Autoreclosers

Switch module

VIM 120 – 12/15kV
VIM 240 – 24/27kV

Protection relay

FTU R200

Remote Terminal Unit

IEC 60870-5-101, IEC 60870-5-104 , IEC61850, DNP3 and MODBUS protocol. Communication via Radio, TETRA and GSM/3G/4G

HUGHES
POWER SYSTEM

AUTORECLOSERS in OVERHEAD NETWORKS

Autoreclosers have been around since 1941 and were invented by Kyle corporation in US. Autoreclosers have always been considered to be one of the "workhorses" of distribution system overcurrent protection.

A distribution autorecloser is designed to interrupt both overload and fault current. Also, per its term, it is designed to "reclose" on the fault repeatedly in a predefined sequence in an attempt to clear the fault.

Autoreclosers are predominantly located on the distribution feeder, though as the continuous and interrupting current ratings increase, they are more likely now to be seen in substations, where a circuit breaker would be located traditionally .

Autoreclosers have two basic functions on the system, reliability and overcurrent protection. While one of the philosophies for the use of autoreclosers is to increase reliability. In the past their use for many utilities was determined mainly due to the fact that feeder breaker did not have protective reach to the end of the feeder. The reason for that was the fact that high load currents forced the minimum trip setting to a higher value than the fault level at the end of the feeder.

Nowadays, Autoreclosers are more frequently applied for reliability reasons, mainly due to three of their benefits: Fault clearance capability, Remote control and Smart grid capabilities.

AUTORECLOSERS as SUBSTATION BREAKERS and in KIOSKS

Autoreclosers are the modern way to refurbish small substations. The cost reduction benefits are big, due to the following reasons: There is no need for any building to install traditional panel breakers, which results in a reduction of construction time and engineering costs.

Autoreclosers installed in kiosks are a viable way to protect underground cable networks. It is also a intelligent solution to protect zones between underground cable networks and overhead line systems.

Autoreclosers are a powerful building block in a modern smart grid network. They quickly reduce the SAIFI and SAIDI figures and have a very short pay-off time.

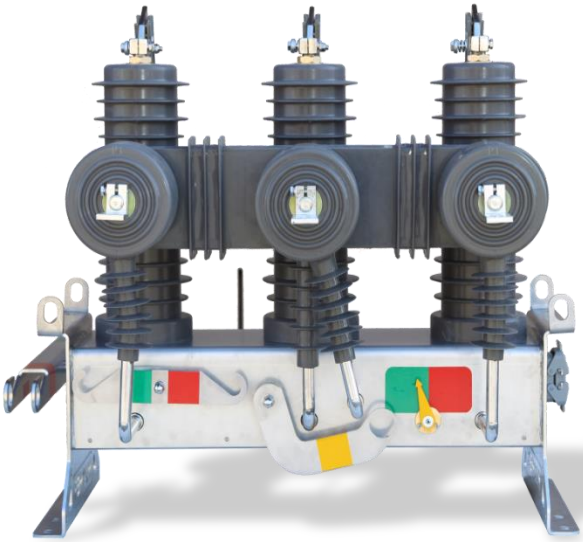
PRODUCT INTRODUCTION in brief

The ACR series of automatic circuit reclosers are designed for use in overhead line distribution networks, secondary substations (transformer kiosks) and in distribution substations.
The switch modules are designed for all voltage classes up to 12kV and 24kV. The vacuum bottles are of AMF type to handle many high current faults as high as 31.5kA with less contact erosion.

