THE ASTRO LINE SERIES

GEMINI 1000/2000 INSTRUCTION MANUAL

INTRODUCTION

The Gemini 1000 and 2000 are both units in a multi-purpose series of industrial control units that are field-programmable to solve multiple applications. This series, known as the Astro-Line family of products, is built around the concept that the end user has the capability to program different personalities and functions into the unit in order to adapt to different indication and control requirements.

The Gemini, which you have purchased, has the same high quality workmanship and advanced technological capabilities that have made Red Lion Controls the leader in today's industrial market.

Red Lion Controls has a complete line of industrial indication and control equipment, and we look forward to being of service to you now and in the future.

CE

CAUTION: Read complete instructions prior to installation and operation of the unit.

CAUTION: Risk of electric shock.

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GENERAL DESCRIPTION

The Gemini is a two input, microprocessor-based device which offers the features and performance of a single (GEM 1000)/dual (GEM 2000) level preset counter or sample time, rate indicator. The 6-digit display features 0.56" LEDs with negative sign and overflow indicators. The internal precision is maintained to 9 digits. The 20 mA Current Loop Option (Gemini 2000 only) makes possible remote or computerized monitoring or control of the count, Presets and Scale Factor.

Flexibility and usefulness are insured through user programmability. With simple front panel keystrokes and rear panel switch settings, any one of a number of configurations can be selected. Once the selection is made, all or part of the keyboard can be disabled to protect the settings and guarantee that no unwanted changes can occur during the measurements. All set-up data is stored in E^2PROM, which will hold data for a minimum of 10 years without power.

Whenever the power comes on, the Gemini performs a series of internal diagnostics to verify the integrity of the stored data. There is also a self-test mode and an ever-present *"watchdog"* timer to prevent processor lockup.

The construction of the Gemini features a metal, die cast bezel for maximum durability with high quality appearance. The sealed front panel meets NEMA 4/IP65 specifications for washdown and/or dust. Electrical connections are made with removable, plug-in terminal strips at the rear of the unit. Clamp type pressure plate terminals accept stripped #14 AWG wire without lugs.

As a counter, the Gemini can monitor bi-directional, unidirectional *(totalizer)*, or quadrature signals. It can double or *(with quadrature)* even quadruple the resolution of the incoming signal. Counting modes also provide for anti-coincidence applications. Both channels of count information are monitored simultaneously, no counts are lost, and the final output can be chosen as the sum or difference of the two input channels.

As a rate indicator, a variety of sampling times are available. Accurate to one hundredth of a percent, the sampling time can be set as 1, 2, 5, 10, 20, or 50 seconds.

The preset level(s) can be selected to control an open collector output(s). The optional Gemini plug-in relay board makes it easy to field upgrade your Gemini to provide 5 amp, 240 VAC relay output(s). The output(s) are also programmable and can be set for terminate at the *"other"* output start, *"other"* output end, at reset or reset end, after time delay, or boundary.

Preset and reset behavior of the output(s) and display are completely programmable. The preset(s) can have a value ranging from -999999 to +999999. Decimal placement will be the same as the decimal placement on the input value.

Various reset modes can be selected: manual reset to zero or preset; automatic reset to zero or preset; or automatic reset after time delay. The manual reset will always override automatic reset, if it has been enabled.

The scale factor, moveable decimal point, dummy right hand zeros, leading zero blanking, and decade divider capabilities of the Gemini permit complete control of the Gemini display. These features provide easy conversion of input signals to desired measurement units *(feet to meters, etc.)*. The input values can be multiplied by any number from -5.9999 to +5.9999 with the scale factor. The addition of up to 3 dummy right hand zeroes gives an effective display multiplication of 10, 100, or 1000. Similarly, the decade divider provides 1, 2, or 3 decades of prescaling.

SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Do not use this unit to directly command motors, valves, or other actuators not equipped with safeguards. To do so, can be potentially harmful to persons or equipment in the event of a fault to the unit.

PROGRAMMING THE GEMINI

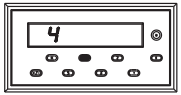
When your Gemini arrives from the factory, it has already been programmed to function as a preset counter.

The personality, functions, and modes are then set by pressing the appropriate keys. A function is defined by a two-digit code which appears on the left side of the display. The mode of that function is shown as a one-digit code on the right side of the display. At times there will be a *(-)* sign modifier.

Data for the presets, scale factor, and time delays are entered differently. Each digit key controls the digit on the display directly above it. Changing the digits can be done by repeatedly pressing the key beneath the digit position you wish to change or by merely holding it down. As you hold it down or press it, the value of that digit will change cyclically, counting up to 9, then to 0, and then up again.

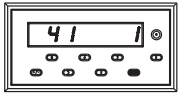
The 6 numbered keys correspond to the six digits, and the *"+/-"* key correspond to polarity.

PROGRAMMING THE PERSONALITY

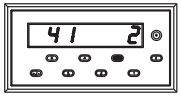


Entering function and mode is easily accomplished by pressing the appropriate digit key. For the personality function, enter 41 by pressing the front panel key 4.

Then press the front panel key 1. The leftmost LEDs show the function; the rightmost is the present mode.

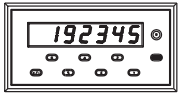


A new mode selection is made by entering a new number. On some of the entries, you have the option of a plus *(+)* or minus *(-)* sign. In the cases where a *"+"* sign is required, no sign will be displayed. If you do enter a *"-"* sign *(using the "+/-" key)*, a minus sign will be displayed in front of the appropriate digit.

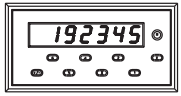


Pressing the "E" key finalizes the change. The display will now show the count or rate value immediately.

If you do not press the "E" key the change will not be recorded. The display will remain for 15 seconds, and then return to normal operating mode using the old function and mode settings. *(Note: The reset button "R", if enabled, is always active. Pressing reset will immediately abort the function selection, and reset the instrument.)*

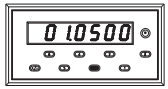


The major personality is function code 41. If it is changed from rate to counter or vice-versa, it may effect settings like count mode, reset mode, and output termination modes.

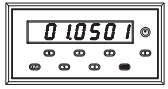


PROGRAMMING THE PRESETS, SCALE FACTOR, & OUTPUT TIME DELAYS

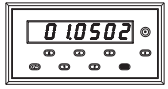
The scale factor and preset values are commonly reprogrammed on a daily basis. As such, single keystroke access has been provided on the front panel.



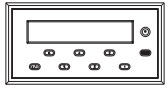
To change the scale factor, press the *"3"* key. The display will then show you're the present scale factor value. The scale factor can be set from -5.9999 to +5.9999.



Changing the digits can be done by repeatedly pressing the key beneath the digit position you wish to change or by merely holding it down.



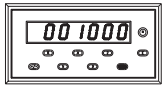
The new value will be entered when the "E" key is pressed. This key must be held down until the display has blanked after which the unit will return to the normal display mode.



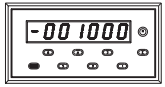
The internal count value is multiplied by the scale factor value, which changes the displayed value accordingly. This is true for all response modes, Count with Inhibit, Count with UP/DN Control, Two Input Anti-Coincidence and for all Quadrature Counting Modes.

PROGRAMMING THE PRESETS, SCALE FACTOR, & OUTPUT TIME DELAYS (Cont'd)

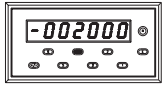
The preset level is changed in the same way as the scale factor. Pressing the *"1"* key will display the present value of preset 1.



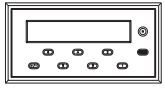
To change the value, merely cycle the digits through as you have done before. The presets can be selected from -999999 to +999999.



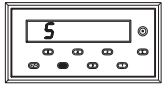
The new value will be entered when the "E" key is pressed. *(The display will blank for a short duration of time and then re-display the count value.)*



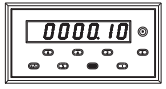
The Scale Factor value will have a direct effect on the preset being entered. For scale factors greater than one, the preset should be an integer multiple of the scale factor. If it is not, the Gemini will automatically adjust the preset value up or down to force it to be evenly divisible by the scale factor.

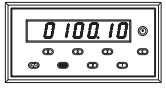


A time delay is changed by entering a two-digit function code. The display will then immediately show the present time delay in seconds with a two decimal place accuracy. The time delay values can be set from .01 to 599.99 seconds.

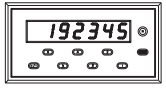


To change output 1 time delay, enter function code 53 and enter the new value by holding down or repeatedly pressing the key below the digit position you wish to change.





The new value will be entered when the "E" key is pressed and the display will immediately return to the count value.



Note: A time delay value of zero cannot be programmed into the Gemini. If a value of 0 is entered into the display and the "E" key is pressed, the unit will continue to use the previous time delay value.

As with the other functions, you must press "E" to record the changes. For the data entry modes, if you do not press the "E" key, a time out of 5 seconds occurs, then the display returns to operating mode without any change to the value. The only time any change will occur is when the "E" key is pressed. As in all other modes, the reset button is always active if enabled. Pressing *"R"* will abort the data entry and reset the instrument.

FACTORY SETTINGS

Keys Struck	Display	Description
4,1	41 1	Personality selected as Counter
4,3	43 1	Count with Inhibit
4,4	44 1	Count on one edge of input (no doubling)
4,5	45 1	Scale Multiplier of 1.0
4,6	46 1	Leading zero blanking and no decimal point
5,1	51 1	Manual reset-to-zero, as long as button remains PUSHED
5,2	52 3	Output 1 terminates at Reset, Normal Output Phase
5,3	0000.10	0.10 second Output 1 time delay. Note that this function will display the actual amount of time delay, and not a mode command. In this case, it displays a 0.10 indicating 0.10 seconds.
*5,4	54 3	Output 2 terminates at Reset, Normal Output Phase.
*5,5	0000.10	0.10 second Output 2 time delay. Note that this function will display the actual amount of time delay, and not a mode command. In this case, it displays a 0.10 indicating 0.10 seconds.
6,1	61 4	No right-hand dummy zeros
6,6	66 4	Reset enabled along with scale factor and presets.
3	01.0000	Scale Factor set to unity
1	000500	Preset 1 value equals 500
*2	001000	Preset 2 value equals 1000

When the unit is shipped from the factory, the functions and modes are programmed as shown above.

*Applies to the Gemini 2000 only.

OPERATOR ACCESSIBLE FUNCTIONS WITH PROGRAMMING DISABLED

(For details on keyboard entry, see preceding section)

One of the important features of the Gemini is the ability to disable programming. With this ability, accidental bumping of the keys or tampering by unauthorized personnel can be prevented. However, it may be necessary to allow reset and certain programming functions, such as, preset and scale factor values to be changed in daily operation. The Gemini, through the use of the *"Operator Accessible Functions"* Modes, can enable these functions even when the *"PGM. DIS."* terminal is connected to *"COMMON"*.

The *"Operator Accessible Functions"* Modes are programmed by a two-digit function code *(66)*, like the other function modes. But in this case, the modes do not take effect until the *"PGM. DIS."* terminal is connected to *"COMMON"*. *(Bear in mind that all function modes of the Gemini are accessible until "PGM. DIS." is connected to "COMMON".)*

There are four basic *"Operator Accessible Functions"* Modes available. These modes enable the following functions.

1. **NO FUNCTIONS EXCEPT RESET ENABLED** - In this mode, manual reset is enabled, but none of the programming functions can be changed. However, the functions can be interrogated.
2. **PRESET PROGRAMMING AND RESET ENABLED** - The entire front panel is disabled with the exceptions of preset programmability and manual reset. All functions can be interrogated.
3. **SCALE FACTOR PROGRAMMING AND RESET ENABLED** - The entire front panel is disabled with the exceptions of scale factor programmability and manual reset. All functions can be interrogated.
4. **SCALE FACTOR AND PRESET PROGRAMMING, AND RESET ENABLED** - The entire front panel is disabled with the exceptions of scale factor and preset programmability, and manual reset. All functions can be interrogated.

All of these four basic modes can be modified with the addition of a minus sign. The minus sign disables the manual reset, at the front panel and the remote reset terminal, at the rear of the unit.

There is also a rear panel DIP switch which permits disabling of the front panel manual reset button. This is independent of the rear terminal remote reset, and can be used in conjunction with any front panel disable mode. The combination of manual and remote inputs provides a high level of security without sacrificing flexibility.

DIAGNOSTICS, SELF TEST, & "WATCHDOG" TIMER

The security and integrity of the Gemini is further enhanced by its self-test, diagnostic and *"watchdog"* timer capabilities.

The diagnostics are concerned with the special, no power memory of the Gemini. Whenever the power is turned off, on purpose or by accident, all pertinent function settings and measurements are automatically saved. Then, when power is restored, the function and data are re-instated. This allows you to program a Gemini once and not have to re-program it until you wish to use it in another mode.

When the function codes and data are saved, computations are made with these values. The result of these computations is stored in the memory to serve as a check against possible error. Then on power up, the same computations are repeated on the stored data. If the results do not agree with the stored results, then a *"P"* will appear on the left side of the display. If this occurs, refer to the troubleshooting guide for directions.

Another error indicator is the *"watchdog"* timer. In order to insure proper software functioning, the program constantly monitors itself. If the proper sequence and timing of internal events does not occur, an *"E"* will appear on the left side of the display. If this occurs, refer to the troubleshooting guide for instructions.

The final type of built-in error checking is the front panel initiated self test. It can be performed at any time, even when the Gemini is running. It will not interfere with the accumulation of counts or control functions. A function code of *"6" "+/-"* starts the test. At this time, whatever was displayed will be replaced by a string of decimal points and the overflow indicator. Then, the display will show a string of 9's, then 8's then 7's, etc., until a string of 0's is shown. The self test will then turn off the overflow indicator and activate the minus *(-)* sign. After this, the unit shows an interlace pattern of -0, 1, 0, 1, 0, 1, then -2, 1, 2, 1, 2, 1, followed by -2, 3, 2, 3, 2, 3, etc., until -8, 9, 8, 9, 8, 9, is reached. At this time, the outputs can be tested by pressing the *"1"* and *"2"* keys.

(The program disable pin must be high in order to allow activation of the output.)

Note: During self test caution should be used when testing the outputs so as not to cause any undesirable or hazardous conditions in the system.

An automatic exit will take place after six seconds or immediately if the Program Disable terminal is connected to common. Normal length of display time for each of the patterns is approximately 0.5 seconds. Rapidly pressing the *"+/-"* key during self test can speed up the process.

INPUT CIRCUITRY & SET-UP

There are two independent input channels on the Gemini. Various types of sensor outputs can be accommodated by appropriate DIP switch set-up; such as TTL or CMOS logic, current sinking, current sourcing, or dry contact.

Channel A consists of a logic input and a separate low level magnetic pickup input.

Channel B is a completely independent count or control input channel. Like Channel A, it can be programmed with DIP switches for a wide variety of logic inputs and is identical to Channel A in this regard.

For a complete detailed description of set-up, see Appendix *"A"*.

OVERFLOW INDICATION

The Gemini features an overflow indicator *(LED)* which is located to the left of the sixth digit and above the polarity annunciator. This LED will turn on if the capacity of the display *(6-digits)* is exceeded or if the internal count capacity *(9-digits)* is exceeded. Use of extremely small scale multiplier and scale factor values can cause the internal count capacity to overflow before the displayed value would overflow. It should also be noted that the use of Right Hand Dummy Zeros or Scale Factors larger than one could cause the Displayed value to overflow before a value of 999,999 *(6-digits)* is accumulated.

When the capacity of the display is exceeded, the count value will be maintained and will be valid. But if the internal count value is exceeded, then this value may no longer be valid.

PROGRAMMING INSTRUCTIONS FOR THE COUNTER VERSION OF THE GEMINI

The first part of this section provides detailed description of the function command codes for counting modes, reset modes, output terminations, etc. Then, using an actual application example, the programming instructions for a counter version will be *"walked through"*, to give the user a full understanding of the Gemini programming procedure. The descriptions below give the function command code first, followed by the individual mode identifier. The Function Command Code Summary in the appendix lists all codes. *(Only commands and modes pertaining to the counter will be discussed in this section.)*

CODE 41 - UNIT PERSONALITY

Two basic personalities are available for the Gemini. They are the counter mode and the rate indicator mode.

[41 1] COUNTER - Setting this mode selects the unit to function as a counter. This is the basic personality mode and must be programmed before any other modes are set. *(This command forces default mode values in certain command codes.)*

CODE 43 - INPUTS A & B RESPONSE MODES

The Gemini has six different input response modes. They are: Count with Inhibit; Count with Up/Down Control; Two-Input Anti-Coincidence Add; Two-Input Anti-Coincidence Add/Subtract; Quadrature; and Quadrature X4.

[43 1] COUNT WITH INHIBIT - Input A in this case, serves as the count input. Input B serves as the inhibit terminal. When Input B is low, count signals appearing at A will be ignored. When Input B is at a high level, negative going *(falling)* signals appearing at A will be counted.

[43 2] COUNT WITH UP/DOWN CONTROL - When in this mode, count direction can be controlled by a second input. Input A serves as the count input, and Input B serves as the direction control signal. When B is at a high level, negative going transitions at A will cause the unit to count in the positive direction. When Input B is at a low level, negative going transitions at A will cause the counter to count in the negative direction.

[43 3] TWO (2) INPUT ANTI-COINCIDENCE ADD/SUBTRACT - This mode effectively separates count pulses which may simultaneously appear at the two inputs. The Gemini unit then processes the count pulses into a string of time-separated pulses, so the internal counter will not lose any counts. Input A serves as the add input, and Input B serves as the subtract input.

[43 4] TWO (2) INPUT ANTI-COINCIDENCE ADD - This mode functions in the same manner as the Two Input Add/Subtract mode except both Input A and Input B serve as *"ADD"* inputs.

[43 5] QUADRATURE COUNTING - Quadrature counting modes are primarily used in positioning and anti-jitter applications. The reason this mode is used is due to the manner in which two pickups are positioned relative to each other. Input B is a pulse train signal shifted 90° away from Input A. These two signals are processed by the Gemini as follows:

Input A serves as the count input, while Input B serves as the quadrature input *(B is the input shifted 90° away from A)*. For quadrature with single edge counting, the counter will count in a positive direction when Input A is a negative going edge and Input B is at a low level. The counter will count in a negative direction when Input A is a positive going edge and Input B is at a low level. All transitions on Input A are ignored when B is at a high level. These logic rules provide the basis for anti-jitter operation which will prevent false counts from occurring due to back-lash, vibration, chatter, etc.

When two edge counting is used, the quadrature mode works the same as with single edge counting when Input B is low. But when Input B is at a high level, counts at Input A are no longer ignored. Instead the logic rules for A are complemented, allowing both edges of A to be counted. This doubles the effective resolution of the encoded input.

[43 6] QUADRATURE TIMES 4 - This mode takes the quadrature mode, with two edge counting, one step further. In quadrature times 4, both Input A and Input B serve as count or quadrature input, depending on their state. In one instance, Input A will serve as the count input and Input B will serve as the quadrature input. In another instance, Input A will be the quadrature input and Input B will be the count input. This enables each edge, positive and negative going, of each input, A and B, to be counted. This results in a resolution four times greater than in the ordinary quadrature mode.

CODE 44 - NUMBER OF COUNT EDGES

The Gemini can be programmed for either single edge or two edge *(doubling)* counting. The number of count edges cannot be set when the count mode is programmed for quadrature X4 operation *(the Gemini will ignore any attempt to enter function command code 44 when set for quadrature X4).*

[44 1] SINGLE EDGE COUNTING - The unit counts on the negative going *(falling)* edge of the count input signal. The count mode descriptions describe how each mode uses this method of edge counting.

[44 2] TWO EDGE COUNTING - This mode is used when doubling of the count signal input is required. The unit counts on the positive going *(rising)* edge of the count input signal, as well as, the negative going *(falling)* edge.

