

Hardware Manual

2900

***Compact Operator Interface Terminal
with loadable communication drivers***

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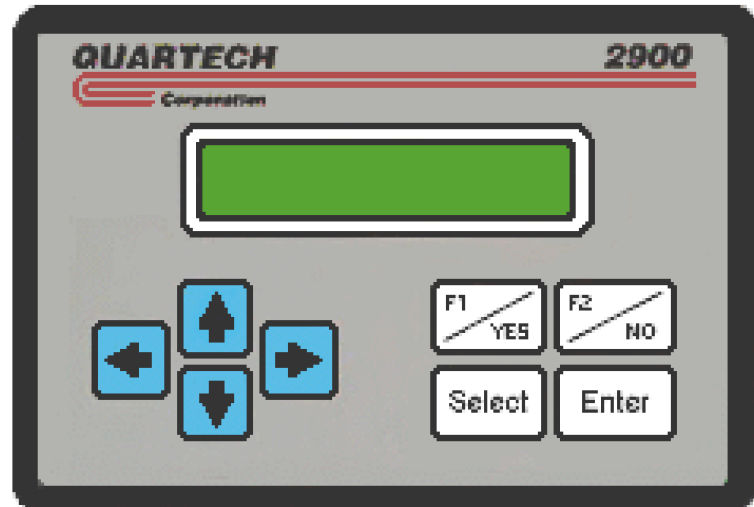
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The 2900 Operator Interface Terminal is a user friendly product specifically designed for use with compact programmable controllers. It enables the operator to easily view and change values in the PLC system without having to learn address and data formats unique to the PLC.

The 2900 OIT is fully programmable using ScreenMaker 2000 Windows™ based off-line software. The system engineer can customize each screen to fit the current application. Text and data can be combined in order to eliminate the need for the operator to know the origin of the data being displayed.

The text can be combined with eight variable fields coming from any data location internal to the PLC. In addition, the values can be scaled and displayed in various formats. Variables can also be defined as read only or read /write thus allowing for system protection.



The up/down arrows allow the operator to navigate through screens in an order predetermined by the system engineer, or the PLC can force the 2900 to a desired screen. The up/down arrows also allow the operator to increment or decrement PLC data values.

The YES/NO keys manipulate individual bits internal to the PLC. These keys can be used for any function that a traditional pushbutton is used for, however, they can also be redefined to function differently on every screen. Since the 2900 OIT utilizes Flash nonvolatile memory, the threat of losing the customized screens (up to 500) due to a power loss, dead battery, etc., is nonexistent.

What are Screens & Fields?

The 2900 is customized for a particular application by creating screens. A screen is similar to a canned message and may include variable information from the PLC. A group of text or a variable is referred to as a field. Each field has an assigned size and position within a screen. Seven field types are currently available a may be combined in any combination to produce a screen. The seven field types are listed here.

- | | |
|----------------------------------|--|
| Static Text | This field allows fixed character strings to be displayed within a screen. The field size and position are user defined. |
| Scrolling Text Horizontal | This field allows fixed character strings to scroll right to left within a defined window. The window size and position are user defined. |
| Scrolling Text Vertical | This field allows lines of fixed character strings to scroll bottom to top within a defined window. The window size and position are user defined. |

- Data Set** This field appears as fixed text within a screen. When this field is created an address and a data value are specified in addition to the field text. Moving the focus, via the **Select** key, to this field and pressing the **Enter** key will cause the data value to be written to the assigned address within the PLC. This field can also be assigned to increment or decrement a value within the PLC by a fixed amount. A limit value is assignable to prevent the PLC data from exceeding the desired value.
- 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 Decimal, Hex, Binary, ASCII, or BCD 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 focus to this field by pressing the **Select** key, a new value is then keyed in and the **Enter** key pressed.
- PLC Message** This field will display variable text string from within the PLC, up to sixteen characters long. The starting address from which character data will be retrieved is specified when the field is created. Although not practical, The text string can be modified through the 2900 keypad.
- Bit Status** When creating this field a mask value and data value for a PLC address are specified. Two character strings are also typed in, one for the true state of the bits and one for the false state of the bit. One of the two character strings will then be displayed depending on the status of the specified data value versus the mask value. If enabled this field will also function as a bit modify. Moving the focus, via the **Select** key, to the field and pressing the **Enter** key will cause the bits to be complimented by the 2900. An application note describing this field can be found in Appendix E of this manual.

Detailed information on screen and field creation can be found in the ScreenMaker User's Guide or refer to the "Help" when creating the application.

Notice

The 2900 is shipped from the factory with the manufacturing test code loaded into its memory. A Communication Driver File must be loaded into the unit prior to loading an Application Screen File. Refer to Section 2: Loading Communication Drivers, for detailed information regarding this subject..

