Model IB-A Industrial Bus Communication Module
Instruction Manual

Clinton Instrument Company

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Contents

Specifications

MODEL IB-A

Industrial Bus Communication Module

- Integrate Clinton A-Series Spark Testers into diverse control systems
- Control and monitor spark test voltage, fault count and process control output through PLC or computer
- Easy setup and operation
- Communications: Ethernet/IP, Modbus TCP, Profibus, PROFINET, DeviceNET

IB-A Shown with MODBUS/TCP Module

Coordinating old and new technologies on the production line is a challenge for today's wire and cable manufacturers. While real time device communication with centralized process control is increasingly important to the industry, control systems range from simple, older devices to sophisticated Programmable Logic Controls (PLCs) and computers. With so many communication protocols in use, the integration of a spark tester into a centralized control system can pose difficulties. Clinton IB-A Modules offer flexibility for integration with a computer or PLC.

Clinton's IB-A Modules are inexpensive plug-in accessories that permit computers and PLCs to control and monitor the test voltage, fault count, and process control output of Clinton A-Series digital spark testers. Each communication module can be connected to the spark tester's standard RS-485 port and mounted to the spark tester or remotely on DIN-rail.

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IB-A

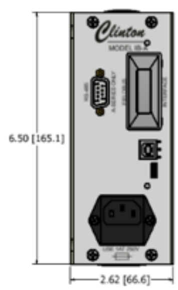
SPECIFICATIONS

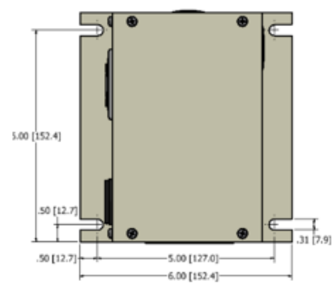
Power Requirements	100 to 240VAC 49-61 Hz. Power supply self-adjusting
Safety	Designed to IEC-1010
Optional Communications	Analog, Ethernet IP, Modbus TCP, Profibus, Profinet, DeviceNET

Compatible Spark Testers

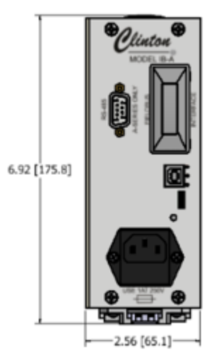
HF-15A Series: HF-15AC, HF-15AR.
DC-A Series: DC-1 & 10A, DC-10 & 20AC, DC-10 & 20AR, DC-1AR with BRC, TST-10W
ARC Remote Display.

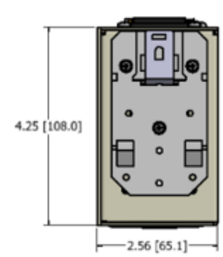
Dimensions for IB-A with Standard Mounting Plate





Dimensions for IB-A with the Din Rail Mount





Clinton INSTRUMENT COMPANY

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Safety

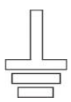
Safety Symbol

The symbols depicted below are safety symbols placed on spark test equipment. It is important to understand the meaning of each.


Caution symbol. Caution- refer to the manual to protect against damage to the equipment or to avoid personal injury.


Indicates Hot Surface. Do not touch.


Risk of electric shock symbol.


Earth ground symbol.

Environmental Conditions

The IB-A is designed to be safe under the following conditions:

- Indoor use.
- Altitude to 2000m.
- Temperatures from 5ºC to 40ºC.
- Humidity to 80% R.H. at 31ºC, decreasing linearly to 50% R.H. at 40ºC

The Clinton Instrument Company certifies that this equipment met its published specifications at the time of shipment. The calibrations of the equipment are checked against Measurement Standards (Reference) maintained by the Clinton Instrument Company. The accuracy of these standards is traceable to the national standards at the National Institute of Standards and Technology (NIST) or derived by ratio type measurements. For customer service or technical assistance with this equipment, please contact:

The Clinton Instrument Company
295 East Main Street, Clinton, CT 06413 USA
Telephone: 860-669-7548 Fax: 860-669-3825
Website: www.clintoninstrument.com
Email: support@clintoninstrument.com

Installation

CAUTION:

The installation procedures listed below are to be performed by qualified service personnel only. Failure to follow these procedures may result in danger to personnel and equipment damage.

Unpacking

Remove the spark tester from the carton. Retain the packing material in the event that the unit is returned for service at some future time.

