IDD™

INSITE *Intelligent Diagnostic Device*

*Introducing the **IDD** Intelligent Diagnostic Device for On-Line **EXPERT SYSTEM** Diagnostics of Bushings and Current Transformers*

- **Low Cost Insulation Diagnostics**
- **Mature INSITE EXPERT SYSTEM**
- **Two Digit Visual ALERTS!**
- **Supervisory I/O Interface**
- **Optional Network Capability**
- **Optional DNP3 Output**
- **Optional Modem**

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This new family of on-line ***I**ntelligent **D**iagnostic **D**evices* (***IDD***) for power apparatus continuously determines the condition of bushings, current transformers, load tap changers (LTCs), circuit breakers and power transformers.

Early warnings of deterioration give substation asset owners valuable lead time to make decisions about upgrading aging or faulty equipment allowing them to live with progressive problems and defer replacements until corrective action can be efficiently scheduled. Since an *Intelligent Diagnostic Device* continuously evaluates the condition of your apparatus, ***IDD***'s unique EXPERT SYSTEM identifies malfunctions at the first sign of degradation. Based on proven process control techniques and field experience with our **INSITE** EXPERT SYSTEM, the ***IDD*** uses a diagnostic program that draws on a knowledge base for continuous self-learning. Prioritized **ALERTS!** communicate abnormal conditions with Informational, Warning, and Action messages that guide maintenance decisions.

To monitor apparatus status and condition *IDD* offers:

- **Savings on capital and operating costs**
- **Deferring apparatus replacements**
- **Increasing power system availability**
- **Providing early warning of deterioration**
- **Avoiding costly damage by managing risk.**

The ***IDD*** includes three basic components: sensors, the ***IDD*** main unit with built in EXPERT SYSTEM and optional outputs for SCADA point **ALERTS!**. Future versions will have external communications capability. The user interface consist of front panel controls and a laptop computer interface that uses a standard web browser.

Designed to operate reliably under extreme weather conditions and in electrically noisy substations, the ***IDD*** records information from sensor measurements, which are processed by the **INSITE™** EXPERT SYSTEM.

The ***IDD*** front panel uses a two-digit visual indication, so you can view alert levels referenced to a look-up table. Optionally, supervisory I/O and Web browser PC interfaces using a serial connection, telephone modem and Ethernet LAN are available for viewing **ALERTS!**.

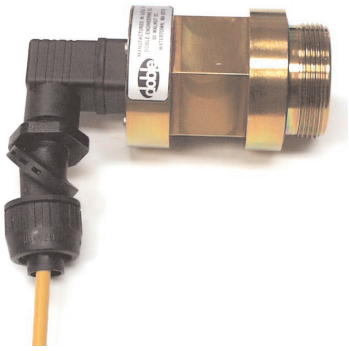
Features:

- **Low-cost insulation diagnostics**
- **Two-digit visual ALERT! indication**
- **SCADA contact interface**
- **Optional modem communications**
- **Optional network capability**

The ***IDD*** provides all the essential elements required by Doble's EXPERT SYSTEM On-line Diagnostics to issue timely, informative **ALERTS!**.

BUSHINGS AND CURRENT TRANSFORMER *IDD*

The Bushings/CT *Intelligent Diagnostic Devices* continuously evaluates the condition of high voltage bushings and current transformers with test taps. Sensors, mounted directly on the bushing test tap or CT tap of any manufacturer, measure electrical signals. The bushing/CT ***IDD*** is suitable for application to three or six bushings or three CTs. It can be mounted in an existing enclosure or in the optional Doble supplied NEMA enclosure.



