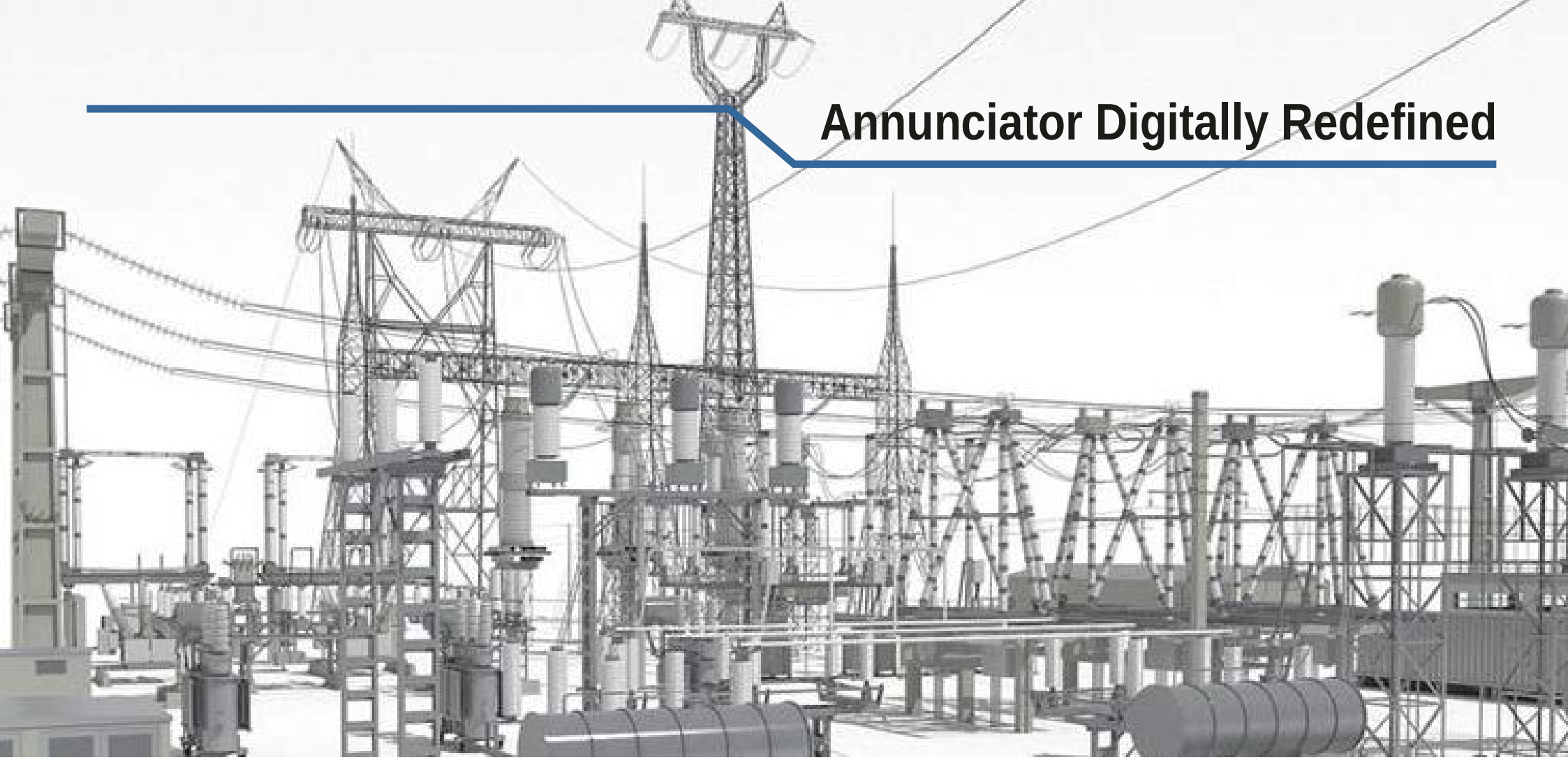

Annunciator Digitally Redefined

A Technical Presentation on:

IEC 61850 Compatible Annunciators

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Introduction

An " EFFECTIVE" control room is crucial to ensure the safe and efficient operation of any plant. The amount of workload on the operators in a control room is dependent on the size and complexity of the plant and the level of automation.

The following main tasks can be categorized for the plant operators.

* Monitoring the plant for safe and efficient operation.
* Detecting and fixing problems.
* Securing seamless generation, transmission and distribution.

In general, it is the control room personnel's responsibility to monitor and take control over the events and incidents during the normal day to day operation and during times when the automatic control or safety systems fails to maintain safe operation.

Hence "HUMAN FACTORS" in combinational with the physical environment is a key element in the safe operation of any plant or industrial system.