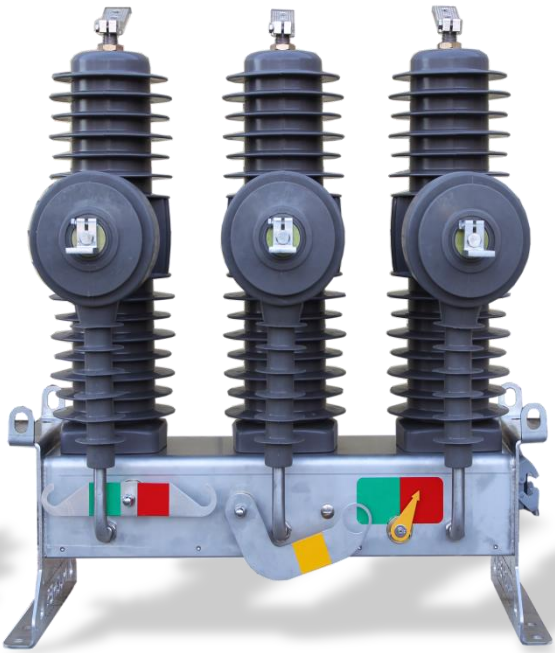
The bushings have an epoxy core, coated with silicone for extra UV protection and mechanical stress during installation and vandalism. The ARC series are solid insulated, environmental friendly, free of sulphur hexa fluoride gas (SF6) and oil for isolation. As it is solid insulated in the free air space, the phase element has no metal cover. This design prevents flash overs between phases, phase to earth and tank explosions in a failure situation.

The switch module frame is manufactured out of 5mm 2333 type of stainless steel for best mechanical stability and to be corrosion proof. All metal parts are carefully selected to avoid electro chemical corrosion as well as for a long problem free operation.

It's of the latest Swedish design and uses latest generation components to ensure a low operating maintenance cost.

