even parity)

If a multiple link is being used a unique unit # must also be given.

3.4 System

When the "**System**" field is selected from the System setup screen the following screen will display:

```
C-lock :0000  Ukey:N  Edit:N  Windows:N
Powerup:Edit  Edit lock:0000  Save setup
```

This screen allows system security and the 9800 power up state to be specified. Two security combination locks are available plus the initial power up state of the 9800. The "**Save setup**" field must be selected prior to exiting this screen to save any modifications made.

3.4.1 Edit lock

The edit lock is associated with edit mode. When this lock is activated a four digit combination must be entered before any editing functions are activated. The combination may be any hexadecimal value from 0001 to FFFF. Assigning a value of zero will disable the edit lock function. The following screen will appear when the edit lock is activated:

```
**** Enter the Edit Mode lock value ****
```

The combination is not displayed as it is keyed in. When all four digits, including leading zeros are keyed in the **[Enter]** key is pressed to complete the process. If an incorrect combination is entered an error message will appear for a moment followed by the above screen. The assigned combination should be stored in a safe place. Without it you can not return to edit mode!

3.4.2 Combination Lock

This combination lock is associated with run mode. The combination lock function is selected by entering a value into the "**C-lock**" field. The value must be a hexadecimal number from 0001 to FFFF. The value zero disables the combination lock function. When this lock is activated the **LOCKED** LED will flash and the selected functions, shown on this screen, will be disabled if so selected. Three functions may be placed under combination lock control.

```
C-lock :0000  Ukey:N  Edit:N  Windows:N
Powerup:Edit  Edit lock:0000  Save setup
```

Ukey: If set to **Y**es the User Keys will be placed under combination lock control. Whenever the Combination lock is activated the User Keys will be ignored.

Edit: If set to **Y**es the PLC modifiable data values will be placed under combination lock control. Whenever the combination lock is activated no modification to PLC data values will be allowed. The cursor may still be moved to a modifiable field, however, pressing the **[Enter]** key will not allow access into the field.

Windows: If set to **Y**es the Window Field will be placed under combination lock control. Whenever the combination lock is activated the Window Fields will become disabled. The cursor may still be moved to a Window field, however, pressing the **[Enter]** key will not allow access into the field.

The actual activation and de-activation of the combination lock will be described in section 5.2.4 of this manual.

3.4.3 Power Up State

The "**Powerup**" field allows the programmer to determine if the 9800 will attempt to communicate with the processor or enter edit mode on power up. If "**RUN**" is selected and the 9800 is unable to communicate with the processor an error message will appear offering a choice of re-trying communications or entering edit mode.

Once programming and system debug is complete it is normal to set this parameter to "**RUN**".

Section 3: Setup System

3.5 User Keys/LEDs

When the "**User keys/LEDs**" field is selected from the system setup screen the following screen will display:

```
Keys 1 -4 : PB  PB  PB  PB
LEDs 1 -4 : SW  SW  SW  SW    Save setup
```

This screen allows the function keys and tri-color Light Emitting Diodes (LED) to be configured. Each key may be configured as either a momentary pushbutton (PB) or a push-on push-off selector switch (SS). Each LED may also be configured to be independently controlled by the PLC or function as an integral part of its associated switch. The following explanation on LED configuration should make their operation clear.

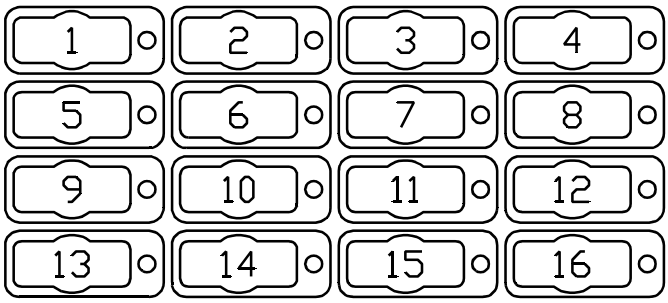
Independently controlled (BT)

When the LEDs are independently controlled by the PLC they have no direct relation to the switches. Each LED may illuminate red, amber or green at any time. Three registers (word addresses) are reserved within the *Dialogue File* that are associated with the LEDs. One register exists for each color the LED may be lit. Since a register is comprised of sixteen bits, one bit in each color register is used to control a particular LED. For example, to light LED 1 red, bit zero in the red register must be energized. A priority scheme exists to resolve the conflict of more than one color bit being energized for a particular LED. Red is highest priority followed by amber then green.

Integral to switch (SW)

When the LEDs are controlled as an integral part of the associated switch, the color registers within the *Dialogue File* are ignored. The operation of the LED is dependant on the state of the switch and the type of switch, e.g., pushbutton or selector switch. If the associated switch is configured as a pushbutton the LED will be off when the switch is de-energized and red when the switch is energized. If the associated switch is configured as a selector switch the LED will be green when the switch is de-energized and red when the switch is energized.

The numbering for the switches and LEDs is shown here.



The configuration for only four switches and
LEDs can be shown on the display a one time. To move from one group to the another set the cursor to the home position then press the **[Enter]** key. To save any changes the "**Save setup**" field must be selected prior to existing this screen.

Section 4: Utilities

When Utilities is selected from the root directory the following screen will display:

```
Screens 000 thru 000        Print setups
Print  Delete               Transfer data
```

This screen allows a contiguous group of screens to be deleted or documented to a printer. It also allows documenting to a printer the configuration parameters contained in the Setup System screens. Another function allows the uploading and downloading of screen files or program files.

Prior to deleting or printing a group of screens, the starting screen number and ending screen number must be keyed in. When printing the COM1 serial port must first be configured using the Setup system screens. Printing the configuration parameters also requires that COM1 first be configured.

The Transfer data field is used with various personal computer software packages such as the Quartech 9229 Offline Programming Software for the 9800. Any special information required will be included with the specific software package.

Section 5: Run Mode

Selecting the Run Mode will cause the 9800 to attempt to establish communication with the PLC. The word "**BUSY**" will appear in the top right of the display to indicate status. If successful the unit will proceed with normal operation. If the 9800 is not successful in establishing communication the following screen will display:

```
PLC comm fault
Retry  Reset
```

If "**Retry**" is selected the 9800 will again attempt to establish communication. If "**Reset**" is selected the 9800 will execute a "Warm boot" ending at the edit root directory or at the edit mode combination screen. The AT keyboard may be used to exit Run Mode by pressing the [Ctrl], [Alt], and [Delete] keys simultaneously. It is not possible to exit run mode from the 9800 keypad.

When in run mode the 9800 must share various information with the PLC. For example the 9800 must provide the PLC with the status of the User Keys; the PLC must dictate what screen(s) should be displayed at any particular time. To accomplish these tasks a group of registers must be reserved in the PLC for use with the 9800. All information exchanges will occur within these registers which is referred to as the *Dialogue File*.

5.1 Dialogue File

The *Dialogue File* consists of a group of up to 32 words of the PLC's memory, reserved for use with the 9800. The *Dialogue File* may be located in any one of four different channels of memory area (HR, LR, IR, or DM); The choice is left up to the programmer. The 9800 must be given the first address, and the number of words reserved (typically between 6 and 32 words). This information is provided to the 9800 during the system setup process as described in section 3.3.