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Problem Statement

With the advent of newer communication technologies and standards such as IEC61850, the general trend and currently available method is to have all reporting and alarms on a PC based HMI system.

The following disadvantages can be summarized.

1) INFORMATION OVERFLOW

Some assets may have hundreds of alarms configured in the system. The PC based system with a list of alarms sounding off at the same time will result in confusion and poor alarm management.

2) OPERATOR FATIGUE

Multiple alarms sounding off at the same time and the constant need to focus and monitor the events on a PC based system will definitely lead to operator fatigue and will induce extreme stress on them. This will result in poor decision making in times of emergencies.

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Problem Statement Contd...

3) POOR ALARM FAMILIARIZATION AND SITUATIONAL AWARENESS

The constant changes to the alarm list will result in continuous screen monitoring for the list of alarms leading to poor situational awareness

4) IMPROPER GUIDANCE ON EXISTING AND NEW ALARMS

Awareness on the existing alarms and newer alarms is a very important factor for proper decision making and there is a very real possibility that the decision making might be impaired due to the list of alarms.

5) OS BASED SECURITY THREATS

Viruses, malawares and trojans specifically reside and target systems based on operating systems such as windows. A simpler loop based software implementation will be more robust compared to OS based HMI's.

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Problem Statement Contd...

6) POOR RELIABILITY

There has been enormous failures of the PC based systems which has resulted in the disconnection of information between the equipment and the operator. This has led to the incorporation of high end computers which has resulted in higher input costs but the problems with other peripheral devices such as monitors still exists (graphic card failures, display failures, display restarting etc are some of the problems)

7) POOR UP-GRADABILITY

Some plants might be subject to modifications or up-gradations. In such instances, significant programming might be required to change the HMI modules. Lack of knowledge or the complexity of the system up-gradation might be considered as a factor influencing this point.

8) POOR AUDIO ALARMING

Audible alarm along with a good visual presentation of the alarm is also vital to the good alarm handling practice. This might be absent in many of the PC based systems.

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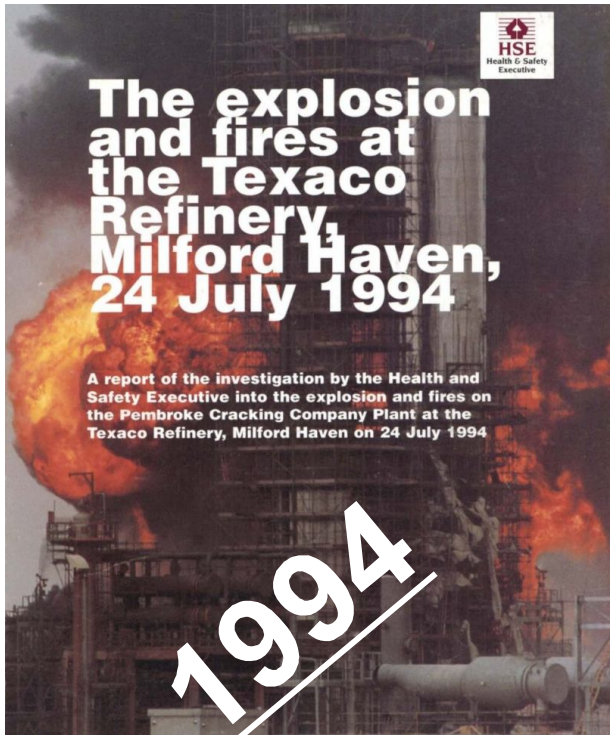
Consequences

SOME OF THE WELL KNOWN OCCURRENCES DUE TO POOR ALARM MANAGEMENT ARE LISTED BELOW.

MILFORD HEAVEN REFINERY



Explosion injured 26 people and caused damage of around $70 million

Key factors included:

* There were too many alarms and they were poorly prioritized.
* In the last 11 minutes before the explosion, the operators had to recognize, acknowledge and act on 275 alarms.

THREE MILE ISLAND REACTOR

BOUNCEFIELD OIL STORAGE DEPOT.

TOSCO AVON INCIDENT

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Impacts of System Failure

FINANCIAL

*Loss of Equipments
*Loss of Revenue

VIOLATIONS

*Environmental or
Fire Safety violations.

SAFETY

*Injuries or loss of life.