Section 2: Loading Communication Drivers

The 2900 is shipped from the factory with manufacturing test code installed. The first step in preparing the 2900 for active duty is to load a communication driver into it. The communication driver makes the 2900 compatible with a particular brand and sometimes model of programmable controller, i.e. Allen-Bradley PLC-5 DF1, Modicon Modbus, etc.

The communication driver must be loaded before an Application Screen File can be loaded.

A Communication Driver File is loaded into the 2900 using ScreenMaker 2000 configuration software running on your personal computer. The 2900 is connected to the personal computer via a communication cable (Quartech cable 2136-10). The specifications for this cable can be found on the next page.

A four position DIP switch is accessible through the rear cover of the 2900. Applying power to the 2900 with Dip Switch 4 set to the ON position (up), will place it into Communication Driver File download mode.

The 2900 will display:



2900 CODE FILE LOAD
Vx.x CONTINUE?

Pressing the **YES** key will trigger the following screen:



WAITING FOR COMMAND
FROM COMPUTER

The Communication Driver Files and instructions for downloading are both part of the ScreenMaker 2000 programming software package. After downloading the desired Communication Driver File into the 2900, remove power and set DIP switch 4 to the OFF position (down). The 2900 is now ready to accept an Application Screen File. Section 3: Loading Screen Files, describes this procedure.

At Quartech we are continually working on new communication drivers for the 2900. These new drivers and upgrades to existing drivers are available free of charge via our web site at www.quartechcorp.com.

Currently available Communication Drivers:

Allen-Bradley SLC500, DH-485.
Allen-Bradley PLC-5, DF1.
Fuji Electric N Series
Mitsubishi FX Series
Idec, Micro3 & Micro3C
Toshiba T1 protocol

Allen-Bradley SLC500, DF1. (Works with MicroLogix PLC)
Allen-Bradley PLC-2
GE Fanuc Series 90
Modicon Modbus.
Omron Host Link
Toshiba EX100 protocol

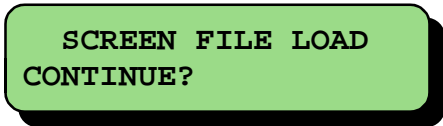
Section 3: Loading Screen Files

The first step in preparing a 2900 for active duty is to download a Communication Driver File into it. That process was discussed in the prior section. The second step is to download an Application Screen File. This section assumes an Application Screen File has already been created using ScreenMaker 2000 software.

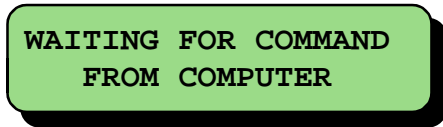
An Application Screen File is loaded into the 2900 using ScreenMaker 2000 configuration software running on your personal computer. The 2900 is connected to the personal computer is via a communication cable (Quartech cable 2136-10). The specifications for this cable can be found at the bottom of this page.

To ready the 2900 for downloading an Application Screen File, hold down the **Enter** key while applying power to it. When power is first applied to the 2900 it will check the **Enter** key state. If the **Enter** key is held down the 2900 will execute the Screen File Load utility.

The 2900 will display:



Pressing the **YES** key will trigger the following screen:



Pressing the **NO** key will cause the 2900 to perform a warm boot which is just like re-powering.

The instructions for downloading are described within the ScreenMaker 2000 programming software package. After downloading the Screen File into the 2900, remove power. The 2900 is now ready for active duty.

File Download Cable Quartech Part Number: 2136-10

Personal Computer		2900	
9 Pin Female D-Type		15 Pin Female D-Type	
RXD	2 >))))))))))))))))))))<	2	TXD
TXD	3 >))))))))))))))))))))<	3	RXD
SC	5 >))))))))))))))))))))<	7	SC
RTS	7 >)),	+))))<	4 RTS
CTS	8 >))-	.))))<	5 CTS
DCD	1 >)),	Drain Wire))<	1 FG
DTR	4 >))1		
DSR	6 >))-		

Section 4: Run Mode

Assuming the 2900 has been successfully downloaded with both a Communication Driver and an Application Screen File it is ready for normal operation. An appropriate communication cable must be connected between the 2900 and programmable controller. A list of communication cables available from Quartech is shown in Appendix A. When power is applied the 2900 will enter the normal Run Mode.

The 2900 will display a series of three informational screens which indicate the Part ID number, serial number, memory size, firmware version and target PLC.

Here is an example of what you will see:

QUARTECH CORPORATION
2900 SERIES

SERIAL NO. 123456
MEMORY: 38,912 BYTES

MODICON MODBUS
Ver 1.00

During the time while the 2900 is displaying the above screens it will also be attempting to establish communications with the PLC. If successful the 2900 will proceed by triggering the lowest screen number contained in its memory. If the 2900 is not successful in establishing communication an error screen will be displayed indicating the suspected problem.

