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Bulletin No. IMA/IM-G
Drawing No. LP0201
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MODEL IMA - APOLLO 6-DIGIT INTELLIGENT SERIAL SLAVE DISPLAY

- *DISPLAYS 6 DIGITS OF SERIAL ASCII DATA*
- *INPUT ISOLATED 20 mA LOOP*
- *STATE-OF-THE-ART DIGITAL ELECTRONICS FOR GREATER RELIABILITY*
- *FULL 6-DIGIT, 7 SEGMENT, HIGH VISIBILITY, 0.56" (14.2 mm) HIGH, RED LED DISPLAY*
- *PROGRAMMABLE FRONT PANEL LOCK-OUT MENU*
- *PEAK/VALLEY MEMORY FUNCTION*
- *DUAL ALARM RELAY OUTPUTS (optional)*
- *NEMA 4/IP65 SEALED METAL FRONT BEZEL*
- *DIN STD BEZEL 1.89" (48 mm) x 3.78" (96 mm)*

GENERAL DESCRIPTION

The Apollo Intelligent Serial Slave Display (IMA) accepts ASCII data from either a terminal, host computer, or Red Lion Controls product with serial communications, and displays the received data. The data may be numeric, alphabetic and/or punctuation, the parameters of how the data is interpreted by the IMA is covered in detail in the 20 mA current loop serial communications section. Serial communication is accomplished via two 20 mA current loops. The IMA provides two 20 mA current sources. The first source is dedicated to the output loop (TBA #12) and can power up to seven units on its loop. The second source (TBA #7) is a quasi current source (1KΩ resistor to +18 VDC) which can power up to three units on its loop. *Note: One source is required to transmit and one source is required to receive.* The peak and valley (max/min) values can be recalled at the touch of a button. A full 6-digit, 7-segment display accommodates virtually any process engineering unit. English-style display prompts and front panel buttons aid the operator through set-up and operation. A front panel lock-out menu protects set-up data from unauthorized personnel. Programmable E1-CON can be utilized for alarm, display hold and reset operations. All set-up data is stored in E^2PROM, which will hold data for a minimum of 10 years without power. All values are retained at power-down.

Optional dual relays with parallel solid state outputs are fully programmable to operate in a wide variety of modes to suit many alarm applications.

The IMA has several built-in diagnostic functions to alert operators of most any malfunction. Extensive testing of noise interference mechanisms and full burn-in makes the IMA extremely reliable in industrial environments. The die-cast front bezel meets NEMA 4/IP65 requirements for washdown applications when properly installed. Plug-in style terminal blocks simplify installation and wiring change-outs.

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.

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

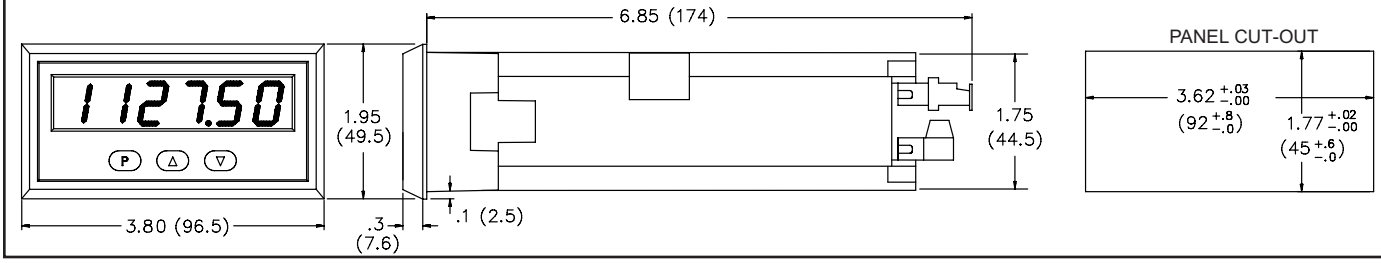
CAUTION: Risk of electric shock.

ORDERING INFORMATION

MODEL NO.	DESCRIPTION	DUAL ALARMS	PART NUMBERS
			115/230 VAC
IMA	Intelligent Serial Slave Display	NO	IMA04161
		YES	IMA04164
For information on Pricing, Enclosures & Panel Mount Kits refer to the RLC catalog or contact your local RLC distributor.			

DIMENSIONS In inches (mm)

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.1" (53.3) H x 5.5" (140) W.



SPECIFICATIONS

1. **DISPLAY**: 6-digit, 7 segment, 0.56" (14.2 mm) High LEDs.
2. **POWER REQUIREMENTS**:
   AC Power: Switch Selectable for 115 / 230 VAC, ±10%, 50/60 Hz, 14 VA.
3. **CONTROLS**: Three front panel push buttons for modifying alarm values and IMA set-up. Two external inputs for disabling the front panel and controlling programmable functions.
4. **INPUT**: Serial ASCII data
   The vocabulary set of ASCII characters that the IMA receives and displays are as follows:
   Numbers: "0-9"
   Alphabetic: "A" "b" "C" "d" "E" "F" "g" "H" "I" "J" "L" "N" "O" "P" "r" "S" "t" "u" "y"
   Punctuation: "." "," "-" "blank"
   Note: If any characters received by the IMA are NOT in the above list, a blank space will be substituted.
5. **Response Time**: 70 msec max.
6. **20 mA SOURCE (TBA pins 6 & 7)**: Capable of driving up to three SI input diodes.
7. **SERIAL COMMUNICATIONS**:
   Type: Bi-directional 20 mA current loop, 20 mA source provided on transmit loop. (Powers up to 7 units in a loop with internal current source.)
   Baud Rate: programmable 300 to 2400
   Maximum address: 99 (Actual number in a single loop is limited by serial hardware specifications.)
   Data Format: 10 bit frame, Odd parity (one start bit, 7 data bit, one odd parity bit, and one stop bit.)
   Serial Hardware Specifications:
   SO - Output Transistor Rating: V_{MAX} = 30 VDC, V_{SAT} = 1 V_{MAX} at 20 mA.
   Note: This will allow up to 28 units max. in each loop.
   SI - Input Diode Rating: VF = 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. (Typically a 30 VDC powered source would be capable of operating between 18 and 22 units in a loop.)
8. **DISPLAY READING RANGE**: -99999 to 999999
9. **ALARMS (Optional)**:
   Solid State: Two, isolated, sinking open collector NPN transistors acting in parallel with relays. V_{SAT} = 1 V @ 100 mA max. V_{MAX} = 30 VDC.
   RELAYS:
   Type: Form C (2)
   Max. Ratings: 5 Amps, 120/240 VAC or 28 VDC (resistive load), 1/8 HP 120 VAC (inductive load).
   Relay Life Expectancy: 100,000 cycles at Max. Rating. (As load level decreases, life expectancy increases.)
10. **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
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