CODE 45 - SCALE MULTIPLIER

There are four scale multiplier values that are available. They are: 1; 0.1; 0.01; and 0.001. They effectively divide the internal count value by 1, 10, 100, and 1000 respectively, to yield the displayed count value. *Note: Use of a small scale multiplier in conjunction with a small scale factor could cause the internal count value to be exceeded before the 6-digit display value is exceeded. See "Overflow Indication" section for more details.*

[45 1] SCALE MULTIPLIER VALUE OF 1 - This value multiplies the internal count by 1.

[45 2] SCALE MULTIPLIER VALUE OF 0.1 - This value multiplies the internal count by 0.1. *(Effectively divides by 10.)*

[45 3] SCALE MULTIPLIER VALUE OF 0.01 - This value multiplies the internal count by 0.01. *(Effectively divides by 100.)*

[45 4] SCALE MULTIPLIER VALUE OF 0.001 - This value multiplies the internal count by 0.001. *(Effectively divides by 1000.)*

CODE 46 - DECIMAL POINT & LEADING ZERO BLANKING

There are six basic modes of decimal point placement on the Gemini. The decimal point is placed to the right of the display digit that corresponds to the mode identifier. *(The right most decimal point, digit 1, is never turned on.)* A *"-"* sign in front of the mode identifier will inhibit leading zero blanking. The absence of the *"-"* sign will enable leading zero blanking.

[46 1]	0	LEADING ZERO BLANKING
[46 2]	0.0	
[46 3]	0.0 0	
[46 4]	0.0 0 0	
[46 5]	0.0 0 0 0	
[46 6]	0.0 0 0 0 0	
[46 -1]	0 0 0 0 0 0	LEADING ZERO BLANKING INHIBITED
[46 -2]	0 0 0 0 0.0	
[46 -3]	0 0 0 0.0 0	
[46 -4]	0 0 0.0 0 0	
[46 -5]	0 0.0 0 0 0	
[46 -6]	0.0 0 0 0 0	

CODE 51 - RESET MODES

The Gemini has six different reset modes. They are: Manual Reset to Zero; Manual Reset to Preset; Automatic Reset to Zero After Output Time Delay; Automatic Reset to Preset after Output Time Delay; Automatic Reset to Zero at the Beginning of the Output Time Delay; and Automatic Reset to Preset at the Beginning of the Output Time Delay. *(Note: For the Gemini 2000, reset to preset modes reset to preset 2 and Output refers to Output 2.)* There are also two methods by which manual reset can act on the unit *(reset must be enabled)*. The first is a *"maintained"* reset action where the unit is held at reset as long as the reset terminal is held low or the front panel reset button is pressed. The second is a *"momentary"* reset in which the unit resets when reset is activated and immediately starts counting even though the terminal may still be low or the reset button may still be pressed. *(Note: In momentary reset, the display will not update until reset is released, but internal counting and all other functions are operative.)* A *"-"* sign in front of the code identifier will provide for *"momentary"* reset, and the absence of a *"-"* sign will give *"maintained"* reset.

[51 1] MANUAL RESET TO ZERO (RTZ) - Manual reset to zero is accomplished by pulling remote reset to ground, or if the front panel reset is enabled, by pressing the front panel reset button. Reset is *"maintained"*.

[51 2] MANUAL RESET TO PRESET (RTP) - Manual reset to preset is accomplished by pulling reset to ground, or if the front panel reset is enabled, by pressing the front panel reset button. Reset is *"maintained"*.

CODE 51 - RESET MODES (Cont'd)

[51 3] AUTOMATIC RESET TO ZERO AFTER OUTPUT TIME DELAY - The counter resets to zero when the output time delay ends. Manual reset is *"maintained"* and will override automatic reset.

[51 4] AUTOMATIC RESET TO PRESET AFTER OUTPUT TIME DELAY - The counter resets to the preset value when the output time delay ends. Manual reset is *"maintained"* and will override automatic reset.

[51 5] AUTOMATIC RESET TO ZERO AT THE BEGINNING OF THE OUTPUT TIME DELAY - When in this reset mode, the unit will automatically reset to zero at the beginning of the output time delay *(when the preset point is reached)*. For the Gemini 2000, the output 1 and output 2 time delays must be shorter than the time required for the counter to count to the preset 2 value. Otherwise, the output*(s)* will appear to be latched on. Manual reset is *"maintained"* and will override automatic reset.

[51 6] AUTOMATIC RESET TO PRESET AT THE BEGINNING OF THE OUTPUT TIME DELAY - In this reset mode, the unit will automatically reset to preset at the beginning of the output time delay *(when zero is reached)*. For the Gemini 2000, the output 1 and output 2 time delay must be shorter than the time required for the counter to count to zero. Otherwise, the outputs will appear to be latched on. Manual reset is *"maintained"* and will override automatic reset.

[51 -1]
[51 -2]
[51 -3]
[51 -4]
[51 -5]
[51 -6]

These modes are the same as above with the exception that Reset is set for "momentary" operation.

CODE 52 - OUTPUT 1 TERMINATION MODES

The Gemini has six Output Termination Modes. They are: Terminate at Output 2 Start; Terminate at Output 2 End; Terminate at Manual Reset; Terminate at Manual Reset End; Terminate After Time Delay; and Boundary.

A Reverse Phase Option is available on the Gemini. This refers to complementing the logic state of the output. With normal phase operation, when the count reaches preset 1 the output will turn on. The reset condition of the output is output off. In reverse phase operation, the output turns off when the preset is reached. The reset condition of the output is output on. *(Note: The state of the relay, if used, is also reversed.)* A *"-"* sign in front of the mode identifier will provide for reverse phase operation. The absence of a *"-"* sign will give normal phase operation.

In all modes except boundary, when the unit is powered up, the relays or outputs will be turned off. This is done to help prevent a hazardous situation from occurring. If other than boundary or time delay operation is selected, the unit should be reset upon power up.

[52 1] TERMINATE AT OUTPUT 2 START - Output 1 will terminate when Output 2 starts. (Gemini 2000 only)

[52 2] TERMINATE AT OUTPUT 2 END - Output 1 will terminate when Output 2 terminates. (Gemini 2000 only)

[52 3] TERMINATE AT MANUAL RESET - In this mode, output 1, once activated, does not deactivate until the moment a reset occurs. The reset can be from the front panel button or from the remote reset terminal at the rear of the unit. The output is set for normal phase operation.

[52 4] TERMINATE AT MANUAL RESET END - This mode is like the preceding output mode, except output 1 deactivates when the reset ends. The output is set for normal phase operation.

[52 5] TERMINATE AFTER OUTPUT 1 TIME DELAY - Once output 1 has been activated, it will deactivate after the predetermined length of output 1 time delay has expired. Manual reset, by either the front panel button or the reset terminal, will override the output 1 time delay and reset the output. The output is set for normal phase operation.

[52 6] BOUNDARY MODE - This mode can be used when the unit is functioning as a counter, but is more applicable to the rate indicator mode. When in boundary mode, the preset 1 value serves as the boundary point. When the count is less than the preset, the output is not activated *(normal phase)*. When the count is greater than or equal to the preset, the output is activated. If the count value were to drop below preset, the output would again deactivate. For negative preset points, the output is not activated when the count value is more positive than the preset value. When the count is more negative than or equal to the preset, the output is activated. If the count becomes more positive than the preset, the output again deactivates. Upon power up, the output will *"remember"* its power down boundary condition and go to that state. The output is set for normal phase operation.

[52 -1]
[52 -2]
[52 -3]
[52 -4]
[52 -5]
[52 -6]

These modes are the same as above with the exception that the output is set for reverse phase operation.

CODE 53 - OUTPUT 1 TIME DELAY

The Gemini has the capability of varying the output time delay from 0.01 second to 599.99 seconds. When the code is entered, instead of a single mode identifier digit being displayed, six digits will be shown. Refer to the *"Programming Preset, Scale Factor, and Output Time Delay"* section for more details about entering. Output time delay will be terminated if the unit is manually reset.

Note: A time delay value of zero cannot be programmed into the Gemini. If a value of 0 is entered into the display and the "E" key is pressed, the unit will not enter the 0, but will revert back to displaying the previous time delay.

CODE 54 - OUTPUT 2 TERMINATION MODES (GEMINI 2000 Only)

The Gemini 2000 has six Output 2 Termination Modes. They are: Terminate at Output 1 Start; Terminate at Output 1 End; Terminate at Manual Reset; Terminate at Manual Reset End; Terminate After Time Delay; and Boundary.

A Reverse Phase Option is available on the Gemini 2000. This refers to complementing the logic state of the output. With normal phase operation, when the count reaches preset 2, output 2 will turn on. The reset condition of the output is output off. In reverse phase operation, the output turns off when the preset is reached. The reset condition of the output is output on. *(Note: The state of the relay, if used, is also reversed.)* A *"-"* sign in front of the mode identifier will provide for reverse phase operation. The absence of a *"-"* sign will give normal phase operation.

In all modes except boundary, when the unit is powered up, the relays or outputs will be turned off. This is done to help prevent a hazardous situation from occurring. If other than boundary or time delay operation is selected, the unit should be reset upon power up.

[54 1] TERMINATE AT OUTPUT 1 START - Output 2 will terminate when Output 1 starts.

[54 2] TERMINATE AT OUTPUT 1 END - Output 2 will terminate when Output 1 terminates.

[54 3] TERMINATE AT MANUAL RESET - In this mode, output 2, once activated, does not deactivate until the moment a reset occurs. The reset can be from the front panel button or from the remote reset terminal, at the rear of the unit. The output is set for normal phase operation.

[54 4] TERMINATE AT MANUAL RESET END - This mode is like the preceding output mode, except output 2 deactivates when the reset ends. The output is set for normal phase operation.

[54 5] TERMINATE AFTER OUTPUT 2 TIME DELAY - Once output 2 has been activated, it will deactivate after the predetermined length of output 2 time delay has expired. Manual reset, by either the front panel button or the reset terminal, will override the output 2 time delay and reset the output. The output is set for normal phase operation.

[54 6] BOUNDARY MODE - This mode can be used when the unit is functioning as a counter, but is more applicable to the rate indicator mode. When in boundary mode, the preset 2 value serves as the boundary point. When the count is less than the preset, the output is not activated *(normal phase)*. When the count is greater than or equal to the preset, the output is activated. If the count value were to drop below preset, the output would again deactivate. For negative preset points, the output is not activated when the count value is more positive than the preset value. When the count is more negative than or equal to the preset, the output is activated. If the count becomes more positive than the preset, the output again deactivates. Upon power up, the output will *"remember"* its power down boundary condition and go to that state. The output is set for normal phase operation.

[54 -1]
[54 -2]
[54 -3]
[54 -4]
[54 -5]
[54 -6]

These modes are the same as above with the exception that the output is set for reverse phase operation.

CODE 55 - OUTPUT 2 TIME DELAY (GEMINI 2000 Only)

The Gemini 2000 has the capability of varying the output time delay from 0.01 second to 599.99 seconds. When the code is entered, instead of a single mode identifier digit being displayed, six digits will be shown. Refer to the *"Programming Preset, Scale Factor, and Output Time Delay"* section for more details about entering. Output time delay will be terminated if the unit is manually reset.

Note: A time delay value of zero cannot be programmed into the Gemini 2000. If a value of 0 is entered into the display and the "E" key is pressed, the unit will not enter the 0, but will revert back to displaying the previous time delay.

CODE 61 - RIGHT HAND DUMMY ZEROS

These zeros are used to effectively move significant digits to the left. Up to three non-functional zeros can be used. Therefore, a normal count of 1 could be shown as a 10, 100, or 1000 without setting or changing any other parameter of the system.

Note: Use of dummy zeros or scale factor values greater than one could cause the displayed value to overflow before a value of 999,999 (6-digits) is accumulated. See "Overflow Indication" section for more details.

[61 1] 1 RIGHT HAND DUMMY ZERO - One is displayed.
[61 2] 2 RIGHT HAND DUMMY ZEROS - Two are displayed.
[61 3] 3 RIGHT HAND DUMMY ZEROS - Three are displayed.
[61 4] NO RIGHT HAND DUMMY ZEROS - None are displayed.

CODE 66 - "OPERATOR ACCESSIBLE FUNCTIONS" MODES

(PGM. DIS. Connected to "COMMON")

The Gemini has four basic levels of *"Operator Accessible Functions"*. However, each of these levels can be modified to enable or disable manual reset. When the *"PGM. DIS." (program disable)* terminal is connected to *"COMMON"*, access to all functions is disabled except for those listed below which will remain enabled. All of the function codes and parameters can be interrogated regardless of the *"Operator Accessible Functions"* mode selected.

A *"-"* sign in front of the mode identifier will disable reset and the absence of a *"-"* sign will enable the reset terminal and front panel reset button.

(Note: Front panel reset can be independently "Disabled" by using the disable reset DIP switch.)

[66 1] NO FUNCTIONS ENABLED EXCEPT RESET - In this mode, manual reset is enabled, but none of the programming functions can be changed.

[66 2] PRESET PROGRAMMING AND RESET ENABLED - In this mode, manual reset and the programming of the Preset Values are enabled.

[66 3] SCALE FACTOR PROGRAMMING AND RESET ENABLED - In this mode, manual reset and the programming of the Preset values are enabled.

[66 4] SCALE FACTOR, PRESET PROGRAMMING AND RESET ENABLED - In this mode, manual reset and the programming of the Scale Factor and Preset Values are enabled.

[66 -1]
[66 -2]
[66 -3]
[66 -4]

These Modes are the same as above with the exception that manual reset is disabled.

PRESET VALUES

Whenever the count value equals the preset value, an output action will occur. *(This action depends on the previously programmed modes)*. The Preset Value may vary from -999,999 to 999,999. Refer to *"Programming The Presets, Scale Factors, And Timed Output Values"* section for instructions on entering the Preset Value.

The Scale Factor value will have a direct effect on the preset being entered. For Scale Factors greater than one, the preset value should be an integer multiple of the scale factor. If it is not, the Gemini will automatically adjust the preset value up or down to force it to be evenly divisible by the scale factor.

"1" - PRESET 1 VALUE
"2" - PRESET 2 VALUE (GEMINI 2000 ONLY)

SCALE FACTOR

"3" SCALE FACTOR - The internal count value is multiplied by the scale factor value, which changes the displayed value accordingly. This is true for all response modes, Count with Inhibit, Count with UP/DN Control, Two Input Anti-Coincidence and for all Quadrature Counting Modes. Scale factor is used primarily for conversion from existing pulses per unit of measure to the required displayed units. This includes conversion from different units of measure *(i.e. feet to meters, etc.)*. The scale factor value may range from -5.9999 to 5.9999. (Refer to *"Programming The Presets, Scale Factor & Output Time Delays"* section for entering instructions.)

It is important to note that the precision of an application cannot be improved by using a scale factor greater than one. To accomplish greater precision, more pulse information must be generated per measuring unit. For example, if 5 pulses are being received per foot of material, the precision of 10th of feet cannot be attained by simply programming a 2.000 scale factor, even though the display is reading in tenths. In this case, the display will increment by two for each count input. Thus, if an odd preset value was entered, such as 6.7 ft., the Gemini will alter the preset to read in even tenths of feet.

Note: Use of a small scale factor in conjunction with a small scale multiplier could cause the internal count value to be exceeded before the 6-digit display value is exceeded. See "Overflow Indication" section for more details.

DUAL PRESET COUNTING & PROGRAMMING APPLICATION EXAMPLE

A typical industrial application for Gemini 2000 will require both a slow down output and a final stop output. The Gemini can easily be programmed to solve this requirement. For instance, let's look at a textile web process that requires a dual output as the web progresses to the proper length. A typical length of material for this application is 10,000 feet for total length, and a slow down output 500 feet prior to the end of the 10,000 foot length. In this case, it would be best to set the unit up as Manual Reset to Preset 2. Preset 2 would be set at 10,000, and Preset 1 would be set for 500. The counter would count down to 500, and output 1 would activate and cause the process to slow down until 0 is reached at which point Output 2 would activate and latch for final stop. The advantage of using manual Reset to Preset 2 is that when changing the total length it is only necessary to change Preset 2 *(length)*. Preset 1 *(slow down)* would remain the same, assuming the same amount of slow down is required.

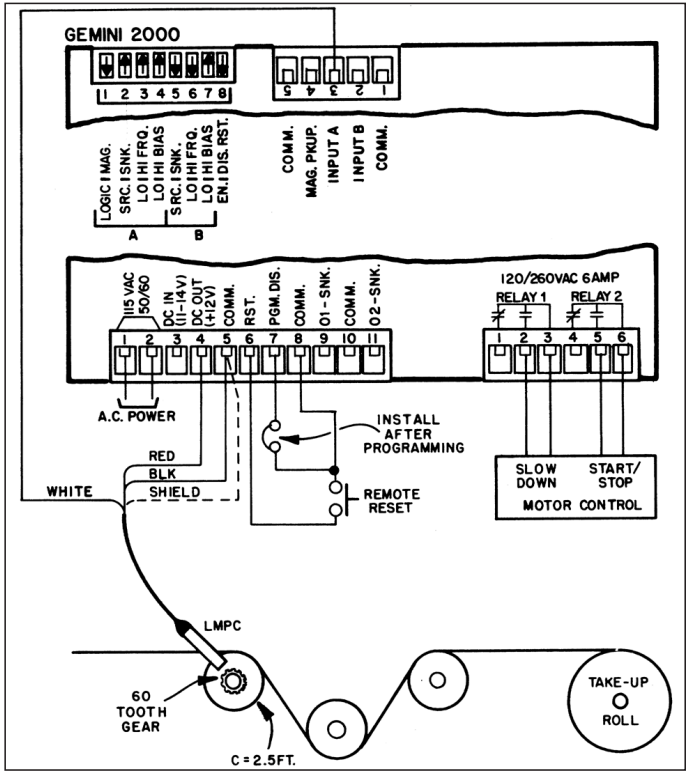
The accompanying drawing shows an LMPC sensing a 60 tooth gear which is attached to a 2.5 ft. circumference drum. Since the unit of measure is a foot, the first step is to find the number of pulses per foot that will be used. The following formula is used.

$$\textit{Pulses/ft.} = \frac{\textit{60 pulses/rev.}}{\textit{2.5 ft./rev.}} = \textit{24 pulses/ft.}$$

Since the desired readout is in feet, and there are 24 pulses per foot, it is necessary to scale the count. To determine the multiplier that is needed, the formula below is used.

$$K = \frac{\textit{"desired reading"}}{\textit{"\# of pulses"}} = \frac{1}{24} = 0.0416667$$

To get the maximum amount of decimal point accuracy a scale multiplier of 0.01 *(divide by 100)* is used which would give us a scale factor *(rounded off)* of 4.1667. If we used the multiplier as the scale factor, and used a scale multiplier of 1, the scale factor would round off to 0.0417, in which case 2 decimal places of accuracy would be lost.



HARDWARE SET-UP

The application drawing shows how the hardware for this system is to be connected. The Red, Black, and White wires of the LMPC are connected to the DC OUT, COMM., and INPUT A terminals respectively. The shield of the LMPC cable is also connected to COMM. A Remote reset button is connected between the RST. and COMM. terminals. After the programming is completed, a jumper is connected between PGM. DIS. and COMM. terminals of the Gemini 2000. This terminal, in conjunction with the *"Operator Accessible Functions"* mode, will prevent accidental changes in the units operating modes. The Normally Open contact of Relay 1 is connected to the slow down actuator, and the Normally Open contact of Relay 2 is connected to the motor control.

DIP switch 1 is set to the LOGIC position. This allows Input A to function as the count input. Switch position 2 is set to SNK. *(current sinking)*, which provides an internal pull-up resistor to 12 VDC. Position 3 is set to HI FRQ. because of the high count speeds involved. Position 4 is set to HI BIAS for higher noise immunity. Since the Gemini 2000 will be counting down, Input B will be used as the direction input which will be fixed. To count down, Input B must be held low. To do this, switch position 5 can be set in the SRC. position which connects a 3.9 K pull-down resistor at Input B to COMM. The positions of switches 6 and 7 are set, as shown, to provide highest noise immunity. Switch position 8 is set to RST. EN. to allow the front panel reset of the Gemini 2000 to operate.