Here are some typical error screens you may see:

NO REPLY FROM PLC
CHECK CABLE / BAUD

COMMUNICATION CABLE
DISCONNECTED

BAD DIALOGUE FILE
CHECK ADDRESS

INVALID SETUP FILE
CHECK PARAMETERS

The 2900 will continuously attempt to communicate with the PLC. If it establishes communications with the PLC, it will proceed into normal run mode. If it fail to establish communication then action must be taken to solve the problem.

An important consideration with an operator interface device is how does the operator navigate from screen to screen and how does the PLC display the appropriate screen to the operator. This, in fact, is one of the areas in which the 2900 excels. The 2900 incorporates dual screen trigger words which allows two screens to be displayed at the same time. The PLC can force any programmed screen to be displayed from either trigger word or the operator can initiate the display.

But first, what exactly are screen trigger words?

The screen trigger words are two contiguous PLC addresses that are reserved for use with the 2900. When an Application Screen File is created using ScreenMaker 2000 software, the system engineer will be required to enter a PLC address for screen trigger word number one. By default, the next PLC address will be the second screen trigger word.

During normal operation the 2900 will monitor these two words to determine what screens should be displayed. Therefore, the PLC application program can simply move a screen number into either of these words and the 2900 will display the appropriate screen. If the operator initiates a screen display the 2900 will write the screen number into the appropriate screen trigger word within the PLC. The PLC will therefore always know what screen(s) the operator is viewing.

- ! A trigger word is always a address word (16 bits long) and treated as an integer value.
- ! The address type is fixed, based on the PLC brand and model.
- ! Legal screen numbers are from 0 to 500. A value of zero will close the screen, blanking the display.

But why use two trigger words?

The use of two triggers words allows the system engineer the ability to create a "windows" type effect. For example: The 2900's top display line could be used to show machine status using Trigger 1. Trigger 2 could be used to send instruction messages to the second line of the display which makes the two functions completely independent. When using more than one trigger word, care and planning is critical for success. Screen settings are important when using two screen triggers because the settings can greatly affect the overall appearance of the 2900 display when both triggers contain valid screen numbers.

Things to consider when using both screen trigger words.

When a screen is created using ScreenMaker 2000 several attributes will accompany the screen file. One of these attributes determines the impact this screen will have on a screen being displayed from the other trigger word. This attribute is the choice of one of three affects designated CLEAR, COVER, and OVERLAY.

CLEAR: If the screen is configured as clear, the entire 2900 display will be cleared before this screen is displayed. This allows only one screen to appear on the display even if another screen was previously opened from the other trigger word. The screen triggered by the other trigger word is not destroyed, only hidden. If this new screen is closed by writing a zero to the trigger word, the screen triggered by the other trigger word will reappear. (Kind of like Windows!)

COVER: If the screen is configured as cover, it will be written on top of the screen previously triggered from the other trigger word. Any parts of the display that are not used by the new screen will remain as they were (again, kind of like Windows). Note however, that any PLC variable fields that show through from the previous screen cannot be accessed using the **SELECT** key. Only those PLC variable fields on the cover screen can be accessed.

OVERLAY: This is identical to COVER with one exception. Any PLC variable fields that completely show through from the other screen can also be accessed using the **SELECT** key.

Methods of Screen Triggering

Triggering screens to the 2900 display can be done in three different ways. The choice is up to the system engineer developing the application. Any of these methods can be used alone or in any combination to create a user friendly application.

Method 1: Screen Triggering via PLC Ladder

As discussed previously, the 2900 will continuously monitor both screen trigger words. The PLC can control what screens are displayed by placing the desired screen number into a trigger word. Typically the simplest way to do this is through a MOVE function using a constant value as the source value. If either of the other two methods to trigger screens is used then the MOVE function must be configured to operate in a one shot fashion so that the 2900 can also write to the screen trigger words.

Method 2: Screen Triggering via the UP and DOWN keys

The **UP** and **DOWN** keys can be used to link screens together in a predefined sequence. When a screen is created using ScreenMaker 2000 software two linking screen numbers can be attached, one to the **UP** key and one to the **DOWN** key.

- ! If a value of zero is set for the link number then the key will be ignored.
- ! If a legal screen number is set then pressing the key will cause the link number to be written to screen Trigger Word 1 resulting in the screen being displayed.

Method 3: Screen Triggering via the YES and NO keys

The **F1/YES** and **F2/NO** keys can be independently configured within each screen to control a particular bit or word in the PLC. Either key can also be configured to act as a screen trigger and can control either or both screen trigger words. When a configured **YES** or **NO** key is pressed it can:

- ! close a screen by writing a zero to the appropriate screen trigger word.
- ! open a new screen by writing the screen number to the appropriate screen trigger word.
- ! leave either screen trigger word unaffected.