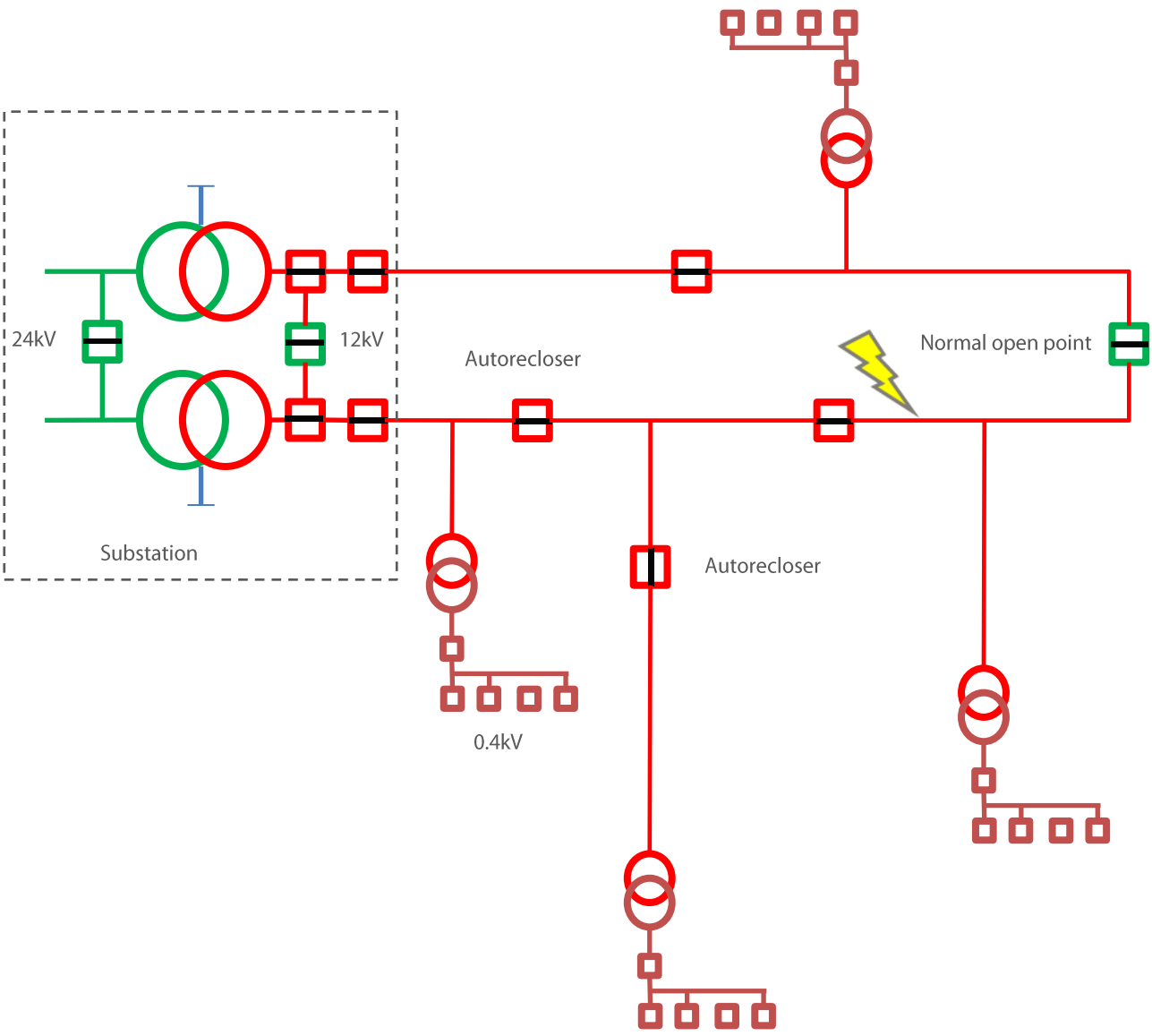


ACR 120 – 12kV



ACR 240 – 24kV

PRODUCT INTRODUCTION in brief



Typical autorecloser application for an overhead line network with FeAl, Cu and isolated lines.
Autoreclosers in trunk and spur lines.

SWITCH MODULE

The ACR series use vacuum interrupter elements of AMF type to ensure handling of many high current faults in a fault clearance situation and many normal operations in a dynamic Smart Grid Network.

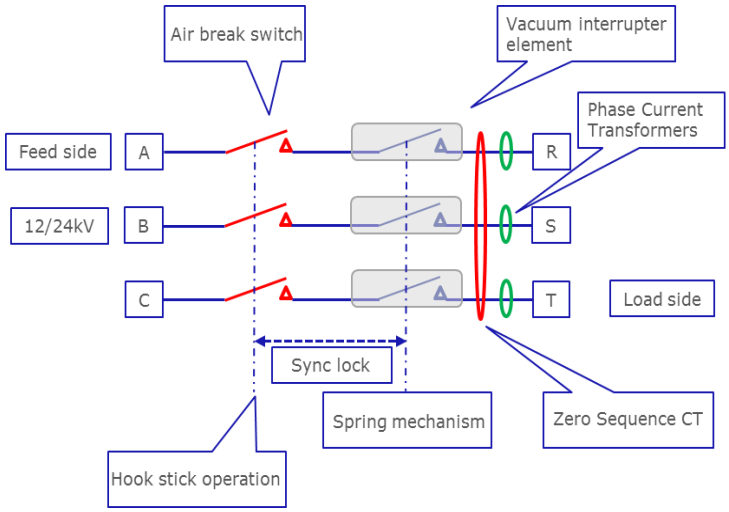
The switch module is normally fitted with a synchronized air break switch for extra operational and personal safety. The air break switch gives visible open points at all phases and can be operated by a hook stick.

The switch module can be tailored with different current transformer arrangements. It can be fitted with only two phase CT's to power an internal electronic circuit and act as a "line fuse". It can be tailored without any CT's as a Time Voltage Sectionaliser to three phase CT's and one core balance CT for extreme low earth current reading and protection.

The switch module is operated by steel springs. The mechanism allows for manual trip and close without any electric power for long and risk free operation.

The status Open/Close of the vacuum interrupters is reflected by a multi cam rotary switch for extra safety. The switch module has a visible mechanical indication of the vacuum interrupters positions. The switch module has an optional mounting frame for easy installation of surge arrestors. To ensure long and maintenance free life of operation, the frame has an integrated filter protecting ventilation and heating system.