The following items are packed with the spark tester:

1. IB-A Industrial Bus Communication Module
2. AnyBus Field bus Module (May be installed in IB-A)
3. A power cord
4. RS-485 connecting cable

Installation

Mounting the IB-A to an A Series Spark Tester

Decide which side of the spark tester you wish to mount the IB-A. Note that you may have to remove the small plate from the IB-A chassis and secure it to the opposite side so that the connections are accessible from the spark tester back panel. Mount the IB-A using the mounting plate and the (4) bolts that attach the end guard to the spark tester, as shown in the picture to the left.

Make sure the spark tester is off before wiring to the IB-A.

Locate the RS-485 port on both the IB-A and the “A” Series Spark Tester. Using the supplied serial cable connect these two ports.

Din-Rail Mounting

The IB-A can be mounted to a standard DIN rail with an optional Din Rail mounting bracket. If you purchase a unit without the DIN bracket it may be purchased separately. Please contact the Sales Department of The Clinton Instrument Company.

Power Wiring

Install an external disconnecting device

Install an external switch or circuit breaker in close proximity to the spark tester and within easy reach of the operator. The switch or circuit breaker must meet the relevant requirements of IEC 947-1 and IEC 947-3 and should be marked as the disconnecting device for the equipment. The rating of the circuit breaker or fuse should be no greater than 5 amperes.

Caution: Be sure the external disconnecting device is OFF and locked out before continuing.

Mains Power

Note that the spark tester has a self-adjusting power supply with an operating voltage range of 100V to 240V at 49-61 Hz.

Installing the CompactCom™ Module

The model IB-A is purchased with a Fieldbus Communications Interface. This interface will allow the installation of several fieldbus options. (DeviceNet, Ethernet IP, Modbus RTU, Modbus TCP, Profibus, Profinet)

To enable the Fieldbus Interface the proper CompactCom™ module will need to be installed into the IB-A.

- First remove the Anybus Slot Cover from the rear of the IB-A.
- Remove the CompactCom™ module from the packaging.
- Slide the CompactCom™ module into the open slot on the rear of the spark tester.
- Secure the CompactCom™ module by tightening the 2 screws.

See the section entitled "Fieldbus Interface" for the details regarding this interface.

Definition of Terms

Actual Voltage- Actual voltage is a metering winding on the high voltage transformer. This winding can be monitored remotely and indicates the level of voltage supplied to the electrode.

Any Fault Alarm- This alarm will respond when a fault of any type is detected. This alarm can be latched, and when latched the voltage can be removed or left on. When the alarm is not latched, the duration of this alarm is selectable. (See Latch, Non-Latch, & Remove Voltage on Fault, below).

Latch, Non-Latch, & Remove Voltage on Fault- These are the conditions under which the fault relay operates when a fault is detected.

Latch- When a fault is detected the fault relay will change state and remain in that state until a reset command is given, either by pressing the front panel reset button, connecting the RESET and GND terminals on the terminal block, or providing a remote reset command through the Compact Comm modules. High Voltage remains ON while the relay is latched.

Non-Latch- When a fault is detected, the fault relay will change state only for the amount of time the fault remains in the electrode. This time can be extended by changing the Process Control Duration Time.

Remove Voltage on Fault- When the unit is in LATCH mode and a fault is detected, the relay will latch. When Remove Voltage on Fault is selected, high voltage will be disabled while the relay is latched, so the wire may be safely handled or inspected. When the system is reset either by pressing the front panel reset button, connecting the RESET and GND terminals on the terminal block, or providing a remote reset command through the Compact Comm modules, the system will be reset, and high voltage will be restored. **Remove Voltage on Fault** has no effect when the unit is in **Non-Latch** mode

Set Point Voltage- This is the desired test voltage that is input through the front panel controls or remotely by PLC

Fieldbus Communications Interface

The model HF-15B can be purchased with an optional Fieldbus Communications Interface. (Model HF-15BX) This interface will allow the installation of several communication options. (DeviceNet, Ethernet IP, Modbus RTU, Modbus TCP, Profibus, Profinet). For each interface a fieldbus specific configuration file and support documentation will be provided to assist in the integration.

For Parameter Addresses see the section entitled "Fieldbus Parameter Addresses". For the specific fieldbus specific data see the section entitled "Fieldbus Specific Information".