The 9800 will monitor and update the *Dialogue File* frequently, so each of its bits may be changed by the PLC application program at any time. The *Dialogue File* structure is shown below, where each entry in the table shows the offset from the base address that you set during system setup.

Channel HR, LR, IR, DM	FUNCTION
Offset +0	Command Register
Offset +1	Green LEDs
Offset +2	Amber LEDs
Offset +3	Red LEDs
Offset +4	Switch Image
Offset +5	Integer Trigger One
Offset +6	Integer Trigger Two
Offset +7	Integer Trigger Three
Offset +8	Integer Trigger Four
Offset +9 : Offset +32	Bit Trigger Table & Clock /Calendar

Section 5: Run Mode

5.2 Command Register

The individual bits in the *Command Register* instruct the 9800 to perform a specific function, or indicate the status of a function. The *Command Register* is always the first word in the *Dialogue File*, its structure is shown below.

BIT	FUNCTION
0	Lock Edit keys
1	Lock User keys
2	Window Field Lock
3	Edit keys C_Locked
4	User Keys C_Locked
5	Window Field C_Locked
6	Invalid Combination Entered
7	Display Stack Screen
8	Stack Request
9	Stack is Empty
10	Stack is Full
11	Help Key Status
12	Value Modified Flag
13	Clear Stack
14	Dim Display
15	Communication Active Flag

5.2.1 Lock Edit Keys (Bit 0)

The *Lock Edit Keys* feature allows the 9800's edit keypad and any external keyboard to be completely disabled by the PLC application program. When *Command Register Bit 0* is energized the 9800 will light the **LOCKED** LED and ignore any edit keys including those from an external keyboard. The display will remain operational, that is, screens may still be triggered by the PLC.

When *Command Register Bit 0* is de-energized the **LOCKED** LED will turn off, providing Bit 1 and Bit 2 are also off, and normal edit key operation will resume.

5.2.2 Lock User Keys (Bit 1)

The *Lock User Keys* feature allows the 9800's sixteen User Keys to be disabled by the PLC application program. When *Command Register bit 1* is energized the 9800 will light the **LOCKED** LED and ignore any activity on the User Keys. The display and edit keys will remain operational.

When *Command Register bit 1* is de-energized the **LOCKED** LED will turn off, providing Bit 0 and Bit 2 are also de-energized, and normal User Key operation will resume.

5.2.3 Lock Window Field (Bit 2)

The *Lock Window Field* feature allows the PLC to prevent all *Window Fields* from operating. The *Window Field* was described in section 2.3.1. When *Command Register bit 02* is energized the 9800 will light the **LOCKED** LED and all *Window Fields* will be disabled. The *Window Fields* will still appear within a screen as they normally would, however, moving the cursor to that field and pressing the enter key will not produce any action.

When *Command Register bit 2* is de-energized the **LOCKED** LED will turn off, providing bit 0 and bit 1 are also de-energized, and all *Window Fields* will function normal.

5.2.4 Combination Lock (Bits 3, 4, 5, 6)

The three locks, previously described, (Bits 0, 1, and 2) are controlled by the PLC alone. The 9800 and the operator have no way to override their effect. A second method of locking the edit keys, function keys, and window fields is available. This method takes the form of a combination lock. Enabling the use of the combination lock feature was described in section 3.4.2 of this manual.

The following Command Register Bits are used with the combination lock feature.

- Bit 3 - Edit keys C_Locked
- Bit 4 - User Keys C_Locked
- Bit 5 - Window Fields C_Locked
- Bit 6 - Invalid Combination Entered

The combination lock may be activated or de-activated by either the PLC or the operator. The combination lock can only be activated if a valid combination value was assigned during system setup. The following rules apply when either the PLC controls the locks or the operator does.

- If any one, or more than one, of Command Register bits 3, 4, or 5 are energized the **LOCKED** LED will flash.
- When the combination lock is activated by the operator, bits 3, 4, and 5 will be energized by the 9800 based on the initial setup that was explained in section 3.4.2.
- When the combination lock is de-activated by the operator, Command Register bits 3, 4, and 5 will be de-energized by the 9800. If any of these bits are being held energized by the application program the 9800 will not be successful in de-energizing them.
- The PLC may energize a bit that can not be energized by the 9800. For example if User Keys were not selected for combination lock control during setup, the PLC may energize the corresponding bit and lock the User Keys.
- The 9800 can not override bits within the command register that are being held energized or de-energized by the PLC's application program. The PLC can override the 9800.

Section 5: Run Mode

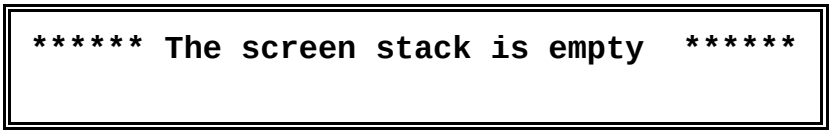
The operator activates the combination lock by pressing the **[LOCK]** key. This will start the **LOCKED** LED flashing and the selected locks will be enforced. De-activating the combination by the operator requires the correct four digit combination value being keyed into the 9800. The process is started by pressing the **[LOCK]** key. Next, the four digit combination value must be entered including any leading zeros, followed by the **[ENT]** key. If the combination value is correct and the PLC is not forcing the combination lock feature ON, the **LOCKED** LED will stop flashing and normal operation will resume. If an incorrect combination value is entered the 9800 will energize *Command Register bit 6*.

5.2.5 Screen Stack (Bits 7, 8, 9, 10,13)

When screens are created one of the attribute flags allows the screens to be placed within a stack that resides inside the 9800's RAM memory. Up to 100 screens may be in the stack at any time. Five Bits within the Command Register are associated with the Stack feature.

- Bit 7 - Display Stack Screen
- Bit 8 - Stack Request
- Bit 9 - Stack is Empty
- Bit 10 - Stack is Full
- Bit 13 - Clear Stack

A special screen, number 720, is associated with the screen stack feature. Whenever The PLC energizes *Command Register bit 7* to enable stack screen display, and no stacked screens are present then screen 720 will be displayed. If *Command Register bit 7* is not energized stacked screens can not be displayed. Screen 720 may be modified or re-sized within the 9800, however it can not be deleted.



The following points describe the basic features offered by the screen stack.

- To direct a screen to the stack the "**Stack**" flag must be set to **Y**es. See section 2.1 for information on the Edit Screen Flags function.
- *Command Register bit 7* (Display Stack Screen) enables stacked screens to be displayed. This bit is controlled by the PLC, however, the PLC program may use one of the 9800 User Keys to energize or de-energize it.
- When *Command Register bit 8* (Stack Request) is energized the next screen on the stack will be moved to the display. If their are no screens in the stack, screen 720 will automatically be displayed. This bit is controlled by the PLC, however, the PLC program may use one of the 9800 User Keys to energize or de-energize it.
- *Command Register bit 9* (Stack is Empty) will be energized by the 9800 when no screens are in the stack. It is at this time that screen 720 is displayed. The 9800 will de-energize this bit when at least one screen is in the stack.