AMF type vacuum switch element



The switch module principle

DOWN POLE cabinet

The down pole cabinet (option) contains all the electronics, battery and a temperature compensated battery charger for the sectionalizer or protection relay for the autorecloser. The cabinet has space and power for a communication unit and a lightning protected gland for an antenna or fibre cable. The cabinet can be fitted with 2 x 12V 17AH or 4 x 12V 17AH batteries.

The cabinet is made of 2.0 mm type 2333 thick stainless steel for extra corrosion protection. The size is 400x570x230mm. All metal parts are carefully selected to minimize the risk of electro chemical corrosion in a hazardous outdoor environment.

The connection to the switch head is made via a Harting type heavy duty IP65/NMEA4 connector for easy and safe installation. The auxiliary power is fed into the cabinet via a 20mm cable gland and is installed to a standard cable screw terminal.

The cabinet has an internal filter protected ventilation and heating system to prevent condensation and to give the electronics a long life and a good working environment.

The cabinet can be fitted with a door alarm to notify the main control room personnel when the cabinet door is open.

The door can be locked with a standard pad-lock.

The cabinet is fitted with a rain/sun protection roof and can be fitted with different mounting arrangements for mounting on: walls, wood poles, concrete poles and steel structures.

400x570mm stainless steel cabinet
with FTU-R200 protection relay

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POWER SYSTEM

LOCAL CONTROL with TABLET COMPUTERS and SECURE WIRELESS LAN

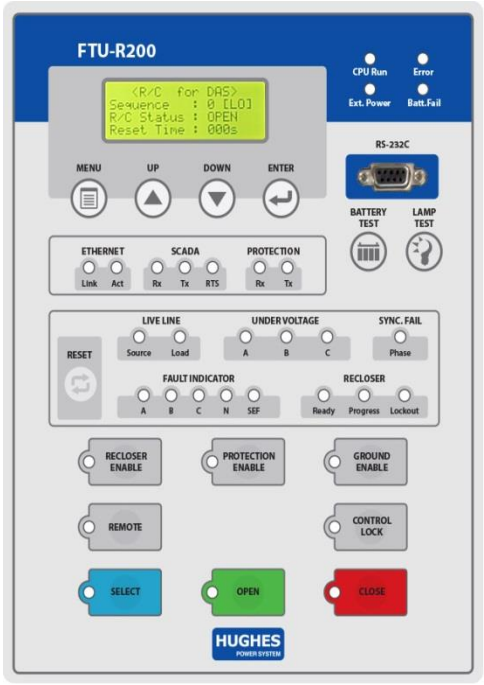
Hughes Protection Relay App is an unique tool for a modern Electrical Utility Linesman. It is used to control and download relay data and voltage/current curves. The App is designed to interface to Hughes FTU-R200 protection relay via a secure WiFi wireless LAN (option). The range of the WiFi device is normally 50 to 100M depending on the surrounding terrain.

The App will automatically connect to the protection relay as soon as the Tablet computer with the Hughes App is in range. It will communicate over a secure WPA2 encrypted wireless radio link. All active actions, such as; Operate the breaker, change relay parameters etc. are secured with an extra password to separate different personnel categories.

PROTECTION RELAY

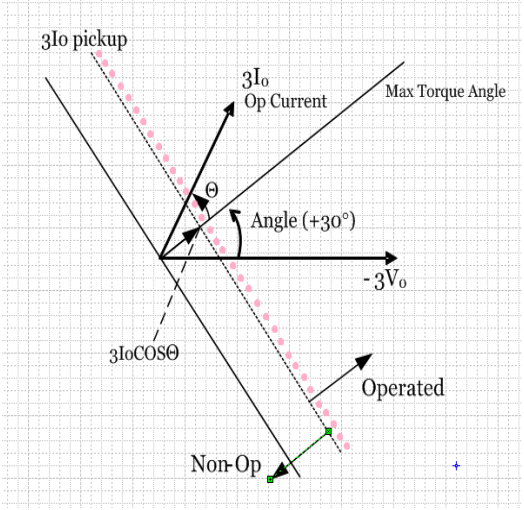
Switch control

- Operator place : Remote, Local (Front Panel/PC Tool)
- Interlocks : Control Lock, Password, Mechanical Lock
- Current Switch status
- Close interlock conditions (Selective) : Live load, Phase sync. fail
- SBO (Select before Operate)
- Secure switch operation
- SBO timeout (settable)
- Auto reclosing
- Recloser On/Off
- Protection On/Off
- Ground protection On/Off
- Battery Test, Reset Indicators