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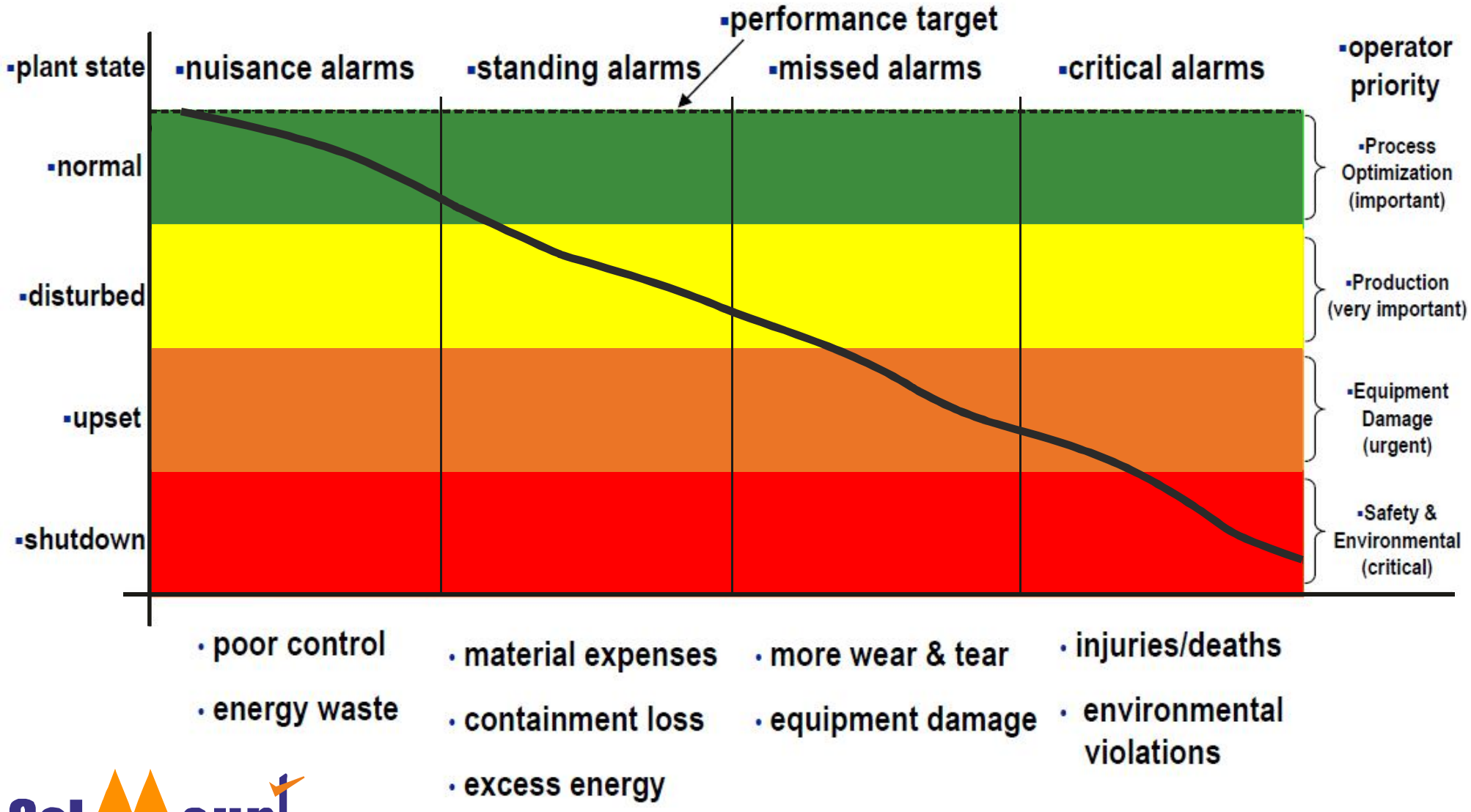
System Failure Performance Impact



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Benefits of Alarm Management

* Avoid unintended shutdowns from missing alarms or responding too slowly to alarms.

* Lower equipment repair costs and increased operational efficiency and/or production rates.

* Increase operator availability and effectiveness with reduction in average alarm and event rate.

* If initial rate is 25/hour/operator and each consumes an average of 45 seconds, then workload can be reduced almost 1 hour per 12 hour shift if rate is reduced by 25%.

* Reduce minor and major Incidents from better alarm management.

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Industry Standard Alarm Event : Guidelines

	EEMUA	Oil & Gas	PetroChem	Power	Other
Average Alarms per Day	144	1200	1500	2000	900
Average Standing Alarms	9	50	100	65	35
Peak Alarms per 10 Minutes	10	220	180	350	180
Average Alarms/ 10 Minute Interval	1	6	9	8	5
Distribution % (Low/Med/High)	80/15/5	25/40/35	25/40/35	25/40/35	25/40/35

Source: Matrikon

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What is the need of Traditional Annunciators?

IMPORTANCE OF TRADITIONAL ANNUNCIATON SYSTEMS

Russian Air Force Kamov Ka-52 cockpit

The picture on the left indicates a cockpit instrumentation of a modern day helicopter.