- *Command Register bit 10* (Stack is Full) will be energized by the 9800 when one hundred screens are in the stack. While this bit is energized no additional screens will be accepted by the stack, they will be lost. The 9800 will de-energize this bit when the number of screens in the stack falls below one hundred.

- When *Command Register bit 13* (Clear Stack) is energized all screens that may be in the stack are deleted leaving the stack empty.

5.2.6 Help Key Status (Bit 11)

This *Command Register* bit is controlled by the **[HELP]** key in the 9800's edit keypad. The **[HELP]** key functions like a pushbutton. When the **[HELP]** key is pressed the 9800 will energize *Command Register bit 11*. When the **[HELP]** key is released the 9800 will de-energize bit 11. The actual use and implementation of this feature is left up to the programmer.

5.2.7 Value Modified Flag (Bit 12)

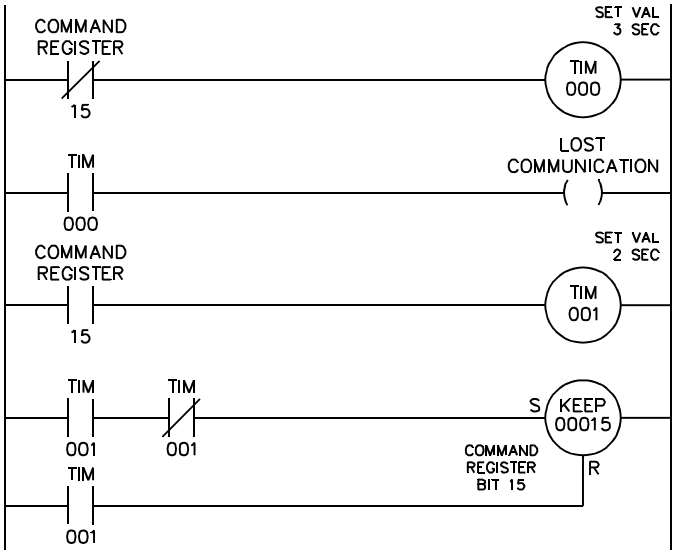
Command Register bit 12 is energized by the 9800 any time a screen sends data to the PLC. This includes Data Set Fields, PLC Data Fields, and Bit Status Fields when used in the bit set format. The 9800 does not de-energize this bit, therefore the PLC application program must acknowledge the modification by de-energizing the bit each time it is set. If this function is not used by the PLC application program then it may simply be ignored.

5.2.8 Dim Display (Bit 14)

Energizing this bit will decrease the brightness of the vacuum fluorescent display. Decreasing the brightness will prolong the life of the display.

5.2.9 Communication Active Flag (Bit 15)

The 9800 will monitor *Command Register bit 15* frequently. This bit will be energized by the 9800 anytime it is found de-energized. The PLC can use this bit as part of a watchdog timer circuit that can detect a loss of communication with the 9800. The following is a typical circuit used to detect a loss of communication with the 9800.



Section 5: Run Mode

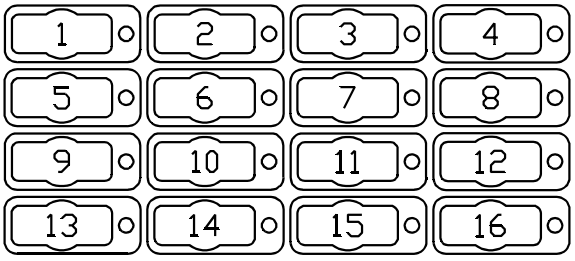
5.3 Tri-Color LED control

As discussed in section 3.5 the sixteen tri-color LEDs may be controlled by their associated switches, or they may be independently controlled by bits inside the PLC. The second, third, and fourth registers of the *Dialogue File* are reserved for this purpose. Each LED is assigned one bit from each of the three color registers. The following table shows the correlation between the LEDs and color register bits.

LED Number	Green Register	Amber Register	Red Register
1	00	00	00
2	01	01	01
3	02	02	02
4	03	03	03
5	04	04	04
6	05	05	05
7	06	06	06
8	07	07	07
9	08	08	08
10	09	09	09
11	10	10	10
12	11	11	11
13	12	12	12
14	13	13	13
15	14	14	14
16	15	15	15

To illuminate an LED a particular color the appropriate bit must be energized. For example, to light LED 10 red, bit number 09 of the red register must be energized. A priority scheme exists so that if more than one color register bit is energized for the same LED the outcome can be anticipated. Red has highest priority, followed by amber then green. Only those LEDs that are configured to be controlled by bits inside the PLC will be affected by the color registers.

The LEDs are numbered as shown here.

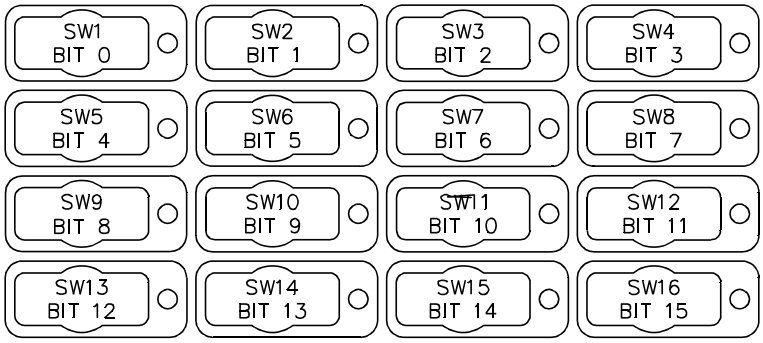


Section 5: Run Mode

5.4 User Keys

As discussed in section 3.5 the sixteen user keys may be configured as momentary pushbutton switches or as push-on/push-off switches. The fifth register in the *Dialogue File* is reserved for use as a switch image register. The 9800 will frequently update the bits in this register to correspond to the action on the user keys.

The following diagram shows the correlation between the switches and the switch image register bits.



The register bits
may be used as normally open or normally closed contacts within the PLC application program just as input bits would be. The effect the 9800's switches have on their assigned register bits depends on how the switch is configured.

Configured as Selector Switch -

When the switch is pressed, it will compliment the state of the associated register bit. For example, if the register bit is energized and the switch is pressed, the register bit will be de-energized by the 9800. If the register bit is de-energized and the switch is pressed, the register bit will be energized. This action produces the push-on/push-off selector switch effect.

Configured as Pushbutton Switch -

When the switch is pressed, the 9800 will energize the associated register bit. When the switch is released, the 9800 will de-energize the associated register bit. This is typical of a standard discrete industrial pushbutton switch.

The 9800 will allow only one key to be activated at one time. If one key is held closed, then a second key is pressed, the second key will not be recognized. If the previously closed key is released the second key will then be recognized.