Protection function

- Fault passage indicator
- 3-stage over current protection (directional or non-directional)
- Fast and delayed TC trip elements for phase and earth fault
- 54 types of built-in TC Curves (IEC, ANSI, Recloser curves) and 4 Customized TC Curves
- Definite time over-current element
- Definite time HCT (High Current Trip)
- Negative sequence over-current protection
- SEF (Sensitive earth fault) detection 3Io
- Cos/sin detection
- Adjustable protection zone –+30 – 90 degrees
- Cold load protection (pickup adjustment)
- Magnetizing inrush restraints
- Sequence coordination
- Open line detection
- Phase sync. fail detection
- Over voltage, under voltage, under /over frequency
- Auto reclosing (up to 4 shots) Operated
- Auto sectionalizing
- 4 setting groups, automatic setting group change depending on power flow

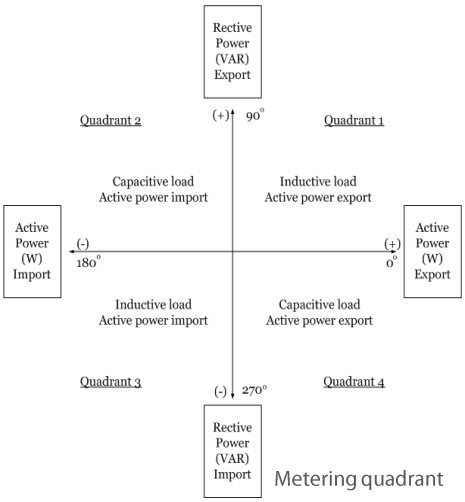


Protection principe

PROTECTION RELAY

Metering

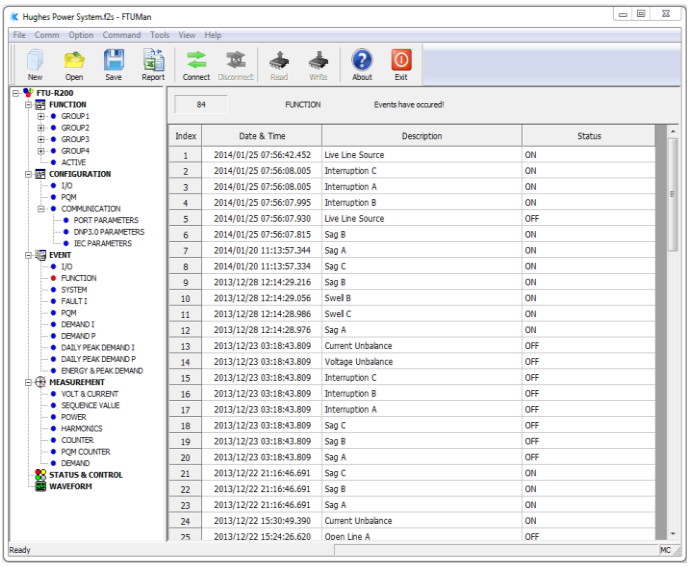
- 128 Samples per cycle
- Galvanic isolation through Aux. CT & Aux. PT
- Secondary of 1000:1 CT ~ 12.5A > 12.5kA in short circuit current
- Up to 200% of rated input voltage
- Currents (A,B,C,N), Voltages (A,B,C/R,S,T) : RMS, Phasors, Sequence components, Harmonics
- Power : Apparent (kVA), Active (kW), Reactive (kVar), Power factor
- Energy : 4-quadrant metering, import / export active energy, inductive / capacitive reactive energy.
- Frequency
- Demand Profile
- Report value by dead band



