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PROFESSIONAL DEVELOPMENT

Annual Power Engineering Exchange (APEX)

Digital Transformation in the Electricity Supply Industry

Transformer Monitoring Needs and Challenges

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Topic of Today

- Digital Transformation – Why do we care
- Transformer Condition Monitoring – Why does it matter
- Transformer Management Unit – What is DRMCC
- Additional Capability – What is in the shadow
- Evolving Technologies – How can we do better

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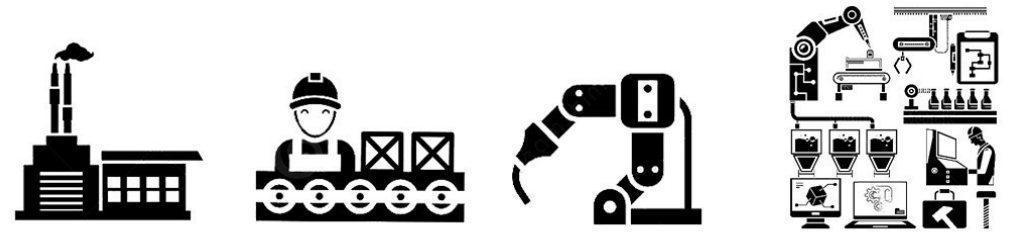
Digital Transformation – Driven by Industrial Revolution



18th Century	19th Century	20th Century	Today
Industry 1.0 Mechanical production equipment powered by steam	**Industry 2.0** Mass production assembly lines requiring labour and electrical energy	**Industry 3.0** Automated production using electronics and IT	**Industry 4.0** Intelligent production incorporated with IoT, cloud technology & big data

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Digitised Assets – Transformer Monitoring Functions

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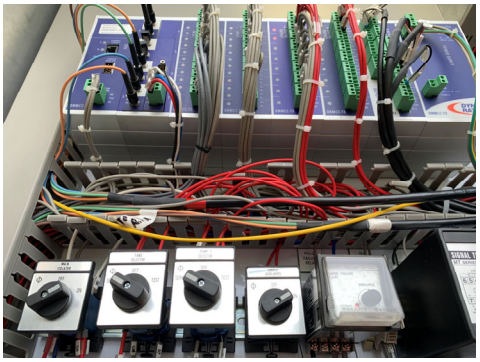
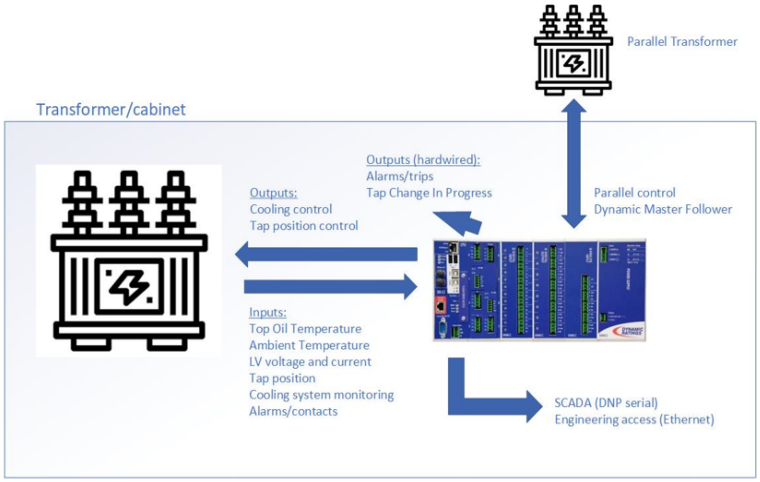
DRMCC – Automatic Voltage Regulator, and More…





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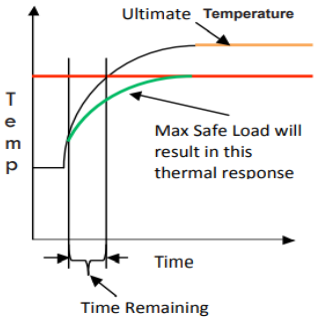
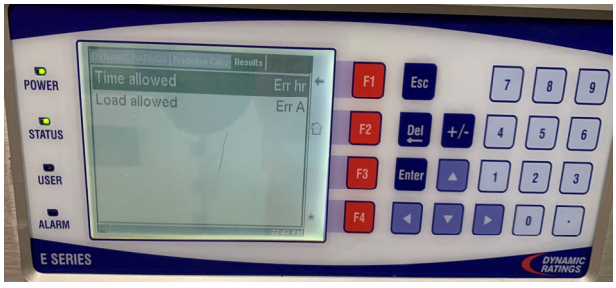
Dynamic Rating – Load for Time, Time for Load



- **Load for Time:** Given an assumed load, how long before the transformer would exceed a specified thermal limit.
- **Time for Load:** Given a specific time duration, what is the maximum load the transformer could sustain without exceeding a specified thermal limit.