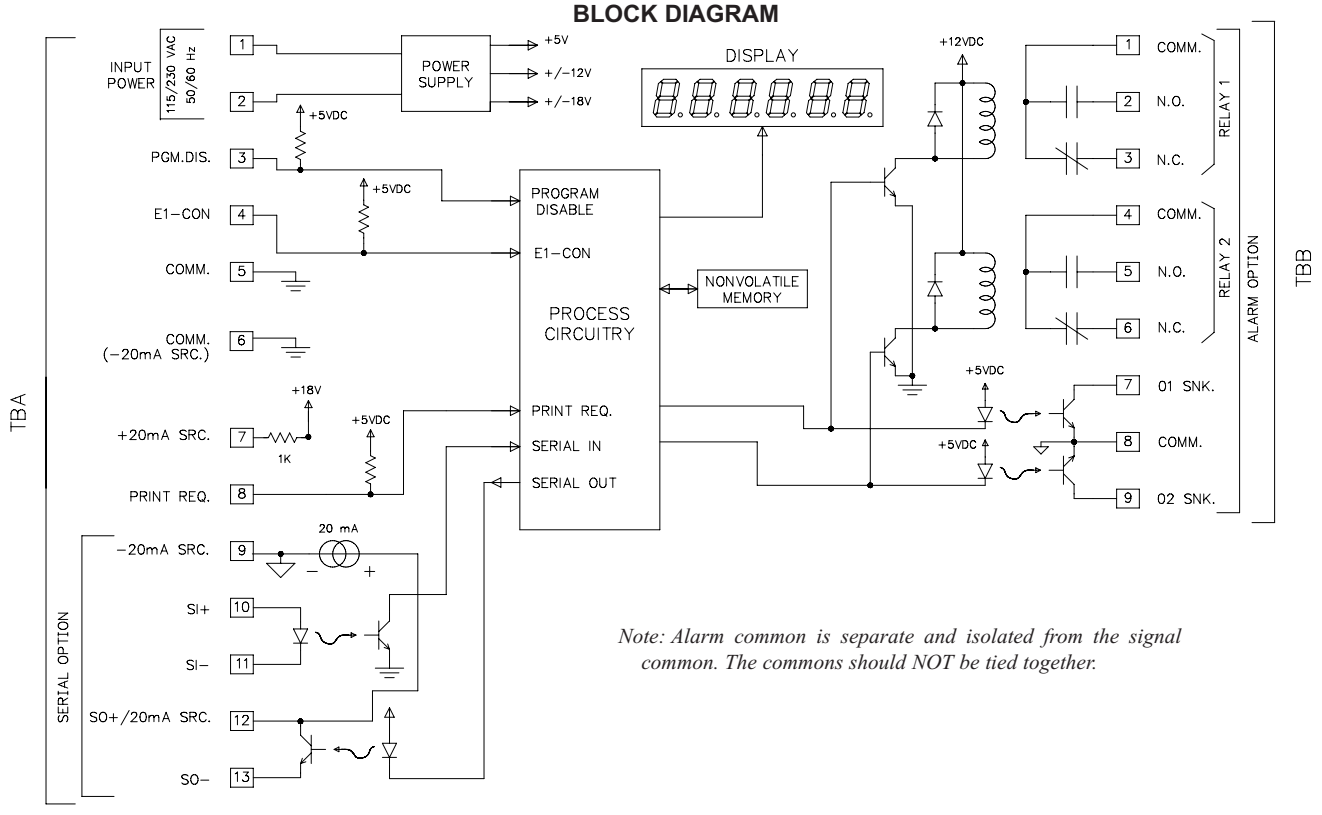
Immunity to EN 50082-2		
Electrostatic discharge	EN 61000-4-2	Level 2; 4 Kv contact [1] Level 3; 8 Kv air
Electromagnetic RF fields	EN 61000-4-3	Level 3; 10 V/m 80 MHz - 1 GHz
Fast transients (burst)	EN 61000-4-4	Level 4; 2 Kv I/O Level 3; 2 Kv power
RF conducted interference	EN 61000-4-6	Level 3; 10 V/rms 150 KHz - 80 MHz
Emissions to EN 50081-2		
RF interference	EN 55011	Enclosure class A Power mains class A

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

Refer to the EMC Installation Guidelines section of this bulletin for additional information.

12. **CONSTRUCTION**: Die-cast metal front bezel that meets NEMA 4/IP65 requirements for indoor use when properly installed. Case body is black, high impact plastic (panel gasket and mounting clips included).
    Installation Category II, Pollution Degree 2.
13. **CONNECTION**: Removable terminal blocks
14. **WEIGHT**: 1.0 lbs. *(0.45 kg)*

BLOCK DIAGRAM



Note: Alarm common is separate and isolated from the signal common. The commons should NOT be tied together.

INSTALLATIONS & CONNECTIONS

INSTALLATION ENVIRONMENT

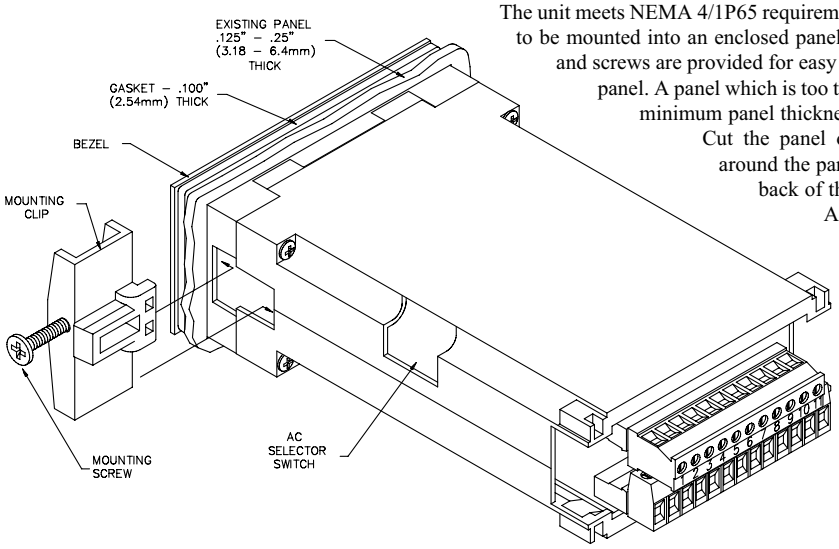
Before installing the IM into the panel, the user should first become familiar with the unit. It may also be desirable to program the unit for the application. When programming is complete, all parameters will be saved in non-volatile memory. The Program Disable (PGM.DIS.) terminal should be connected to COMM. to prevent accidental or unauthorized programming changes

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.

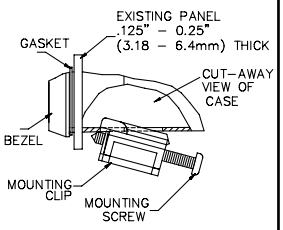
PANEL INSTALLATION



The unit meets NEMA 4/1P65 requirements for indoor use when properly installed. The units are intended to be mounted into an enclosed panel with a gasket to provide a water-tight seal. Two mounting clips and screws are provided for easy installation. Consideration should be given to the thickness of the panel. A panel which is too thin may distort and not provide a water-tight seal. (Recommended minimum panel thickness is 1/8" [3.2 mm].)

Cut the panel opening to the specified dimensions. Remove burrs and clean around the panel opening. Slide the panel gasket over the rear of the unit to the back of the bezel.

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 mounting clips by inserting the wide lip of the clips into the wide end of the hole, located on either side of the case. Then snap the clip onto 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 over-tighten screws.

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 Panel Installation Figure, above or label on case). The unit is shipped from the factory with the switch in the 230 VAC position.

CAUTION: Make sure the AC selector switch is set to the appropriate position before applying power to the unit. Damage to the unit may occur if the AC selector switch is set incorrectly.

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. In extremely high EMI environments, additional measures may be needed. The unit becomes more immune to EMI with fewer I/O connections. Cable length, routing and shield termination are very important and can mean the difference between a successful or a troublesome installation. 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 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 bottom board (TBA) and optional top board (TBB). When wiring the unit, remove the terminal block and use the numbers on the label to identify the position number with the proper function. Strip the wire, leaving approximately 1/4" bare wire exposed (stranded wires should be tinned with solder). Insert the wire into the terminal and tighten down the screw until the wire is clamped tightly. Each terminal can accept up to one 14-gage, two 18-gage or four 20-gage wire(s). After the terminal block is wired, install it into the proper location on the PC board. Wire each terminal block in this manner.

POWER WIRING (AC Version)

Primary AC power is connected to TBA #1 and #2 (marked VAC 50/60 Hz, located on the left hand side of the bottom terminal block). To reduce the chance of noise spikes entering the AC line and affecting the IMA, the AC power should be relatively "clean" and within the specified +/-10% variation limit. Drawing power from heavily loaded circuits or circuits which also power loads that cycle on and off, (contactors, relays, motors, machinery, etc.) should be avoided.