Metering quadrant

Event / Fault log

- SOEs are stored on non-volatile memory with 1ms time-stamp
- Event history buffers are categorized by group
  - ✓ I/O Events, Function Events, System Events
  - ✓ Fault current Events
  - ✓ PQM Events
  - ✓ Demand I,P,Q
  - ✓ Daily Max. I,P,Q
  - ✓ Counter : Switch open, Fault, Restart



Event /Fault log

- Fault waveform recording
  - ✓ 8 faults, 6 PQM waveforms can be stored on non-volatile memory
  - ✓ 1 Manual triggered waveform
  - ✓ 128 samples/cycle, 20 cycles
  - ✓ Waveforms are stored as COMTRADE file format through PC maintenance software
  - ✓ Memory size : 2 Mbytes

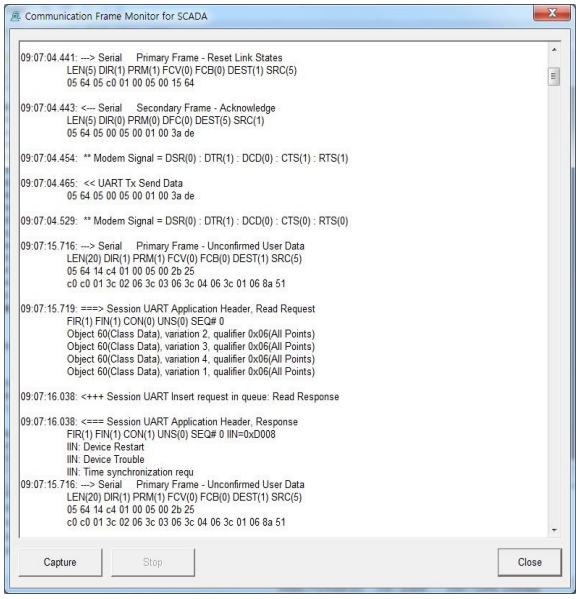
PROTECTION RELAY

Communication

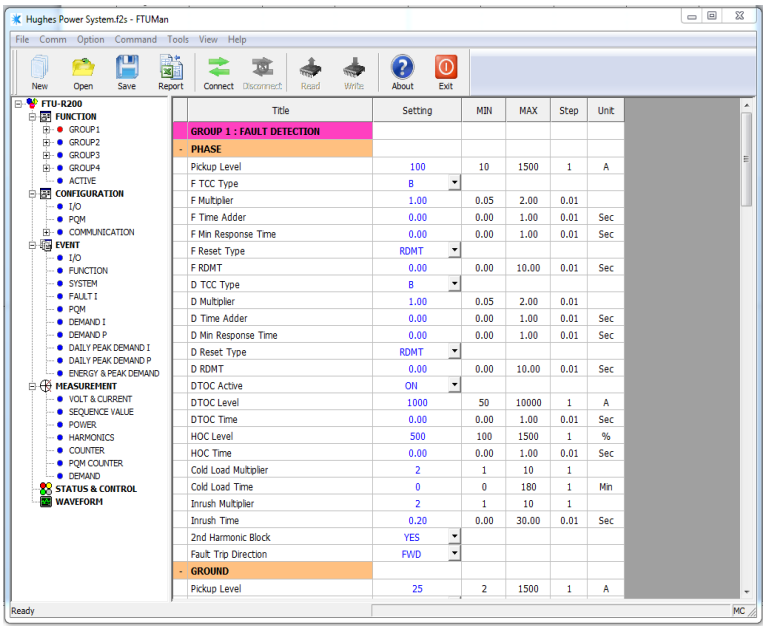
- Supports DNP3.0 Subset level 3, DNP over TCP/IP
- IEC60870-5-101, IEC60870-5-104 TCP/IP
- MODBUS RTU TCP/IP
- Index mapping & class assignment
- SMS to Cell phone
- Unsolicited Dial-Up
- Built-in protocol monitor