STEP BY STEP PROGRAMMING OF THE GEMINI 2000

Refer to the programming section for instructions on programming function codes and entering Scale factor and Presets.

STEP 1 - Select function code 41 *(Unit Personality)*. Select and enter an identifier of 1 if it isn't already. This sets unit personality to a counter.

STEP 2 - Enter function code 43 *(Input A & B Response Modes)*, and enter a mode identifier of 2 *(A = CNT, B = UP/DN)*.

STEP 3 - Enter function code 44 *(Number of Count Edges)*, and enter a 1 for single edge counting.

STEP 4 - Enter function code 45 *(Scale Multiplier Values)*, and enter a mode identifier of 3 for a scale multiplier of 0.01.

STEP 5 - Enter function code 46 *(Decimal Point & Leading Zero Blanking)*, and enter a mode identifier of 1 for no decimal points with Leading Zero Blanking.

STEP 6 - Enter function code 51 *(Reset Modes)*, and enter a mode identifier of 2 for Manual reset to Preset 2. This mode was chosen to allow set-up time for a new roll or take-up spool.

STEP 7 - Enter function code 52 *(Output 1 Termination Modes)*, and enter a mode identifier of 3 *(Terminate at Start of Manual Reset)*. Output 1 is the slow down output which once activated should remain so until the unit is reset for start up.

STEP 8 - Enter function code 54 *(Output 2 Termination Mode)*, and enter a mode identifier of -3 *(Terminate at start of Manual Reset, reverse phase operation)*. This mode was selected so that when the system is powered up, the relay would be in the open condition which is motor drive off. To start the process, the Reset button is pushed which would close the Output 2 Relay *(turn on motor drive)* and would stay closed until 0 is reached, at which time it would open *(turn motor drive off)*.

STEP 9 - Enter function code 61 *(Right Hand Dummy Zeros)*, and enter a mode identifier of 4 for no Right Hand Dummy zeros.

STEP 10 - Press *1* and then enter the desired slow down value (500 is used in this application).

STEP 11 - Press *2* and enter the total length of material to be processed (10,000 feet).

STEP 12 - Press *3* and enter a scale factor value of 4.1667.

STEP 13 - Enter code 66 *(Operator Accessible Functions Modes)* and enter a mode identifier of 2 *(Presets and Reset Enabled)*. When the *"PGM. DIS."* terminal is connected to *"COMM."*, the only changes that will be possible are resetting the unit and changing the presets.

PROGRAMMING INSTRUCTIONS FOR THE RATE INDICATOR VERSION OF THE GEMINI

The first part of this section provides detailed descriptions of the function command codes for scale multiplier, leading zero blanking, output terminations, etc. Then, using an actual application example, the programming instructions for a rate indicator will be *"walked through"* to give the user a full understanding of the Gemini programming procedure. The descriptions below give the Function Command Code first, followed by the individual mode identifier. The Function Command Code Summary in Appendix *"D"*, lists all codes. *(Only commands and modes pertaining to the rate indicator will be discussed in this section).*

CODE 41 - UNIT PERSONALITY

Two basic personalities are available for the Gemini. They are the counter mode and the rate indicator mode.

[41 2] RATE INDICATOR - Setting this mode selects the unit to function as a rate indicator. This is the basic personality mode and must be programmed before any other modes are set. *(This command forces default mode values in certain command codes.)*

CODE 44 - NUMBER OF COUNT EDGES

The Gemini can be programmed for either single edge or two edge *(doubling)* counting.

[44 1] SINGLE EDGE COUNTING - The unit counts on the negative going *(falling)* edge of the count input signal.

[44 2] TWO EDGE COUNTING - This mode is used when doubling of the count signal input is required. The unit counts on the positive going *(rising)* edge of the count input signal, as well as, the negative going *(falling)* edge. This effectively *doubles the resolution* of the input signal.

CODE 45 - SCALE MULTIPLIER

There are four scale multiplier values that are available. They are: 1; 0.1; 0.01; and 0.001. They effectively divide the internal count value by 1, 10, 100, and 1000 respectively, to yield the displayed rate value.

[45 1] SCALE MULTIPLIER VALUE OF 1 - This value multiplies the internal rate by 1.

[45 2] SCALE MULTIPLIER VALUE OF 0.1 - This value multiplies the internal rate by 0.1. *(Effectively divides by 10.)*

[45 3] SCALE MULTIPLIER VALUE OF 0.01 - This value multiplies the internal rate by 0.01. *(Effectively divides by 100.)*

[45 4] SCALE MULTIPLIER VALUE OF 0.001 - This value multiplies the internal rate by 0.001. *(Effectively divides by 1000.)*

CODE 46 - DECIMAL POINT & LEADING ZERO BLANKING

There are six basic modes of decimal point placement on the Gemini. The decimal point is placed to the right of the display digit that corresponds to the mode identifier. *(The right most decimal point, digit 1, is never turned on.)* A *"-"* sign in front of the mode identifier will inhibit leading zero blanking. The absence of the *"-"* sign will enable leading zero blanking.

[46 1]	0	LEADING ZERO BLANKING
[46 2]	0.0	
[46 3]	0.0 0	
[46 4]	0.0 0 0	
[46 5]	0.0 0 0 0	
[46 6]	0.0 0 0 0 0	
[46 -1]	0 0 0 0 0 0	LEADING ZERO BLANKING INHIBITED
[46 -2]	0 0 0 0 0.0	
[46 -3]	0 0 0 0.0 0	
[46 -4]	0 0 0.0 0 0	
[46 -5]	0 0.0 0 0 0	
[46 -6]	0.0 0 0 0 0	

CODE 51 - RESET MODES (Manual Reset to Zero)

In the majority of rate indicator applications, the setting of function code 51 is not relevant to the desired operation of the unit, and thus need not be programmed. The Gemini is designed to automatically update at the end of every sample time cycle, which will provide a continuous rate indication reading, as is

the case with all standard rate indicators. In order to ensure this type of operation, it is important that the reset Disable/Enable switch be disabled to preclude any unwanted re-start of the sample time cycle.

Certain special application requirements may exist for the sample time cycle to commence at a specific time. In these applications, the remote reset terminal or the front panel reset button *(if the Disable/Enable switch is set to the enable position)*, may be used to activate the following two reset modes, thus starting the sample time.

[51 1] MANUAL RESET TO ZERO (RTZ) - Manual reset to zero is accomplished by pulling remote reset to ground or by pressing the front panel reset button. In this mode the sample time is initiated immediately upon release of the reset button.

[51 -1] MANUAL RESET TO ZERO (RTZ) - Same as [51 1] except that the sample time is initiated immediately upon pressing the reset button.

CODE 52 - OUTPUT 1 TERMINATION MODES

The Gemini has two standard Output 1 Termination Modes when operating as a rate indicator. They are: Terminate After Time Delay and Boundary.

A reverse phase option is available on the Gemini. This refers to complementing the logic state of the output. For normal phase operation the reset condition of the output is output off. For reverse phase operation the reset condition of the output is output on. *(Note: The state of the relay, if used, is also reversed.)* A *"-"* sign in front of the mode identifier will provide for reverse phase operation. The absence of a *"-"* sign will give normal phase operation.

[52 5] TERMINATE AFTER OUTPUT 1 TIME DELAY - In this mode, output 1 activates at the end of each sample time in which the rate is *lower than Preset 1*. Once the output has been activated, it will deactivate after the predetermined length of output 1 time delay has expired. If the output 1 time delay is longer than the sample time, the output time delay will continually be restarted without timing out until the rate exceeds the Preset 1 value. Manual reset, by either the front panel button or the reset terminal, will override the output time delay and reset the output. The output is set for normal phase operation.

[52 6] BOUNDARY MODE - When in the boundary mode, the preset 1 value serves as the boundary point. When the rate value is more negative than the preset, the output is not activated. When the rate value is more positive than or equal to the preset, the output activates. If the rate value were to drop below preset, the output would again deactivate. For negative preset points *(Negative Scale Factor)*, the output is not activated when the rate value is more positive than the preset value. When the rate value is more negative than or equal to the preset, the output is activated. If the rate value becomes more positive than the preset, the output again deactivates. The output is set for normal phase.

In addition, when functioning as a rate indicator, the Gemini also has two special use function modes, Terminate at Manual Reset and Terminate at Manual Reset End. These modes are infrequently used. However, they may be useful when a requirement exists to latch and manually release the output.

[52 3] TERMINATE AT MANUAL RESET - In this mode, Output 1 activates when the rate exceeds the Preset 1 value. Once activated, the output does not deactivate until the moment a reset occurs. The reset can be from the front panel button or from the remote reset terminal, at the rear of the unit. The output is set for normal phase operation.

[52 4] TERMINATE AT MANUAL RESET END - This mode is like the preceding output mode, except the output deactivates when the reset ends. The output is set for normal phase operation.

[52 -3]
[52 -4]
[52 -5]
[52 -6]

These modes are the same as above with the exception that the output is set for reverse phase operation.

CODE 53 - OUTPUT 1 TIME DELAY

The Gemini has the capability of varying the output time delay from 0.01 second to 599.99 seconds. When the code is entered, instead of a single mode identifier digit being displayed, six digits will be shown. Refer to the *"Programming Preset, Scale Factor, and Output Time Delay"* section for more details about entering. Output time delay will be terminated if the unit is manually reset.

Note: A time delay value of zero cannot be programmed into the Gemini. If a value of 0 is entered into the display and the "E" key is pressed, the unit will not enter the 0, but will revert back to displaying the previous time delay.

CODE 54 - OUTPUT 2 TERMINATION MODES (Gemini 2000 Only)

The Gemini 2000 has two standard Output 2 Termination Modes when operating as a rate indicator. They are terminate After Time Delay and Boundary.

A Reverse Phase Option is available on the Gemini 2000. This refers to complementing the logic state of the output. For normal phase operation, the reset condition of the output is output off. For reverse phase operation, the reset condition of the output is output on. *(Note: The state of the relay, if used, is also reversed.)* A *"-"* sign in front of the mode identifier will provide for reverse phase operation. The absence of a *"-"* sign will give normal phase operation.

[54 5] TERMINATE AFTER OUTPUT 2 TIME DELAY - In this mode, output 2 activates at the end of each sample time in which the rate is <u>higher than Preset 2</u>. Once output has been activated, it will deactivate after the predetermined length of output 2 time delay has expired. If the output 2 time delay is longer than the sample time, the output time delay will continually be restarted without timing out until the rate is lower than Preset 2 value. Manual reset, by either the front panel button or the reset terminal, will override the output time delay and reset the output. The output is set for normal phase operation.

[54 6] BOUNDARY MODE - When in the boundary mode, the preset 2 value serves as the boundary point. When the rate value is more negative than the preset, the output is not activated. When the rate value is more positive than or equal to the preset, the output is activated. If the rate value were to drop below preset, the output would again deactivate. For negative preset points *(Negative Scale Factor)*, the output is not activated when the rate value is more positive than the preset value. When the rate value is more negative than or equal to the preset, the output is activated. If the rate value becomes more positive than the preset, the output again deactivates. The output is set for normal phase operation.

In addition, when functioning as a rate indicator, the Gemini 2000 also has two special use function modes, Terminate at Manual Reset and Terminate at Manual Reset End. These modes are infrequently used. However, they may be useful when a requirement exists to latch and manually release the output.

[54 3] TERMINATE AT MANUAL RESET - In this mode, Output 2 activates when the rate exceeds the Preset 2 value. Once activated the output does not deactivate until the moment a reset occurs. The reset can be from the front panel button or from the remote reset terminal, at the rear of the unit. The output is set for normal phase operation.

[54 4] TERMINATE AT MANUAL RESET END - This mode is like the preceding output mode, except the output deactivates when the reset ends. The output is set for normal phase operation.

[54 -3]
[54 -4]
[54 -5]
[54 -6]

These modes are the same as above with the exception that the output is set for reverse phase operation.

CODE 55 - OUTPUT 2 TIME DELAY (Gemini 2000 Only)

The Gemini 2000 has the capability of varying the output time delay from 0.01 second to 599.99 seconds. When the code is entered, instead of a single mode identifier digit being displayed, six digits will be shown. Refer to the *"Programming Preset, Scale Factor, and Output Time Delay"* section for more details about entering. Output time delay will be terminated if the unit is manually reset.

Note: A time delay value of zero cannot be programmed into the Gemini 2000. If a value of 0 is entered into the display and the "E" key is pressed, the unit will not enter the 0, but will revert back to displaying the previous time delay.

CODE 61 - RIGHT HAND DUMMY ZEROS

These zeros are used to effectively move significant digits to the left. Up to three non-functional zeros can be used. Therefore, a normal count of 1 could be shown as a 10, 100, or 1000 without setting or changing any other parameter of the system.

Note: Use of dummy zeros or scale factor values greater than one could cause the displayed value to overflow before a value of 999,999 (6-digits) is accumulated. See "Overflow Indication" section for more details.

[61 1] 1 RIGHT HAND DUMMY ZERO - One is displayed.
[61 2] 2 RIGHT HAND DUMMY ZEROS - Two are displayed.
[61 3] 3 RIGHT HAND DUMMY ZEROS - Three are displayed.
[61 4] NO RIGHT HAND DUMMY ZEROS - None are displayed.

CODE 63 - SAMPLE TIME

The Gemini offers six different lengths of sample times. They are 1 second; 2 seconds; 5 seconds; 10 seconds; 20 seconds; and 50 seconds. Sample Time is defined as the time period allowed for input pulses to accumulate. At the conclusion of this time period, the number of pulses which occur during the sample time, is multiplied by the programmed scale factor value and then displayed. *(For an explanation of how to determine the proper sample time, refer to Appendix "E").*

[63 1] SAMPLE TIME OF 1 SECOND
[63 2] SAMPLE TIME OF 2 SECONDS
[63 3] SAMPLE TIME OF 5 SECONDS
[63 4] SAMPLE TIME OF 10 SECONDS
[63 5] SAMPLE TIME OF 20 SECONDS
[63 6] SAMPLE TIME OF 50 SECONDS

CODE 66 - "OPERATOR ACCESSIBLE FUNCTIONS" MODES

(PGM. DIS. Connected to "COMMON")

The Gemini has four basic levels of *"Operator Accessible Functions"*. However each of these levels can be modified to enable or disable manual reset. When the *"PGM. DIS." (program disable)* terminal is connected to *"COMMON"*, access to all functions is disabled except for those listed below which will remain enabled. All of the function codes and parameters can be interrogated, regardless of the *"Operator Accessible Functions"* mode selected.

A *"-"* sign in front of the mode identifier will disable reset and the absence of a *"-"* sign will enable the reset terminal and front panel reset button.

(Note: Front panel reset can be independently "Disabled" by using the disable reset DIP switch.)

[66 1] NO FUNCTIONS ENABLED EXCEPT RESET - In this mode, manual reset is enabled, but none of the programming functions can be changed.

[66 2] PRESET PROGRAMMING AND RESET ENABLED - In this mode, manual reset and the programming of the Preset Values are enabled.

[66 3] SCALE FACTOR PROGRAMMING AND RESET ENABLED - In this mode, manual reset and the programming of the Preset values are enabled.

[66 4] SCALE FACTOR, PRESET PROGRAMMING AND RESET ENABLED - In this mode, manual reset and the programming of the Scale Factor and Preset Values are enabled.

[66 -1]
[66 -2]
[66 -3]
[66 -4]

These Modes are the same as above with the exception that manual reset is disabled.

PRESET VALUES

Whenever the count value equals the preset value, an output action will occur. *(This action depends on the previously programmed modes)*. The Preset Value may vary from -999,999 to 999,999. Refer to *"Programming The Presets, Scale Factors, And Timed Output Values"* section for instructions on entering the Preset Value.

The Scale Factor value will have a direct effect on the preset being entered. For Scale Factors greater than one, the preset value should be an integer multiple of the scale factor. If it is not, the Gemini will automatically adjust the preset value up or down to force it to be evenly divisible by the scale factor.

"1" - PRESET 1 VALUE
"2" - PRESET 2 VALUE (GEMINI 2000 ONLY)

SCALE FACTOR

"3" SCALE FACTOR - The internal count value is multiplied by the scale factor value, which changes the displayed value accordingly. Scale factor is used primarily for conversion from existing pulses per unit of measure to the required displayed units. This includes conversion from different units of measure *(i.e. feet to meters, etc.)*. The scale factor value may range from -5.9999 to 5.9999. *(Refer to "Programming The Presets, Scale Factor & Output Time Delays" section for entering instructions.)*

It is important to note that the precision of an application cannot be improved by using a scale factor greater than one. To accomplish greater precision, more pulse information must be generated per measuring unit. For example, if 5 pulses are being received per foot of material, the precision of 10th of feet cannot be attained by simply programming a 2.000 scale factor, even though the display is reading in tenths. In this case, the display will increment by two for each count input. Thus, if an odd preset value was entered, such as 6.7 ft., the Gemini will alter the preset to read in even tenths of feet.

DUAL PRESET RATE PROGRAMMING APPLICATION EXAMPLE

A typical industrial Dual preset rate indicator application would be the speed control of a web press operation in a newspaper plant. The Gemini 2000 as pictured, is programmed to read out in feet/min. every two seconds. The input is from the rotary pulse generator that is attached on the drive roll. In this case, the RPG is delivering 120 pulses/rev. and the circumference of the roll is 6.35 ft. By substituting in our formulas as shown in Appendix "E", the correct parameters are determined.

FORMULA [A]

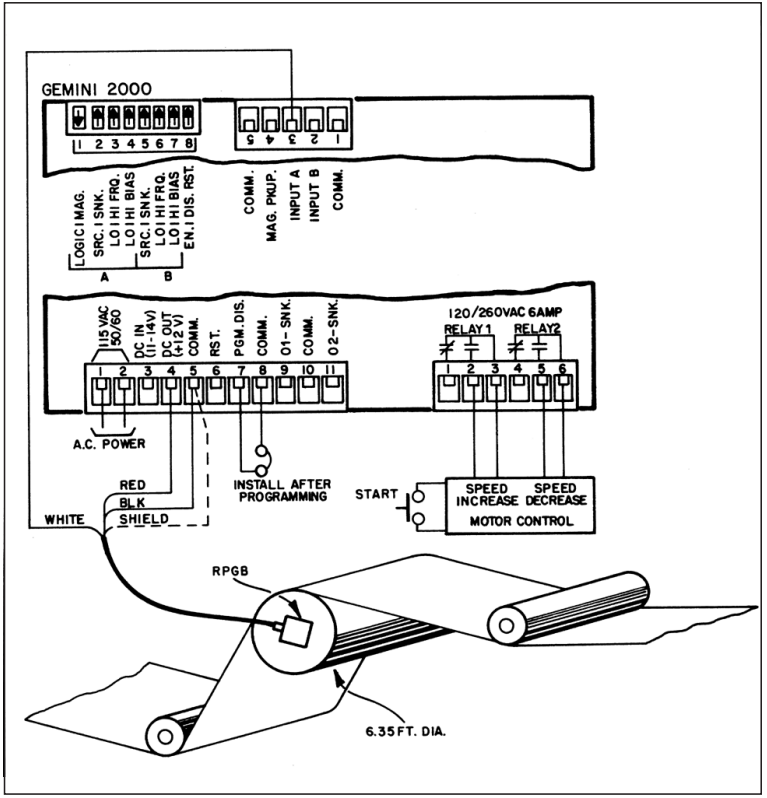
$$PPS = \frac{RPM \times PPR}{60\ sec.} = \frac{1 \times 120}{60} = 2\ PPS$$

FORMULA [B]

$$SCALE\ FACTOR = \frac{DESIRED\ READING}{PPS \times SAMPLE\ TIME} = \frac{6.35}{2 \times 2} = 1.5875$$

By programming a 1.5875 Scale Factor and a 2-second sample time, the Gemini 2000 will display the FPM of the roll every 2 seconds. If added resolution is desired, the number of count edges could be changed to 2, and the scale factor would become 0.7938.