Typical Bushing Tap Adapter

Available Types:

Bushing Tap Adapters
ASEA GOB
Felton & Guillaume 30 mm
GE Type "U"
Haefely - Trench COT
LAPP POC
Micanite
Ohio Brass GK10
The Bushing Company
Texolex
Westinghouse Type O

CT Tap Adapters
Arteche, External
Arteche CTI-420, Internal
Haefely

(If your bushing is not listed here contact Doble Engineering Company)

Technical Specifications and Options*

Bushing Tap Adapters:	Protection level 1	2 redundant limiters to 13V peak, continuous
	Protection level 2	2800V spark gap, surge
IDD Electrical Inputs:	Input Measuring Range	0 - 100 ma
	Accuracy	+ 1% of reading
	Resolution	12 bit
	Sampling rate	5kHz
	Isolation between phases	2500V RMS, 60Hz, for one minute
Power Supply:	90 - 264 volts, 47-63 Hz *or* 100 - 280 Vdc	
Environment:	Surge withstand	ANSI/IEEE C37.90.1-1989 (R1994)
	CE EMI/EMC	directive 89/336/EMC
	CE Safety	directive 72/23/EEC
	ESD	EN 61000-4-2
		Ambient Operating Temp: -40° to 65° C
		Storage Temp: -40° to 85° C
		Humidity: 5% to 95% non-condensing
Physical dimensions:	17.25" H x 15.25" W x 3" D (438.2mm H x 387.4mm W x 76.2mm D) for control cabinet mounting	
Optional Painted Steel Enclosure:	NEMA 4, 20" H x 24" W x 8" D (508mm H x 609.6mm W x 203.2mm D)	
Optional Plastic Enclosure:	NEMA 4, 18" H x 16" W x 10" D (457mm H x 406mm W x 25mm D)	

Supervisory I/O:

Four output contacts:

- ACTION **ALERT!**
- WARNING **ALERT!**
- INFORMATION **ALERT!**
- Self Monitoring
- Ratings: Switching 10A @ 240Vac resistive, 3A @ 240Vac inductive, 0.5A @ 125Vdc, 0.25A @ 250Vdc
  Dielectric Strength 3000Vac, coil to contacts, 1000Vac between contacts
  Surge Strength 6000V, coil to contacts

Two inputs:

- Remote **ALERT!** Acknowledge
- Remote **ALERT!** Reset
- Ratings: Input Range 12V to 300Vdc, 12V to 264Vac
  Input Current: 1mA @ 24Vdc, 2 mA pk @ 264V RMS
- Isolation voltage: 2500V RMS, 60Hz, 1 minute

Remote Communications Options:

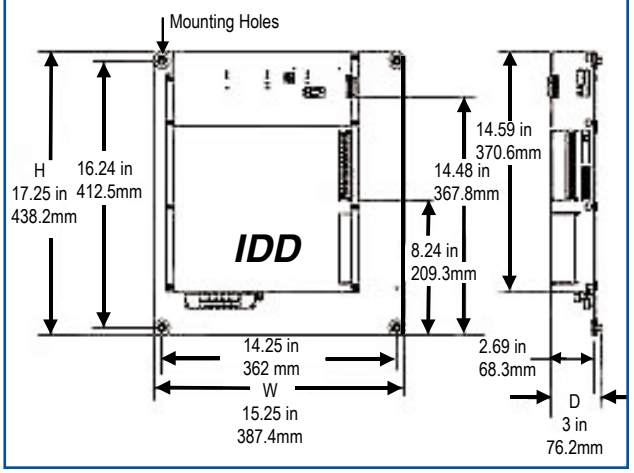
Serial RS-485	PPP
Modem	TCP/IP
DNP	

Future *IDDs:*

- Load Tap Changer Transformers
- Circuit Breakers

** Specifications subject to change without notice.*

Outline Drawing



For more information about *IDD*s, contact the Doble Engineering Company or our local representative:

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The Bushing/CT *IDD* Expert System Detects:

- **Insulation Deterioration In:**
  - condenser core
  - core surface
  - porcelain inner surface
- **Changes In:**
  - capacitance
  - power factor

The condition of a deteriorating bushing/CT in a three phase set is determined by evaluating changes in the sum of the three leakage currents. This method is described below:

Bushings and current transformers are diagnosed by phasor addition of currents available at the test taps (Figure 1). If the bushings are identical and system voltages are perfectly balanced, then the sum current will equal zero. Since bushings are never identical and system voltages are never perfectly balanced, the sum current is a non-zero value. As a result, the sum current is unique for each bushing set (Figure 2). The initial sum current is learned and the condition of bushings is evaluated by measuring the changes.