Note: This feature is available only when the CLEAR or COVER screen attribute is selected. The function keys are not operable when the OVERLAY screen attribute is selected.

Section 6: Command Word

The *Command Word* is a group of sixteen bits within the PLC that are reserved for use with the 2900. When an Application Screen File is created using ScreenMaker 2000 software, the system engineer will be required to enter a PLC address for the *Command Word*. The *Command Word* is viewed by the 2900 as sixteen individual bits or coils. These bits instruct the 2900 to perform a specific function, or indicate the status of a function. The 2900 will monitor and/or write to the *Command Word* on a continuous basis, therefore, each bit may be changed by the PLC application program at any time.

	Reference	Function
Least significant bit	Bit 1	Lock PLC Variable Fields
	Bit 2	Lock Screen Navigation
	Bit 3	Lock F1/YES & F2/NO Keys
	Bit 4	
	Bit 5	
	Bit 6	Data Change Made
	Bit 7	
	Bit 8	2900 Power-up
	Bit 9	F1/YES key
	Bit 10	F2/NO key
	Bit 11	
	Bit 12	
	Bit 13	
	Bit 14	
	Bit 15	
Most significant bit	Bit 16	

The bit numbers in the table above are for reference only since memory configurations and designations vary between PLC brands. For example: with some PLCs what is labeled here as Bit 1 will actually be the first coil number in a group of sixteen contiguous coils. In Allen-Bradley PLCs the bit numbers are octal with the least significant bit designated 00. Still others use hexadecimal designations.

Locks (Bits 1, 2, 3)

These three bits allow the PLC application program to disable specific 2900 functions. The 2900 does not alter the Lock bits. When any of the Lock bits are energized, the associated lock is enabled, and will remain enabled until it is de-energized in the PLC application program.

Lock PLC Variable fields, Bit 1

When this bit is energized the 2900 will ignore the **Select** key. This action will prevent the operator from changing any PLC variables that are contained on the 2900 display.

Lock Screen Navigation, Bit 2

When this bit is energized the 2900 will ignore the **Up** and **Down** arrow keys preventing the operator from triggering screens via this method.

Lock F1/YES & F2/NO Keys, Bit 3

When this bit is energized the 2900 will ignore the assignable function keys.

Data Change Made, Bit 6

This bit is energized by the 2900 any time the operator initiates the writing of data to the processor. This includes PLC Data fields, PLC Text fields, Data Set fields, and Bit Status fields used as Bit set fields. The 2900 does not de-energize the bit, therefore the PLC's application program must de-energize it each time it is set. This function may be useful in an application program designed to automatically change a screen on the 2900 after the operator enters data in a particular screen. If this function is not required by the PLC application program it may simply be ignored.

2900 Power-up, Bit 8

When power is applied to the 2900 it will de-energize this bit, energize it, then de-energize it again. This will produce a pulse that indicates to the PLC that the 2900 has just connected to it.. This may be useful to initiate some specific action when the 2900 is first powered. If the function is not required by the PLC application program it may simply be ignored.

F1/YES key, Bit 9 & F2/NO key, Bit 10

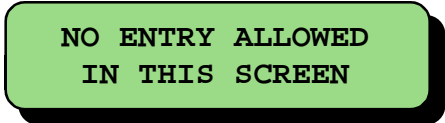
These two bits contain the status of the **F1/YES**, and **F2/NO** keys when configured to write to the Command Word. For more information on the configuring these keys refer to the Section 7.

The 2900 keypad is made up of eight tactile feedback keys used for navigation and data entry.

Select Key


This key is used to select a variable field you want to modify or initiate action from. Within this document we refer to this as “assigning focus”. Each time the **Select** key is pressed, a flashing block character will be displayed. Depending on the field type, the character will be over the left most character (PLC Data, PLC Text) or over the entire field (Data Set, Bit Status). As the **Select** key is pressed, focus will move from variable field to variable field in the order that they were created. When the **Select** key is pressed and no additional variable fields exist, the flashing cursor will move off screen.

If the **Select** key is pressed but no variable fields are accessible the following message will momentarily display.



NO ENTRY ALLOWED
IN THIS SCREEN

If the **Select** key is pressed but the variable field lock bit is energized by the PLC the following message will momentarily display.



PLC CONTROLLED
WRITE PROTECTION

Enter Key

This key is used to initiate the writing of a value to the PLC.