The drive mechanism of the roll will react to a contact closure to increase or decrease speed at a set rate for the duration of the closure. The 2-second sample time with a 0.5 second closure *(Time delay)* at the beginning of each sample time, will allow the web process to remain within the lower and upper tolerances. In this application, the lower speed limit is 500 FPM and the upper limit is 700 FPM. When time delay output termination modes are used in the Gemini 2000, Output 1 activates when the rate is lower than Preset 1 and Output 2 activates when the rate is higher than Preset 2. With this in mind, Output 1 is connected to the speed increase drive and set to the lower limit and Output 2 is set to the upper limit of the speed range. When the rate drops below 500 FPM for the 2-second sample time, Output 1 will activate for 0.5 seconds. Conversely, when the rate exceeds 700 FPM for the 2-second sample time, Output 2 will activate for 0.5 seconds.



HARDWARE SET-UP

The application drawing shows how the hardware for this system is to be connected. The Red *(supply)*, Black *(Common)*, and White *(signal)* leads of the RPG Cable are connected to the *"DC OUT", "COMM."*, and *"INPUT A"* terminals respectively. The shield of the cable is connected to *"COMM."*. The normally open contact of Relay 1 is connected to the *"Speed Increase Control"* and the normally open contact of Relay 2 is connected to the *"Speed Reduction Control"*. A *"Start"* button is used to start up the system and get it *"up to speed"*, at which point the Gemini 2000 can take over and control the speed. After programming is completed, a jumper is placed between the *"COMM."* and *"PGM. DIS."* terminals of the unit. This terminal, working in conjunction with the *"Operator Accessible Functions"* mode, will prevent accidental changes in the unit's operating modes.

The Input DIP Switch position 1 is set to the LOGIC position since an RPG is being utilized. Position 2 is set to *"SNK."*, which provides an internal pull-up resistor to +12 VDC. *(The RPGB has an open collector sinking output.)* Position 3 is set to *"HI FRQ."* since the input rate will be over 100 cps. Position 4 is set to *"HI BIAS"* to provide higher noise immunity. Because Input B is not used, the settings of Positions 5-7 are all selected as shown to provide maximum noise immunity. Position 8 is set to *"DIS. RST."* to disable the front panel reset button. For more detailed descriptions of the Input switch set-up, see Appendix *"A"*.

STEP BY STEP PROGRAMMING OF THE GEMINI 2000

The steps for programming the Gemini should be followed in this order each time a change is made in a basic parameter of the system. *(The preset value, scale factor value and output time delay value can be changed at any time or in any sequence, provided the unit is already operating in a valid mode, and an "Operator Accessible Functions" mode is not preventing this change.)*

Refer to the programming section, for instructions in programming function codes and entering Scale Factor and Preset Values.

STEP 1 - Enter code 41 *(Unit Personality)*, and a mode identifier of 2 for a rate indicator unit personality.

STEP 2 - Enter code 44 *(Number of Count Edges)*, and enter 1 for single edge counting.

STEP 3 - Enter code 45 *(Scale Multiplier Values)*, and enter a mode identifier of 1 for a scale multiplier of 1.

STEP 4 - Enter code 46 *(Decimal Point and Leading Zero Blanking)* and enter 1 for no decimal points and lead zero blanking.

STEP 5 - Enter code 52 *(Output 1 Termination Modes)* and enter 5 for time delay operation.

STEP 6 - Enter code 53 *(Output 1 Time Delay)* and enter a time delay value of 0000.50.

STEP 7 - Enter code 54 *(Output 2 Termination Modes)* and enter a mode identifier of 5 for time delay operation.

STEP 8 - Enter code 55 *(Output 2 Time Delay)* and enter a time delay value of 0000.50.

STEP 9 - Enter code 61 *(Right-Hand Dummy Zeros)* and enter an identifier of 4 for no right-hand dummy zeros.

STEP 10 - Enter code 63 *(Sample Time)* and enter a mode identifier of 2 for a 2 second sample time.

STEP 11 - Press *"1"*. Enter the lower speed limit for Preset 1 which is 000500 for this application.

STEP 12 - Press *"2"*. Enter the upper speed limit for Preset 2, which is 000700 for this application.

STEP 13 - Press *"3"*. Enter the Scale factor for this application which is 1.5875.

STEP 14 - Enter code 66 *("Operator Accessible Functions" mode)* and enter a -1 for all Operator Functions disabled. For this application the Scale Factor and speed limits are fixed and do not require changing. Also there is no need to reset the Sample time so Reset is locked out. *(Note: After this code is programmed, the "PGM. DIS." terminal is connected to "COMM." to prevent any accidental changes.)*

GEMINI 2000 20 mA CURRENT LOOP COMMUNICATIONS

The Gemini 2000 20 mA Current Loop Communications Option allows a *"two-way"* serial communications link to be established in order to monitor or change the count value, Presets and Scale Factor from a remote location. Some typical devices that can be connected with the Gemini 2000 are: a printer, terminal, programmable controller, or host computer. For devices that use RS232, a GCM232 Serial Converter Module is available to convert the 20 mA Current Loop signals to RS232 and vice-versa.

There are two loops that must be established. One for sending commands to the Gemini 2000 and one for receiving the data values from the Gemini 2000. Up to sixteen Geminis or other RLC units with 20 mA serial communication capability, can be connected together in the *"loop"* if a 24 V external current source is utilized. A maximum of seven units can be installed in the loop if the Gemini's 20 mA current source is used. The units are assigned addresses by setting the Serial DIP Switches on each unit. The applications can be as simple as attaching a printer to obtain hard copy of the display information or as involved as using a host computer to automatically set up Presets and Scale Factors on a number of Geminis.

With the Communications Option, the following functions can be performed:

1. Interrogation of the Count Value, Presets, and Scale Factor.
2. Changing of the Presets and Scale Factor.
3. Resetting of the Count Value and Outputs.
4. Automatic print-out when using a printer and the *"Print Request"* Terminal.

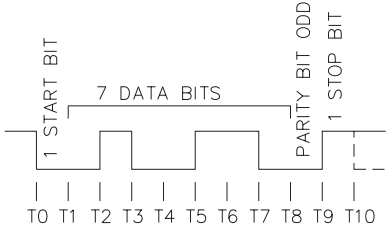
COMMUNICATION FORMAT

Data is sent by switching off and on the current in the 20 mA current loop. Data is received by monitoring the switching action and interpreting the codes that are transmitted. In order for data to be interpreted correctly, there must be identical formats and Baud Rates.

The format that the Gemini 2000 will accept is: 1 start bit, 7 data bits, 1 odd parity bit, and 1 stop bit. The Baud Rates that are available are: 300, 600, 1200 and 2400.

The selection of the Baud Rate is done by setting DIP switches. Refer to the *"Current Loop Installation"* section, for set-up instructions.

FIG. 1: DATA FORMAT-10 BIT FRAME [300, 600, 1200, 2400 Baud]



SENDING COMMANDS & DATA TO THE GEMINI 2000

When sending commands to the Gemini 2000, a command string must be constructed. The command string may consist of command codes, value identifiers, and numerical data. Following is a list of commands and value identifiers that are used when communicating with the Gemini 2000.

COMMAND	DESCRIPTION
N (4EH)	Address command; followed by a one or 2 digit unit address number 1-15 and one of the following commands.
P (50H)	Transmit per Print Options command.
R (52H)	Reset command
T (54H)	Transmit Value command; followed by a value identifier (A-D); operates on count value, Presets and Scale Factor.
V (56H)	Change Value command; followed by a value identifier (A, B, D); operates on Scale Factor and Presets.
X (58H)	Transmit and reset count command.

VALUE IDENTIFIER	DESCRIPTION	MNEMONIC
A (41H)	Preset 1	(PS1)
B (42H)	Preset 2	(PS2)
C (43H)	Count Value	(CNT)
D (44H)	Scale Factor	(SCF)

The command string is constructed by using the above commands and value identifiers, along with the data values that are required. Data values may or may not contain the decimal point if a decimal point is programmed into the Gemini 2000. The Gemini 2000 will accept the decimal points, however, it does not interpret them in any way. Leading zeros can be eliminated, however, all trailing zeros must be present. For example, if a Scale Factor of 1.0000 is to be sent, the data value can be transmitted as 1.0000 or 10000. If a *"1"* is transmitted, the Scale Factor will be changed to 0.0001.

The Address command is used to allow a command to be directed to a specific unit in the Serial Communications Loop. Whenever the unit address is zero, transmission of the Address command is not required. This is done for applications which do not require more than one Gemini. For applications that require several units, it is recommended that each unit in the loop be given a separate address. If they are given the same address, a command such as the Transmit Value Command, will cause all the units to respond at the same time, resulting in erroneous data.

The command string is constructed in a specific logical sequence. The Gemini 2000 will not accept command strings that do not follow this sequence. Only one operation can be performed per command string. Below is the procedure to be used when constructing a command string.

1. If the Gemini 2000, to which the command is to be sent, is assigned an address other than zero, the first two or three characters of the command string must consist of the Address Command *(N)* and the address number of the unit *(1-15)*.
2. The next character*(s)* in the command string is the actual command that the Gemini 2000 is to perform and the value identifier if it pertains to the command. *(A command such as the Transmit per Print Options, "P", command does not require a Value Identifier.)*
3. If the change command is being used, the next characters in the command string are the numerical data value.
4. The last character in the command string is the command terminator *(*)*. This character must be sent in order to tell the Geminis that the command string is complete, so that they can begin processing the command.

Below are some typical examples of properly constructed command strings.

(EX. 1) Change Preset 1 on the Gemini 2000 with an address of 2 to 00123.4.

COMMAND STRING: N2VA1234*

(EX. 2) Have the Gemini 2000, with an address of 13, transmit the Count value.

COMMAND STRING: N13TC*

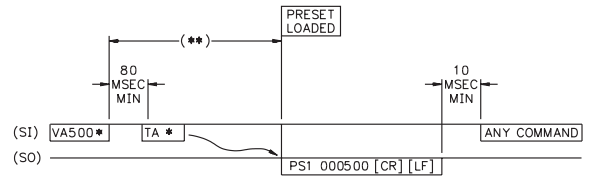
As shown, all commands must be terminated with a *"Command Terminator" (* or 2AH)*. The Gemini 2000 will not process the command until the terminator is sent. If illegal commands or characters are sent to the Gemini 2000, they still would need to be terminated by an *(*)*. If they are not terminated, the next command will not be accepted.

When writing application programs in Basic, the transmission of spaces or carriage return and line feed should be inhibited by using the semicolon delimiter with the PRINT statement. The Gemini 2000 will not accept a carriage return or line feed as valid characters.

When a *"Change Value"* command is sent to the Gemini 2000, a short amount of time is required for the unit to process the data. This time increases with the count rate. During this time, only one additional command may be sent to the Gemini 2000. This may be done 80 msec after the transmission of the *"Change Value"* command. After the second command has been transmitted, the unit will ignore any further commands until 10 msec after both the *"Change Value"* and second command have been processed. It is recommended that a *"Transmit Value"* command follow a *"Change Value"* command. If this is done, the reception of the data can provide a timing reference for sending another command and will insure that the change has occurred.

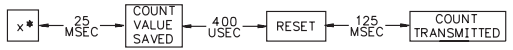
The timing diagrams show the timing considerations that need to be made.

FIG. 2: TIMING FOR SENDING COMMANDS



(**) *This is the time that it takes the Gemini 2000 to process the preset. It varies with the Count Rate and Scale Factor Value.*

FIG. 3: TRANSMIT COUNT & RESET COMMAND TIMING

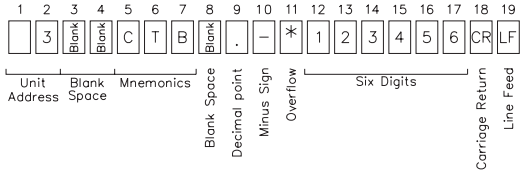


RECEIVING DATA FROM THE GEMINI 2000

Data is transmitted from the Gemini 2000 when a *"Transmit Value"* or *"Transmit per Print Options"* command is sent to the unit, or when the *"PRINT REQ."* terminal is activated. The Gemini 2000 can transmit 4 values: Count value, Presets 1 & 2, and Scale Factor. A list of the abbreviations used when the Gemini 2000 transmits the values are shown below.

CNT - Count Value
PS1 - Preset 1
PS2 - Preset 2
SCF - Scale Factor

A typical transmission, with the *"PR.ID" (Print ID)* switch in the up position, is shown below.



The first two digits transmitted are the unit address followed by two blank spaces. If the unit address is 0, the first locations will be left blank. The next three letters are the abbreviation for the mnemonic value followed by one blank space. The actual values are transmitted last. Negative values are indicated by a *"-"* sign. For positive values, the *"+"* sign is not transmitted. Overflowed count values are shown by an asterisk preceding the most significant digit of the value. The decimal point position will *"float"* within the data field depending on the actual value it represents.

For peripheral control purposes, a single line transmission will have a <CR> attached to the end of the above string. For a *"T"* command or each line of a block transmission, only the above character string is sent. For the last line of a block transmission, a <SP> <CR> <LF> is attached to the end of the above character string.

An example of a typical serial transmission:

3 CNT -1234.56 < CR> < LF>

If the *"Print Request"* terminal initiates the transmission, a 400 msec delay is inserted before the transmission to keep multiple transmissions from overrunning the printer.

When the Print ID switch is in the down position, the unit will not transmit the characters before the data value *(address, Value ID, spaces)* or the 400 msec printer delay. The same above value when transmitted with the *"PR.ID"* switch in the down position, is transmitted as: -1234.56 < CR> < LF>

Note: When using the Gemini with a printer, with the "Print ID" switch in the down position, some printers may not work, since the printer delay is not transmitted.

PRINT OPTIONS

The various Print Options are used mainly in conjunction with a printer and the Print Request Terminal. They provide a choice of Gemini 2000 data values to be printed when either the Print Request Terminal is activated or the *"Transmit per Print Options" (P)* command is sent to the Gemini 2000. The various Print Options available are:

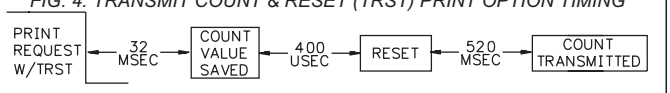
1. Print Count Value Only
2. Print Count Value & Presets
3. Print Count Value & Scale Factor
4. Print Count, Presets, & Scale Factor

A typical printout is shown below. The Print Options are selected by setting S4 and S5 on the Serial DIP Switch. See *"Serial DIP Switch Set-up"* section for the various switch settings.

1	CNT	000054
1	PS1	000100
1	PS2	000200
1	SCF	01.0000

The Transmit Count and Reset action of the *(X)* command is available for use with the Print Options. This option is selected by setting the TRST switch *(Serial switch position 6)* in the down position. This capability is useful in a totalizing application where a *"shift total"* is desired without shutting down the machine to take the reading and reset the unit.

FIG. 4: TRANSMIT COUNT & RESET (TRST) PRINT OPTION TIMING



CURRENT LOOP INSTALLATION

WIRING CONNECTIONS

When wiring the 20 mA current loop, remove the 7-position terminal block *(TBD)*, located on the right side of the top board. Refer to the numbers listed with the terminal descriptions below or on the top label, and install each wire in its proper location on the terminal block. When all connections are made, replace the terminal block into its proper location.

It is recommended that shielded (screened) cable be used for serial communications. This unit meets the EMC specifications using Alpha #2404 cable or equivalent. There are higher grades of shielded cable, such as, four conductor twisted pair, that offer an even higher degree of noise immunity.

TERMINAL DESCRIPTIONS FOR TERMINAL BLOCK TBD

1. **-20 mA SRC (COMMON)** - Common for 20 mA SRC & Print Request terminal.
2. **PRINT REQUEST** - The Print Request Terminal is connected to common to request the Gemini 2000 to transmit according to the Print Options mode that has been selected. *(Minimum Activation time = 25 msec.)*
3. **+20 mA SRC** - The 20 mA SRC terminal provides the source current for one of the loops.
4. **SO- (Serial Out-)**
5. **SO+ (Serial Out+)**
   The Gemini 2000 transmits the requested data on these terminals *(SO- & SO+)*. They are connected in series to the receive input of the device to be connected.
6. **SI- (Serial In-)**
7. **SI+ (Serial In+)**
   The Gemini 2000 receives commands on these terminals *(SI- & SI+)*. They are connected in series with the transmit or output terminals of the device to be connected.
   Note: The serial input terminals must be held in the mark condition (current on) in order for the Gemini 2000 to respond to a Print Request terminal activation.

CURRENT LOOP INSTALLATION (Cont'd)

SERIAL DIP SWITCH SET-UP

The Serial DIP switches are accessible through the side of the Gemini 2000. A list of the DIP switch positions and their functions are shown in Figure 5.

BR0 & BR1, BAUD RATE - Set-up is shown in Figure 5, below. When changing the Baud Rate, the unit should be powered-down and then powered back up again. The unit will only recognize a baud rate change upon power-up, after activating the *"Print Request"* terminal or after a few characters have been sent at the new baud rate *(If the two previous conditions have not occurred, the Gemini will see the characters as erroneous and it will check the baud rate and set itself to operate at the new rate).*

PR.ID - PRINT ID. - When this switch is in the up position, the Gemini 2000 will print the unit address, data value ID and the data value when a transmission is requested. The unit will also insert a 400 msec delay between transmissions when the *"P"* command or Print Request terminal is used. This switch position is generally used when the unit is connected with a printer.

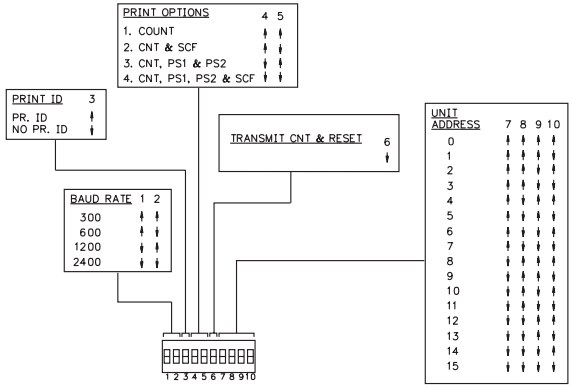
When the switch is in the down position, the Gemini 2000 will transmit only the data value, without the unit address and data ID. The 400 msec delay, described above, will not be inserted. This switch position usage is intended for applications where the Gemini is communicating with a computer. In these circumstances printing the address and value ID and inserting a 400 msec print delay is usually unnecessary and needlessly slows down communication throughput.

PC0 & PC1, PRINT OPTIONS - Used to control which values are transmitted when the Print Request terminal is activated or when the Transmit per Print Options command *"P"* is sent to the Gemini 2000.

TRST, TRANSMIT CNT & RESET - Used in conjunction with Print Options. When this switch is in the down position, the unit will transmit and reset the count when the *"PRINT. REQ."* terminal is activated or the *(P)* command is received.

AD0, AD1, AD2 & AD3, UNIT ADDRESS - These switches are used to give each unit a separate address when more than one unit is connected in the Loop. See Figure 5, for Switch Set-up.

FIG. 5: DIP SWITCH SET-UP



When connecting a printer or any device in which the Gemini 2000's Serial Inputs (SI+, SI-) are not used, they must still be connected to a 20 mA source and be in the Mark condition (Current on) in order for the Gemini 2000 to respond to a Print Request.