USER INPUT WIRING

User inputs (PGM.DIS.and E1-CON) are digital inputs that are active when connected to TBA #5 Common. Any form of mechanical switch, sinking collector logic with less than 0.7 V saturation may be used. The use of shielded cable is recommended. Follow the EMC Installation Guidelines for shield connection.

OUTPUT WIRING

RELAY CONNECTIONS

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.

COMMUNICATION WIRING

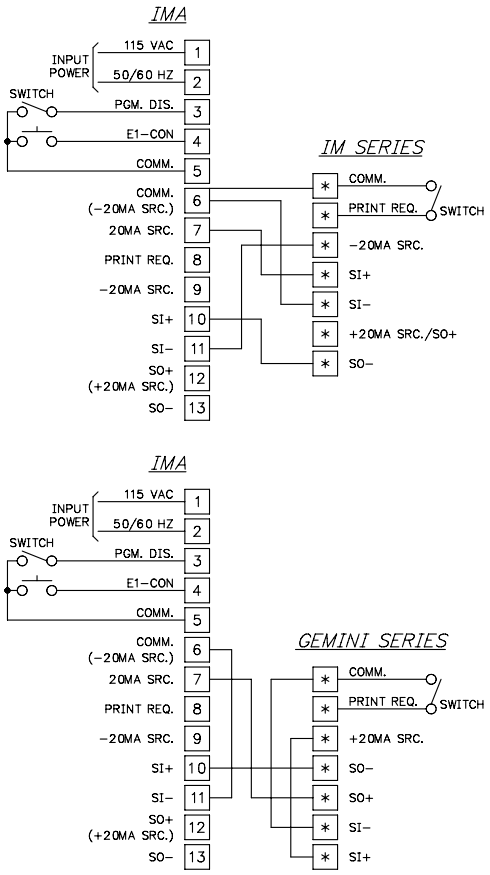
It is recommended that shielded (screened) cable be used for serial communications. This unit meets EMC specifications using Alpha #2404 cable or equivalent. There are higher grades of shielded cable, such as, four conductor twisted pair, that offer an even higher degree of noise immunity.

When wiring the 20 mA current loop, remove the bottom terminal block (TBA), located on the rear of the unit. Refer to the numbers listed with the terminal descriptions below or those located on the label. Install each wire in its proper location on the terminal block. When all connections are made, replace the terminal block into its proper location.

When connecting the unit using its various options, the different commons of these options should NOT be connected to one another. The output options and TBA common are all internally isolated from one another. Connecting them would defeat this feature. Refer to the diagrams that illustrate the connections. Also refer to the manual of the unit the IMA is being connected to.

Note: Power to all inputs of terminal block should be turned off before removing terminal block and making connections.

CONNECTING THE IMA AS A SLAVE



* Reference current loop installation for terminal block numbering.

SERIAL TERMINAL DESCRIPTIONS

Terminal Block A (TBA - lower terminal block):

6. (Comm.) - 20 mA SOURCE
7. + 20 mA SOURCE (Quasi)

   Note: TBA #6 & TBA #7 are capable of powering up to three units.

8. PRINT REQ. - The Print Request terminal is pulled low to common (TBA #5) to request the unit to transmit according to the Print Options that have been selected in Program Module #1. *(See Serial Pro 1 - Program Serial Communications section for more details.)*

   Note: In order to guarantee a printout, the Print Request terminal must be held low for at least 20 msec. If this time exceeds 800 msec., then a second printout will occur.

9. - 20 mA SRC. - 20 mA current source return path for the transmit loop. Current flows into this pin.
10. SI+ (Serial In+) -
11. SI- (Serial In-) - The unit receives commands on the SI terminals. They are connected in series with the transmit or output terminals of the device to be connected.
12. SO+/+20 mA SRC. (Serial Out+) - 20 mA current source for the transmit loop (internally connected).
13. SO- (Serial Out-) - The unit transmits the requested data on the SO terminals. They are connected in series to the receive input of the device to be connected.

    Note: The Serial Input terminals must be held in the mark condition (current flowing) in order for a transmission to occur.

OPERATING THE IMA

After completing all set-up operations, the unit is ready to install and operate. When power is applied, a display test consisting of illuminating all segments for 2 seconds is performed. A minus sign "-" will precede numbers that are negative. On power-up, the unit will always display the last information displayed at power down.

Note: The last numeric information that the unit received will also be saved in memory.

QUICK PROGRAMMING

To limit access to the set-up parameters, connect a key-switch or wire from PGM.DIS. (TBA #3) to COMM. (TBA #5). With this pin connected to common, only a predetermined amount of data can be viewed or altered, as programmed in programming module #3. If "NO" was programmed for all of the available steps in module #3, then pressing "P" will display "Loc" briefly, then return to normal operating mode. However, if "YES" was programmed in one or more of the steps, then "P" will invoke entry into a series of commonly modified parameters while protecting the crucial set-up information. This is referred to as the "quick programming" mode. When "quick programming" mode is entered, the alarms and hysteresis values can be modified in the same manner as in the regular programming mode, the new alarm and hysteresis values will take effect when "P" is pressed. The other operations in the "quick programming" mode require special key sequences as shown:

To reset a latched alarm, scroll through steps in "quick programming" mode using the "P" button until "LAtCH1"or "LAtCH2" appears in the display. If they do not appear, they are not latched.

To reset: While "LAtCH1"or "LAtCH2" is being displayed, press "DOWN" button and hold, then press "P" button. Pressing "P" alone causes no action on the alarm.

To reset peak and valley buffers, scroll through steps in "quick programming" mode using the "P" button until "PEA" or "VAL" appears in the display.

To reset: While "PEA" or "VAL" is being displayed, press "DOWN" button and hold, then press "P" button. Pressing "P" alone causes no action on the buffer.

After each operation, a message will appear briefly in the display to acknowledge the action.

FACTORY CONFIGURATION

The following chart lists the program set-ups of the unit when shipped from the factory. All of the programmed parameters can be restored back to the Factory Configuration by entering the specific access code in "Pro 6". Refer to "Programming Module #6" section for the procedure.

"Pro 1" - PROGRAM SERIAL COMMUNICATIONS

"bAud"	-	1200
"AddrES"	-	0
"Print"	-	0
"FULL"	-	yES

"Pro 3" - PROGRAM FUNCTIONS ACCESSIBLE WITH FRONT PANEL LOCKOUT ENGAGED

"dSP AL"	-	yES
"ENt AL"	-	yES
"dSPHyS"	-	yES
"ENtHyS"	-	yES
"rSt AL"	-	yES
"dSPbUF"	-	yES
"rStbUF"	-	yES

"Pro 4" - PROGRAM REMOTE INPUT FUNCTION

"E1 - CON"	-	0 (display hold)

"Pro 5" - PROGRAM ALARMS

"trAc"	-	NO
"dISP"	-	NO
"LAtC-1"	-	NO
"AL-1"	-	0.00
"HyS-1"	-	0.01
"Act-1"	-	HI
"LAtC-2"	-	NO
"AL-2"	-	0.00
"HYS-2"	-	0.01
"Act-2"	-	HI

PROGRAMMABLE FUNCTIONS

Programming of the IMA is divided into modular steps. Each module is a short sequence of data entries. The front panel buttons "UP" and "DOWN", (shown as "arrows" on the front panel) are used to change the data and set-ups, while the "P" button is used to save or enter the data. After pressing "P" which gains entry into the programming mode, the programming modules are identified by the message "Pro" and a number in the display. "UP" and "DOWN" are used to select the desired programming module and "P" is used to enter it. All of the subsequent programming steps follow the same procedure. The rear terminal labeled "PGM.DIS." must be ungrounded to gain access to programming.

The following table lists the programming steps.