- ! After modifying the value in a PLC Data field using the arrow keys, the **Enter** key is pressed to initiate the writing of the new value to the PLC. If writing is successful, focus will be removed from this field and the cursor will move off screen.
- ! If a Data Set field has been selected, pressing the **Enter** key will write the assigned value to the PLC. If writing is successful, focus will be removed from this field and the cursor will move off screen. If this field is configured as a Increment or Decrement type then after pressing the **Enter** key the 2900 will first read the current value from the PLC, add or subtract the assigned value then write the new value back to the PLC. The focus will remain on this field until the **Select** key transfers it.
- ! If a Bit status field has been selected, pressing the **Enter** key will toggle the state of the target bits in the PLC which will also change the character string displayed. Focus will then be removed from the field and the cursor will move off screen.

Up & Down Arrow Keys

The **Up** and **Down** arrow keys are dual function.

- ! If the **Select** key has not placed focus on any variable fields then the **Up** and **Down** arrow keys are used for navigation. When a screen is created using ScreenMaker 2000 the system engineer has the option to assign a next and previous screen linking number. Refer to Section 5: Methods of Screen Triggering, to review this feature. If a next screen linking number was assigned then pressing the **Up** arrow key will trigger that screen, if a previous screen linking number was assigned then pressing the **Down** arrow key will trigger that screen.
- ! If the **Select** key has been used to place focus on a variable field and it is a PLC Data or PLC Text field then the **Up** and **Down** arrow keys are used to modify the data value. Pressing the **Up** arrow key will increment the number or character currently occupied by the flashing cursor. Pressing the **Down** arrow key will decrement the number or character currently occupied by the flashing cursor.

Left & Right Arrow Keys

These keys are used to navigate within a PLC Data or PLC Text Field. When focus is initially directed on either of these fields the flashing cursor will park over the left most character position. The **Right** and **Left** arrow keys are then used to move the cursor to a desired position within the field. As discussed above the **Up** and **Down** arrow keys allow an individual character to be modified.

F1/YES & F2/NO Keys

These two keys are programmable function keys that can be re-defined for each screen created for the 2900. There are four different configurations that can be made for a key. Within each screen the two keys may be configured differently. A function key can also be configured to function as a momentary pushbutton switch or push-on/push-off selector switch. The configuration options are as follows:

- Switch Image** In this configuration the switch status will be written to a pre-defined bit within the *Command Word*. The F1/YES key will write its status to bit number nine while the F2/No key will write its status to bit number ten.
- PLC Bit Address** This configuration allows the switch status to be written to a specific bit or coil address within the PLC. Restrictions apply to various brands of PLC, however, in all cases PLC input and output addresses can not be specified.
- Bit Status** In this configuration the switch essentially becomes a Bit Set Field without text but with the additional feature that it can operate in a momentary fashion. For detailed information regarding the Bit Status function refer to the application note in Appendix E.
- Screen Trigger** This configuration allows the key to function as a screen trigger. Unlike the **Up** and **Down** arrow keys, this screen trigger can write to either *Screen Trigger Word* or both at the same time. For more information refer to Section 5, screen trigger method three.

The F1/YES and F2/NO keys may be locked by energizing bit three in the Command Word.

A power input terminal block, serial communication interface connector and DIP switch are accessible through the rear cover of the 2900. A description of each is found below.

Input Power:

A removable three position terminal block is provided for wiring 24 VDC source power.

Serial Communication Port

A 15 pin male D-Type connector provides The RS-485 and RS-232 communication interface to Programmable Controllers, Personal Computers or other host devices.

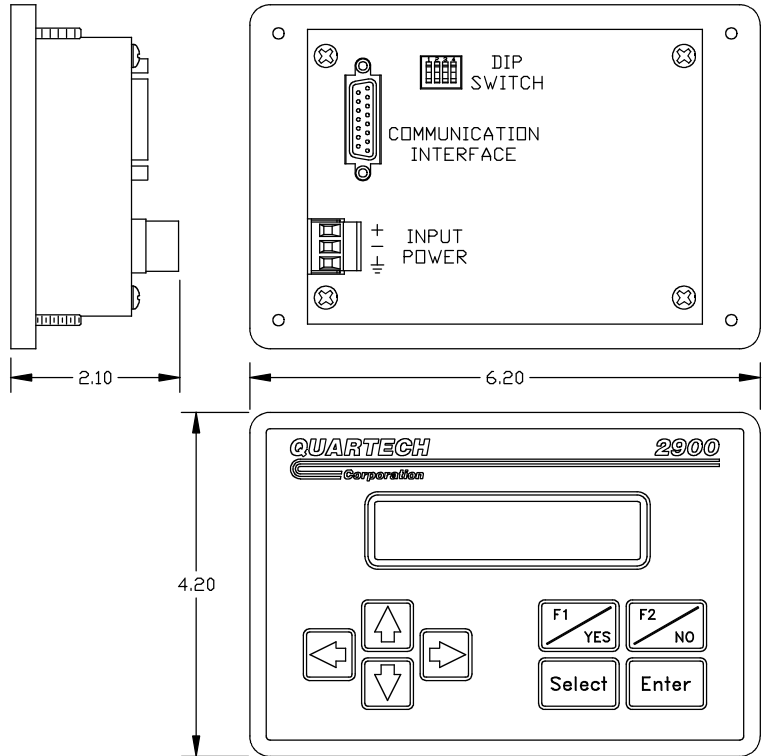
4 Position DIP Switch

Switch 1 & 2 allow a termination resistor to be connected across the RS-485 receiver.