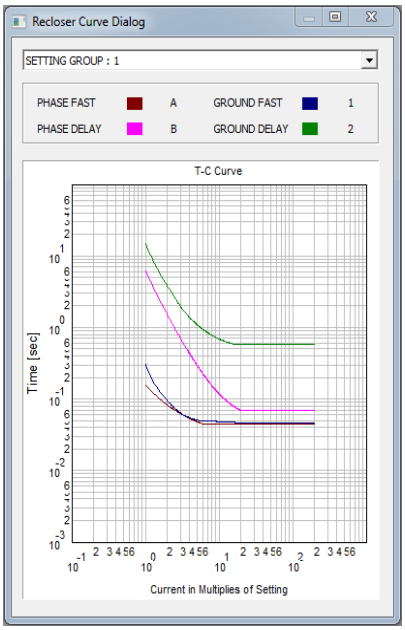
Power Quality Monitoring

- Sag, Swell, Interruption Detection
  - ✓ Status
  - ✓ Events : Time-stamp, Magnitude, Duration
  - ✓ Counters : Statistics for each phase, duration classified by IEEE 1159.
  - ✓ Accumulated interruption time
  - ✓ Waveform recording on events
- Harmonics
  - ✓ THD (Total harmonic distortion)
  - ✓ Each components up to 31th harmonics
  - ✓ Events by threshold setting, Counter