Section 5: Run Mode

5.5 Screen Triggering

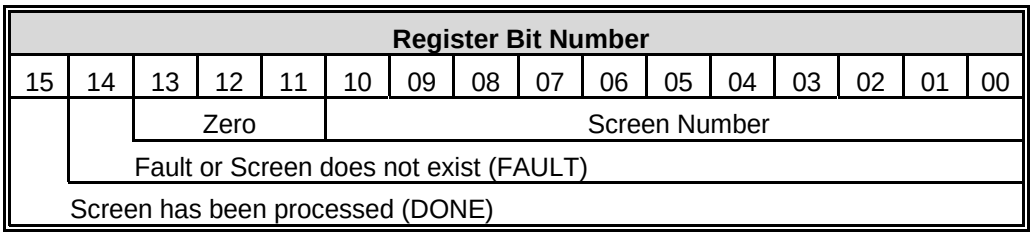
A trigger is a means by which a screen is made to display. The 9800 has two screen trigger methods, Integer Trigger and Bit Trigger. Both trigger methods may be used simultaneously. The two trigger methods will be discussed separately.

5.5.1 Integer Trigger

To trigger a screen using the Integer Trigger method a value, which is the screen number, is written into an integer trigger register within the PLC. The 9800 provides four integer trigger registers in the *Dialogue File*. These are the sixth, seventh, eighth, and ninth registers within the *Dialogue File* (see section 5.1). Each trigger register is independent. Any one or all may be used simultaneously; however, when using more than one trigger register care and planning is critical for success.

Using multiple trigger registers can make the application program in the PLC simpler and easier to understand. In most applications there are multiple types of messages that need to be displayed. Some examples are: status, faults, instructions, setups, and maintenance messages. Providing multiple triggers allows these messages to be grouped, thus adding greater organization to the PLC's application program.

Each of the 9800's integer trigger registers is structured as shown below.



Since the screen number can not be greater than 722 only the eleven least significant bits of the trigger register are used when a screen number is moved into it. The 9800 uses bits 15 and 14 to indicate status to the PLC. The 9800 will set bit 15 (the DONE bit) to a ONE when the screen specified by bits 00 through 10 has been accepted for display, stack, or printing. If the screen does not exist within the 9800, or the screen has syntax errors, bit 14 (the FAULT bit) will also be set to a ONE. (Several examples of integer triggering are shown on the next page.) If the DONE bit is cleared by the PLC, the 9800 will re-trigger the given screen.

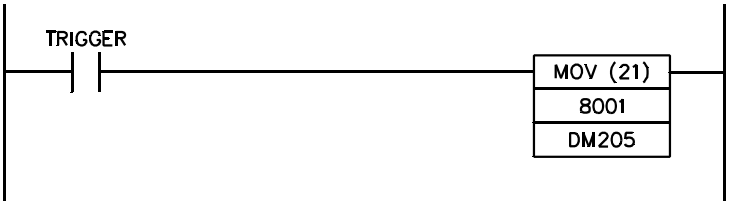
Displaying a screen is often referred to as "opening a screen". Each time a new screen number is moved into a particular trigger register, that screen number will be recognized by the 9800 and the screen will become open. The screen that was previously specified by that trigger register will be removed from the display prior to the new screen being opened; this is referred to as "closing a screen". Only one screen may be open for each trigger register at any one time. You may open more than one screen at a time by using different trigger registers to open each screen.

It is possible to close a currently open screen without opening another to replace it. This is done by moving a value of zero into the trigger register.

Section 5: Run Mode

Example 1:

This example shows the basic circuit for triggering a screen using the integer trigger method. This circuit assumes the *Dialogue File* starts at DM200. The integer trigger register used is at DM205. When the trigger circuit energizes the screen number will be moved into the integer trigger register causing the screen to be displayed.



Note that the constant has a value of 8001h. This will keep the DONE bit from being cleared by the MOVE. This circuit will trigger the screen once; if the DONE bit were cleared by the MOVE, the screen would be re-triggered over and over again. You might also use AND and OR functions to mask off the DONE bit, so that its value does not change.

Section 5: Run Mode

5.5.2 Bit Trigger

To trigger a screen using the Bit Trigger method an individual bit within the *Dialogue File* must be energized. The tenth word through the twenty ninth word in the Dialogue File are reserved for use with Bit Trigger mode. Each bit within these 20 words is associated with a single screen. This allows one bit for each of the 319 possible with bit trigger mode. Screens 320 through 719 can not be triggered by bit trigger mode.

The table below shows the screens assigned to each bit in the *Dialogue File*. If a *Dialogue file* of HR000 is used.

	Bit 00	Bit 01	Bit 02	Bit 03	Bit 04	Bit 05	Bit 06	Bit 07	Bit 08	Bit 09	Bit 10	Bit 11	Bit 12	Bit 13	Bit 14	Bit 15
HR9	*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
HR10	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
HR11	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
HR12	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
HR13	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
HR14	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
HR15	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111
HR16	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127
HR17	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143
HR18	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159
HR19	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
HR20	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191
HR21	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207
HR22	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223
HR23	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239
HR24	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255
HR25	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271
HR26	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287
HR27	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303
HR28	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319

Notice that HR9, bit 00 does not have a screen number assigned to it. This bit is used to close any screen that was opened by Bit Trigger mode, furthermore, as long as this bit is energized the 9800 will ignore the bit triggers.

The 9800 scans the bit trigger table starting from register HR9 bit 00 and continuing through bit 15 of HR28 or the last word reserved, which ever is lower. If Bit Trigger mode is not going to be used, or if only a portion of the screens are to be bit triggered, the number of registers reserved within the *Dialogue File* should be reduced to only what is needed. This will improve the 9800's response time.

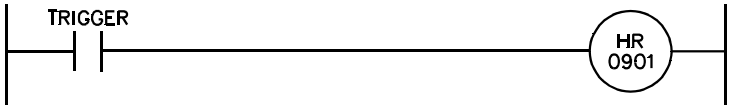
The first off-to-on transition that is found will cause the associated screen to be displayed. Only one bit trigger screen may be open at any time, therefore, each time a new off-to-on transition is found the currently displayed screen will be closed prior to opening the new one.

Section 5: Run Mode

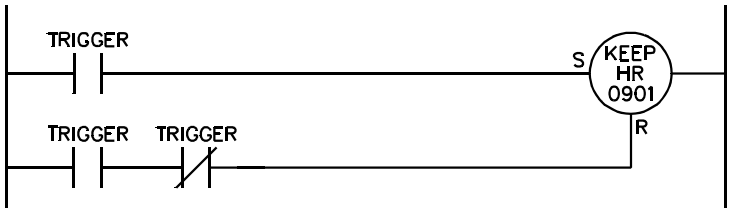
The 9800 maintains an image of the bit trigger table. Each time the table of bits is read from the PLC it is first compared to the image, to detect off-to-on transitions, then it is saved as the new image. Once a screen has been displayed it can not be opened again until its trigger bit has been detected in the de-energized state. When the 9800 detects an off-to-on transition it will acknowledge the acceptance of the trigger by attempting to de-energize the trigger bit in the PLC. If the trigger circuit in the PLC is programmed as a standard contact the 9800 will not be capable of de-energizing the bit. If the contact is programmed as a transitional contact, the 9800 will be able to de-energize the bit.

In the following example the trigger circuit controls a standard coil directly. When the trigger circuit energizes the coil will energize; when the trigger circuit de-energizes the coil will de-energize. In this configuration the 9800 can not de-energize the coil when the screen has been displayed. This is not a problem; however, a potential problem with this circuit does exist. If the trigger circuit is not energized long enough for the 9800 to read it in the energized state, the screen will not be displayed. The amount of time it takes the 9800 to read the trigger bit is dependent on several parameters, including the size of the Dialogue File, the number of variables currently displayed, and the number of devices communicating with the PLC.