Fieldbus Communications Parameters

The following table shows the default communication parameters for the various fieldbuses that are supported by the HF-15BX Spark Tester. See the section entitled CIC XM Utility for the steps required to modify these parameters. Note, the Data Sizes are fixed and cannot be changed

Interface Types	Parameter	Default
Modbus RTU	Station Number	40
Modbus RTU*	Interface (RS-232 or RS-485)	RS-232
Profibus	Station Address	40
DeviceNet	Node Address	40
Modbus TCP Ethernet IP Profinet	IP Address	10.10.10.101
Modbus TCP Ethernet IP Profinet	Subnet Mask	255.255.255.0
Modbus TCP Ethernet IP Profinet	Gateway	10.10.10.120
Modbus TCP Ethernet IP Profinet	DHCP	Off
Profinet	Station Name**	""
All	Data Sizes	Output: 32 Words *** Input: 32 Words ***

* This is factory set as RS-232. If two wire RS-485 or four wire RS-485 is required, consult the factory.

** On the Profinet module is the Station Name is not set, the MS LED will flash 3 times. This value can be set by the Profinet Master.

*** Specify the Output Words first followed by the Input Words. (A Word is 16 bits)

Fieldbus Spark Tester Parameter Addresses

The fieldbus parameters are 2 bytes each. The LSB will be at the lower byte offset, the MSB at the higher byte offset. As an example, the setpoint is 5000 volts (1388H in hexadecimal). The setpoint is at a word address 5. When reading the two bytes of the setpoint the LSB (value of 88H) would be received first and the MSB (value of 13H) would be received second. Some PLCs start with addresses of 0, some start with 1. The table below assumes the addresses start with 0.

REMOTE ENABLE must be set to 1 before any other parameters can be modified. When set, REMOTE ENABLE locks out voltage control from the display.

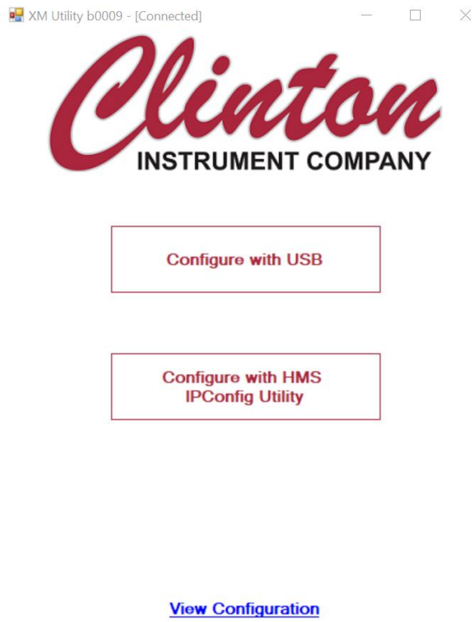
The unit responds to changes in data. For example, the REMOVE VOLTAGE COMMAND and the AF RESET COMMAND can be activated initially by changing their values to 1. Subsequent changes must use a value that differs from the previous one. For example, to activate either of these commands again their values could be changed to 0.

Command	**Address**	**R/W**	**Notes**
INTERFACE_STATUS	0	R	Spark Tester Status: 1234 – Good, 9876 – Communication Lost
RESERVED	1	-	
RESERVED	2		
FAULT_RESET_COMMAND	3	W	Will reset All Fault Alarms
REMOTE ENABLE	4	RW	Enables Data writes from External bus
SETPOINT VOLTS	5	RW	Requested voltage in Volts
RESERVED	6	-	
VMON VOLTS	7	R	Voltage at metering windings (Actual Voltage) in Volts
RESERVED	8 - 9	-	
FAULT_COUNT	10	RW	All fault count (Write 0 To Clear This Count)
RESERVED	11 - 14	-	
STATUS FLAGS 0	15	R	See Definitions below
STATUS FLAGS 1	16	R	See Definitions below
FAULT_MODE	17	RW	The value for the alarm modes is as follows: 0 – Momentary, 32 – Latch, 64 – Remove Voltage on Fault
PROCESS_CONTROL_TIME	18	RW	fault relay closure time in mS (50-2500)
RESERVED	19 - 29	-	