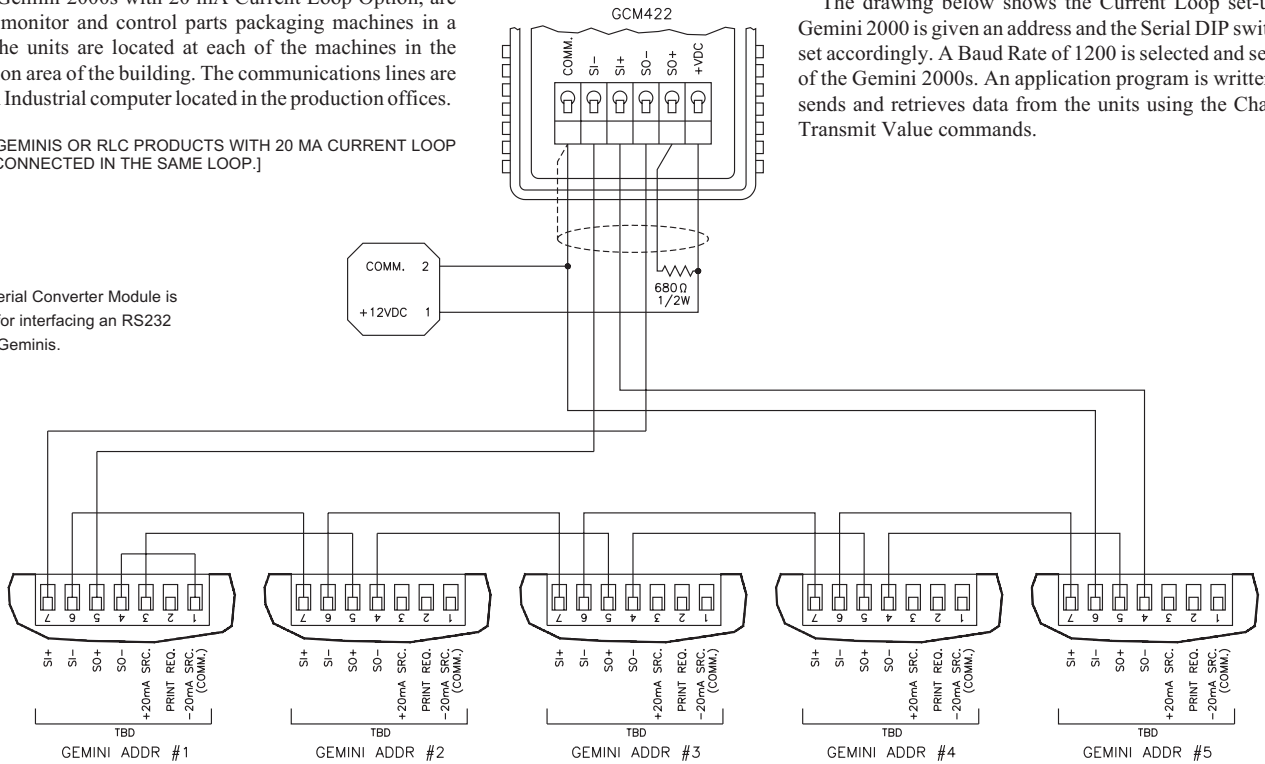
PROCESS MONITORING SYSTEM

Five Gemini 2000s with 20 mA Current Loop Option, are used to monitor and control parts packaging machines in a plant. The units are located at each of the machines in the production area of the building. The communications lines are run to an Industrial computer located in the production offices.

[OTHER GEMINIS OR RLC PRODUCTS WITH 20 MA CURRENT LOOP CAN BE CONNECTED IN THE SAME LOOP.]

The drawing below shows the Current Loop set-up. Each Gemini 2000 is given an address and the Serial DIP switches are set accordingly. A Baud Rate of 1200 is selected and set in each of the Gemini 2000s. An application program is written, which sends and retrieves data from the units using the Change and Transmit Value commands.

Note: A Serial Converter Module is available for interfacing an RS232 device to Geminis.



TROUBLESHOOTING GEMINI SERIAL COMMUNICATIONS

If problems are encountered when trying to get the Gemini*(s)* and host device or printer to communicate, the following checklist can be used to help find the solution.

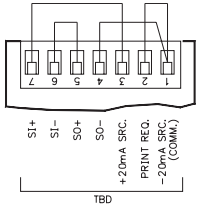
1. Check all wiring. Refer to the previous application examples and use them as a guide to check your serial communication wiring. Proper polarity of all Geminis and other peripherals must be observed. If a multimeter or ammeter is available, insert it in series in each Serial loop and check for current flow with all units powered up. If no current is flowing, either the loop is not wired correctly, or some other fault has occurred. If too much current has been sent through a Serial Input or Output, the unit may have been damaged. If a Gemini is suspected, it can be tested for operation by using the Serial Loop-back test described in the next section.
2. If the Gemini is set-up with a *"host computer"*, device or printer, check to make sure that the computer or device is configured with the same communication format as the Gemini. The only communication format the Gemini will accept is; 1 start bit, 7 data bits, odd parity, and 1 stop bit.
3. Check the baud rate settings and make sure all devices in the loop are set to the same baud rate.
4. Check the Gemini's unit address. If the Address command is not used when transmitting a command to the Gemini, the Gemini's address must be set to 0. See *"Sending Commands & Data to the Gemini"* section for command structure.
5. If two-way communications are to be established between the Gemini and a computer, try getting the computer to receive transmissions from the Gemini first. The Gemini's *"PRINT REQ."* terminal can be used to initiate the transmissions from the Gemini.
6. When sending commands to the Gemini, the * *(2Ah)* must terminate the command. NO CARRIAGE RETURNS *(0Dh)* OR LINE FEED *(0Ah)* CHARACTERS SHOULD BE SENT TO THE GEMINI. If they are sent, the Gemini will not respond to the next command.
7. For applications where 1200 Baud or lower is used, the command terminator (*) can be sent before the string to eliminate any illegally transmitted characters.

SERIAL LOOP-BACK SELF-TEST

The Gemini 2000 has a Serial Loop-back Self-test feature. This test enables the user to verify the operation of the Gemini when problems are encountered trying to get the Gemini and *"Host device"* communicating. In this test, the Gemini's Serial Input and Output Loops are connected together with the 20 mA source supplying the loop current. The Gemini then transmits data *"to itself"*. If the data is received properly, the Gemini 2000 will change its Scale Factor value to 0.1111. To perform the loop-back test, follow the test sequence as described below.

1. With the unit powered down, wire up the serial terminal block, *"TBD"*, as shown in the diagram below.
2. Set the Gemini's unit address to 15 *(set switches 7-10 of the Serial DIP Switch to the down position)*.
3. Apply power to the unit. On power-up the Gemini will perform the loop-back test. To check the results: Call up the Scale Factor value by pressing the *"3"* key. If the Serial loop is functioning properly the Scale Factor value will be 0.1111. If this result is not obtained, double check the connections with those shown in the diagram, and the unit address switch positions and repeat step 3.
4. If the connection between the Print Request terminal, *"PRINT REQ."* and *"COMMON"* is disconnected while the unit is under power, the Scale Factor value will change back to its previous setting.

If the unit does not pass this test, contact your local Red Lion Controls distributor.



APPENDIX "A" - INSTALLATION & INPUT CONFIGURATION SWITCH SET-UP

Before installing the Gemini into the panel, the user should first become familiar with the unit. It may also be desirable to program the unit for the application at hand *(Refer to the "Programming and Applications" sections)*. Once the unit is programmed, the settings will be saved in memory. The Program Disable *"PGM. DIS."* terminal should be connected to *"COMM."* to prevent accidental or unauthorized programming changes.

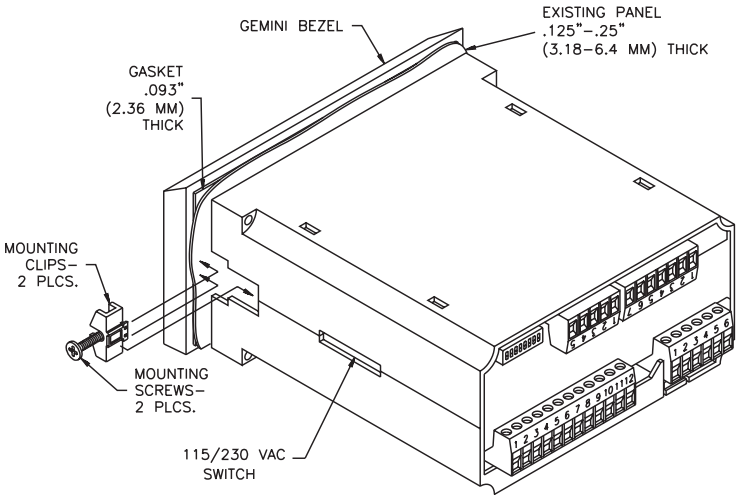
Installation Environment

The unit should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the unit near devices that generate excessive heat should be avoided.

The bezel should be cleaned only with a soft cloth and neutral soap product. Do NOT use solvents. Continuous exposure to direct sunlight may accelerate the aging process of the bezel.

Do not use tools of any kind (screwdrivers, pens, pencils, etc.) to operate the keypad of the unit.

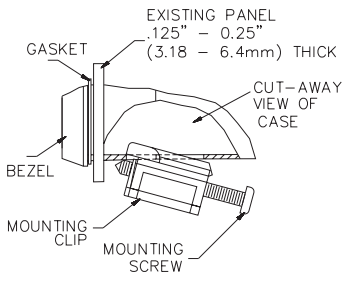
PANEL MOUNTING *(Note, See Appendix "B" for Dimensions)*



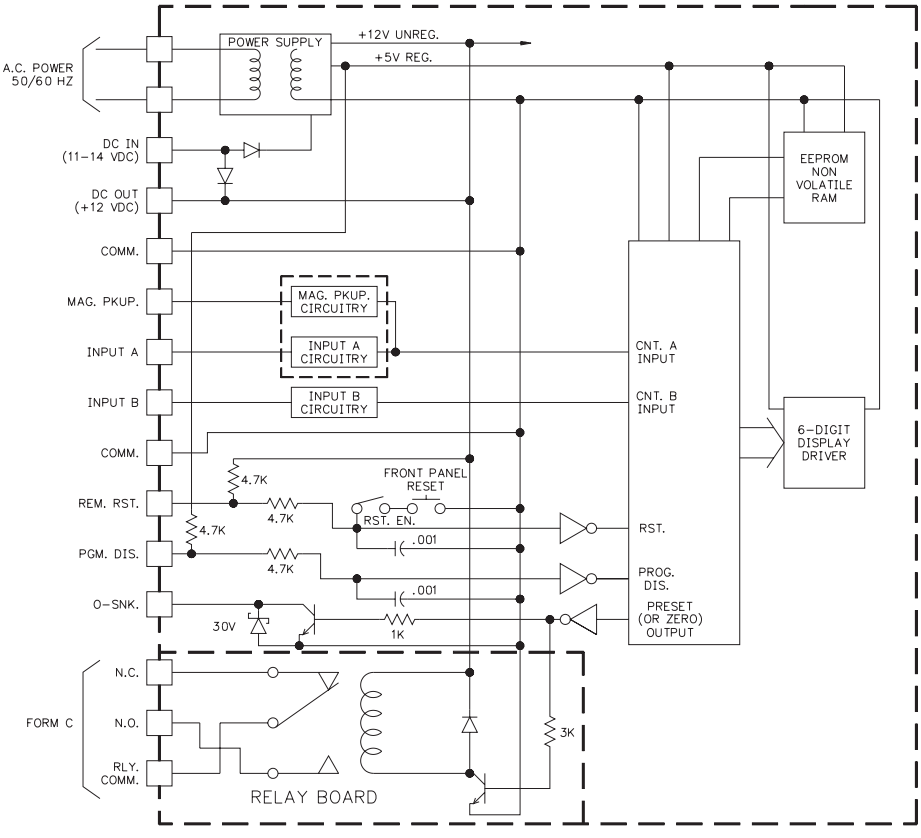
The Gemini is intended to be mounted into an enclosed panel with a gasket to provide a water-tight seal. The unit meets NEMA 4/IP65 requirements for indoor use when properly installed. Two mounting clips and screws are provided for easy installation. Consideration should be given to the thickness of the panel. Too thin of a panel may distort and not provide a water-tight seal. *(Recommended minimum panel thickness is 1/8".)*

After the panel cut-out has been completed and deburred, remove the backing from the adhesive side of the gasket, and carefully stick the gasket to the panel. DO NOT APPLY THE ADHESIVE SIDE OF THE GASKET TO THE COUNTER BEZEL. Insert the unit into the panel. As depicted in the drawing, install the screws into the narrow end of the mounting clips. Thread the screws into the clips until the pointed end just protrudes through the other side. Install each of the two mounting clips by inserting the wide lip of the clips into the wide end of the holes located on either side of the case. Tighten the screws evenly to apply uniform compression, thus providing a water-tight seal.

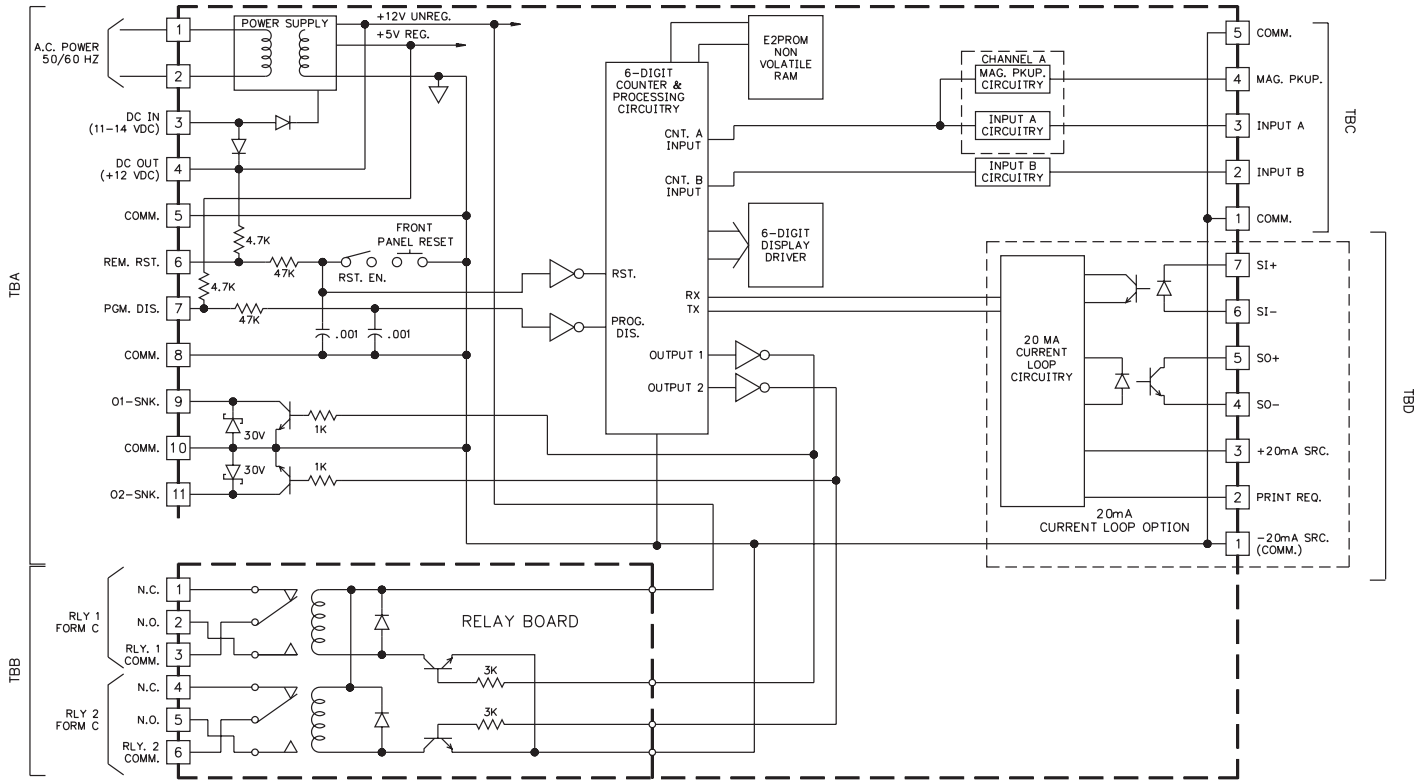
CAUTION: Only minimum pressure is required to seal panel. Do NOT overtighten mounting screws.



GEMINI 1000 BLOCK DIAGRAM



GEMINI 2000 BLOCK DIAGRAM



SELECT AC POWER (115/230 VAC)

The AC power to the unit must be selected for either 115 VAC or 230 VAC. The selector switch is located through an access slot on the side of the case (See the Installation Figure on the previous page, or the label on the case). The unit is shipped from the factory with the switch in the 230 VAC position.

Caution: Damage to the unit may occur if the AC selector switch is set incorrectly.

EMC Compliance Installation

This unit complies with the Electromagnetic Compatibility (EMC) standards listed in the specifications. Compliance to the EMC standards was demonstrated by means of a test set-up using the following installation methods:

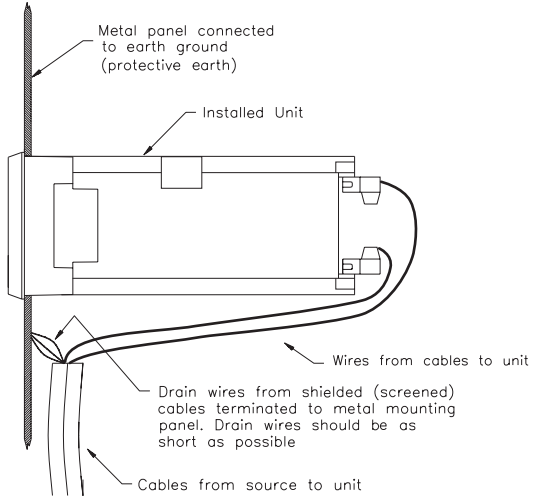
1. Unit mounted in a metal panel connected to earth ground (protective earth).
2. Shielded (screened) cables for Signal and Control inputs with shield drain wire connected to earth ground at the mounting panel only.

Multi-conductor Cable	Function Used For
Belden #8771 - 3 conductor, #22 AWG with foil shield and drain wire	Input A, Input B, PGM DIS, and REM RST
Alpha #2404 - 4 conductor, #22 AWG with foil shield and drain wire	20 mA serial option
Alpha #1173C - 3 conductor, #22 AWG non-shielded	Relay Outputs and Solid State Outputs

3. Metal bezel of unit connected to mounting panel with 9 inch (23 cm) ground lead from rear bezel screw. Test: Immunity to ESD per EN 61000-4-2.
4. EMI filter (Shaffner FN610) placed on the DC mains cable for EMI frequencies above 40 MHz when using optional power supply. Test: RF Conducted Immunity EN 61000-4-6

Shield Termination

EMC compliance installation testing had the drain wire for the shielded cable terminated as shown. The drain wire was less than 0.5" (12.7 mm) long.



Additional EMC Installation Guidelines

Although this unit is designed with a high degree of immunity to ElectroMagnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into the unit may be different for various installations. Listed below are some additional EMC guidelines for successful installation in an industrial environment.

1. The unit should be mounted in a metal enclosure, which is properly connected to protective earth.
   a. If the bezel is exposed to high Electro-Static Discharge (ESD) levels, above 4 Kv, it should be connected to protective earth. This can be done by making sure the metal bezel makes proper contact to the panel cut-out or connecting the bezel screw with a spade terminal and wire to protective earth.
2. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
   a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
   b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
   c. Connect the shield to common of the unit and leave the other end of the shield unconnected and insulated from earth ground.
3. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
4. Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.
5. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:
   Ferrite Suppression Cores for signal and control cables:
   Fair-Rite # 0443167251 (RLC #FCOR0000)
   TDK # ZCAT3035-1330A
   Steward #28B2029-0A0
   Line Filters for input power cables:
   Schaffner # FN610-1/07 (RLC #LFIL0000)
   Schaffner # FN670-1.8/07
   Corcom #1VR3
   Note: *Reference manufacturer's instructions when installing a line filter.*
6. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.
7. Switching of inductive loads produces high EMI. Use of snubbers across inductive loads suppresses EMI.
   Snubbers:
   RLC #SNUB0000

WIRING CONNECTIONS

After the unit has been mechanically mounted, it is ready to be wired. All conductors should meet voltage and current ratings for each terminal. Also cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the unit (AC or DC) be protected by a fuse or circuit breaker.