By learning the initial value of the sum current and comparing it to the latest value, change is determined by analysis of subsequent ***IDD*** recordings. Subtraction of the initial sum current and the average sum current phasors provides the power factor and capacitance diagnostic parameters. The change in the quadrature component of the sum current shown in **red** is used to calculate the change in **Capacitance (C)** and the change in the in-phase component shown in **blue** is used to calculate the change in **Power Factor (PF)**. The phase angle α between the sum and reference currents is used to determine which bushing created the change (Figure 3).

Presently, there many apparatus-years of experience using Doble's EXPERT SYSTEM DIAGNOSTICS. The system has successfully identified incipient problems in transformer and circuit breaker bushings. More importantly, this technology has kept asset managers informed of the status of their equipment on a continuous basis. ***IDD*** information also supports successful reliability centered maintenance (RCM) programs.

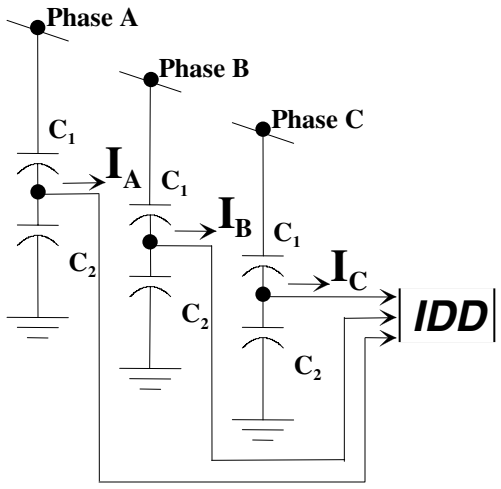

Figure 1

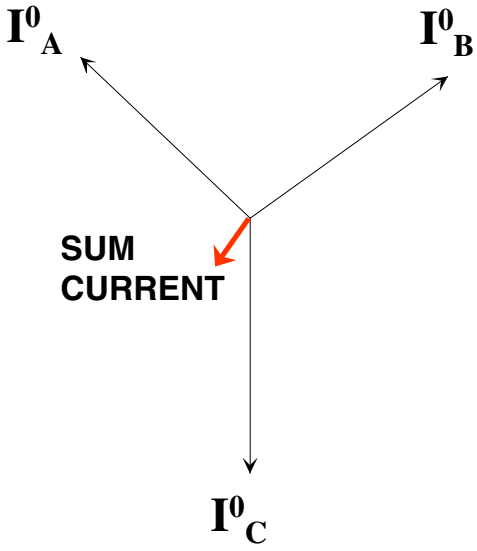

Figure 2

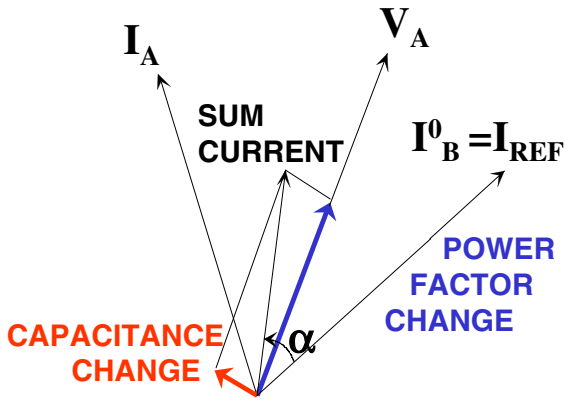

Figure 3