

FINDING PARTIAL DISCHARGE IN SWITCHYARDS

This paper focuses on unwelcome external sources of Partial Discharge from a Switchyard, their impact on TEV measurement indoors and the subsequent successful identification & solution to the dilemma.

By Greg Linton, HV Diagnostic Services Limited

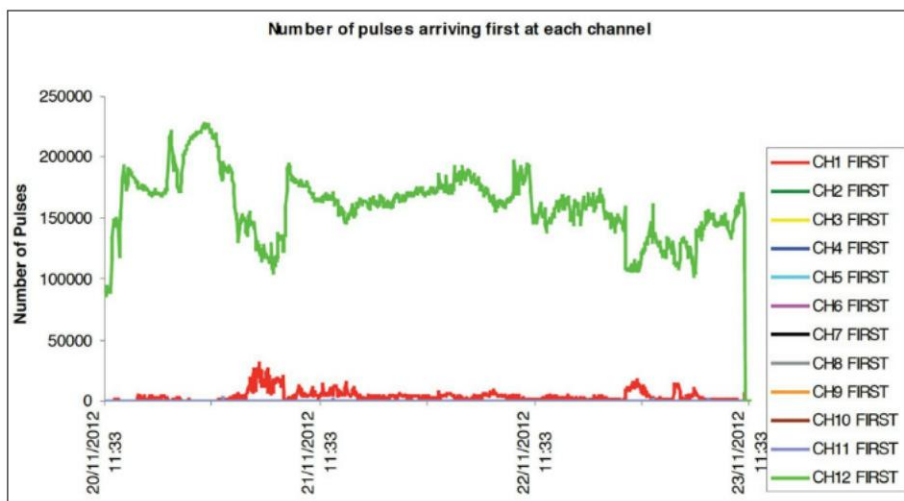
The Substation forming the basis of this discussion has been regularly surveyed for Partial Discharge activity since being first commissioned in 2008, and had consistently exhibited high background TEV levels affecting measurements on the 11kV switchboard inside. Continuous Monitoring on two separate occasions over the years confirmed the interference present at site, which is useful when assessing switchboard condition but doesn't help determine the origin outside.

Some of the traditional detection methods don't readily transfer outside due to the non-contact nature of working in live Switchyards nor do they have the precision required for working at distance when dealing with excessive sources capable of swamping the environment. In a perfect world we would eliminate these unwanted external noises, correcting a potential problem while at the same time allowing further confidence in the substation equipment inside.

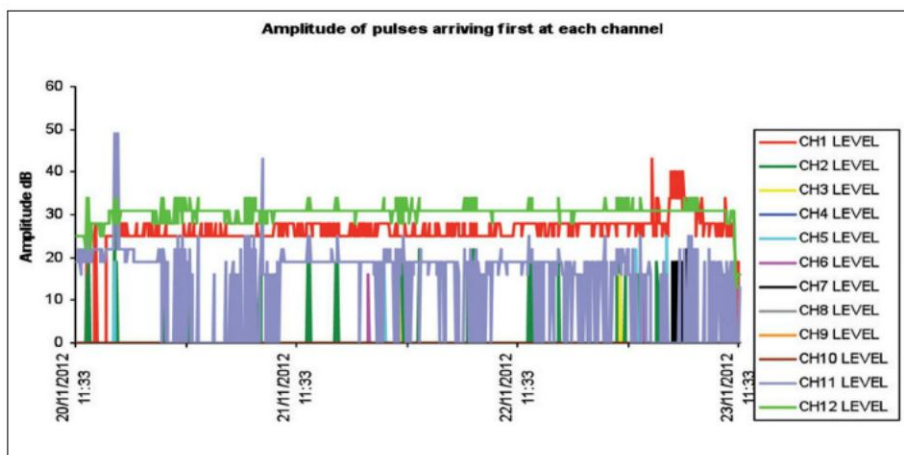
LOCATION OF INTERNAL PARTIAL DISCHARGE

Fast forward several years and the development & release by EA Technology of the PD Hawk. Designed to detect Electromagnetic waves the PD Hawk instrument is primarily used for location of internal Partial Discharge in transmission and distribution outdoor substations, specifically for the safe working in a High Voltage switchyard. Optimised to reject corona it detects and measures radio signals using a tunable, compact and highly directional antenna. The PD Hawk is also made significantly more powerful with the application of a specifically designed Android App allowing data capture in one of two modes; Pulse Mode and Scan Frequencies Mode. This captured data can be instantaneously emailed for further analysis and saved as .csv or .jpeg files allowing bespoke reports to be produced.