Switch 3 is not assigned.

Switch 4 - Run / Driver File Load

This switch is set to the on position only when a new communication driver is to be loaded into the unit. See Section 2 for details.

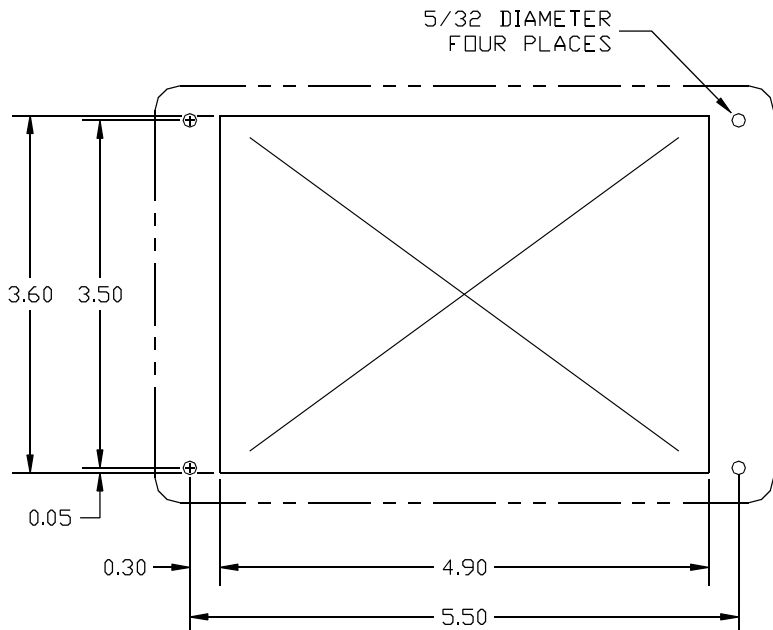


Enclosure Door Cutout

The 2900 is designed to be mounted in the door of an enclosure or on an operators console. Care must be taken to prevent metal chips or other conductive particles such as wire clippings from entering the unit. Failure to protect the unit may cause damage when power is applied and may void the warranty.

A minimum clearance of six inches should be kept between the 2900 and any other device that generates heat. In the event that the internal enclosure temperature periodically exceeds 50°C (122°F), fans or a purge air system must be used.

All Dimensions in inches



Specifications:

Display:	40 character (20x2) STN LCD with LED backlight dark blue characters on a yellow/green background.
Keypad:	8 tactile feedback keys rated for one million operations.
Memory:	Programmable Erasable Read Only Memory (Flash), 38,912 bytes, 500 screens max
Communications	RS-232 & RS-485 software selected
Electrical:	24 VDC, $\pm 5\%$, @ 200 ma
Temperature:	0°C to +50°C Operational, -20°C to +70°C Storage
Humidity	10% to 95%, Non-condensing, Operational or storage
Vibration/Shock:	0.5mm displacement (X,Y,Z axis), 10-55Hz, 30G shock
Weight:	2 pounds
Mounting:	Maintains NEMA 4, 4X, & 12 enclosure rating.

Wiring Considerations

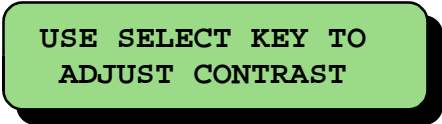
Care should be taken when routing DC power supply wires and the communication cable. Follow these guidelines for a trouble free installation. The DC power lines and communication cable must be kept away from AC power lines. Keep both at least one foot away from 115 VAC lines, and two feet away from higher 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.

Appendix B: LCD Contrast Adjustment

All Liquid Crystal Display products require contrast adjustment if operated over a wide temperature range. The 2900 allows the LCD contrast to be adjusted from the front panel keypad.

- ! To enter the contrast adjustment mode, press the **Left** and **Right** arrow keys simultaneously. You must not be editing a variable field to activate this mode.

This screen will display:



USE SELECT KEY TO
ADJUST CONTRAST

- ! Press and hold the Select key until the desired contrast is achieved. When the Select key is released the contrast will be frozen.
- ! To exit the contrast adjustment mode, press the **Left** and **Right** arrow keys simultaneously. The previously displayed screen will return.