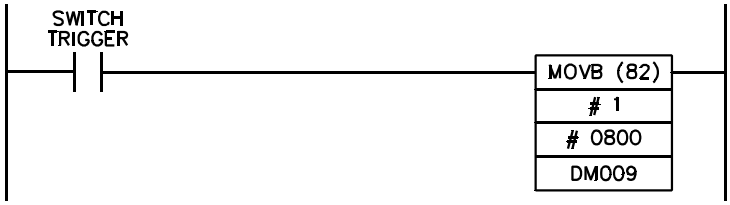
If Dialogue file is at HR000, this circuit will trigger screen one.



In the following example the trigger coil is a latch type, since the 9800 will unlatch the bit the reset input on the KEEP instruction should be set as shown. Remember the important feature of this circuit is that if the TRIGGER circuit de-energizes, the latch coil will remain energized allowing the 9800 to detect it and display the appropriate screen. When the 9800 is done, it will then unlatch the bit.



As a final example, we will show a sample circuit to trigger a screen when the *Dialogue File* is located in DM channel memory. We will use one of the 9800's pushbuttons as the trigger contact.



The Move bit instruction in this example will move a 1 to bit 8 of DM009. In other words this will set bit 8 in the first BITTRIGG register to trigger screen number 8. The Move bit instruction acts like a latch. That is, it will not clear the bit when the pushbutton is released. But remember, the 9800 will clear the bit after the screen is triggered.

Section 5: Run Mode

5.6 Programmers Tool

Screen 722 is a special screen which allows access to any Data Table address within the PLC; however, I/O Image Table addresses can not be modified. Screen 722 can not be accessed by the screen editor, however, it can be triggered by Integer Trigger mode or through a window field. Bit Trigger mode does not have a bit assigned to this screen. When screen 722 is triggered it will appear as shown below.

```
Address:??000/U        Format:HEX
Data   :****
```

******** CAUTION ********

This feature should be used only by individuals completely familiar with the application program resident in the PLC. Entering a value into an address without knowing what impact it might have on the operation of the PLC is very dangerous.

5.7 Date/Time

The 9800 contains a real time clock (Timekeeper) that allows the date and time to be displayed within screens. The date and time are each individual fields. In addition the date and time may be sent to the Omron. If the date and time is to be sent to the Omron, the *Dialogue File* must have twelve or more elements. The date and time will be stored as BCD data in the last three elements of the *Dialogue File*. These last three elements will not be interpreted as Bit Triggers.

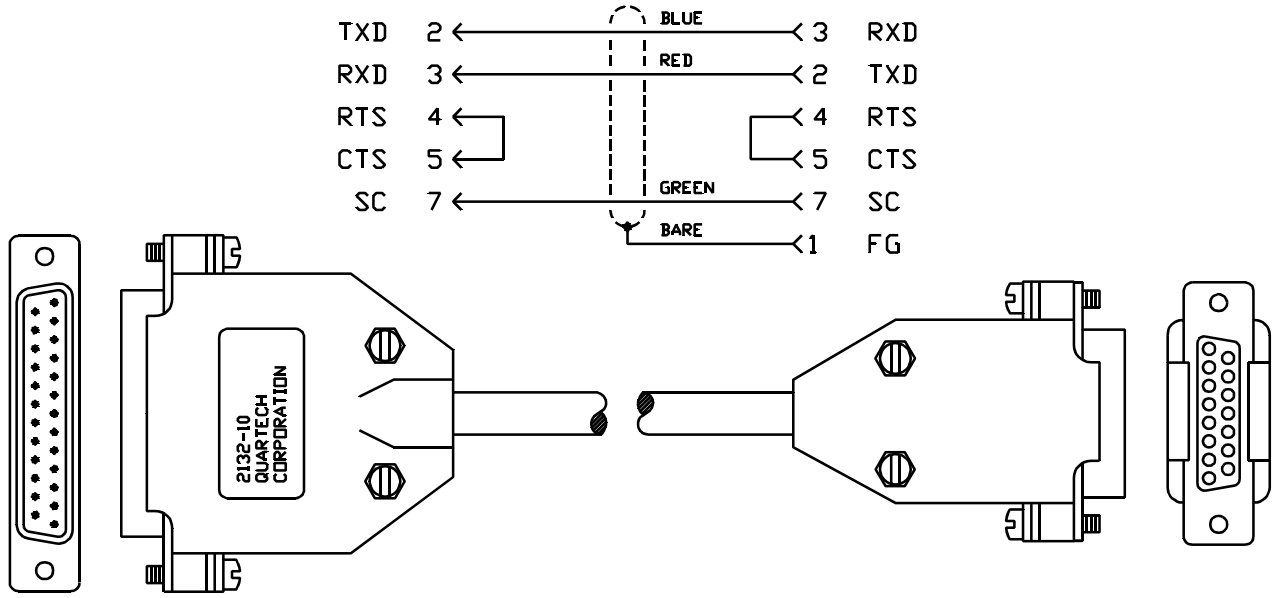
The date and time will be stored as shown below. HRXXX is assigned *Dialogue File.*

	/15	/14	/13	/12	/11	/10	/09	/08	/07	/06	/05	/04	/03	/02	/01	/00
HRXXX:[Last - 2]	Seconds [00-59]								Minutes [00-59]							
HRXXX:[Last - 1]	Hours [00-23]								Day [01-31]							
HRXXX:[Last]	Month [01-12]								Year [00-99]							

Appendices:

Appendix A: Communication Basics

The 9800 communicates with the Omron C-Series processor, through its Host Link Adapter. The following communication cable is necessary to connect the 9800 to the Host Link Adapter with a RS-232 interface. This cable is a standard production item at Quartech. The standard length of this cables is ten feet, however, lengths up to fifty feet are available.



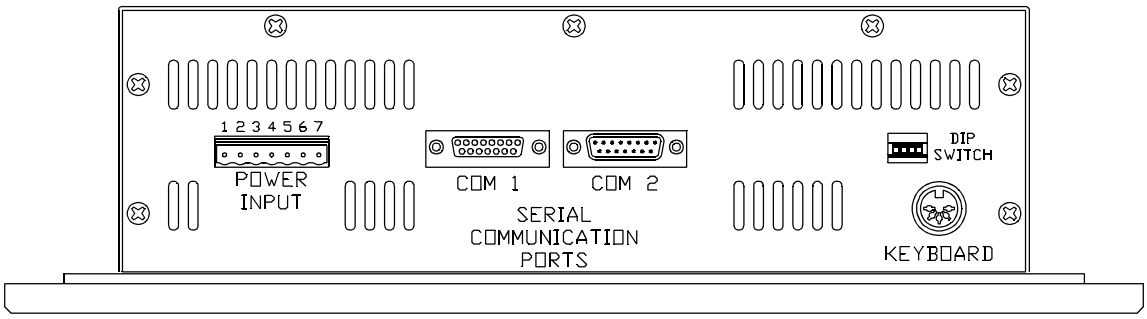
Quartech Model 2132-10 communication cable.
9800 to Omron C-Series Host Link Adapter
with RS-232 Interface

The 9800 communicates with the PLC through the Host Link Adapter. Several parameters in the 9800's PLC port setup must match that of the Host Link in order to establish communications.