"Pro 0" - RETURN TO DISPLAY MODE

"Pro 1" - PROGRAM SERIAL COMMUNICATIONS

"bAud"	-	Enter baud rate
"AddrES"	-	Enter loop address number
"Print"	-	Enter print function
0	-	numeric display
1	-	numeric display, peak/valley
2	-	numeric display and alarms
3	-	numeric display, peak/valley, alarm and hysteresis
"FULL"	-	Enable complete or abbreviated printing

"Pro 3" - PROGRAM FUNCTIONS ACCESSIBLE WITH FRONT PANEL LOCKOUT ENGAGED

"dSP AL"	-	Enable display alarms
"ENt AL"	-	Enable enter alarms *
"dSPHYS"	-	Enable display hysteresis
"ENtHYS"	-	Enable enter hysteresis *
"rSt AL"	-	Enable reset latched alarms
"dSPbUF"	-	Enable display of peak/valley readings
"rStbUF"	-	Enable reset of peak/valley readings *

"Pro 4" - PROGRAM REMOTE INPUT FUNCTION

"E1-CON"	-	Enter function of remote input (Reset/Hold)
0	-	display hold
1	-	reset peak/valley
2	-	reset peak and start peak indication
3	-	reset valley and start valley indication
4	-	reset latched alarms
5	-	suppress all alarms

"Pro 5" - PROGRAM ALARMS

"trAc"	-	Enable alarm value tracking
"dISP"	-	Enable display alarm annunciators
"LAtC-1"	-	Enable alarm #1 latching
"AL-1"	-	Enter alarm #1 value
"HYS-1"	-	Enter hysteresis value for alarm #1
"Act-1"	-	Enter alarm #1 action (high or low)
"LAtC-2"	-	Enable alarm #2 latching
"AL-2"	-	Enter alarm #2 value
"HYS-2"	-	Enter hysteresis value for alarm #2
"Act-2"	-	Enter alarm #2 action (high or low)

"Pro 6" - SERVICE OPERATIONS (Protected by access codes)

"Code 39"	-	Serial loop self test.
"Code 66"	-	Reset programming to factory configuration

** This sequence may be subject to being locked-out due to other programmed sequences.*

PROGRAMMING THE IMA

Prior to installing and operating the IMA, it may be necessary to change the set-ups to have the display correspond to a particular application. Although the IMA has been programmed at the factory, the set-ups will generally have to be changed.

Before actually trying to program the IMA, it is advised to organize all the data for the programming steps to avoid any possible confusion and to read the complete manual before proceeding.

To set-up the IMA, connect AC power as outlined in the connections section. Remove the jumper wire (if installed) from TBA # 3 (PGM.DIS.). This will allow the operator to enter and modify all of the IMA's parameters. Press the front panel button labeled "P", momentarily. The display will show "Pro" alternately flashing with "0". This is the IMA's programming mode. The programming mode is divided into sections, numbered 0-6, each of which can be individually accessed. The front panel "UP" and "DOWN" arrow buttons can be used to select one of these numbers and the "P" button used to enter the selected programming module. In all of the programming modules, "UP" and "DOWN" button are used to either select from a list of choices or enter a value. The "P" button is used to save the new value and progress to the next step within a module *(Note: the new value takes effect when "P" is pressed).* Upon completion of a module, the IMA returns to the "Pro" < > "0" stage. Pressing the "P" button at this point causes the IMA to display "End" and return to normal display mode.

The following table explains the basic function of each step.

Note: < > This indicates that the display will alternate between the English prompt and the actual data.

DISPLAY	RESULT OF "P" BUTTON
"Pro" < > "0"	Causes the IMA to return to normal display mode. Any changes to set-up data are permanently stored in the E^2PROM.
"Pro" < > "1"	Module #1 is the serial communication parameter programming. Baud rate, unit address, print request function and condensed prints are all programmable.
"Pro" < > "2"	NOT USED
"Pro" < > "3"	Module #3 allows the user to program what can be accessed from the front panel when the PGM.DIS. (Program Disable, TBA #3) pin is connected to common (TBA #5). This feature protects critical set-up data from accidental modification while allowing access to setpoints and other functions. The front panel lock-out menu (quick programming) includes alarm modification and peak/valley display or resetting. *Note: The term "Quick Programming" is used to refer to the ability to change the information that can be accessed from the front panel when the "PGM.DIS." terminal is connected to "COMM.".*
"Pro" < > "4"	Module #4 programs the function of the remote input "E1-CON" pin (TBA #4). The functions of the remote input "E1-CON" pin include display hold, peak/valley modes, and alarm reset.
"Pro" < > "5"	This module allows programming for the basic configuration of the alarm option. The programming includes Hi/Lo acting, tracking, alarm display, latched or auto-reset, and alarm and hysteresis values.
"Pro" < > "6"	This module provides the capability of a serial current loop test and initializing the set-ups to factory settings. A code number entry step is required, to protect from inadvertent entries.

MODULE #1 - PROGRAM SERIAL COMMUNICATIONS

Several programmable parameters must be programmed before serial communication can occur.

BAUD RATE

Select one of the baud rates from the list to match the baud rate of the terminal, host computer, or Red Lion Controls product with 20 mA current loop installed.

"bAud" < > "300" - 300 baud
"600" - 600 baud
"1200" - 1200 baud
"2400" - 2400 baud

UNIT ADDRESS NUMBER

If a terminal or host computer is used to communicate to multiple units in the 20 mA loop, different address numbers may be assigned to each unit. If only one unit is in the loop, an address of "0" may be given, eliminating the need for the address command.

"AddrES" < > "0" to "99"

PRINT REQUEST FUNCTION

A selection of print operations can be programmed. These print operations occur when the print request input is activated (TBA #8) or when a "P" command is sent via the serial communications. If the option to which a particular print code applies is not installed, that parameter will not be printed.

"Print" < > "0" - numeric input
"1" - numeric input, peak, valley
"2" - numeric input, alarm 1 and alarm 2
"3" - numeric input, peak, valley, alarm 1, alarm 2, and hysteresis

FULL OR ABBREVIATED TRANSMISSION

When transmitting data, the IMA can be programmed to suppress the address number, mnemonics and some spaces, if abbreviated transmission is desired by selecting "NO". This feature may be helpful when interfacing with a computer. When interfacing to a printer, a "yES" response, for full transmission, is usually desirable.

"FULL" < > "yES" or "NO"

Note: A selection of "NO" results in faster transmission.

An example of full and abbreviated transmission is as follows:

2INP -125.750 <CR> <LF>	full transmission
-125.750 <CR> <LF>	abbreviated transmission

MODULE #2 - NOT USED

MODULE #3 - PROGRAM FUNCTIONS ACCESSIBLE WITH FRONT PANEL LOCKOUT

This programming module programs what is accessible through the front panel when the PGM.DIS. pin is connected to common (TBA #5).

Note: The term "Quick Programming" is used to refer to the ability to change the information that can be accessed from the front panel when the "PGM.DIS." (TBA #3) terminal is connected to "COMM." (TBA #5).

DISPLAY ALARM VALUES

If the alarm option is installed, this selects whether the alarm values will or will not be displayed.

"dSP AL" < > "yES" or "NO"

ENTER ALARM VALUES *

If "YES" was selected for display alarm values, this will select if alarm values may be modified from the front panel. *(If "NO" was selected for display alarm values, then this step will default to "NO" and will not be displayed for selection.)*

"ENt AL" < > "yES" or "NO"

DISPLAY HYSTERESIS VALUES

If the alarm option is installed, this selects whether the hysteresis values will or will not be displayed.

"dSPHYS" < > "yES" or "NO"

ENTER HYSTERESIS VALUES *

If "YES" was selected for display hysteresis values, this selects whether hysteresis values may be modified from the front panel. *(If "NO" was selected for display hysteresis values, then this step will default to "NO" and will not be displayed for selection.)*

"ENtHYS" < > "yES" or "NO"

RESET LATCHED ALARMS

If the alarm option is installed, this will select if a latched alarm(s) can be reset from the front panel.