In spite of having many multifunction displays, the most important alarms such as in coming missile warning, missile lock, target lock etc. are still provided on traditional windows to enhance the pilot situational awareness. This design methodology is incorporated in our annunciation system.

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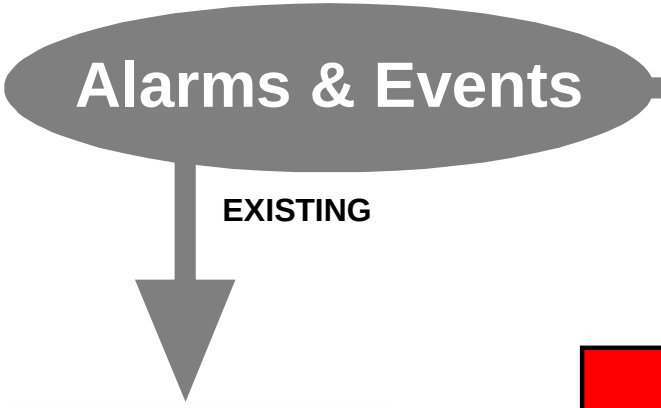
Our Solution

OPTIMIZATION / PROPOSED SOLUTION FOR ALARM MANAGEMENT

Keeping in mind the improvements in the communication technologies, *SELMOUNT* is introducing a unique alarm management and annunciation system which incorporates the latest digital trends and at the same time providing a backup alarming system in a time proven technique.



> Increased performance
> Easier to maintain
> Easier to up-grade
> Easier to implement

OUR GOAL

* Present important alarms to the operator in an efficient manner.
* Segregate critical and non-critical alarms.
* Introduce a backup/redundant alarm method.
* Provide bay wise/panel wise annunciation.
* Incorporate a modular structure for easy maintenance and up-gradability.
* Provide good audible alarms.

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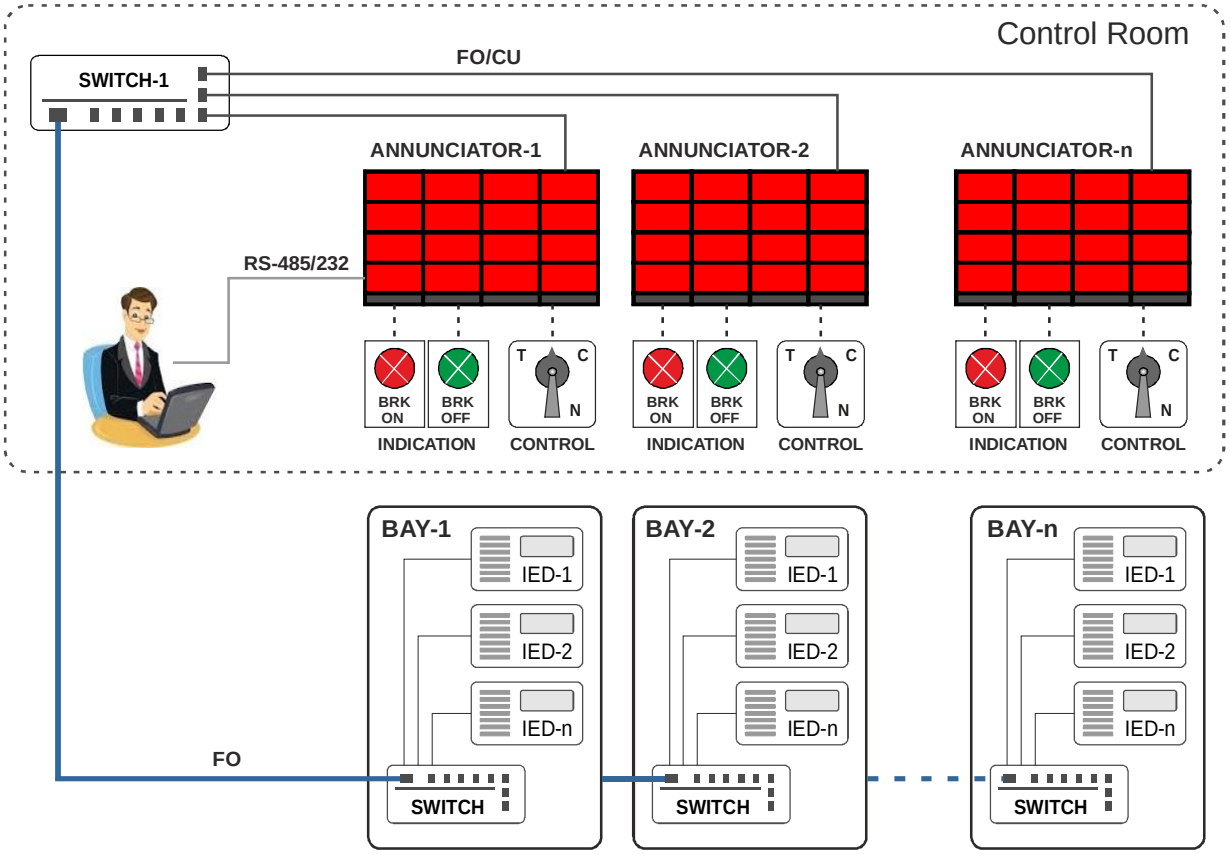
Methods of Implementation