All wiring connections are made on removable plug-in terminal blocks. There is a separate terminal block for the count inputs, bottom board, optional relay board, and optional 20 mA current loop. When wiring the unit, remove the terminal block and refer to the *"Block Diagram"* to identify the terminal block position number with the proper function. Simply strip the wire, leaving approximately 1/4" bare wire exposed *(standard wires should be tinned with solder)*. Insert the wire into the terminal and tighten down the screw until wire is clamped in tightly. Each terminal can accept up to two 18-gage wires. After the terminal block is wired, install in proper location on board. Wire each terminal block in this manner.

PRIMARY A.C. POWER WIRING

For best results, the A.C. primary power should be relatively *"clean"* and within the specified +/-10% variation limits. Drawing power from heavily loaded circuits or from circuits that also power loads that cycle on and off, should be avoided.

The AC power is connected to the bottom left terminals TBA 1 & 2, marked as AC Power, 50/60 Hz. The voltage selector switch, located on the side of the unit, is used to select the proper voltage. The switch is a slide movement type and can be set by using a small screwdriver. If the switch is towards the front of the unit, it is set for 230 VAC input. The switch is in the 230 VAC position when shipped from the factory.

***Note**: Before applying power to the unit, make sure the AC power selector switch is set for the proper voltage setting.*

USING AN EXTERNAL POWER SOURCE

The Gemini can be operated from a D.C. power source that provides 11-14 VDC at the units rated power consumption. The power source can be a 12 V battery or an external power supply that is capable of supplying the unit's rated current. It is not necessary to provide battery backup to retain count information. The Gemini has an internal memory in which the count is stored upon power-down. Refer to the *"Block Diagrams"*.

Relay Wiring

To prolong contact life and suppress electrical noise interference due to the switching of inductive loads, it is good installation practice to install a snubber across the contactor. Follow the manufacturer's instructions for installation.

***Note:** Snubber leakage current can cause some electro-mechanical devices to be held ON.*

SERIAL COMMUNICATIONS

The Gemini 2000 can be purchased with 20 mA Current Loop Option. On these units, refer to the 20 mA Current Loop section for installation and operational procedures of the Serial loop.

INPUT A & MAGNETIC PICKUP INPUT

The Magnetic Pickup Input and Input A utilize some common circuitry. For this reason the Input A switches are used to set up both Magnetic Pickup and Logic Input A. S1 selects between Magnetic Pickup Input or Logic Input A. WHEN THE MAGNETIC PICKUP INPUT IS BEING USED, S2 MUST BE IN THE SNK POSITION or the unit will not count.

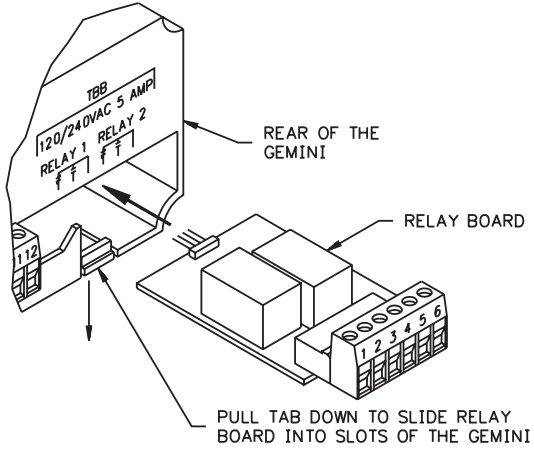
S3 *(HI/LO FRQ)* and S4 *(HI/LO BIAS)* do not affect the Magnetic Pickup Input. When S1 is in the Logic position, the Magnetic Pickup Input is disabled and Input A can be used.

INPUT B

Input B is designed specifically for Logic type inputs. It is identical to the count input of SC Series counters. When Input A is set up for Logic operation, both Input A and Input B operate identically. S5, S6, and S7 function the same as S2, S3, and S4.

INSTALLATION & REMOVAL OF THE RELAY BOARD

To install the relay board, locate the relay opening at the lower right-hand corner, on the back of the Gemini. Pull the tab down while sliding the board into the two slots in the housing. The relay board will seat into the unit, allowing the tab to return to its original position. To remove the relay board, pull down on the tab just enough to allow the relay board to slide out. Grasp the terminal connector and slowly pull until the relay board is removed.



NOTES:

1. SENSOR VOLTAGE AND CURRENT

The +12 V sensor supply voltage on the *"DC OUT"* terminal is nominal with +/-25% variation due to line and internal load variations. All RLC sensors will accommodate this variation.

2. HI/LO FRQ SELECTION

The HI/LO FRQ selection switch must be set on *"LO FRQ"* when switch contacts are used to generate count input signals. Since the *"LO FRQ"* mode also provides very high immunity against electrical noise pickup, it is recommended that this mode also be used, whenever possible, with electronic sensor outputs. The *"LO FRQ"* mode can be used with any type of sensor output, provided pulse widths never decrease below 5 msec, and the count rate does not exceed 100 cps.

3. V_{IL} and V_{IH} levels given are nominal values +/-10% when the voltage on "DC OUT" terminal is +12 VDC. These nominal values will vary in proportion to the variations in the "DC OUT" terminal voltage, which are caused by line voltage and load changes.

4. When shielded cable is used, the shield should be connected to *"COMM."* at the counter and left unconnected at the sensor end.

5. Input B set-up is identical to that of Input A. Input B is for Logic Inputs only.

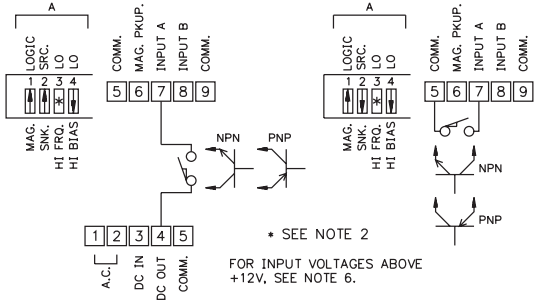
6. Inputs A and B can accept source pulses from other circuits up to +28 V in amplitude. For voltages above +28 V, a limiting resistor and zener diode should be used to limit the voltage at the input.

GEMINI 1000 CONNECTIONS & CONFIGURATION SWITCH SET-UPS FOR VARIOUS SENSOR OUTPUTS (SEE NOTE 5)

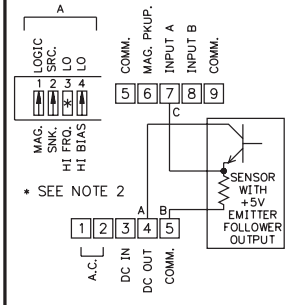
COUNT SWITCH OR ISOLATED TRANSISTOR OUTPUTS

CURRENT SOURCE CONNECTED (COUNT ON OPENING)

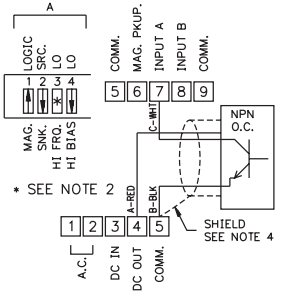
CURRENT SINK CONNECTED (COUNT ON CLOSING)



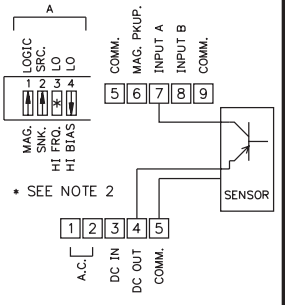
OLDER STYLE SENSORS WITH –EF OUTPUT–CURRENT SRC CONN. (COUNT ON FALLING EDGE)



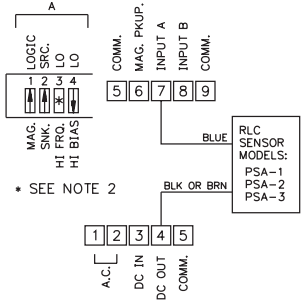
SENSORS WITH CURRENT SINK OPEN COLLECTOR (NPN O.C.) (COUNT ON TURN–ON)



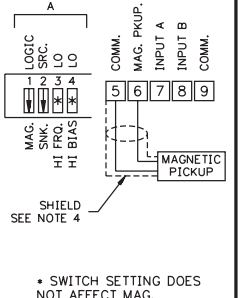
SENSORS WITH CURRENT SOURCE OUTPUT (PNP O.C.) (COUNT ON TURN–OFF)



2 WIRE PROXIMITY SENSORS CURRENT SOURCE CONNECTED (COUNT ON CURRENT FALL)

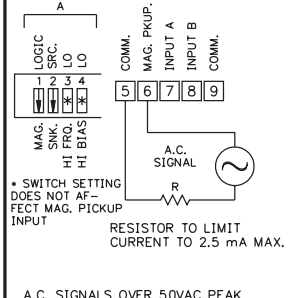


MAGNETIC PICKUPS



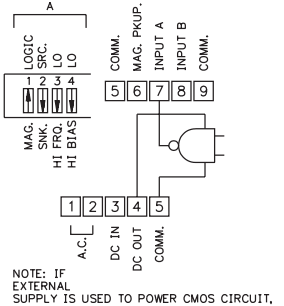
* SWITCH SETTING DOES NOT AFFECT MAG. PICKUP INPUT

A.C. INPUTS FROM INVERTERS, TACH. GENERATORS, ETC.



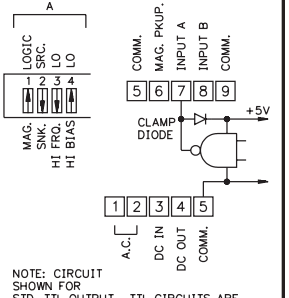
A.C. SIGNALS OVER 50VAC PEAK SHOULD BE ISOLATED BY A STEP DOWN TRANSFORMER

INTERFACING WITH CMOS CIRCUITRY (B TYPE)



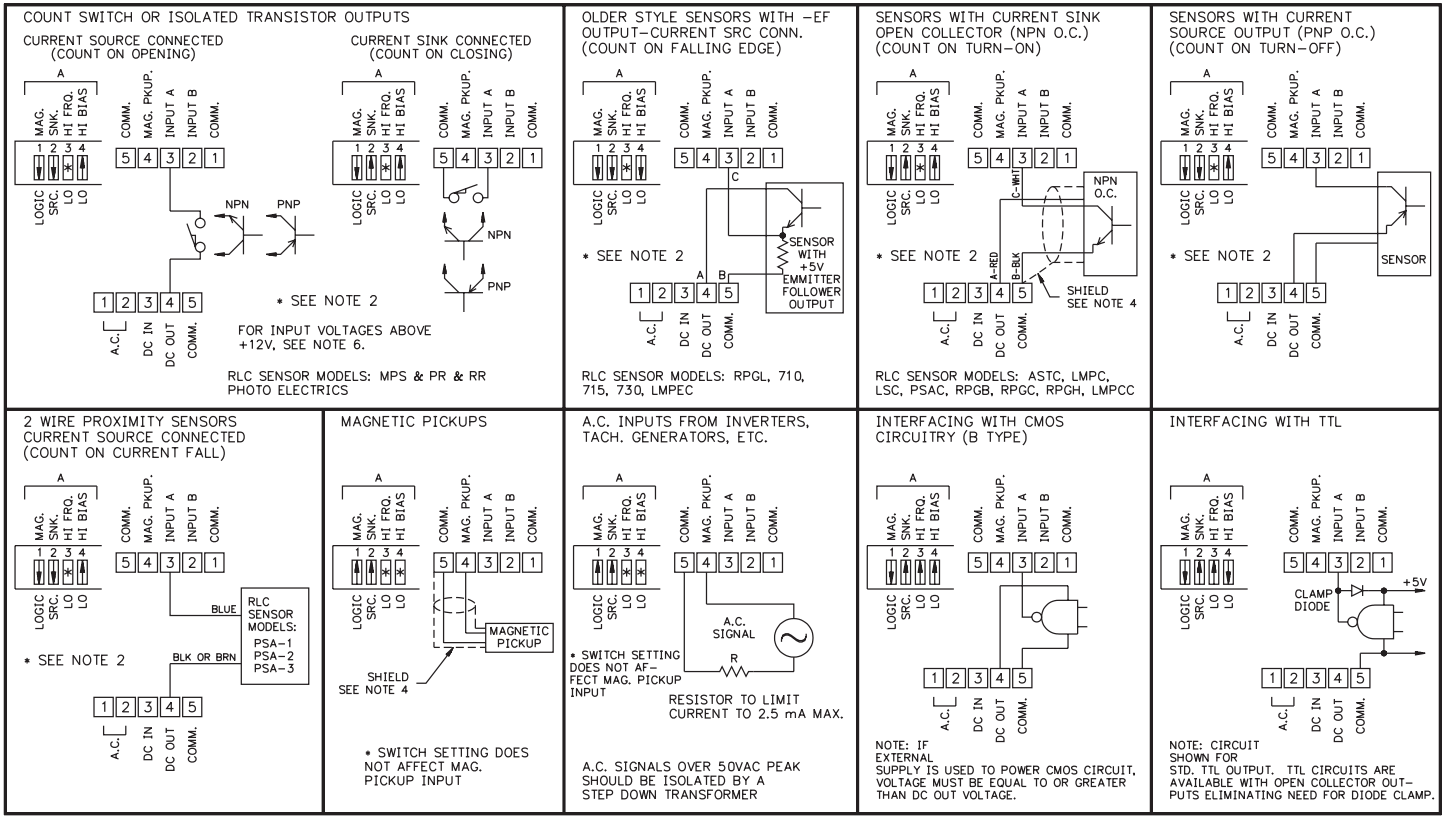
NOTE: IF EXTERNAL SUPPLY IS USED TO POWER CMOS CIRCUIT, VOLTAGE MUST BE EQUAL TO OR GREATER THAN DC OUT VOLTAGE.

INTERFACING WITH TTL



NOTE: CIRCUIT SHOWN FOR STD. TTL OUTPUT. TTL CIRCUITS ARE AVAILABLE WITH OPEN COLLECTOR OUTPUTS ELIMINATING NEED FOR DIODE CLAMP.

GEMINI 2000 CONNECTIONS & CONFIGURATION SWITCH SET-UPS FOR VARIOUS SENSOR OUTPUTS (SEE NOTE 5)



GEMINI 1000 SENSOR INPUT CONNECTIONS & INPUT CONFIGURATION SWITCH SET-UP

The accompanying diagram shows the details of the count Input A and magnetic pickup circuit. The schematic circuit for Input B is almost identical to that of Input A, with the exception that Input B does not have the Magnetic Pickup circuitry paralleled with it. The four switches used to set up Input A and the Magnetic Pickup are designated S1, S2, S3, and S4. To set up Input B; use switches S5, S6, and S7. The functions of these switches are as follows:

CHANNEL A

S1 - MAG: Enables the Magnetic Pickup terminal to be used.
LOGIC: Disables the Magnetic Pickup Input.
Note: SWITCH S2 MUST BE IN THE "SNK" POSITION FOR MAGNETIC PICKUP INPUT.

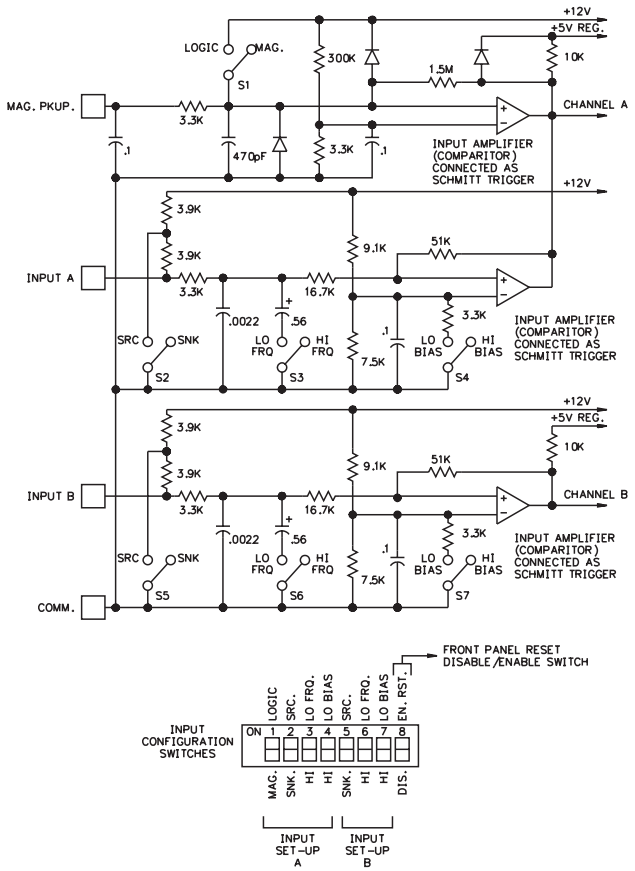
S2 - SNK: Provides a 7.8 K pull-up resistor for sensors with sinking outputs.
SRC: Provides a 3.9 K pull-down resistor for sensors with sourcing outputs.

S3 - HI FRQ: Removes damping capacitor and allows operation up to 10 KHz. Minimum count ON/OFF times - 50 usec.
LO FRQ: Connects damping capacitor for switch contact debounce. Limits count speed to 100 cps max. Min. count pulse ON/OFF time - 5 msec.

S4 - HI BIAS: Sets input trigger levels at mid-range to accept outputs from 2-wire proximity sensors, resistive photo-cells, and logic pulses with full 0 to +12 V swings. (V_{IL} = 5.5 V, V_{IH} = 7.5 V)
LO BIAS: Sets input trigger levels to the low range to accept logic pulses with 0 to 5 V swings. (V_{IL} = 1.5 V, V_{IH} = 3.75 V)

CHAN. B

S5 - Same as S2, for Input B - does not affect Magnetic Pickup Input.
S6 - Same as S3, for Input B.
S7 - Same as S4, for Input B.
S8 - DIS. RST.: Disables front panel reset.
EN. RST.: Enables front panel reset if *"Operator Accessible Functions"* mode *(Code 66)* has Reset enabled.