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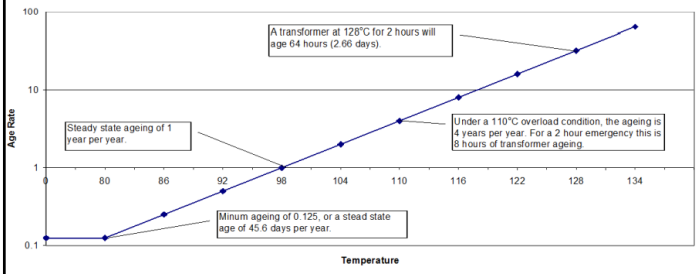
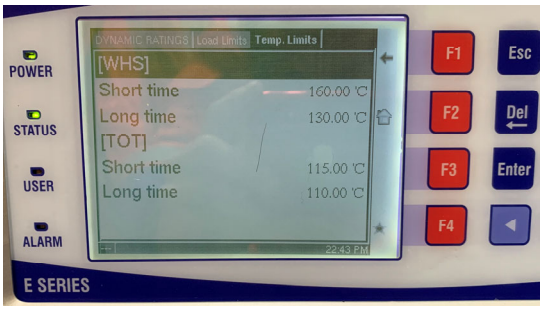
Setting and Configurations – Are they up to scratch?





IEC60076-7

Table 2 – Maximum permissible temperature limits applicable to loading beyond nameplate rating

Types of loading	Small transformers	Large and medium power transformers
Normal cyclic loading		
Winding hot-spot temperature and metallic parts in contact with cellulosic insulation material (°C)	120	120
Other metallic hot-spot temperature (in contact with oil, aramid paper, glass fibre materials) (°C)	140	140
Inner core hot-spot temperature (°C)	130	130
Top-oil temperature, in tank (°C)	105	105
Long-time emergency loading		
Winding hot-spot temperature and metallic parts in contact with cellulosic insulation material (°C)	140	140
Other metallic hot-spot temperature (in contact with oil, aramid paper, glass-fibre materials) (°C)	160	160
Inner core hot-spot temperature (°C)	140	140
Top-oil temperature, in tank (°C)	115	115
Short-time emergency loading		
Winding hot-spot temperature and metallic parts in contact with cellulosic insulation material (°C)	See 7.3.1	160
Other metallic hot-spot temperature (in contact with oil, aramid paper, glass fibre materials) (°C)	See 7.3.1	180
Inner core hot-spot temperature (°C)	See 7.3.1	160
Top-oil temperature, in tank (°C)	See 7.3.1	115
NOTE For more information on the core temperature, see Annex B.		

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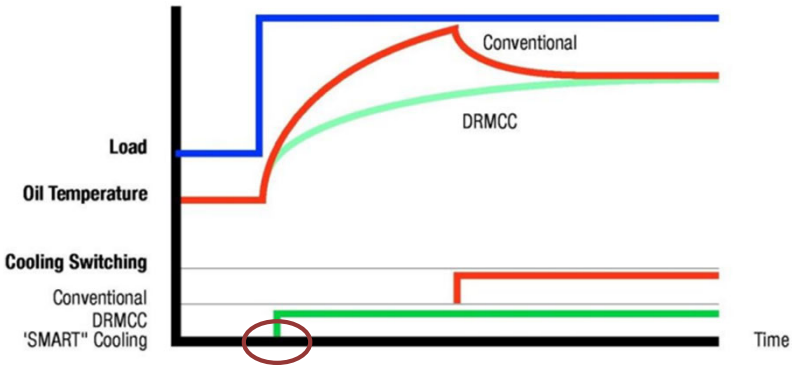
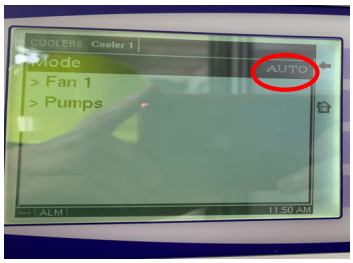
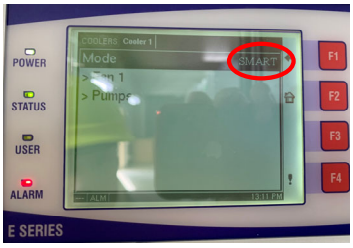
What 's more – Smart Cooling







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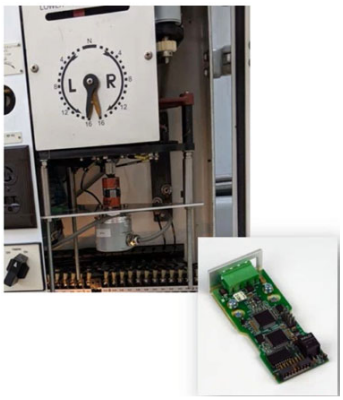
More Potential: OLTC Motor Energy Monitoring