"rSt AL" < > "yES" or "NO"

DISPLAY PEAK/VALLEY MEMORY BUFFER

This selects whether peak and valley buffers will be displayed.

"dSPbUF" < > "yES" or "NO"

RESET PEAK/VALLEY MEMORY BUFFER *

If "YES" was selected for the previous step, this selects whether the peak and valley buffers may be reset from the front panel. *(If "NO" was selected, then this step defaults to "NO" and will not be displayed for selection.)*

"rStbUF" < > "yES" or "NO"

Depending on functions selected under Pro 3 and Pro 5, alarms, hysteresis, peak, and valley values can be monitored and/or changed when PGM.DIS. is tied to COMM. This provides a "QUICK PROGRAMMING" method for "day to day" process changes. *(See QUICK PROGRAMMING SECTION for more details.)*

** This sequence may be subject to being locked out due to other programmed sequences.*

PEAK/VALLEY

The indicator will record the lowest numeric value *(valley)* and highest numeric value *(peak)*, automatically, for later recall. This information is valuable in monitoring the limits of the process over any length of time since these values are stored at power-down to span over shifts, days, etc. An external input can be programmed to reset or engage the unit into a peak/valley reading indicator. Additionally, the peak and valley can be viewed and reset from the front panel, if so programmed.

Note: The peak/valley measurement is not instantaneous, when the IMA receives data a maximum 70 msec response time of the IMA is required.

MODULE #4 - PROGRAM REMOTE INPUT

PROGRAM FUNCTION OF E1-CON PIN (TBA #4)

The function of the E1-CON pin, when tied to input "COMM." (TBA #5), may be programmed according to the following table.

"E1-CON" < > "0" - A low level holds the display (display hold). While the reset/ hold pin is low, the IMA continues to process the serial transmission data. If the data is numeric only, the IMA continues to drive the alarms.

"1" - A negative going edge resets both peak and valley buffers.

Note: If P/V is displayed, a change will not appear on the display until the next time the P/V is called up.

"2" - A negative going edge resets only the peak buffer and the IMA enters a peak reading display mode as long as the pin is low. If the input goes high, peak detection and indication are stopped and the last peak reading is retained.

"3" - A negative going edge resets only the valley buffer and the IMA enters a valley reading display mode as long as the pin is low. If the input goes high, valley detection and indication are stopped and the last valley reading is retained.

"4" - If the alarm option is installed, a negative going edge resets the latched alarm(s).

"5" - If the alarm option is installed, a low level resets a latched or unlatched alarm into a non-asserted state. This provides manual override of alarms for system start-up and other unusual events such as system testing.

MODULE #5 - PROGRAM ALARM/SETPOINT

If the alarm option is installed, this module is used to configure the operation of the alarms to a variety of combinations. The programmable options are HI/LO acting, auto/manual reset (latching), tracking, display alarms, alarm values and hysteresis (deadband) values. Alarm parameters will respond to numeric data ONLY.

ALARM TRACKING

With alarm tracking, whenever alarm #2 is changed, alarm #1 will also change so that the offset between alarm #2 and alarm #1 remains the same. This is useful for hierarchical setpoints (pre-alarm and alarm) when one change applies to both alarm values. When programming from the front panel, tracking only occurs when PGM.DIS. is low (front panel lock-out mode, alarm #1 will not appear). Tracking will always occur if alarm #2 is modified via serial communications independent of "PGM.DIS.".

"trAc" < > "yES" or "NO"

DISPLAY ALARMS

If display alarms are desired, a message will flash on the display every 5-10 secs when an alarm activates. For Alarm 1 the message will flash "AL1 on" and Alarm 2 will flash "AL2 on", this warns an operator of an alarm condition. The message will stop when the unit is no longer in an alarm condition.

"dISP" < > "yES" or "NO"

AUTO OR MANUAL RESET FOR ALARM #1

The reset action of alarm #1 may be programmed to reset automatically (unlatched) or be programmed to require a manual reset (latched), through either a remote input (Pro 4, E1-CON) or through the front panel (Pro 3, reset latched alarms). Latched alarms are usually used where an operator is required to take some action for the alarm condition.

"LAtC-1" < > "yES" or "NO"

PROGRAM VALUE FOR ALARM #1

The range of the alarm value is -99,999 to 999,999.

"AL-1" < > "-99999" to "999999"

PROGRAM HYSTERESIS VALUE FOR ALARM #1 (Cannot be programmed if alarm latch is programmed)

The hysteresis (deadband) value for alarm #1 may be programmed from 1 to 999,999. The value is either added to or subtracted from the alarm value depending on whether the alarm is high or low acting. *(See alarm section for operation.)*

"HYS-1" < > "1" to "999999"

ALARM #1 HIGH OR LOW ACTING

The action of alarm #1 may be programmed to activate either when the numeric value goes above the alarm value (high acting) or goes below it (low acting).

"Act-1" < > "HI" or "LO"

AUTO OR MANUAL RESET FOR ALARM #2

The reset action of alarm #2 may be programmed to reset automatically (unlatched) or be programmed to require a manual reset (latched), through either a remote input (Pro 4, E1-CON) or through the front panel. Latched alarms are usually used where an operator is required to take some action for the alarm condition.

"LAtC-2" < > "yES" or "NO"

PROGRAM VALUE FOR ALARM #2

The range of the alarm value is -99,999 to 999,999.

"AL-2" < > "-99999" to "999999"

PROGRAM HYSTERESIS VALUE FOR ALARM #2 (Cannot be programmed if alarm latch is programmed)

The hysteresis (deadband) value for alarm #2 may be programmed from 1 to 999,999. The value is either added to or subtracted from the alarm value depending on whether the alarm is high or low acting. (See "alarms" section for operation.)

"HYS-2" < > "1" to "999999"

ALARM #2 HIGH OR LOW ACTING

The action of alarm #2 may be programmed to activate either when the numeric value goes above the alarm value (high acting) or goes below it (low acting).

"Act-2" < > "HI" or "LO"

Note: Depending on options selected under Pro 3 and Pro 5, alarms, hysteresis, peak, and valley values can be monitored and/or changed when PGM.DIS. (TBA #3) is tied to COMM (TBA #5). This provides a "QUICK PROGRAMMING" method for "day to day" process changes. (See QUICK PROGRAMMING SECTION for more details.)

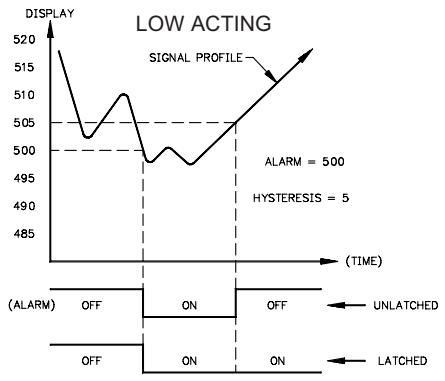
ALARMS (Optional)

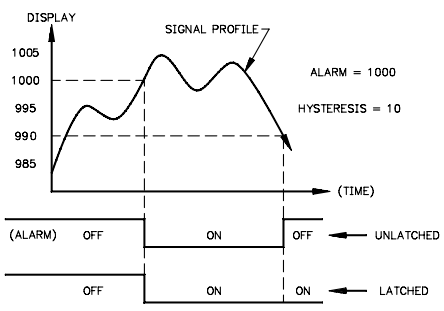
The alarm option consists of an additional printed circuit board with nine terminals. Six of these terminals are for the two Form-C relays and the other three terminals are for the two open collector transistors, which act in parallel with the relays. The two alarms are completely independent with programmable values, hysteresis (deadband), high or low acting, auto or manual reset and tracking one another, if desired. If the alarms are programmed to latch (manual reset), then they will have to be reset either by the front panel or RESET/HOLD pin. The alarms are triggered from the numeric display value, to activate external alarms, control valves, etc. Additionally, the alarms may be programmed to activate an alarm display to alert operators of the condition.