GEMINI 2000 SENSOR INPUT CONNECTIONS & INPUT CONFIGURATION SWITCH SET-UP

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CHAN. B

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S8 - DIS. RST.: Disables front panel reset.
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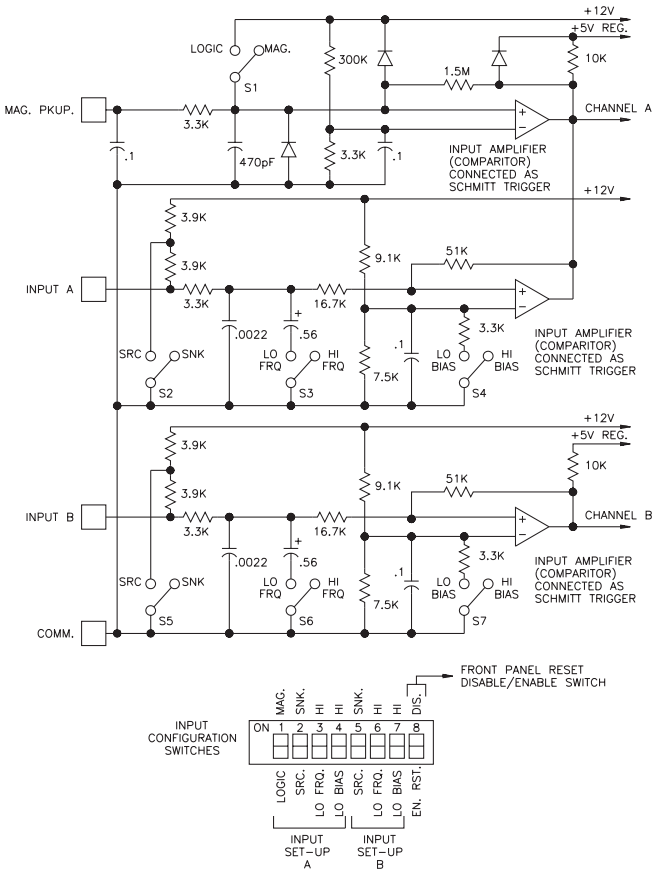
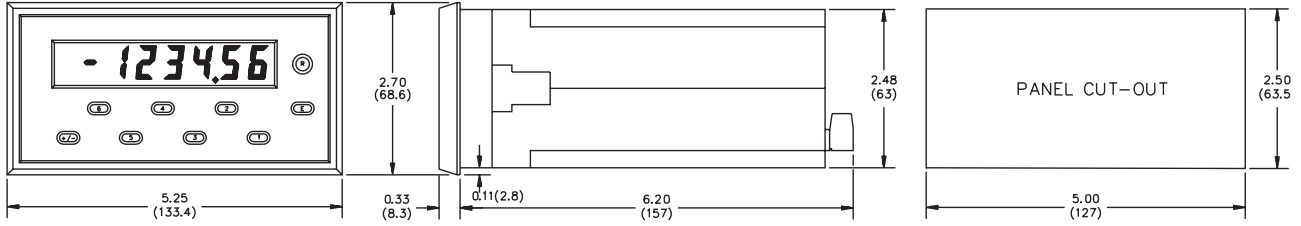


APPENDIX "B" - SPECIFICATIONS & DIMENSIONS

1. **DISPLAY:** 6-digit, 0.56" *(14.2 mm)* High LED display.
2. **POWER REQUIREMENTS:**
   AC Power: Switch selectable 115/230 VAC (±10%), 50/60 Hz, 20 VA
   DC Power: 11 to 14 VDC @ 0.7 amp maximum
3. **SENSOR POWER:** +12 VDC *(±25%)* @ 100 mA.
4. **MEMORY:** Non-volatile E^2PROM memory retains all programming information and count value when power is removed or interrupted.
5. **INPUTS A AND B:** Switch selectable to accept count pulses from a variety of sources including switch contacts, outputs from CMOS or TTL Circuits, and all standard RLC sensors.
   Current Sourcing - Unit provides 3.9 KΩ pull-down load for sensor with current sourcing outputs. *(Max. input voltage = 28 VDC @ 7 mA.)*
   Current Sinking - Unit provides 7.8 KΩ pull-up load for sensors with current sinking outputs. *(Max. sensor current = 1.6 mA.)*
   Debounce - Damping capacitor provided for switch contact debounce. Limits count rate to 100 Hz max. With 50% duty cycle.
   Lo Bias - Input trigger levels V_{IL} = 1.5 V, V_{IH} = 3.75 V
   Hi Bias - Input trigger levels V_{IL} = 5.5 V, V_{IH} = 7.5 V
   Note: Bias levels given are ±10% @ 12 VDC. They vary proportionally with sensor supply voltage.
6. **MAGNETIC PICKUP INPUT:**
   Sensitivity - 150 mV peak nominal
   Hysteresis - 100 mV nominal
   Input impedance - 26.5 KΩ @ 60 Hz nominal
   Maximum Input Voltage - ±50 Vp
7. **MAXIMUM COUNT RATES:**
   Uni or Bi-Directional Modes - 9 KHz, 8 KHz *(X2)*
   2-Input Anti-Coincidence Modes - 5 KHz, 4 KHz *(X2)*
   Quadrature Modes - 5 KHz *(X1)*, 4 KHz *(X2 or X4)*
   Rate Indicator Version - 10 KHz, 8 KHz *(X2)*
8. **CONTROL INPUTS:**
   Reset - Active low (V_{IL} = 1.5 V max.), internally pulled up to +12 VDC (I_{SNK} = 3 mA), Response time = 10 msec.
   Program Disable - Active low (V_{IL} = 1.5 V max.), internally pulled up to +5 VDC (I_{SNK} = 1 mA).
   Print Request - (GEM 2 only) Active low (V_{IL} = 1.5 V max.), internally pulled up to +5 VDC (I_{SNK} = 1 mA).
9. **SERIAL COMMUNICATIONS (Optional Gemini 2000 only):**
   Type - Bi-directional 20 mA current loop, 20 mA source provided. *(Powers up to 7 units in a loop with internal current source.)*
   Baud Rate - Programmable 300 to 2400.
   Maximum Address - 16 units *(0 to 15). (Actual number in a single loop is limited by serial hardware specifications.)*
   Data Format - 10 bit frame, Odd parity *(one start bit, 7 data bits, one odd parity bit, and one stop bit.)*

DIMENSIONS In Inches (mm)

Note: Mounted units require a clearance of 6.8" (W) behind the panel.



9. **SERIAL COMMUNICATIONS (Optional):** (Cont'd)

Serial Hardware Specifications -

SO - Output Transistor Rating: V_{MAX} = 30 VDC, V_{SAT} = 1 V_{MAX} at 20 mA. *(Can address 16 units in a loop)*

SI - Input Diode Rating: V_F = 1.25 V_{TYP}; 1.5 V_{MAX}

Note: The compliance voltage rating of the source must be greater than the sum of the voltage drops around the loop.

10. **OUTPUT(S):**

Solid-State - Current sinking NPN open collector transistor(s). I_{SNK} = 100 mA maximum. V_{OH} = 30 VDC maximum *(Internal Zener diode protected)*. V_{OL} = 1 VDC max. @ 100 mA.

Relay(s) - Mounted on a field replaceable P.C. board. Form C contacts rated at 5 amps @ 120/240 VAC or 28 VDC *(resistive load)*, 1/8 H.P. @ 120 VAC *(inductive load)*. The operate time is 5 msec. nominal and the release time is 3 msec. nominal.

Relay Life Expectancy - 100,000 cycles at Max. Rating. *(As load level decreases, life expectancy increases.)*

Programmable Timed Outputs - The timed outputs can be set from 0.01 to 599.99 seconds, ±*(0.01% + 10 msec)*.

11. **CERTIFICATIONS AND COMPLIANCES:**

SAFETY

IEC 1010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.

IP65 Enclosure rating (Face only), IEC 529

Type 4 Enclosure rating (Face only), UL50

ELECTROMAGNETIC COMPATIBILITY:

Immunity to EN 50082-2

Electrostatic discharge	EN 61000-4-2	Level 2; 4 Kv contact [1] Level 3; 8 Kv air
Electromagnetic RF fields	EN 61000-4-3	Level 3; 10 V/m 80 MHz - 1 GHz
Fast transients (burst)	EN 61000-4-4	Level 4; 2 Kv I/O Level 3; 2 Kv power [2]
RF conducted interference	EN 61000-4-6	Level 3; 10 V/rms 150 KHz - 80 MHz
Power frequency magnetic fields	EN 61000-4-8	Level 4; 30 A/m

Emissions to EN 50081-2

RF interference	EN 55011	Enclosure class A Power mains class A

Notes:

1. Metal bezel of unit connected with ground from rear bezel screw to metal mounting panel.

2. When the unit is DC powered, a power line filter (RLC# LFIL0000 or equivalent) was installed, so as not to impair the function of the unit.

Refer to the EMC Compliance Installation section of the manual for additional information.

12. **ENVIRONMENTAL CONDITIONS:**

Operating Temperature: 0 to 50°C

Storage Temperature: -40 to 80°C

Operating and Storage Humidity: 85% max. relative humidity (non-condensing) from 0°C to 50°C.

Altitude: Up to 2000 meters

13. **CONSTRUCTION:** Metal die-cast bezel, plastic case. This unit is rated for NEMA 4/IP65 indoor use. Installation Category II, Pollution Degree 2.

14. **WEIGHT:** 2.1 lbs (0.9 kg)

APPENDIX "C" - TROUBLESHOOTING GUIDE

The majority of difficulties arising with the Gemini 2000 are related to incorrect power hook-up and programming set-up. Always check all connections, function codes, Scale Factor, and presets as a first step in troubleshooting.

Before applying power, double check all wiring. Improper AC voltage or AC connections may result in permanent damage to the unit.

For further technical assistance, contact technical support at the numbers listed on the back cover of the instruction manual.

PROBLEM	*POSSIBLE CAUSE*	*REMEDIES*
NO DISPLAY	1. Power off, improperly connected, or power brown-out.	1. Check all wiring, verify power.
P ON DISPLAY	1. Data error on power-up.	1a. Press "E" key. b. Check all function codes.
E ON THE DISPLAY	1. Data error detected by processor.	1a. Press "E" key. b. Check all function codes. c. Check signal lines for possible noise sources.
RIGHT HAND DIGITS LOCKED TO ZERO	1. Right-hand zeros programmed.	1. Check function code 61 for dummy "0" program.
NO RESPONSE TO FRONT PANEL	1. Panel disabled.	1. Consult manual on "Operator Accessible Functions" modes.
UNIT DOES NOT COUNT	1. No input. 2. Input selected incorrectly. 3. Wrong Personality. 4. Count Inhibit. 5. If in Rate Mode, sample time not complete. 6. Scale Factor / Multiplier too small.	1. Check sensors/connections. 2. Check rear panel DIP switches. 3. Check function code 41 for counter mode. 4. Check function code 43. If set for 1, when Input B is low, count is inhibited. 5. Allow sample time to complete 6. Check scale factor value and scale multiplier values.

APPENDIX "C" - TROUBLESHOOTING GUIDE (Cont'd)

PROBLEM	*POSSIBLE CAUSE*	*REMEDIES*
UNIT WILL NOT ACCEPT THE DESIRED PRESET VALUE	1. When scale factors greater than 1 are used, the preset value must be evenly divisible by the scale factor value.	1. Unit automatically adjusts preset value to be evenly divisible by the scale factor value.
UNIT COUNTS INCORRECTLY	1. Input type incorrectly selected. 2. Inputs incorrectly connected or loose connections. 3. Electrical interference. 4. Wrong counting mode. 5. Scale factor incorrect.	1. Check rear panel DIP switches. Turn on LO FRQ. switch for count speed of less than 100 cps. 2. Check sensors/input connections. 3. Check connections and wiring for noise sources. 4. Verify functions and modes. 5. Change scale factor value.
UNIT WILL NOT RESET	1. Front panel reset disabled. 2. Reset disabled.	1. Check rear panel DIP switch. 2. Check function code 66.
DATA VALUES & FUNCTIONS WILL NOT CHANGE OR NOT RECORDED	1. Front panel locked out. 2. Incorrect procedures ("E" not pressed)	1. Consult manual on "Operator Accessible Functions" Mode (66) 2. Consult manual on programming.
UNIT CHANGES FUNCTION OR MODE "BY ITSELF"	1. Incorrect programming procedure	1. Consult manual on programming functions in sequential order.
CANNOT PROGRAM CODE 43 (INPUTS A & B RESPONSE MODES)	1. Unit is in tachometer mode.	1. Check function Code 41.
CANNOT PROGRAM CODE 51 - 2, 3, 4, 5, 6	1. Unit is in rate or boundary mode. Code 51 is automatically set to 1.	1. Change 54 then program 52.

APPENDIX "C" - TROUBLESHOOTING GUIDE (Cont'd)

PROBLEM	*POSSIBLE CAUSE*	*REMEDIES*
CANNOT PROGRAM CODE 52 - 1 , 2	1. 54 -6 is programmed. 2. Unit is in tachometer mode.	1. Change 54 then program 52.
CANNOT PROGRAM CODE 52 - 6	1. 54 - 1, 2 is programmed. 2. Unit is in tachometer mode.	1. Change 54 then program 52.
CANNOT PROGRAM CODE 54 - 1, 2	1. 52 -6 is programmed. 2. Unit is in tachometer mode.	1. Change 52 then program 54.
CANNOT PROGRAM CODE 54 - 6	1. 52 -1, 2 is programmed. 2. Unit is in tachometer mode.	1. Change 52 then program 54.
CANNOT PROGRAM CODE 63 (Sample Time)	1. Unit is in Counter mode.	1. Check function Code 41.
OUTPUT DOES NOT TERMINATE AT MANUAL RESET END	1. Reset mode set for "Momentary" reset.	1. Change reset mode to "Maintained" reset (51).

Note: For Serial Communication problems refer to "Troubleshooting Gemini Serial Communications" section.

APPENDIX "D" - GEMINI FUNCTION COMMAND CODE SUMMARY

CODE	MODE	DESCRIPTION	COMMENTS
41		UNIT PERSONALITY	
	1	Counter	
	2	Rate	Automatically selects [51 1], [52 6] & [54 6] if [54 1,2] or[52 1,2] was programmed.
43		INPUTS A & B RESPONSE MODES (counter only)	
	1	Count with Inhibit	Input A = Count, Input B = Inhibit
	2	Count with Up/Down Control	Input A = Count, Input B = Up/Down
	3	Input Anti-Coincidence Add/Subtract	Input A = Add, Input B = Subtract
	4	Input Anti-Coincidence Add	
	5	Quadrature	
	6	Quadrature x4	
44		NUMBER OF COUNT EDGES	Cannot be programmed in Quad x4.
	1	1	Count on falling edge of count input.
	2	2	Count on both edges of count input.
45		SCALE MULTIPLIER	
	1	1	
	2	0.1	
	3	0.01	
	4	0.001	
46		DECIMAL POINT & LEADING ZERO BLANKING	
	-	(+) Leading Zero Blanking Enabled	
	-	(-) Leading Zero Blanking Disabled	*
	+/-1	No Decimal Point	
	+/-2	Decimal Point Right of Digit 2	
	+/-3	Decimal Point Right of Digit 3	
	+/-4	Decimal Point Right of Digit 4	
	+/-5	Decimal Point Right of Digit 5	
	+/-6	Decimal Point Right of Digit 6	

**Polarity sign is displayed in front of the identifier, a (-) sign is displayed, a (+) sign is not.*

APPENDIX "D" - GEMINI FUNCTION COMMAND CODE SUMMARY (Con't)

CODE	MODE	DESCRIPTION	COMMENTS
51		RESET MODES	
	-	(+) Maintained	Unit will remain reset as long as reset is activated.
	-	(-) Momentary	Unit will reset instantly and will start counting again even if reset is still activated.*
	+/-1	Manual to zero	Automatically selected when Rate or Boundary [54 6],is programmed, all others are locked out.
	+/-2	Manual to Preset **	
	+/-3	Auto to Zero after Output Time Delay **	Output activates at Preset **
	+/-4	Auto to Preset after Output Time Delay **	Output activates at zero. **
	+/-5	Auto to Zero at Preset **	
	+/-6	Auto to Preset at Zero **	
52		OUTPUT 1 TERMINATION	
	-	(+) Normal Phase	Output normally "OFF", turns "ON" at preset.
	-	(-) Reverse Phase*	Output normally "ON", turns "OFF" at preset.*
	+/-1	Terminate at Output 2 Start (Gemini 2000 Only)	
	+/-2	Terminate at Output 2 End (Gemini 2000 Only)	
	+/-3	Terminate at Manual Reset	
	+/-4	Terminate at Manual Reset End	
	+/-5	Terminate after Output 1 Time Delay	
	+/-6	Boundary	
53	NA	OUTPUT 1 TIME DELAY	Range 0.01 to 599.99 sec.
54		OUTPUT 2 TERMINATION (Gemini 2000 Only)	
	-	(+) Normal Phase	Output normally "OFF", turns "ON" at preset.
	-	(-) Reverse Phase*	Output normally "ON", turns "OFF" at preset.*
	+/-1	Terminate at Output 1 Start	
	+/-2	Terminate at Output 1 End	
	+/-3	Terminate at Manual Reset	
	+/-4	Terminate at Manual Reset End	

**Polarity sign is displayed in front of the identifier, a (-) sign is displayed, a (+) sign is not.*
*** For the Gemini 2000, all reset to preset modes reset to preset 2 and Output refers to Output 2.*

APPENDIX "D" - GEMINI FUNCTION COMMAND CODE SUMMARY (Con't)

CODE	MODE	DESCRIPTION	COMMENTS
54		OUTPUT 2 TERMINATION (Con't)	
	+/-5	Terminate after Output 2 Time Delay	
	+/-6	Boundary	Automatically selects [51 1].
55	NA	OUTPUT 2 TIME DELAY (Gemini 2000 Only)	Range 0.01 to 599.99 sec.
61		RIGHT-HAND DUMMY ZEROS	
	1	1 Dummy Zero	
	2	2 Dummy Zeros	
	3	3 Dummy Zeros	
	4	No Dummy Zeros	
63		SAMPLE TIME IN SECONDS (rate only)	
	1	1	
	2	2	
	3	5	
	4	10	
	5	20	
	6	50	
66		"OPERATOR ACCESSIBLE FUNCTIONS" MODES	"PGM DIS" Terminal connected to "COMM."
	-	(+) Reset Button & "RST" Terminal Enabled	Front panel reset can be independently disabled by using DIP switch.*
	-	(-) Reset Button & "RST" Terminal Disabled*	Both front panel and rear terminal are disabled
	+/-1	No Functions Enabled	
	+/-2	Preset Programming Enabled	
	+/-3	Scale Factor Programming Enabled	
	+/-4	Preset & Scale Factor Programming Enabled	
1	NA	PRESET 1	Up to +/-999999
2	NA	PRESET 2	
3	NA	SCALE FACTOR	Up to +/-5.9999

**Polarity sign is displayed in front of the identifier, a (-) sign is displayed, a (+) sign is not.*

APPENDIX "E" - SCALING FOR RATE INDICATION

The Gemini offers a simplified method of scaling a rate indication display. This unit offers the capability to monitor the entire range of any linear rate process. Numerous programming capabilities that are available with the Gemini, make this unit the most versatile rate indicator on the market today. The Gemini is designed to internally count input pulses for a programmable sample time period. At the end of the sample time period selected, the unit displays the pulses accumulated after they have been internally multiplied by a programmable scale factor. The unit maintains this display until it is updated by the next successive sample time period. This is an automatic process that provides a very convenient and adaptable method for rate indication applications.

The first step in determining the sample time and scale factor to be programmed is to calculate the pulses per second *(PPS)* generated by the application set-up at a known process rate. The standard formula for determining PPS at a known process rate or machine speed is:

FORMULA [A]

$$\frac{\text{Revolutions/Minute (RPM) x Pulses/Revolution (PPR)}}{\text{60 Seconds}} = PPS$$

This formula is an excellent starting point, and will work in many applications; however, applications will occur that do not fit this formula. In these cases, it will require simple deductions to determine the correct PPS.

The next step is to choose a sample time to be programmed from those available *(1, 2 ,5, 10, 20, and 50 seconds)*.

The following guidelines apply:

1. The sample time is also the display update time. Unless the application dictates a longer update time *(i.e. greater precision or fewer display changes)*, the basic rule is to start the calculation process with a one-second sample time.
2. When using the Gemini as a control mechanism, it is imperative that the update time be shorter than the maximum allowable control reaction time. This is another reason to begin with the one-second sample time.

APPLICATION EXAMPLE [A]

PARAMETERS AT MONITORED SPEED
A) Speed of shaft - 1200 RPM
B) Gear teeth per revolution - 50
C) Web sped at 1200 RPM - 820 FPM
D) Desired Readout - FPM

To begin the process of determining the sample time and scale factor, the parameters from application *(A)* should be inserted into Formula *(A)* to determine the PPS:

$$\frac{RPM \times PPR}{60} = PPS = \frac{1200 \times 50}{60} = 1000\ PPS$$

The next step is to choose a scale factor, that when multiplied by 1000 will cause a display of 820. The following formula will produce the correct scale factor:

FORMULA [B]

$$\frac{\text{Desired Reading}}{\text{PS x Sample Time}} = \text{Scale Factor}$$

$$\frac{820}{1000 \times 1} = \text{Scale Factor} = 0.8200$$

Thus, by programming a scale factor of 0.8200, the Gemini is now set to display the correct FPM readout throughout the entire process, as it varies in speed.

A majority of the applications will be completed with a one-second sample time. The following guidelines *(next page)* will assist in varying the sample time and other factors, if the calculated scale factor exceeds the 5.9999 scale factor capability of the Gemini.