LTC Motor Energy	
Average Current RMS	5.6 A
Average Power	1341 W
Average Voltage	239.5V
Energy	1800 Joule
Peak Current	11.7 A
Peak Power	2802 W
Duration	1.95 Sec
Energy Alarm Thresholds	
High (Neutral Tap)	2500 Joules
Low (Neutral Tap)	500 Joules
High (Other Taps)	2000 Joules
Low (Other Taps)	200 Joules
High Alarm	Off
Low Alarm	Off

Pilot Project

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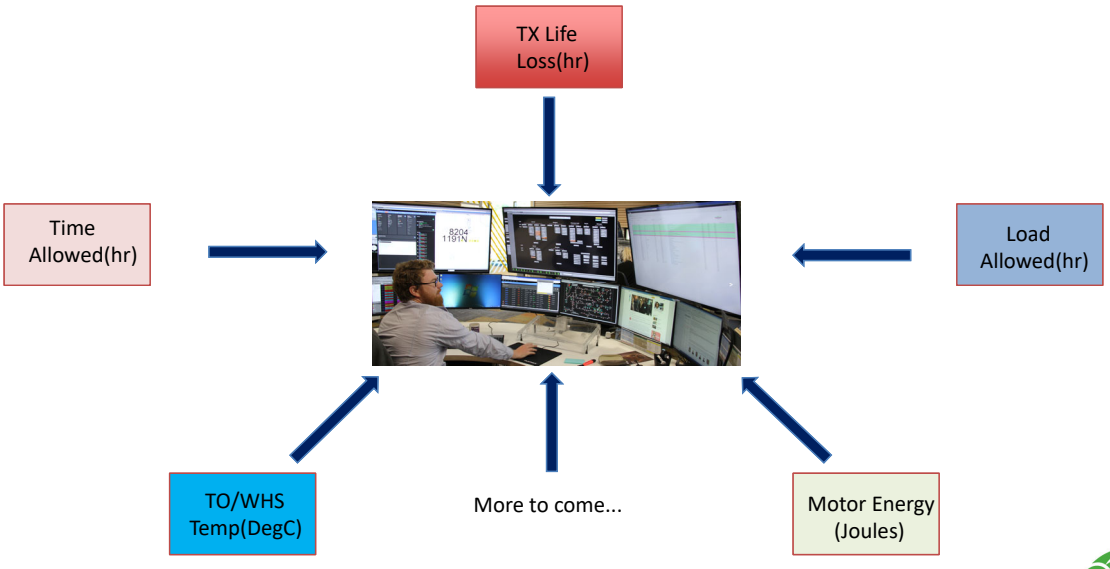
Data Governance – Values and Warning Management



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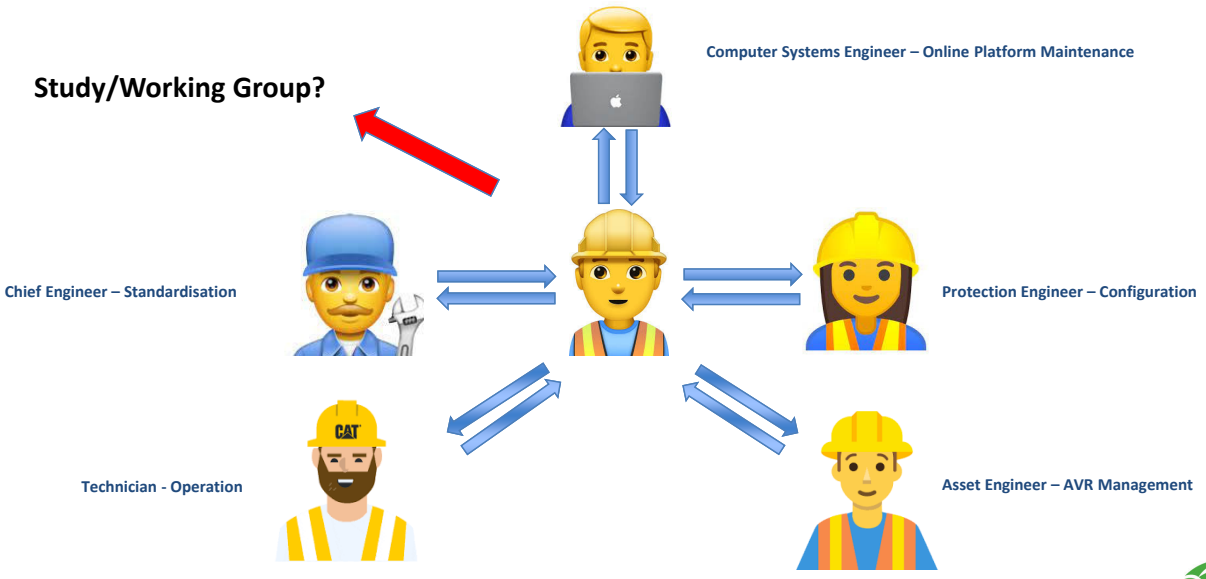
Communicate – Who are affected?



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Summary

- Digital Transformation is happening in the power industry
- Understand how can a function work before implementing
- We need to react responsively with evolving technologies

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Thank You

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