Our first opportunity to trial PD Hawk came in 2013 with a loan unit, and following that year's EEA Conference & Trade Exhibition this Substation was chosen (for obvious reasons). Using a systematic route through the switchyard we very quickly closed in on the maximum signal, present at a specific pole structure.



Continuous Activity logged inside over 3 days of Monitoring, high pulse count.



CH 1 & 12 (together with 2 & 11) are Aerials positioned along wall forming a perimeter between indoors and out.



The resultant investigation exposed a deficiency within the pin/bolt not making a positive connection into the Bus, possibly due to being too short and allowing discharge to occur between unbonded points of differing potential, with carbonisation and pitting clearly evident to the metal parts. (Shown previous page.)

Upon remedying the situation, TEV Location survey results inside immediately improved and have remained low now for consecutive site visits, note the reduction to the Background Air & Metalwork reference and the positive effect on switchboard levels. (see survey tables)

More recently, PD Hawk has found a new application enabling the detection of defective cable joints in underground cable pits and cabling tunnels which when used in conjunction with the UltraTEV Plus+ & UltraDish, provides a powerful combination that can detect both radio and ultrasonic emissions associated with PD, safely, non-intrusively and from a distance. The directionality of both devices also makes location and joint identification straightforward.



AIR		6		METALWORK				23		TEMPERATURE		22°C	
	SWITCH POSITION (OPEN, CLOSED, EARTHED, ABSENT)	BUSBAR 1 UPPER/FRONT	BUSBAR 2 LOWER/REAR	SWITCH TANK	CT CHAMBER	VOLTAGE TRANSFORMER	TERMINATION BOX	BAND JO /END CA		BUSBAR 1			
1 Rd	C	15		22	21		22						
	C	15		22	23	18	20						
	C	14		18	21	18	18						
51	C	17		16	20		20						
	C	9		17	20		-						
	C	14		12	18		21			13			
	C	8		13	19	11	22						
	C	10		16	18	12	18						
1 Rd	C	13		14	17		24						

September 2012 – typical up to that point



SUMMARY

The PD Hawk is a valuable tool for identifying PD sources internal to switchyard plant and an important addition to the condition monitoring Instruments Portfolio from EA Technology, while effectively strengthening the services offered in New Zealand by HV Diagnostic Services Ltd.

AIR		Clear		METALWORK				0		TEMPERATURE		17°C	
	SWITCH POSITION (OPEN, CLOSED, EARTHED, ABSENT)	BUSBAR 1 UPPER/FRONT	BUSBAR 2 LOWER/REAR	SWITCH TANK	CT CHAMBER	VOLTAGE TRANSFORMER	TERMINATION BOX	BAND JO /END CA		BUSBAR 1			
1 Rd	C	3		1	3		7						
	C	2		1	4	3	6						
	C	3		2	2	2	4						
51	C	2		3	2		5						
	C	2		2	2		-						
	C	3		6	3		5			3			
	C	3		2	2	3	5						
	C	3		2	3	3	6						
1 Rd	C	3		12	2		5						

September 2013 – the new benchmark here

SPECIALIST Condition Assessment Services, Products & Support

Why HVDS

- Experience with over 15 years of local NZ insight to share
- Expertise with a proven & successful track record
- Independent, knowledgeable and candid advice
- Consultancy incl CBRM via our Australian colleagues

Core Activities

- In service PD surveys for ground mount switch assets
- Overhead Ultrasonic, UHF & IR assessment in Switchyards
- VLF mapping of Cables, Offline & accurate
- Instrument Training, basic Calibrations & Spares

Distribution Portfolio

- UltraTEV family of Testers, Alarms & Monitors, EA Technology
- Thermal Cameras – Entry level to Professional, Guide Infrared
- The Safety assured maintenance aperture system, Viewsafe UK.

MEASURE, LOCATE AND QUANTIFY PD ACTIVITY IN SWITCHGEAR, CABLE AND OVERHEAD ASSETS

Australia
+61 (0) 7 3256 0534
neil.davies@eatechnology.com
www.eatechnology.com

viewsafe
Safety assured maintenance aperture

GUIDE
Infrared thermal imaging

New Zealand
+64 (0) 3 962 0225
greg.linton@hvds.co.nz
www.hvds.co.nz