We provide two types of architecture for implementing the annunciation system. Both the methods of implementations are listed in the following pages along with a comparative statement between the two architectures. The customer can choose any one of the systems based on their specific requirements.

ARCHITECTURE-1 [INDIVIDUAL IEC61850 COMPATIBLE ANNUNCIATORS]



SALIENT FEATURES

1) Each individual annunciator is IEC61850 compatible.
2) Fiber or copper communication media option available.
3) Any window can be configured to any MMS tag of IED's.
4) Can access report control blocks of the IED's.
5) Many MMS tags can be configured to the same window.
6) Window mapping through serial port.
7) Sequence of events (SOE) for individual annunciator available on serial port.
8) Can be directly connected to the ethernet switch in the control room.
9) Manual circuit breaker trip/close functions available.
10) Repeat relays / Indication lamp contacts available as an option.
11) Standby supply available for the annunciator.
12) Annunciator supply self supervision with AC fail and DC fail options available.
13) Remote panel AC/DC fail monitoring available through a dedicated server module or from the BCU or any other IED.
14) Easy legend replacement.
15) Local digital inputs and outputs available.

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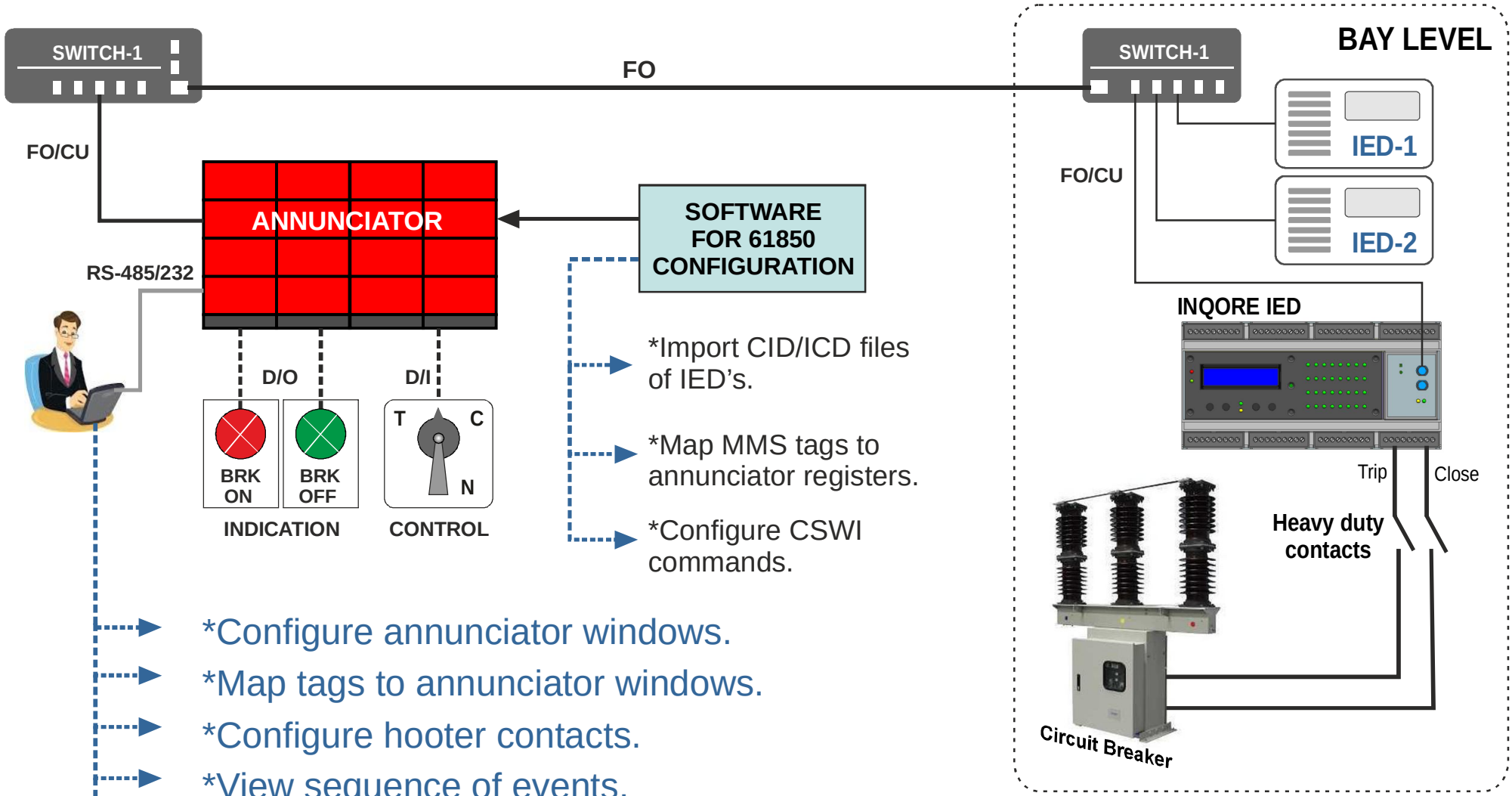
Method of Operation (Architecture-1)