Appendix C: Error & Warning Messages

The 2900 is manufactured with pride and quality and is designed to provide years of trouble free operation. A vast number of diagnostic messages have been included in the 2900's firmware to inform the system engineer and operator of any abnormality that may occur. These messages fit into three general categories which are:

Hardware Failure Configuration & Communication Errors Operational Status

When an abnormality is encountered a message will appear on the display indicating the nature of the problem. Some conditions will cause the 2900 to halt operation. Other conditions will cause a warning message to display momentarily. Still other conditions will cause a message to simply remain on the screen until the abnormality is corrected. Below is a list of some of the messages that may appear.

Category 1, Hardware Failure.

These conditions will cause the 2900 to halt operation.

Message displayed	Possible Cause
ROM CHECKSUM ERROR	This would occur if the units loaded firmware (Driver File) became corrupt.
INTERNAL RAM ERROR	On power-up the 2900 performs a read/write verification on installed RAM memory. These messages would indicate a hardware failure.
EXTERNAL RAM ERROR	
FAILSAFE CODE xxxx	This message would only occur if firmware became corrupt, if an intermittent memory failure occurred, or maybe from a major power surge.
TOO MANY FIELDS MAXIMUM IS 32	These messages would occur during an Application File download and only if the file became corrupt during transfer.
TOO MANY VARIABLES MAXIMUM IS 8	

Category 2, Configuration & Communication Errors.

The messages in this category may vary depending on the type or model of PLC that is being used with the 2900. In most cases these messages are self explanatory. Below is a sample of some common messages that may be displayed.

Message displayed	Possible Cause
BAD DIALOGUE FILE CHECK ADDRESS	This address selected for either the Screen Trigger Word or Command Word is not available in the connected PLC, or file is corrupt.
INVALID SETUP FILE CHECK PARAMETERS	Perhaps the setup file was not downloaded, it is corrupt, or maybe a node address is outside a legal range.
NO REPLY FROM PLC CHECK CABLE / BAUD	The 2900 is unable to communicate with the PLC. The cause maybe anything for PLC power loss to communication hardware failure or broken wires.
---NOTICE--- FUNCTION KEY ABORT	This occurs if a function key is assigned to a PLC address that is not available in the current PLC. It will appear momentarily.

Appendix C: Error & Warning Messages

Category 3, Operational Status.

These are informative messages to advise the operator of a invalid entries, limitations, or general status.

Message displayed	Possible Cause
ILLEGAL VALUE	These messages will display momentarily after an operator presses the Enter key in an attempt to write a new value to the PLC. The normal screen will return allowing the operator to attempt another entry.
BELOW SET LIMIT	
ABOVE SET LIMIT	
VALUE AT MAXIMUM	These messages will display momentarily after an operator presses the Enter key while focus is on a <i>Data Set Field</i> that is configured as <i>Increment</i> or <i>Decrement</i> and the result of this write would exceed the set limit.
VALUE AT MINIMUM	
ALL SCREENS CLOSED	The value in both Trigger Words is zero so no screen are being displayed.
PLC STATUS: ERROR 2900 STATUS: STOP	This 2900 continuously monitors the RUN status of the PLC. If the PLC is halted for programming or by a fatal fault then the 2900 will display the appropriate message. If the PLC is faulted the 2900 will reset if the PLC returns online without a fault.
PLC STATUS: STOP 2900 STATUS: STOP	
SCREEN # ---- DOES NOT EXIST	If a value is placed into either Trigger Word that is greater than 500 or is equal to a non-existent screen number in the 2900 then one of these two messages would appear. Either will cause the 2900 to halt operations.
SCREEN # ---- IS ILLEGAL	
PLC CONTROLLED WRITE PROTECTION	These messages will display momentarily if the operator attempts an action that has been locked out by the PLC through the lock bits in the <i>Command Word</i> . See Section 6 for information on this subject.
FUNCTION KEYS ARE DISABLED BY THE PLC	
SCREEN NAVIGATION IS DISABLED BY THE PLC	

Application Note 1: Understanding the Bit Status Field

The Bit Status field is a very powerful field, but can be a little difficult to understand, especially when used as a Bit Set. Hopefully, the following examples will bring both its power and true simplicity to light.

In this example we will monitor and control a single bit within a word. ScreenMaker 2000 will prompt you to enter two text strings, one for the true state and one for the false state.

True Text = MOTOR ON False Text = MOTOR OFF

You will also be prompted to enter a Mask Value and Data Value.

Mask Value = 0000 0000 0000 0010 Data Value = 0000 0000 0000 0010

You will also be prompted for an address within the PLC. In this example lets call it "PLC Value". It must be the address of a data word (16 bits long). We will assume some values as we proceed.