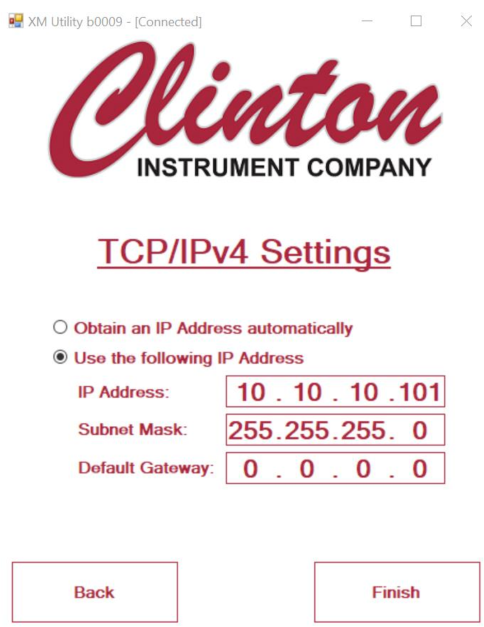
Below are the individual bits for Status Word 0			
GLOBAL VOLTAGE ENABLED	Bit 0	R	Set when all conditions allow voltage to be generated
AV HVL STATUS	Bit 1	R	Set when the Actual Voltage >= HVL On voltage
RESERVED	Bit 2 - 3	-	
AF ALARM STATUS	Bit 4	R	State of the AF Alarm (Fault Relay) cleared by Fault Reset (Fault Light)
RESERVED	Bit 5 - 15	-	
Below are the individual bits for Status Word 1			
RESERVED	Bit 0 - 2	-	
COVER_OPEN_STATUS/HV ENABLE	Bit 3	R	Indicates the cover state: 1 – Cover Closed & HV Enabled, 0 – Cover is Open or HV Enable missing
RESERVED	Bit 4 - 7	-	
HV ON STATUS (can Fake HV on)	Bit 8	R	Simulates HV On Relay (On >- 500V) for DC-1A On >= 50V)
FAULT RELAY STATUS	Bit 9	R	State of Fault Relay
RESERVED	Bit 10 - 15	-	

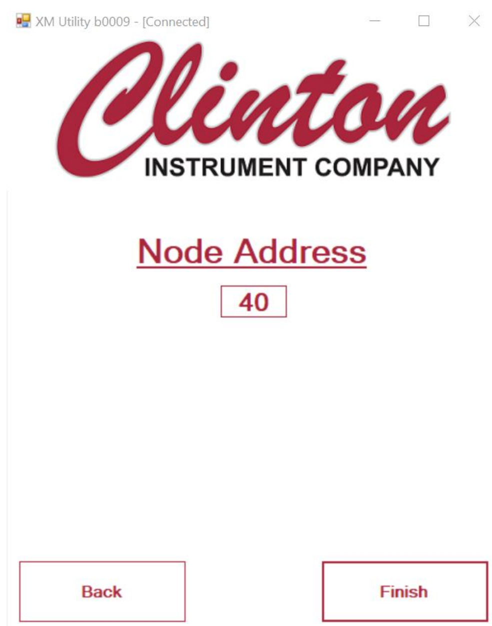
CIC IBA Utility

To configure any of the active CompactCom™ modules (DeviceNet, Ethernet IP, Modbus RTU, Modbus TCP, Profibus, Profinet), plug in a USB B cable and run the CIC IBA Utility. If the USB cable is not connected the CIC IBA Utility will prompt for the USB cable as shown.



Once the cable is connected if you have ethernet based communication (Profinet, Modbus TCP or Ethernet IP) you will have a choice of configuring over USB or configuring using HMS IPConfig tool shown above. Go to www.anybus.com for more information on using IPConfig. The configuring for Ethernet based fieldbus types is shown on the left. The second type of edit screen is for non-Ethernet based fieldbuses (DeviceNet, Profibus, Modbus RTU) shown on the right. Simply edit the fields that require changes.





Once edits are complete, press the Finish Button. The following screen will be shown indicating a power cycle is required.

Once power has been cycled the new values will be used.

Maintenance

Fuses

The fuses in this equipment are not expected to fail in normal operation. Their failure may be an indication of equipment malfunction requiring qualified repair personnel.

There is one fuse associated with the IB-A operating voltage, located in the power entry module located on the back panel of the unit.

Troubleshooting

CAUTION: Troubleshooting is to be performed by qualified service personnel only. Failure to follow the procedures in this manual may result in danger to personnel and equipment damage.