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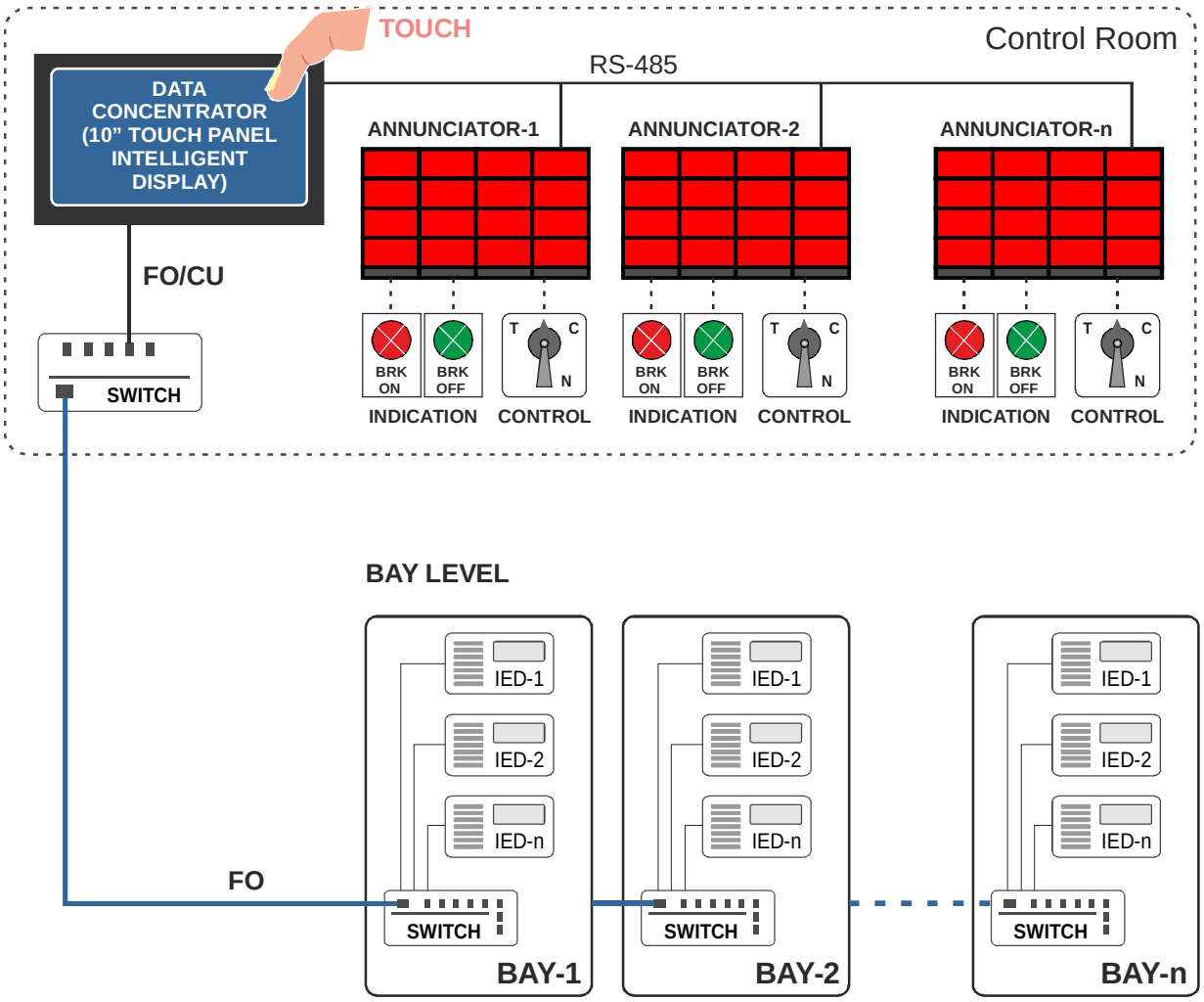
Methods of Implementation