Alarm #1 can be made to track Alarm #2 by enabling alarm tracking. This is useful in alarm set-ups where a pre-warning control activates before a second alarm shuts off the process. When tracking is programmed, changing the shut-off trip value (Alarm #2) automatically changes Alarm #1 so that the offset between Alarm #2 and Alarm #1 remains the same. Alarm and hysteresis values can be modified through the serial communications to provide automatic control. The following diagrams depict how the alarms work with both "HI" and "LO" acting set-ups.

Programming of the alarms can be done in the normal programming mode "Pro 5" or the unit can be programmed so that the values can only be changed in the "quick programming" mode.

ALARM TIMING DIAGRAMS





MODULE #6 - SERVICE OPERATIONS

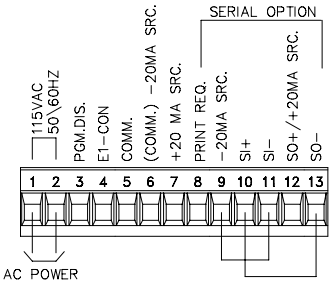
SERIAL HARDWARE (Loop-back) DIAGNOSTICS

The internal serial communications hardware in the IMA can be tested to verify proper operation. The procedure consists of connecting the Serial Input (SI), Serial Output (SO), and 20 mA Source into a simple loop, and then entering an access code.

Connect the IMA as shown below. Enter "Pro 6", key-in "Code 39", and then press "P". If the serial communication hardware is operational, "PASS" will be displayed. Conversely, if there is an internal problem, "FAIL" will be displayed. After the diagnostic test is complete, press "P" to return to "Pro 0".

"CodE" "39"

REAR VIEW OF BOTTOM TERMINALS



RESTORING ALL PROGRAMMING PARAMETERS BACK TO FACTORY CONFIGURATION

All of the programming in Modules #1 thru #6 can be restored back to the factory configuration by entering a specific access code (refer to the "Factory Configuration" section for the data that will be entered). The procedure consists of entering "Pro 6", keying-in "Code 66", and then pressing "P". The IMA responds by displaying "INItAL" for several seconds, and then returns to "Pro 0".

Note: When this procedure is performed, ALL of the parameters that were programmed into the IMA are overwritten.

"CodE" "66"

20 mA CURRENT LOOP SERIAL COMMUNICATIONS

GENERAL DESCRIPTION

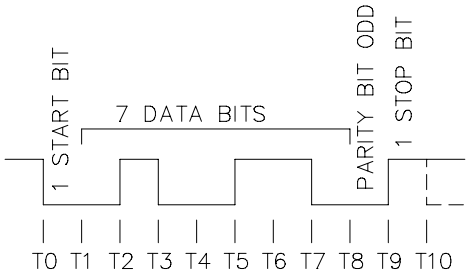
The serial communication is a half-duplex, two-way, 20 mA current loop that interfaces with a terminal, a host computer or a Red Lion Controls product equipped with serial communications.

Generally the IMA will be used as a slave to a Red Lion Controls product when it is required to observe the same process display value at different locations. When used in this manner, the IMA can be set-up as receive only and the master unit (Red Lion Controls product) set-up as transmit only. The master unit's print request will be pulled low so that it will be constantly transmitting to the IMA *(Note: Not sending mnemonics from the master unit will result in the fastest transmission)*. Both the master unit and the IMA must have an address of zero and if more than one IMA is used as a slave then all units must have an address of zero. The master unit will normally be set-up to transmit only one of the print options.

When the IMA is used with a host computer or terminal, the two loops are required for all hook-ups; the transmit (out-going data) loop and the receive (in-coming data) loop. The IMA accepts the ASCII data which can, depending on data received, activate alarms, record peak/valley readings or solely display the data. The IMA also provides an additional 20 mA current source. The built-in 20 mA source can be used in the transmit loop (only) by connecting the current return wire to -20 mA SRC., instead of SO+. To bypass the built-in current source, make transmit loop connections to SO+ and SO-. Additionally, multiple units and other Red Lion Controls instruments can be serially addressed, up to a maximum of 99 units. (The actual number in a single loop is limited by the Serial Hardware Specifications). To eliminate problems with ground loops, the serial circuitry is isolated from earth common. Optional 20 mA to RS232C and 20 mA to RS422 converter modules expand the unit's flexibility.

The IMA has a built-in feature that can be used to test the internal Serial Communications hardware. This is accomplished by performing a simple "loop-back" test, which verifies that the serial input, serial output, and 20 mA source are all functioning properly. Refer to the "Programming Module #6" section for the procedure.

DATA FORMAT - 10 BIT FRAME [300, 600, 1200, 2400 Baud]



COMMUNICATION FORMAT

Data is sent by switching current on and off in the loop and is received by monitoring the switching action and interpreting the data that is transmitted. In order for data to be correctly interpreted, there must be identical formats and baud rates among the communicating equipment. The only format available with this IMA is 1 start bit, 7 data bits, 1 odd parity bit and 1 stop bit. The baud rates are programmable and the choices are: 300, 600, 1200 and 2400.

Before serial communication can take place, the IMA must be programmed to the same baud rate as the connected equipment. In addition, the loop address number, print options and full or abbreviated transmission must be programmed.

When used with a terminal or a host computer and only one unit is employed, a "0" may be used to eliminate the requirement for the address specifier when sending a command. If more than one IMA is on the loop, assignment of unique addresses, other than zero, for each IMA is required if unique display data is to be written to each slave. Valid addresses of 0 to 99 may be assigned. Refer to the "Programming Module #1" section to program the serial communications.

SENDING COMMANDS TO THE IMA

The vocabulary set of ASCII characters that the IMA receives and displays are as follows:

Numbers: "0-9"
Alphabetic: "A" "b" "C" "d" "E" "F" "G" "H" "I" "J" "L" "N" "O" "P" "r" "S" "t" "u" "y"
Punctuation: "." "," "-" "blank"

Note: If any characters received by the IMA are NOT in the above list, a blank space will be substituted.

Data transmitted to the IMA for the display can be one of two types, LITERAL or NUMERIC. The format structure for sending data to the IMA is shown below:

N xx I d1 d2 d3 d4 d5 d6 EOT

N	-	Addresses a particular unit in a multiple loop
xx	-	Represents the address
I	-	Must be a # for literal data; or omitted for numeric data.
d1-d6	-	Valid data depending on the type of transmission.
EOT	-	End of transmission, must be either an asterisk (*) or carriage return (0DH). The display will only show the last 6 characters in a transmission.

Note: Both upper and lower case characters transmitted to the IMA will be displayed as shown above in the alphabetic list.

LITERAL DATA TRANSMISSION

Data that is preceded by a # character is interpreted as a LITERAL transmission and can contain any character from the IMA vocabulary set. [This will avoid confusion between a literal character (N, T, V or R) and a command character (N, T, V or R) .] Alarm setpoints and peak/valley readings DO NOT respond to any LITERAL transmission. Any character sent that is NOT in the vocabulary set will be recognized as a blank space and that digit location will be blank. All transmissions must be terminated by an asterisk (*) or a carriage return (CR). The following are examples of LITERAL Transmissions:

TRANSMISSION:												DISPLAY CHARACTERS:					
N	x	x	I	d1	d2	d3	d4	d5	d6	EOT		6	5	4	3	2	1
			#	S	T	A	R	T	1	*		S	T	A	R	T	1
			#	O	P	E	N			CR				O	P	E	N
			#	S	y	S	/	1	5	*		S	y	S		1	5
			#	A	b	1	2	3	C	d	CR	b	1	2	3	C	d
N	5		#	H	E	L	P	M	E		*	H	E	L	P		E

Note: Some characters in the vocabulary will display the same when received by the IMA, they are "G-6" "I-1" "O-0" "S-5" ". ,".