1. Review the applications to ascertain if more input pulses can be generated. In all rate indication applications, it is best to generate the highest pulse rate possible.
2. If the scale factor is calculated to be between 6.0000 and 11.9998, Function Code 44 *(number of count edges)* may be programmed [44 2], which will allow the calculated scale factor to be divided by 2.
3. If the scale factor is over 5.9999, the sample time may be increased to a higher level *(2,5,10,20, or 50 seconds)*. Keep in mind the update display time and the control requirements of the application.

4. Any calculated scale factor may be divided by a factor of 10, by programming Function Code 61 *(dummy right-hand zeros)* to [61 1], which will display a constant zero in the least significant digit.

(Note: This decreases the precision of the display from +/-1 digit to +/-10 digits.)

The same procedure may be accomplished for 100 and 1000 with [61 2] and [61 3].

The use of one or more of the above capabilities will solve most applications where the calculated scale factor value exceeds 5.9999.

There are two other considerations that should be discussed concerning sample time and scale factor calculations.

1. Occasionally, the input pulse rate will greatly exceed the desired readout, and this may result in a scale factor with only 1 or 2 significant digits programmed into the Gemini. For example, assume a calculated scale factor of 0.003246. Instead of programming 0.0032, the Function Code 45 *(scale multiplier)* is programmed [45 3], which multiplies the input pulses by 0.01 and allows the scale factor of 0.3246 to be used. This increases the precision by adding two additional significant digits.
2. In applications where greater precision is desired, it may be necessary to use a longer sample time. This will take a larger sample of incoming pulses, and will in fact result in greater precision. *(In most cases, the input pulses available will allow for +/-1 digit precision even at the one-second sample time level.)*

APPLICATION EXAMPLE [B]

The shaft of a positive displacement pump has a 14-tooth sprocket that is being sensed by an LMPC0000. The unit is pumping 810 liters of water per minute when the shaft is turning 400 RPM. The desired readout is in liters per minute *(LPM)*.

CALCULATING PPS

$$\frac{RPM \times PPR}{60} = PPS = \frac{400 \times 14}{60} = 93.33\ PPS$$

CALCULATING SCALE FACTOR AT 1-SECOND SAMPLE TIME

$$\frac{Desired\ Readout}{PPS \times Sample\ Time} = \frac{Scale}{Factor} = \frac{810}{93.33 \times 1} = 8.68$$

In this application, the 5.9999 scale factor has been exceeded. To complete the requirements, the calculated scale factor 8.68 is divided by 2, and the resultant 4.34 is loaded into the scale factor. Then the Function Code 44 *(number of count edges)* is programmed [44 2], which doubles the input pulse rate, and causes the Gemini to register the correct display at the 4.34 scale factor level.

APPLICATION EXAMPLE [C]

In this application, a photo-cell sensor is being used to count each bottle as it moves along a bottling process. The requirement is to display bottles per minute *(BPM)*. There is no rotary motion that can be sensed to gain a greater input pulse rate. Normal rate is 400 BPM.

The PPS formula does not fit this application. In this case, in order to calculate PPS, the 400 BPM rate is simply divided by 60 seconds.

$$\frac{400\ BPM}{60\ seconds} = 6.66\ PPS$$

First, the 6.66 PPS is factored into Formula (B), using a one-second sample time.

$$\frac{Desired\ Readout}{PPS \times Sample\ Time} = \frac{Scale}{Factor} = \frac{400}{6.66 \times 1} = 60.06\ Scale\ Factor$$

The 60.06 is well above the 5.9999 capability, and the use of other Gemini 2000 capabilities will be necessary.

The magnitude of difference between the calculated scale factor and 5.9999 indicates that a sample time of 10 should be tried next.

$$\frac{60.06}{5.9999} = 10.01 - Sample\ Time\ 10\ seconds$$

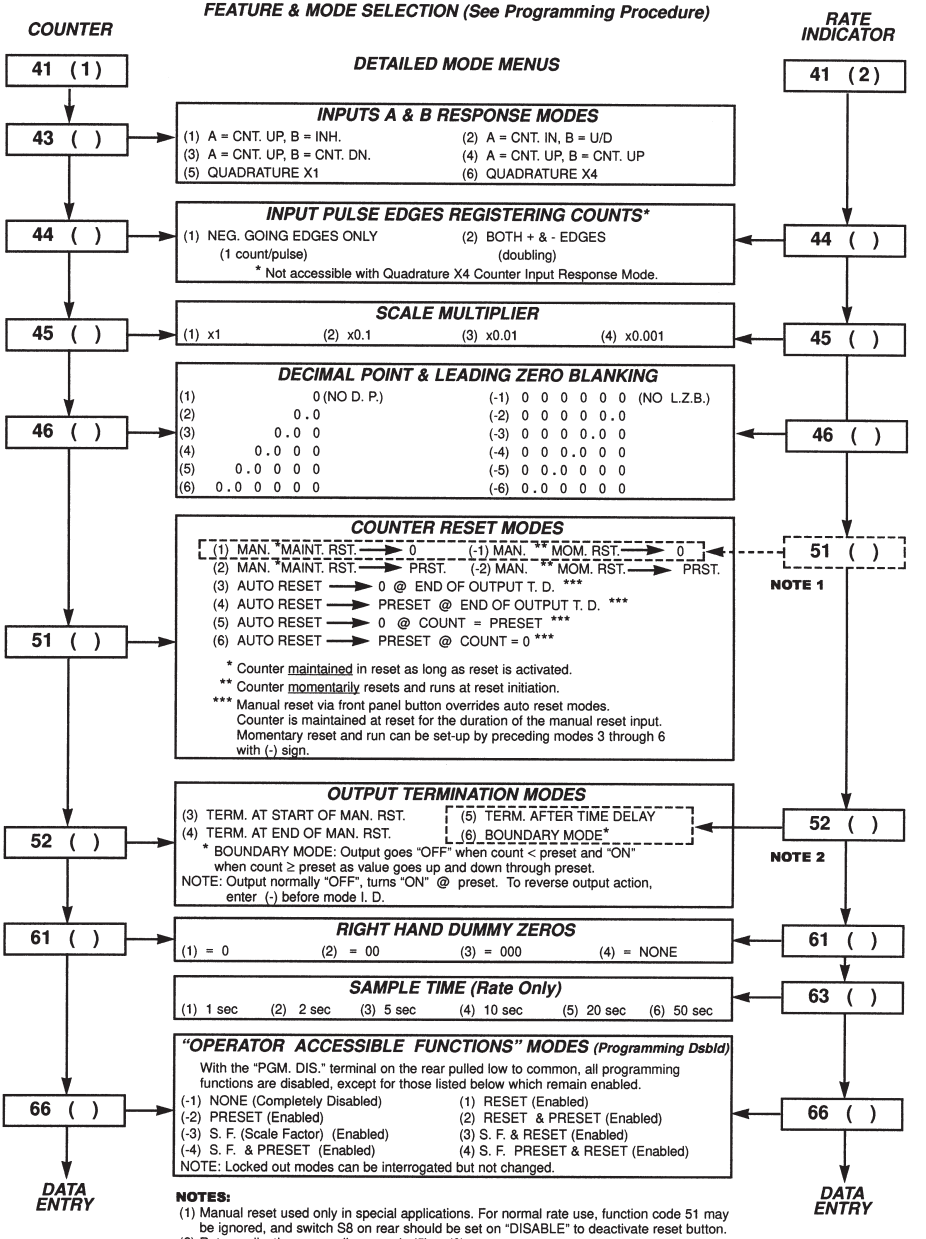
$$\frac{Desired\ Readout}{PPS \times Sample\ Time} = \frac{Scale}{Factor} = \frac{400}{6.66 \times 10} = 6.0060$$

This is just above the 5.9999 scale factor range; however, we can use Function Code 44 to bring this scale factor value within the unit's range. Simply divide 6.0060 by 2 and program 3.0030 into the scale factor. Then program Function Code 44 *(number of count edges)* to [44 2] to double the input pulse rate. The Gemini will now update every 10 seconds, and indicate the correct BPM rate.

This application demonstrates how the various Gemini capabilities can be grouped together to solve a special rate indication application.

APPENDIX "F" - GEMINI 1000 PROGRAMMING CHART

FEATURE & MODE SELECTION (See Programming Procedure)



NOTES:

(1) Manual reset used only in special applications. For normal rate use, function code 51 may be ignored, and switch S8 on rear should be set on "DISABLE" to deactivate reset button.

(2) Rate applications normally use only (5) or (6).

GEMINI 1000 PROGRAMMING

SOME NOTES & HINTS ON PROGRAMMING THE GEMINI 1000

1. Be systematic about programming! Plan out the exact features & functions you need for your application. Write out the code entries you need from start to finish, and then enter the codes completely. Don't start in the middle of the program codes & make arbitrary entries to "see what it will do." This is a sure way to create confusing results. Finally, after you are done, record your program & file it where you can find it later if you want to make changes. You can use this card to write in your codes in the program ladder on the reverse side, together with any fixed data entries, for convenient future reference.

2. Watch out for conflicting modes! The programs in the GEMINI 1000 have been written to prevent illegal code entry. However, to provide optimum flexibility, some reliance must be placed on the programmer to avoid conflicting codes. For example, when set-up as a counter with any of the automatic reset modes (51 3, 4, 5 or 6), the entry of a manual output termination code (52 3) or (52 4) results in a situation where the counter will cycle but the output simply latches on & stays on until a manual reset occurs.

3. The GEMINI 1000 can be interrogated at any time to see what modes & data entries have been made. Such interrogation can be made during a counting cycle or a sample time run without interrupting the normal counting process. In the lockout mode, all functions can also be interrogated, but those functions locked out cannot be changed. Making changes in program modes or data during a run is not recommended since mid-cycle changes can result in unanticipated outputs for that particular cycle.

PROGRAMMING PROCEDURE FOR FUNCTION & MODE SELECTION ☆

(Applies To Programming Chart)

To enter a programmable function or mode, enter the function selector code desired and then select the particular mode identifier required.

For example, to set up a decimal point to display a reading in 1/100ths with leading zero blanking, function selector code #46 must be entered. (See codes on reverse side.)

Press button #4, then button #6. The display will temporarily interrupt its normal readout (without interfering with the normal operation of the unit) and will display the entered code on the L.H. side.

[46] (DISPLAY READOUT)

Next enter the mode identifier (button #3) that defines the decimal point location & LZB condition. This code is displayed on the right.

[46 3] (DISPLAY READOUT)

Now enter this new selection by pressing the "E" button.

PROGRAMMING PROCEDURE FOR DATA ENTRY

(Applies To Both Counter [41 1] ***Mode & Rate Indicator*** [41 2] ***Mode)***

In data entry, the front panel pushbuttons are identified by two different sets of references and will cause two different reactions in the course of making a data entry.

In the first phase of a data entry cycle, the particular data entry mode is called up by pushing the buttons identified by their panel markings. (i.e. Buttons "5", "3", or "1"). Once the data entry mode has been entered, the existing data appears on the display and the buttons below the display reference themselves to the digits directly above each button. The data can then be changed a digit at a time by depressing the button directly below the digits to be changed. After the new data value is obtained, the "E" button is depressed to enter the new value.

[53] OUTPUT TIME DELAY SETTING☆

Entering Code "53" will call up the time delay setting in seconds & hundredths. The T.D. can now be set to the new value by incrementing each digit with the button underneath that digit. Press the "E" button to enter the new T.D. value. (Max. T.D. = 599.99 sec.)

[3] SCALE FACTOR

One stroke of the "3" button calls up the existing scale factor. (The scale factor is the multiplier used to convert the actual count pulses coming into the unit & stored in the counter into the direct readout display). The value can now be changed by incrementing each digit with the button below it. Depressing the "E" key enters the new S.F. S.F. can be set at any value from -5.9999 to +5.9999.

[1] PRESET

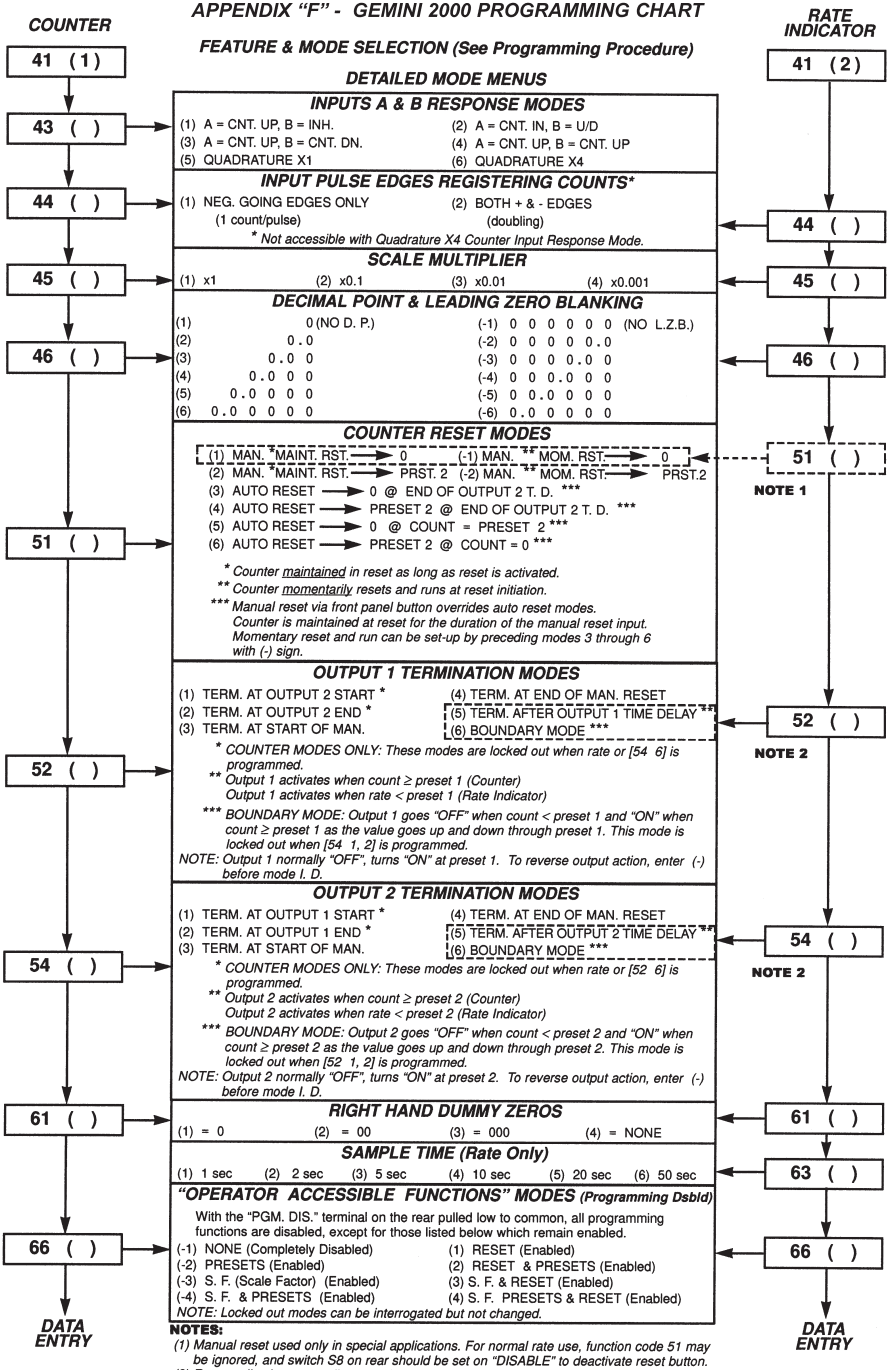
One stroke of the "1" button calls up the preset value which can then be changed by incrementing each digit with the button below it. Depress the "E" button to enter the new Preset.

☆Program before connecting "PGM. DIS." to "COMMON".

SELF TEST ROUTINE 6, +/-

Depressing "6" & then "+/-" starts the self test routine by lighting all decimal points, then all 9's, all 8's, all 7's etc., down to all zeros. Then it displays alternate 1's & 2's, etc., until alternate 8's & 9's are displayed. At this time, the output can be manually activated for testing by pressing the "1" button. (Output test is disabled when "PGM. DIS." terminal is pulled to "COMMON".) Pressing the "E/CNT" button will exit the Test Mode at any time, or automatic exit will occur six (6) seconds after the Test Mode is completed. Test Mode can be run at any time and will not interfere with the normal operation of the Gemini 1000 during a run.

APPENDIX "F" - GEMINI 2000 PROGRAMMING CHART



NOTES:

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(2) Rate applications normally use only (5) or (6).

GEMINI 2000 PROGRAMMING

SOME NOTES & HINTS ON PROGRAMMING THE GEMINI 2000

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PROGRAMMING PROCEDURE FOR FUNCTION & MODE SELECTION ☆

(Applies To Programming Chart)

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For example, to set up a decimal point to display a reading in 1/100ths with leading zero blanking, function selector code #46 must be entered. (See codes on reverse side.)

Press button #4, then button #6. The display will temporarily interrupt its normal readout (without interfering with the normal operation of the unit) and will display the entered code on the L.H. side.

[46] (DISPLAY READOUT)

Next, enter the mode identifier (button #3) that defines the decimal point location & LZB condition. This code is displayed on the right.

[46 3] (DISPLAY READOUT)

Now enter this new selection by pressing the "E" button.

PROGRAMMING PROCEDURE FOR DATA ENTRY

(Applies To Both Counter [41 1] ***Mode & Rate Indicator*** [41 2] ***Mode)***

In data entry, the front panel pushbuttons are identified by two different sets of references and will cause two different reactions in the course of making a data entry.

In the first phase of a data entry cycle, the particular data entry mode is called up by pushing the buttons identified by their panel markings. (i.e. Buttons "5", "3", or "1"). Once the data entry mode has been entered, the existing data appears on the display and the buttons below the display reference themselves to the digits directly above each button. The data can then be changed a digit at a time by depressing the button directly below the digits to be changed. After the new data value is obtained, the "E" button is depressed to enter the new value.

[53,55] OUTPUT TIME DELAY SETTING☆

Entering Code "53" or "55" will call up the output 1 or output 2 time delay setting in seconds & hundredths. The T.D. can now be set to the new value by incrementing each digit with the button underneath that digit. Press the "E" button to enter the new T.D. value. (Max. T.D. = 599.99 sec.)

[3] SCALE FACTOR

One stroke of the "3" button calls up the existing scale factor. (The scale factor is the multiplier used to convert the actual count pulses coming into the unit & stored in the counter into the direct readout display). The value can now be changed by incrementing each digit with the button below it. Depressing the "E" key enters the new S.F. S.F. can be set at any value from -5.9999 to +5.9999.

[1,2] PRESETS

One stroke of the "1" or "2" button calls up the preset value which can then be changed by incrementing each digit with the button below it. Depress the "E" button to enter the new Preset.

☆ Program before connecting "PGM. DIS." to "COMMON".

SELF TEST ROUTINE 6, +/-

Depressing "6" & then "+/-" starts the self test routine by lighting all decimal points, then all 9's, all 8's, all 7's etc., down to all zeros. Then it displays alternate 1's & 2's, etc., until alternate 8's & 9's are displayed. At this time, the outputs can be manually activated for testing by pressing the "1" or "2" button. (Output test is disable when "PGM. DIS." terminal is pulled to "COMMON".) An automatic exit will occur six (6) seconds after the Test Mode is completed. Test Mode can be run at any time and will not interfere with the normal operation of the Gemini 2000 during a run.

APPENDIX "G" - ORDERING INFORMATION

MODEL NO.	DESCRIPTION	OPTIONS		PART NUMBERS
		W/Relay Board	W/20 mA Current Loop	115/230 VAC
GEM1	Gemini 1000	Yes	No	GEM10060
GEM2	Gemini 2000	Yes	No	GEM20060
		Yes	Yes	GEM20160
—	Gemini 1000 Relay Board			RLYBD000
—	Gemini 2000 Relay Board			RLYBD002
For Information on Pricing, Enclosures, Base Mount Kits, & Panel Adapter Kits, refer to the Red Lion Controls Catalog or contact your local RLC distributor.				

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LIMITED WARRANTY

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to one year from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company's liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company's option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company's products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained and relies on no other warranties or affirmations.

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