The IB-A does not appear on network

1. Use the IB-A utility to verify your network settings. Cycle power on the IB-A to save the settings.
2. Verify the PLC or PC control system has the Input and Output map sizes of 32 individual words each.
3. Make sure the CompactCom module is inserted properly.

I cannot change the fieldbus parameters of the IB-A over the network

1. Remote Enable must be set to 1 before any parameters can be changed.

Replacement Parts

Part Number	Description
02603	1 amp low breaking time delay fuse, 5x20mm
91232	Power entry module
91233	Power Supply 24VDC
92563i	Assembly PCB Communication Module

Note: Printed circuit boards are carefully constructed and calibrated at the factory. Components are not supplied for field repair of boards. Please return faulty circuit boards to the factory or to your Clinton sales representative for evaluation.

Optional Accessories

Part Number	Description
92273-DN	Module CompactCom DeviceNet
92273-EI	Module CompactCom EtherNet/IP
92273-MR	Module CompactCom Modbus RTU
92273-MT	Module CompactCom Modbus TCP
92273-PB	Module CompactCom Profibus
92273-PN	Module CompactCom Profinet

Warranty

The information contained in this document is subject to change without notice. The Clinton Instrument Company makes no warranty of any kind with regard to this material, including, but not limited to, the implied warranties or merchantability and fitness for a particular purpose.

The Clinton Instrument Company shall not be liable for errors contained herein or for incidental damages in connection with the furnishing, performance, or use of this material.

We warrant to the original purchaser that the equipment described herein is free from defects in materials and workmanship for a period of one year from the date of invoice, our obligation under this warranty being limited to repair or replacement of the defective parts. This warranty does not apply to fuses, lamps, or any normally expendable parts. Any part appearing to have defects in material or workmanship, upon our examination only and as determined by us, and providing the equipment has not been subject to abuse, misuse, or alteration, will be repaired or replaced at no charge for materials and labor, either upon receipt of the defective part or equipment, transportation charges prepaid, at our plant or at the equipment location, as selected by us. No parts or equipment shall be returned without our prior permission. Any parts replaced under this warranty shall be warranted until the expiration date of the original warranty.

The warranties herein are in lieu of all other warranties, expressed or implied, and of all other obligations or liabilities on our part concerning this equipment.

Grounding of Conductors during the spark test

Grounding of conductors during the spark test

by Henry Clinton

Nearly all industry-wide specifications for insulated wire and cable pertaining to in-line spark testing require the grounding or earthing of the conductors under test. It is the purpose of this discussion to examine the reasons for this and to define the conditions which allow for a safe and effective spark test when conductors are not grounded. Although this testing mode cannot be used to satisfy most industry specifications, it can be useful when quality must be strictly monitored and conductor grounding is inconvenient or impossible.

D-C spark testing

If a direct potential is used for spark testing, it is absolutely necessary to ground the conductor or conductors under test. In Fig. 1, C_g represents the capacitance of the product to ground, which could be in the range of 100 to 2,000 picofarads, depending on the size and length of the conductor.

If the conductor is not grounded, the potential on the conductor with respect to ground will rise when the first insulation fault passes through the electrode. This is because C_g charges towards the D-C test potential applied to the electrode through the arc.

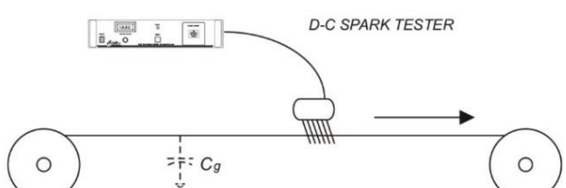


FIG. 1

If the conductor is not grounded but is initially at ground potential, when the first insulation defect passes through the electrode, an arc forms between the electrode and the conductor. The current flowing through this arc charges capacitance C_g, elevating the potential of the conductor by a value which is a function of arc time duration and the value of the current. After the defect or fault has completed its passage through the electrode, C_g retains this elevated potential, since C_g has no discharge path to ground. The effective test potential on the product insulation is now reduced by this retained conductor potential. If a second insulation flaw traverses the electrode, additional charging of C_g takes place, further reducing the effective test potential. Eventually the effective test potential falls below that required to cause an arc to occur on the passage of an insulation flaw, and all subsequent flaws will be undetected. Usually, current and traverse time are large enough to sully charge C_g on the passage of the first flaw, so it will be the only one detected.