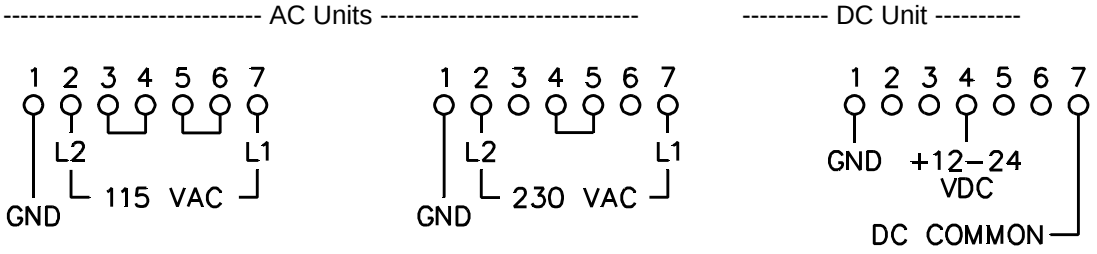
Appendices:

Appendix B: 9800 Access Plate

All connections to the 9800 are made through various connectors located at the bottom of the unit. DIP switches are also accessed through this bottom plate. This following diagram shows the placement of the various connectors and switches.



POWER INPUT
These seven terminals are used to select and receive the input power. The following schematics show the possible connections.



KEYBOARD
The keyboard port accepts a standard IBM compatible AT keyboard. This keyboard is used with the resident editor or for making selections and entering data while in RUN mode. Additional information is available on page 5 of this manual.

COM 2 SERIAL COMMUNICATION PORT
COM2 is the communication port used to interface with the Host Link Adapter on the PLC. The interconnecting cable is described in Appendix A.

Appendices:

COM 1 SERIAL COMMUNICATION PORT

COM 1 is an auxiliary serial communication port that is used to document the screens and setup files of the 9800. It is also used with the Quartech model 9229 Offline Programming Software. Information on the configuration of *COM 1* is described in section 3.1. Below is the signal pin assignments for *COM 1*.

RS-232	
PIN	**SIGNAL**
1	(FG) Frame Ground
2	(TXD) Transmit
3	(RXD) Receive
4	(RTS) Request To Send
5	(CTS) Clear To Send
7	(SC) Signal Common

RS-485	
PIN	**SIGNAL**
14	(TXDA) Transmit +
6	(TXDB) Transmit -
8	(RTSA) Request To Send +
15	(RTSB) Request To Send -
12	(RXDA) Receive +
13	(RXDB) Receive -
10	(CTSA) Clear To Send +
11	(CTSB) Clear To Send -
7	(SC) Signal Common
9	(FG) Frame Ground

RS-232

The signals are terminated in a typical data terminal configuration. The cable between the 9800 and any other device should not exceed fifty feet.

RS-485

The cable between the 9800 and any other device may be up to 4,000 feet providing communication cable specifically made for RS-485 communication is used. The Signal Common (**SC**) pin is used to provide a common reference between the 9800 and connected device. In many applications the circuit reference will be provided through an earth ground connection. To use this reference method a 100 ohm resistor is placed between pin 7 and pin 9 on the mating connector. This will connect the RS-485 DC common signal to earth ground. When using this reference method the **GND** terminal on the 9800 must be connected to a hard earth ground point. Before selecting the earth ground method an important specification must be considered. The RS-485 drivers and receivers will operate with a common mode voltage between -7 and +7 volts peak. Generally this means that the voltage potential between the earth ground of one device and the earth ground of any other device must not exceed seven volts. When the earth ground potentials exceed the seven volts peak limit an alternate circuit reference is available. To use the alternate method an additional conductor must be provided in the transmission cable. The additional conductor is connected to the **SC** terminal of all units (*Do not use the shield drain wire for this purpose!*).

DIP SWITCH

DIP switches three and four are not used on this unit. DIP switches one and two are used to enable line termination resisters on the RXDA/RXDB and CTSA/CTSB inputs of the COM1 port. Line termination is required to reduce signal reflections on a transmission line which are caused primarily by capacitive loading. Line termination becomes increasingly important as baud rate and line length increase. DIP switch one enables the line termination resistor for the RXDA/RXDB circuit. DIP switch two enables the line termination resistor for the CTSA/CTSB circuit. In most applications both these DIP switches may be set to the ON position.

Appendices:

Appendix C: Error Codes

The 9800 will display one of the following error messages if it encounters a configuration, communication, or hardware error it cannot recover from without the help from an operator.

- *RAM memory Fault!*
- *Keyboard did not respond!*

These errors typically indicate hardware failure. If re-powering the unit does not correct the problem, repair may be necessary.

- *PLC comm fault!*

These errors may occur due to excessive electrical noise or improper grounding. Action must be taken to correct the source of the problem.

- *Invalid Dfile*
- *Unit not setup for Omron*
- *This PLC not supported*
- *PLC access fault*
- *PLC in Program*

These errors are configuration related. Action must be taken to correctly configure the 9800.

- *Not enough EEPROM to save screen!*

Additional EEPROM memory must be added to the unit before more screens can be saved. See price list for available memory modules. Also, see Application Note AN9800A, for hints on using memory more efficiently.

The following messages may be displayed in response to certain keystrokes. These are not fatal errors. The message will be displayed for a few seconds then the 9800 will resume operations.

- *Value entered is out of range!*
- *Invalid address entered!*
- *Screen range is invalid!*
- *Invalid lock data!*