NUMERIC DATA TRANSMISSION

This is data that contains numbers and/or punctuation. Alarm and peak/valley readings DO respond to NUMERIC transmission and the unit will react appropriately to this data. If any non-numeric characters are embedded in the transmission they will not be recognized and therefore NOT displayed. A minus sign (-) followed by more than five numbers causes the display of the unit to display "-.....". The comma is interpreted and displayed as a period, if more than one period is sent in a transmission only the first period will be recognized. If a unit has a one digit address, a leading zero must be used (ex. N03, N05, etc.). All transmissions must be terminated by an asterisk (*) or a carriage return (CR). The following are examples of NUMERIC transmissions:

TRANSMISSION:												DISPLAY CHARACTERS:					
N	x	x	I	d1	d2	d3	d4	d5	d6	EOT		6	5	4	3	2	1
				1	2	3	4	5	6	CR		1	2	3	4	5	6
			2	A	A	2				*						2	2
			.	3	3	3				CR				0	.	3	3	3
				1	2	3	4	5	6	7	*	2	3	4	5	6	7
			-	1	2	3	4	5	6		CR	-	.	.	.	.	.
N	0	8		9	8	.	6				CR				9	8	. 6
				J	A	4	4				CR					4	4
				3	.	4	.	2	1		CR			3	.	4	2	1

COMMAND DATA TRANSMISSIONS

When sending commands to the unit a command string must be constructed. The command string may consist of command codes, value identifiers, and numbers with or with out punctuation characters only (excluding blanks). Below is a table outlining the codes the IMA will recognize.

COMMAND	FUNCTIONS
T	transmits the requested information specified by the value identifier (A, C-H)
V	change a value specified by the value identifier (C-F)
N	address a particular IMA in a multiple unit loop (0-99)
R	reset a value specified by a value identifier (C, D, G & H)
P	print per programmable print options (A, C-H)

VALUE	IDENTIFIERS	SERIAL MNEMONICS
A	display value	INP
C	alarm #1	AL1
D	alarm #2	AL2
E	hysteresis #1	HS1
F	hysteresis #2	HS2
G	peak reading	PEK
H	valley reading	VAL

A command string is constructed by using the above commands and value identifiers along with the proper ASCII character values that are required. The IMA will accept "+" or "-" in front of the data value and numbers without "+" are understood to be positive. Leading zeros can be eliminated and both lower and upper case characters are accepted. The address command is used to allow a command to be directed to a specific unit on the loop. If the IMA is assigned an address of "0", transmission of the address command is not required. This is done where only one IMA is in the loop.

The command string is constructed in a specific logical sequence. The IMA will reject command strings that do not conform. Only one operation can be performed per command string. Below is a description of how to construct a command string.

1. If the IMA has an address other than zero, the first three characters of the string must consist of the address command (N) followed by the unit address number (0-99). If the IMA has an address of 0, the address command is optional.
2. The next two characters in the string are the actual command the IMA must perform and the identifier on which it operates.
3. If the change value command is being used (V), the next characters in the string after the value identifier, are the numbered and/or punctuation data.
4. All commands must be terminated by an asterisk (*) or a carriage return (CR).

COMMAND STRING EXAMPLES

IMA with address 3, transmit input display value.

N3TA *

IMA with address 0, change alarm #1 to 1500.

VC1500 <CR>

IMA with address 1, reset peak.

N1RG *

IMA with address 99, print per the print options.

N99P <CR>

RECEIVING DATA FROM THE IMA

Data is transmitted from the IMA whenever a “T” or “P” command is received or the remote print request input is activated. If the abbreviated transmission was programmed “NO”, just data will be transmitted with no built-in delay. If abbreviated transmission is programmed “yES”, then there is a 400 msec delay built-in to the string.

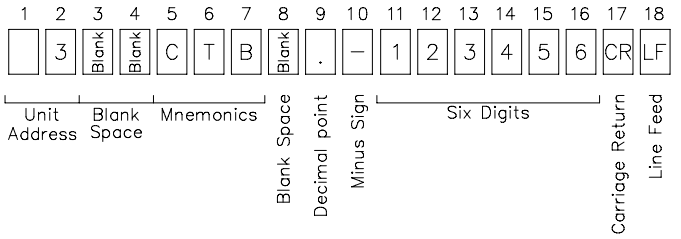
The data string output is shown below. The first two characters transmitted are the unit address number, unless it is zero, in which case it is left blank. Then two blank spaces are sent. The next three characters are the abbreviation for the identifier value (mnemonics), which is then followed by a blank. The actual characters are transmitted next, which can be numbers and/or punctuation ONLY. The field is right justified with leading zeros. Negative numbers are indicated by a minus sign fixed next to the identifier. A carriage return and a line feed are transmitted next. For various reasons, “extra” characters are added onto the end of the above character string. (These characters could be and are used for control or signaling purposes.) These characters are:

< CR> sent after single line transmissions from IM unit.

< SP> < CR> < LF> sent after “last line of a block” transmission from IM unit.

For a “T” command or after each “line of a block” transmission, no additional characters are sent.

If the abbreviated transmission is selected, the address, mnemonics, and any blank spaces (first eight characters) are not transmitted (the data strings are left justified in this case).