ARCHITECTURE-2 [DATA CONCENTRATOR WITH IEC61850 CAPABILITY & RS-485 ANNUNCIATORS]



SALIENT FEATURES

1) One data concentrator with IEC61850 Interface.
2) Multiple annunciators can be connected to the data concentrator on RS-485 bus or optional CAN bus. (redundancy available for the serial port also)
3) PRP (parallel redundancy) option available for the data concentrator.
4) Touch panel 10.1 Inch embedded electronic display available for the data concentrator.
5) Easy configuration of the annunciators via the graphical user interface.
6) Diagnostics, SOE, time stamped data can be viewed on the HMI.
7) Highly economical model.
8) Utilizes only one port of the ethernet switch.
9) Both fiber and copper communication options available.
10) Highly configurable.
11) All other features of architecture-1 is also available.

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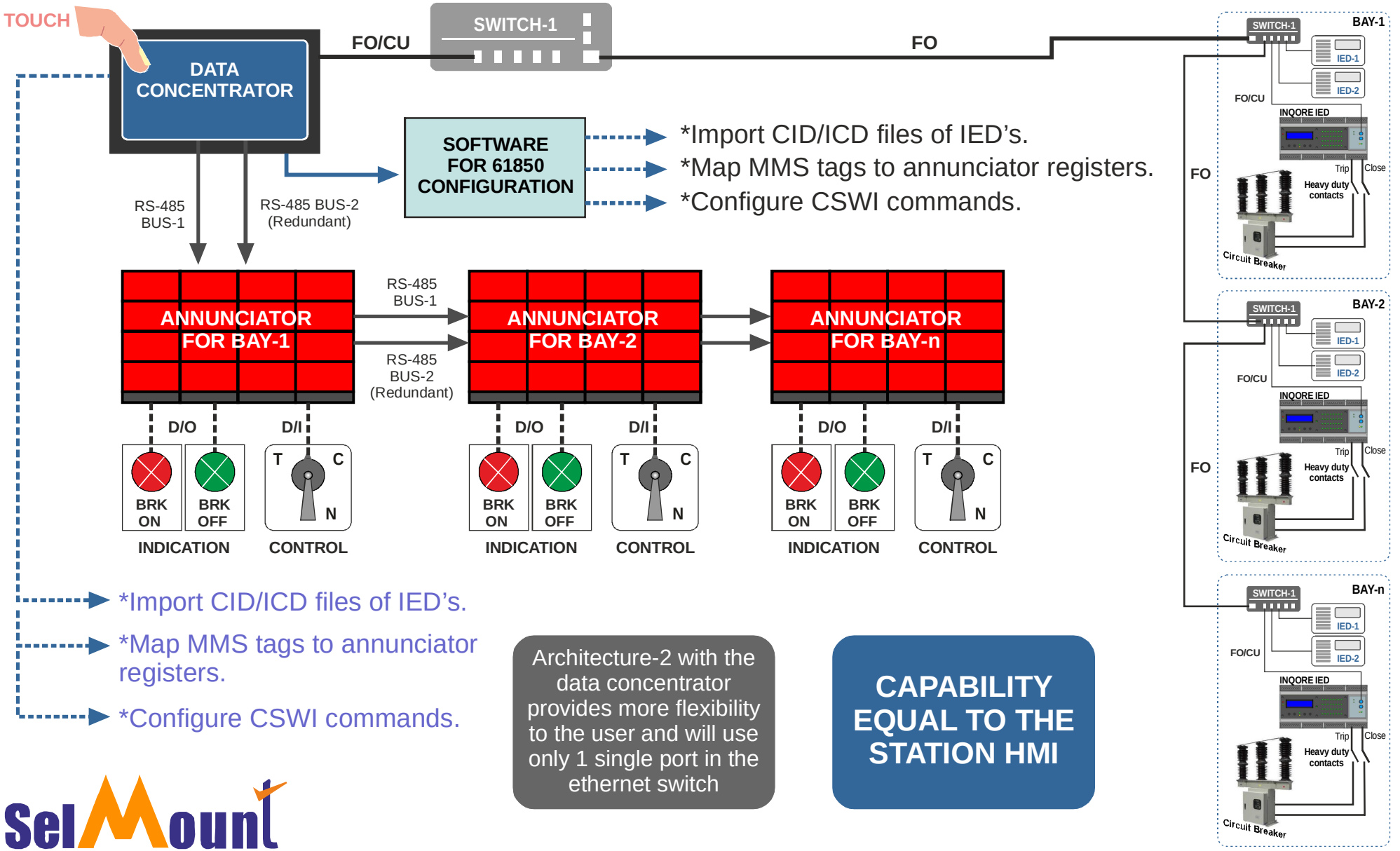
Method of Operation (Architecture-2)