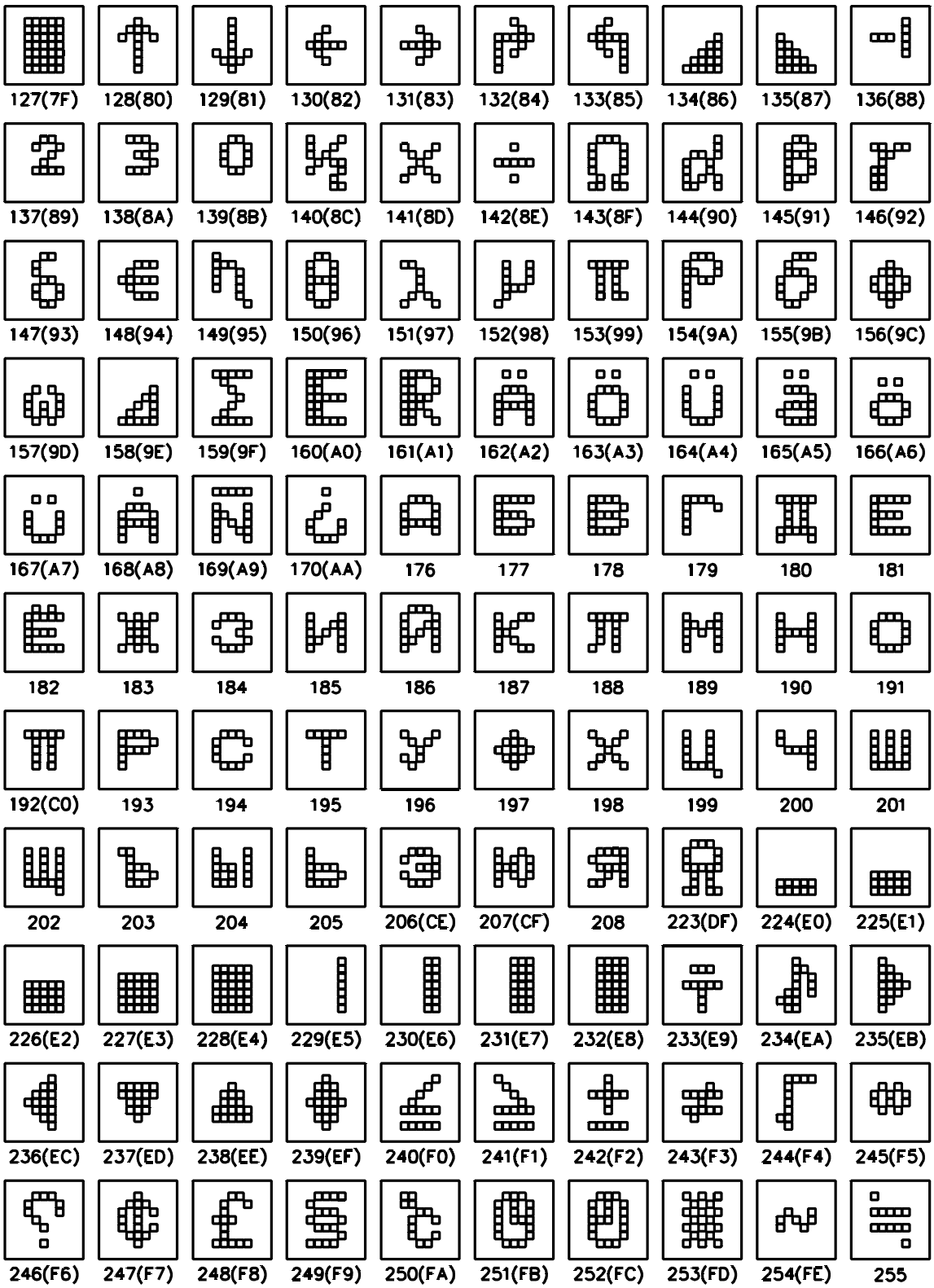
Appendix D: Special Graphic Set

The 9800 provides over 100 special characters which may be used within any text string. The table on the following page shows the characters that are available. Below each character is a decimal number and in most cases a hexadecimal number in parentheses. The number in parentheses indicates that this character may be selected using the 9800's built-in editor. To access the character set the **[F9]** key must be pressed while editing a field. Once the graphic set is displayed the cursor is moved to the desired character and the **[Enter]** key is pressed.

When using the offline programming software all the characters in the table are available. To use the characters in a field you must enter the three digit decimal number found under the character. To enter the number, press and hold the [Alt] key, then type in the code using the "number pad" keys located on the right side of the computer's keyboard. When you release the [Alt] key the character will be inserted into the text. It is important to use the "number pad" keys, the number keys along the top of the keyboard will not work.

Many of the 9800's extended characters cannot be displayed on the computer's screen. If this is the case the computer will display '■'.

Appendices:


127(7F) 128(80) 129(81) 130(82) 131(83) 132(84) 133(85) 134(86) 135(87) 136(88)
137(89) 138(8A) 139(8B) 140(8C) 141(8D) 142(8E) 143(8F) 144(90) 145(91) 146(92)
147(93) 148(94) 149(95) 150(96) 151(97) 152(98) 153(99) 154(9A) 155(9B) 156(9C)
157(9D) 158(9E) 159(9F) 160(A0) 161(A1) 162(A2) 163(A3) 164(A4) 165(A5) 166(A6)
167(A7) 168(A8) 169(A9) 170(AA) 176 177 178 179 180 181
182 183 184 185 186 187 188 189 190 191
192(C0) 193 194 195 196 197 198 199 200 201
202 203 204 205 206(CE) 207(CF) 208 223(DF) 224(E0) 225(E1)
226(E2) 227(E3) 228(E4) 229(E5) 230(E6) 231(E7) 232(E8) 233(E9) 234(EA) 235(EB)
236(EC) 237(ED) 238(EE) 239(EF) 240(F0) 241(F1) 242(F2) 243(F3) 244(F4) 245(F5)
246(F6) 247(F7) 248(F8) 249(F9) 250(FA) 251(FB) 252(FC) 253(FD) 254(FE) 255

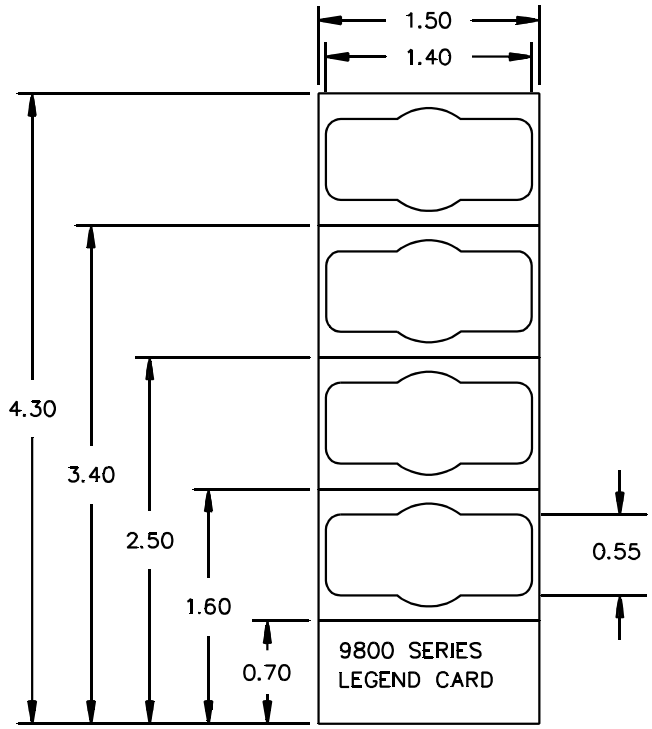
Appendices:

Appendix E: Legend Cards

Each of the 16 user keys has a 9/16" x 1 3/8" legend area which allows the user to label each key. A set of legend cards is included with the 9800. The legend cards are kept clean by inserting them into a 'see through' pocket within the polyester overlay.

To gain access to the pocket in the overlay, it is necessary to remove the keyboard assembly from the bezel. to do this, remove the eighteen, No. 6, Allen head screws from the rear of the overlay backing plate. The keyboard assembly can then be removed from the bezel.

Four legend card pockets are open at the bottom edge of the overlay. After labeling each legend card, carefully cut it to size and insert it into the correct pocket. Assemble the overlay to the bezel in the reverse order as removal.



Quartech can provide custom legend cards produced to your specifications. Custom graphics and color may be included in each legend. Contact Quartech Customer Service for price and delivery.