Example 1:

Assumed PLC Value 0000 0000 0000 1111
AND with Mask Value 0000 0000 0000 0010
Results 0000 0000 0000 0010

Example 2:

Assumed PLC Value 0000 0000 1111 0000
AND with Mask Value 0000 0000 0000 0010
Results 0000 0000 0000 0000

The final step for the 2900 is to compare the result value to the Data Value. In example one the result is equal to the Data Value, therefore, the True Text (MOTOR ON) would be displayed in the field. In example two the result and Data Value are not equal, therefore, the False Text (MOTOR OFF) would be displayed in the field.

Now assume the results of example one, the field is currently displaying "MOTOR ON". Further assume you use the **Select** key on the 2900 to assign focus to this field then press the **Enter** key.

Assumed PLC Value 0000 0000 0000 1111
AND with compliment of Mask Value 1111 1111 1111 1101
write this value to the PLC 0000 0000 0000 1101
2900 reads PLC Value back 0000 0000 0000 1101
2900 ANDs it with Mask Value 0000 0000 0000 0010
Results 0000 0000 0000 0000

Formula 1

Result does not match Data Value so the field text will change to "MOTOR OFF". Its that simple!

Lets try the opposite case. Assume the results of example two, the field is currently displaying "MOTOR OFF". You use the **Select** key on the 2900 to assign focus to this field then press the **Enter** key.

Assumed PLC Value 0000 0000 1111 0000
AND with compliment of Mask Value 1111 1111 1111 1101
Results 0000 0000 1111 0000
OR with Data Value 0000 0000 0000 0010
write this value to the PLC 0000 0000 1111 0010
2900 reads PLC Value back 0000 0000 1111 0010
2900 ANDs it with Mask Value 0000 0000 0000 0010
Results 0000 0000 0000 0010

Formula 2

Result does match Data Value so the field text will change to "MOTOR ON".

Appendix D: Application Notes

The Bit Status field can be used to create giant selector switches, up to sixteen positions. To keep the following example simple, a three position selector switch will be created. Also for easier viewing, only the least significant four bits of data will be shown for the Mask Value, Data Value, and PLC Data. So, assume the twelve most significant bits are zero.

First, three Bit Status fields must be created using ScreenMaker 2000.

<u>Data Set Field 1</u>		<u>Data Set Field 2</u>		<u>Data Set Field 3</u>	
PLC Address	PLC Data	PLC Address	PLC Data	PLC Address	PLC Data
Mask Value	0111	Mask Value	0111	Mask Value	0111
Data Value	0001	Data Value	0010	Data Value	0100
True Text	RED	True Text	GREEN	True Text	BLUE
False Text	red	False Text	green	False Text	blue

Start by assuming the value "PLC Data" equals: 0001. Remember, we are ignoring the most significant twelve bits. The 2900 display will look like this:.



Notice the Red Field has solved true, while the Green and Blue fields have solved false. Here is why.

	<u>Data Set 1</u>	<u>Data Set 2</u>	<u>Data Set 3</u>
PLC Data	0001	0001	0001
AND with Mask Value	<u>0111</u>	<u>0111</u>	<u>0111</u>
Results	0001	0001	0001
Compare to Data Value	0001	0010	0100
Compare Results	True	False	False

Lets see it work. Using the **Select** key, place focus on the "green" field. The block cursor will be flashing over the word "green" when it has focus. The **Enter** key is pressed to initiate the write. Here is what will happen:

Since the field is currently displaying the false state, Formula 2 will be executed.

PLC Data	0001	
AND with compliment of Mask Value	<u>1000</u>	
Results	0000	
OR Data Value	<u>0010</u>	
Results	0010	Write this value to PLC

When the 2900 updates the fields, the screen will look like this:



Notice the Green Field has solved true, the Red is now false, and the Blue field remains false. Here is why.

	<u>Data Set 1</u>	<u>Data Set 2</u>	<u>Data Set 3</u>
PLC Data	0010	0010	0010
AND with Mask Value	<u>0111</u>	<u>0111</u>	<u>0111</u>
Results	0010	0010	0010
Compare to Data Value	0001	0010	0100
Compare Results	False	True	False

In this last example lets see what will happen if the Green field is activated again. Using the **Select** key, place focus on the "GREEN" field. The block cursor will be flashing over the word "GREEN" when it has focus. The **Enter** key is pressed to initiate the write. Here is what will happen:

Since the field is currently displaying the True state, Formula 1 will be executed.

PLC Data	0010	
AND with compliment of Mask Value	<u>1000</u>	
Results	0000	Write this value to PLC

When the 2900 updates the fields, the screen will look like this:



Notice the Red, Green, and Blue fields are all false. Here is why.

	<u>Data Set 1</u>	<u>Data Set 2</u>	<u>Data Set 3</u>
PLC Data	0000	0000	0000
AND with Mask Value	<u>0111</u>	<u>0111</u>	<u>0111</u>
Results	0000	0000	0000
Compare to Data Value	0001	0010	0100
Compare Results	False	False	False