Architecture-2 with the data concentrator provides more flexibility to the user and will use only 1 single port in the ethernet switch

CAPABILITY EQUAL TO THE STATION HMI

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Comparison b/w Architecture 1 & 2

Sl. No	Features	Architecture-1	Architecture-2	Remarks
1	Fiber communication media	✓	✓	Either FO or CO
2	Copper communication media	✓	✓	Either FO or CO
3	Ports required in ethernet switch	1 each for annunciator (Ex. 4 ethernet port for 4 annunciators	Only 1 port	
4	Annunciator window configuration	Via RS-485 port (PC/Laptop)	Through touch panel GUI	Limited functions are available in architecture-1
5	Additional binary O/P's	Available (configuration is via RS-485 port) PC/Laptop needed	Available Configuration through GUI	Binary O/P's can be used to drive indication ckts. Interfacing with 3rd party devices etc.
6	Sequence of events	Available annunciator wise. Viewable only via PC/Laptop	Comprehensive time stamped details available on LCD. Bay wise/ IED wise segregation possible	
7	Redundancy	Highly redundant as each annunciator is individually connected to ethernet switch	PRP option is available on the data concentrator. RS-485 redundant channel is optional for annunciator communication	
8	Control inputs	✓	✓	
9	61850 parameter configuration	✓	✓	
10	Analog values (MMXU, MMTR)	X	✓	
11	Price comparison b/w architecture 1 & 2	+ +	+	
12	Up-gradability	Very high	Very high	Additional annunciators can be added as & when required
13	Communication diagnostics	X	✓	

The Conclusion

WITH REFERENCE TO THE DATA SUMMARIZED IN THIS PRESENTATION IT IS CONCLUDED THAT,

* The digital annunciators/alarm management system is effective and it is a mandatory requirement for all EHV substations irrespective of SAS or BAY type construction.

* By providing the proper alarm management system in parallel to the station HMI, the safety to the operators/equipments in the substation can be increased and we can also improve the performance of the entire system.

* All existing SAS and BAY substations which are in service without annunciaton should be retrofitted with the proper alarm management system.

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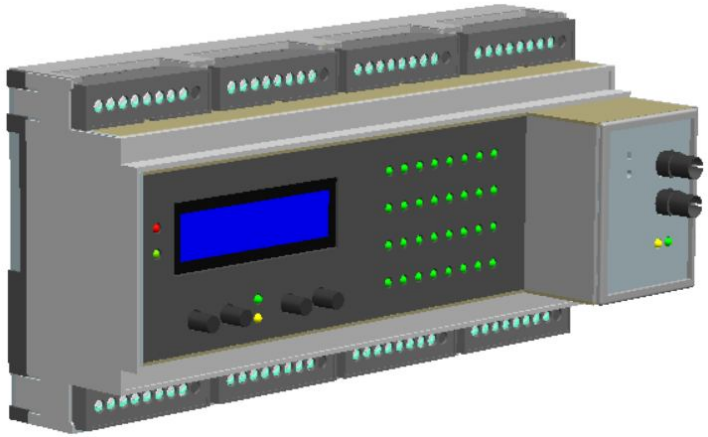
IEC 61850 Server Module (DI/DO)



SELMOUNT introduces a new IEC61850 server module which has upto 24 digital inputs (optically isolated) and four relay outputs which can be used for various functions such as circuit breaker trip and close operations. Additional heavy duty relays/contactors can be connected to this module depending on the customer requirements.

SALIENT FEATURES

1) Any auxiliary contacts available can be converted to IEC61850 MMS tags using this module.
2) variants with potential contacts and analog inputs also available.
3) Using this module, many of the inputs can be derived without disturbing the existing IED's.
4) This module has provision for DC supply input and a backup AC supply input and also has self supervision of these two supplies.
5) Fiber or copper interface options available.
6) Buffered report control blocks available for reporting to any client module.
7) SNTP time synchronization available.
8) Accepts control switch operation commands from the client modules.
9) Dual RS-485 modbus ports available as options.
The module can act as a modbus RTU to IEC61850 gateway and vice versa.
10) Easy LCD interface.
11) DIN rail mounting.

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Annunciator Digitally Redefined

Manufactured by:

SELMOUNT POWER SYSTEMS PVT. LTD.

(AN ISO 9001-2015 COMPANY)
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