Appendices:

Appendix F: Installation

The 9800 is designed to be mounted in the door of an enclosure or on an operators console for ease of use. A template is provided to assist in the drilling and cutting of the mounting holes for the unit. Care should be taken to protect the unit from metal chips and conductive particles. Failure to protect the unit may cause damage when power is applied and may void warranty.

A minimum clearance of six inches should be kept between the unit and any other device that generates heat. In the event that the internal enclosure temperature periodically exceeds 55 degrees Celsius (131 degrees Fahrenheit), fans or a purge air system should be used to increase the air flow, and eliminate "Hot Spots" that occur within the panel.

Electrical Requirements

AC powered units: 115 VAC or 230 VAC, ±10%, 50/60 Hz, Fuse at ½ Amp

DC powered units: 12 VDC to 24 VDC, ±5%, 1½ Amps

Environment:

Operating Temperature:	0°c to 55°c
Storage Temperature	-20°c to 70°c
Operating Humidity	0% to 85% (non-condensing)
Storage Humidity	0% to 95% (non-condensing)
Vibration (10Hz to 55Hz)	Displacement: 0.5mm, Constant X,Y,Z axis
Shock	40G
Weight	9 pounds

Wiring Considerations

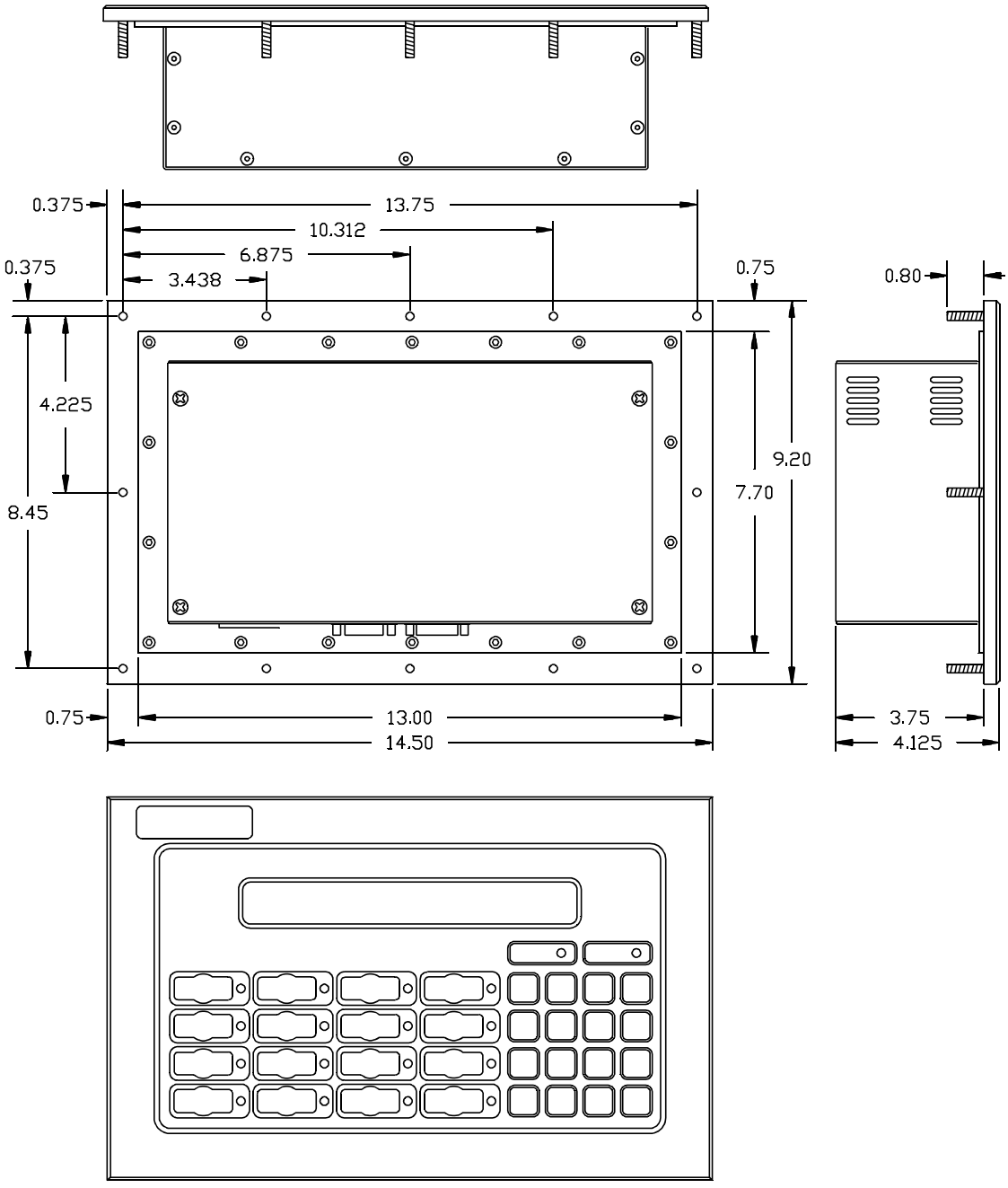
Care should be taken when routing DC power supply cable and the communication cable. Follow these guidelines for a trouble free installation.

- The DC power lines and communication cable must be kept away from AC power lines. Keep both at least one foot away from 120 VAC lines, and two feet away from higher voltage lines. This especially applies to the communication cable. If the cables must cross AC power lines, cross them at right angles (90°).
- Keep the cables away from sources of high energy fields such as arc welders, AC motors, motor starters, servo controllers, generators, induction heaters, and transformers.

Appendices:

Mechanical Dimensions

Mounting studs are number 10-24. Mounting hardware is included.



All dimensions in inches

Quick Reference

Dialogue File

Channel HR,LR,IR,DM	FUNCTION
Offset +0	Command Register
Offset +1	Green LEDs
Offset +2	Amber LEDs
Offset +3	Red LEDs
Offset +4	Switch Image
Offset +5	Integer Trigger One
Offset +6	Integer Trigger Two
Offset +7	Integer Trigger Three
Offset +8	Integer Trigger Four
Offset +9 : Offset +32	Bit Trigger Blocks & Clock/Calendar

Command Register

See section 5.1 for details. See section 5.2 for details.

BIT	FUNCTION
0	Lock Edit keys
1	Lock User keys
2	Window Field Lock
3	Edit keys C_Locked
4	User Keys C_Locked
5	Window Field C_Locked
6	Invalid Combination Entered
7	Display Stack Screen
8	Stack Request
9	Stack is empty
10	Stack is full
11	Help key
12	Value Modified
13	Clear Stack
14	Dim Display
15	Communication Active Flag

Special Screens:

Screen 0	User identification on power up. See section 1.3 for details.
Screen 720	Screen stack status. See section 5.2.5 for details.
Screen 722	Programmers Tool. See section 5.6 for details.

Editor Function Keys:

[F1] Flash
[F2] Edit Screen Flags
[F3] Edit Text
[F4] Edit Field Parameters
[F5] Move Field
[F6] Resize Field
[F7] Add Field
[F8] Remove Field
[F9] Graphic Set
[F10] Transmit Control Codes