Furthermore, the entire length of product is now charged to the test potential. If the operator accidentally comes into contact with the conductor or with a flawed insulation area anywhere along the wire line, C_g can discharge through his body to ground. If by coincidence a faulted insulation area is within the electrode, the maximum current output of the spark tester can also pass through his body. While this current , in the case of Clinton spark testers, is well below a dangerous level, the involuntary muscular reaction resulting from this event can itself cause a secondary accident.

It is thus apparent that from the dual standpoints of utility and safety the conductors of a product being spark tested with a D-C potential should be grounded.

A-C spark testing, general

If an A-C potential is used for the spark test, and the conductors are not grounded, the diagram in Fig. 2 applies.

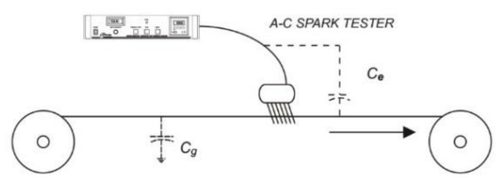
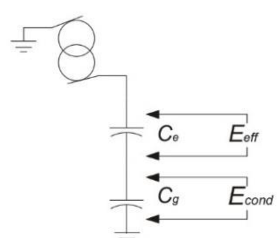


FIG. 2

Note that the electrode to product capacitance C_e is shown, and that C_e and C_g comprise a voltage divider which determines the A-C potential from conductors to ground, and also the effective test potential applied across the product insulation.



$$\frac{E_{eff}}{E_{cond}} = \frac{C_g}{C_e}$$

$$E_{cond} = E_{app} - E_{eff}$$

$$E_{eff} = \frac{C_g}{C_e \; C_g} E_{app}$$

If C_g is very large compared to C_e, Eeff is nearly equal to Eapp. For example, if C_e = 5pf and C_g - 1000pf, 99.5% of the applied test potential is impressed across the product insulation. If C_g is 100pf, however, the effective test voltage drops to 95% of the applied value.

Power mains frequency testing

When an insulation defect passes through the electrode, the arc which forms to the ungrounded conductor in effect connects the conductor to the electrode. If the spark tester operates at the

MEASURING & TESTING

mains frequency, the ungrounded conductor will be elevated to nearly the full test potential. If an operator comes into contact with a bare spot in the insulation at this time, current can flow through his body to ground. The maximum value of this current will be the maximum output level of the spark tester. For Clinton mains frequency spark testers this level is less than the " let-go" threshold and is not dangerous in itself However, as in the D-C case, the event is unexpected and unpleasant, and can lead to a secondary accident. From the standpoint of flaw detection, the detector circuitry must differentiate between normal electrode current and the new level when the arc connects C_g to the electrode, which is a small increment. As in the D-C case, grounding of the conductors under test is a practical necessity.

High Frequency spark testing

When the A-C test frequency is increased to 3Khz, two dramatic changes occur. First, because a short electrode is used, the capacitance to the conductor C_e is kept small. For a 2 in. electrode C_e might be typically 2 to 20pf, increasing with the applied potential. The other change is the low reactance of Cg, which allows the current to be conducted readily to ground through a capacitive path rather than by direct connection.

The ratio of C_g /C_e is usually high, so that nearly all of the applied test potential appears across the product insulation. When an insulation flaw passes through the electrode, current drawn from the spark tester increases sharply in this same ratio, subject to the current limiting characteristics of the test equipment. This means that flaws can be detected reliably. If required, C_g can be increased by passing a considerable length of the product close to the grounded surface.

Although the maximum resistive current which can be delivered by a Clinton 3Khz spark tester is well below the "let-go" threshold, a mild shock could still be experienced if an operator contacts a bare spot on the product while a second defect is in the electrode. For this reason the entire line should be provided with protective guards to prevent this.

The ratio of C_g/C_e can be experimentally determined by measuring Econd, the conductor to ground potential, with a high impedance A-C volt-meter or an oscilloscope.

$$\frac{C_g}{C_e} = \frac{E_{app} - E_{cond}}{E_{cond}}$$

Summary

Spark testing of ungrounded conductors is usually not permitted by industry-wide specifications, and is unsatisfactory in any event if D-C or A-C power mains frequency test potentials are used. A satisfactory test for quality control purposes can be made on ungrounded conductors at 3Khz, however, if proper precautions are followed.

Henry Clinton is president of Clinton Instrument Co., Clinton, CT.