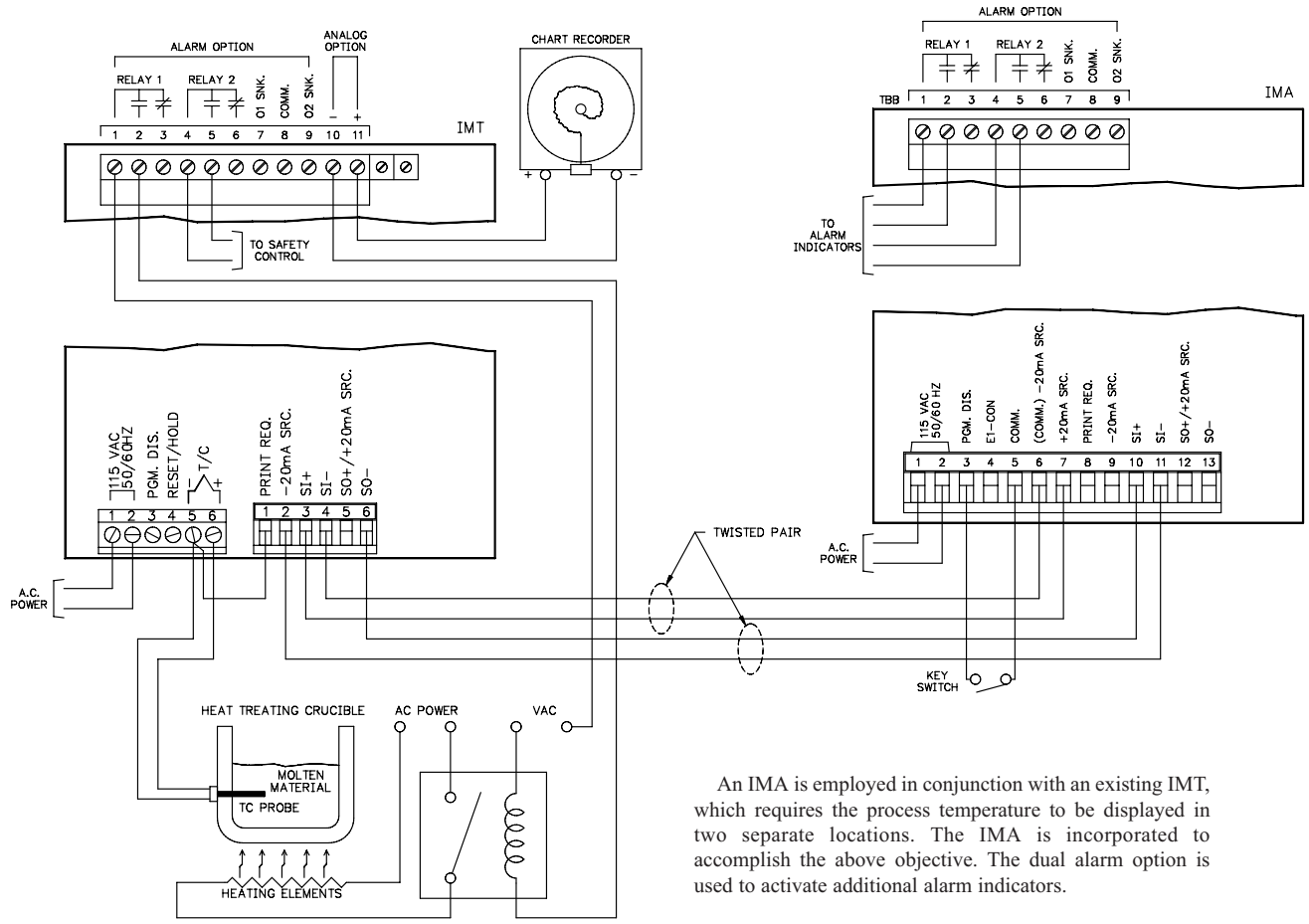


If the transmitted data is overrunning the peripheral’s buffer, the receive channel to the IMA may be used for handshaking purposes. Examples of transmissions are as follows:

2 INP-125.750 < CR> < LF> full transmission

-125.750 < CR> < LF> abbreviated transmission

SERIAL COMMUNICATION EXAMPLES CONNECTING TO A RED LION CONTROLS PRODUCT



An IMA is employed in conjunction with an existing IMT, which requires the process temperature to be displayed in two separate locations. The IMA is incorporated to accomplish the above objective. The dual alarm option is used to activate additional alarm indicators.

Communication set-ups:

IMT: Baud rate 2400, address 0, print code 0, abbreviated transmission.

IMA: Baud rate 2400, address 0. Print code and abbreviated transmission are NOT applicable.

Current loop connections are made so that the IMT is in transmit mode only and the IMA is in receive mode only. A key switch is installed at program disable terminal to prevent access to certain parameters after set-up. The print request is connected to common in order for the IMT to continuously transmit to the IMA.

A GEMINI 2000, used as a rate indicator, requires that the rate be displayed in two different locations. Also, additional alarm outputs would be useful to provide warning indication at the remote location.

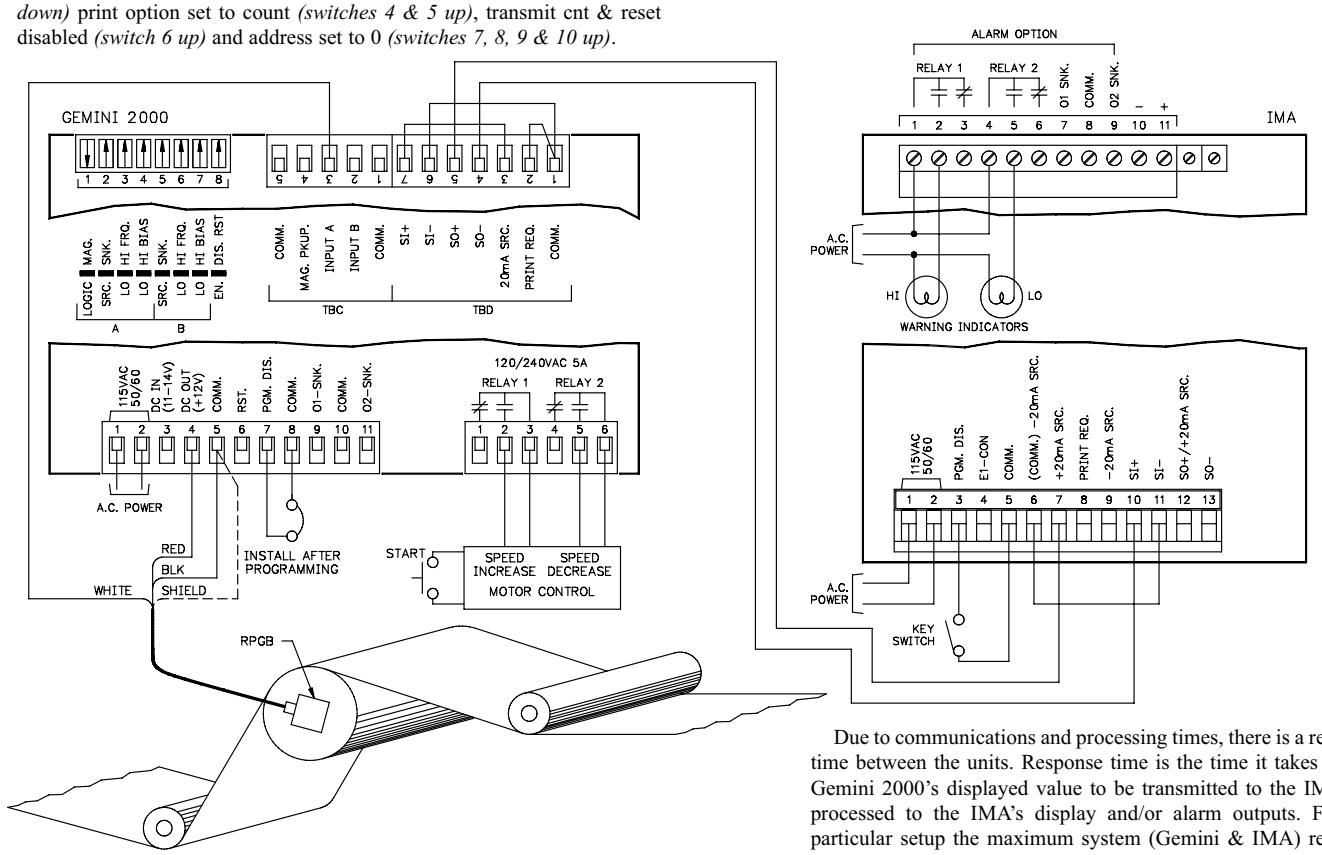
An IMA is used for the above requirements.

Communication set-ups:

Gemini 2000: Baud rate 2400 *(switches 1 & 2 down)*, no print ID *(switch 3 down)* print option set to count *(switches 4 & 5 up)*, transmit cnt & reset disabled *(switch 6 up)* and address set to 0 *(switches 7, 8, 9 & 10 up)*.

IMA: Baud rate 2400, address 0. Print code and abbreviated transmission not applicable.

Current loop connections and set-up parameters are done so the Gemini 2000 is in the transmit mode only and the IMA is receive only. Alarms are programmed into the IMA to activate if the desired rate becomes too HI or too LOW.



Due to communications and processing times, there is a response time between the units. Response time is the time it takes for the Gemini 2000's displayed value to be transmitted to the IMA and processed to the IMA's display and/or alarm outputs. For this particular setup the maximum system (Gemini & IMA) response time is 170 msec. The print request is connected to common in order for the Gemini to transmit continuously to the IMA.

TROUBLESHOOTING

The majority of all problems with the indicator can be traced to improper connections or improper programming set-ups. Be sure all connections are clean and tight and check the programming set-ups for correct data. For further technical assistance, contact technical support at the appropriate company numbers listed at the back of the bulletin.

PROBLEM	POSSIBLE CAUSE	REMEDIES
NO DISPLAY	1. Power off, improperly connected or brown-out. 2. All blanks being transmitted.	1a. Check wiring b. Verify power. 2. Verify program.
"PPPPPP" IN DISPLAY	1. Program data error.	1. Press "P" and check data set-ups.
DISPLAY NOT UPDATING	1. Communications wires improperly connected. 2. Communication set-ups incorrect	1a. Verify wiring. 1b. Verify print request is low on unit transmitting to IMA. 1c. Perform serial loop back test. 1d. Verify print request is HI on IMA. 2. Verify baud rate and address are properly set.

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