Communication monitor



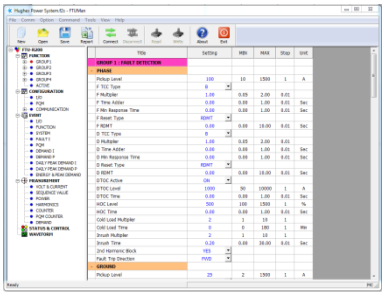


Protection curves

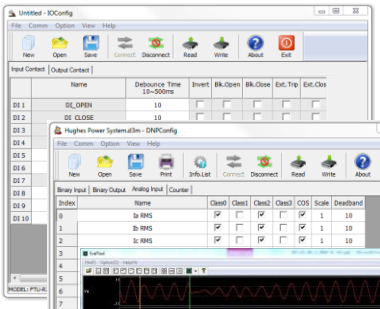
PROTECTION RELAY

Maintenance software structure

Read/Write



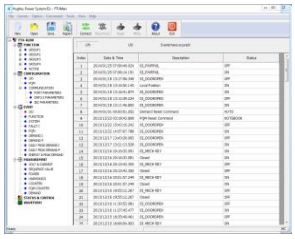
Configuring



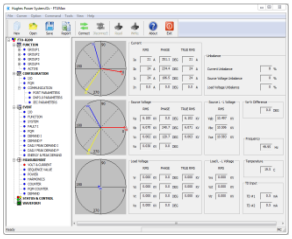
I/O configuring

Protocol configuring

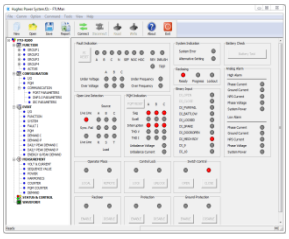
Wave form analyse tool



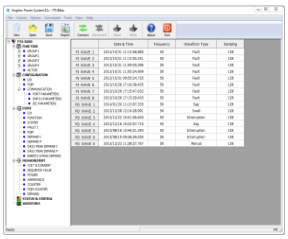
Log



Metering



Status



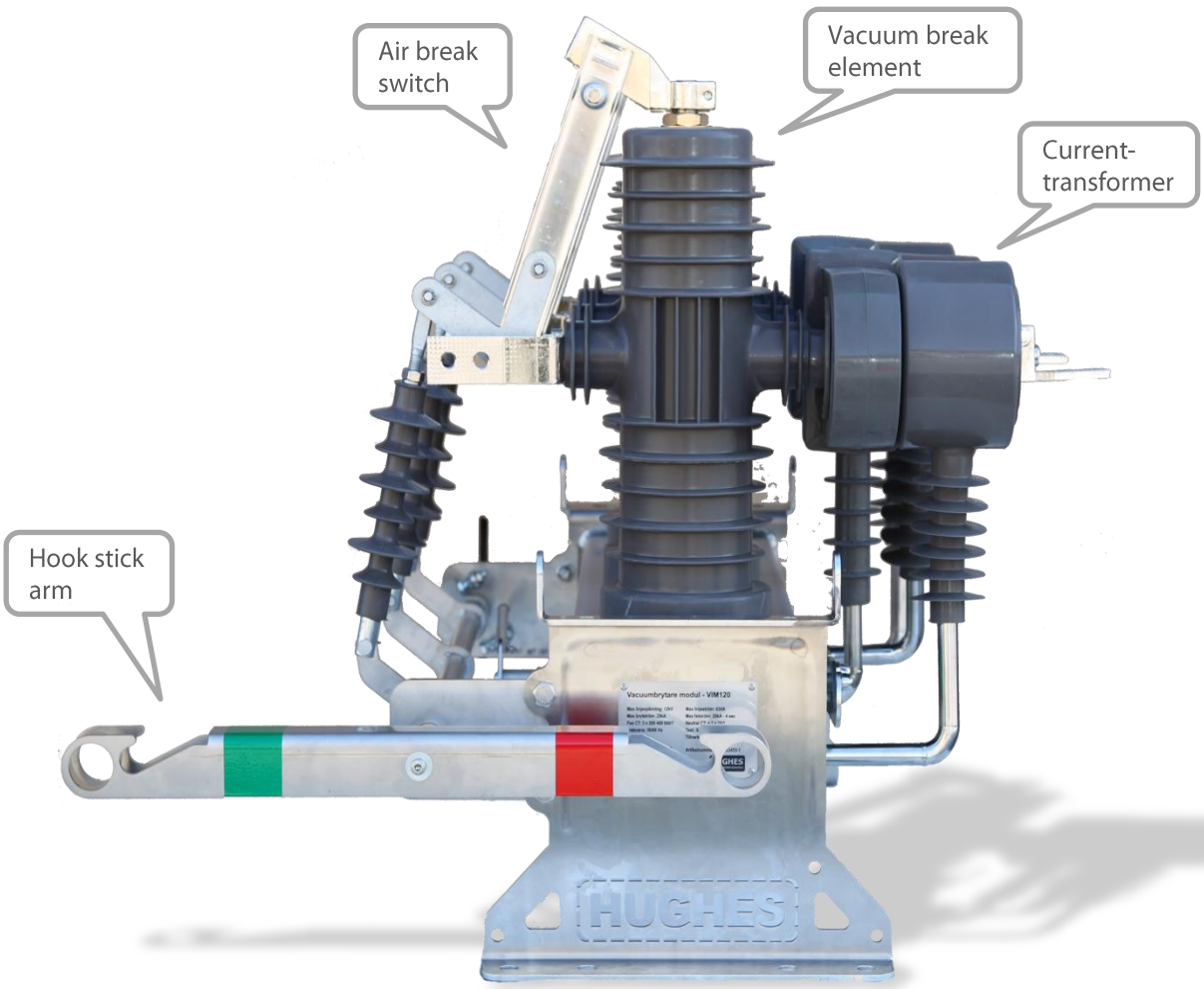
Wave forms

MECHANICS

The VIM series of switch module components are mainly made out of 2333 type stainless steel, plated copper, hot dip galvanized mild steel, epoxy and silicone rubber. All metals are carefully selected to avoid electro chemical corrosion as well as for a long problem free operation.

The bushings has a core of epoxy and have an extra layer of silicone to protect from UV light and mechanical stress during installation and vandalism.

The switch frame has a synchronized air break switch mounted on the feed side for visible open points of all three phases. This feature gives extra operational and personal safety. The air break switch is operated by a hook stick or via an operating rod with a handle down at the pole.



HUGHES POWER SYSTEM

VACUUM INTERRUPTER MODULE (VIM) building blocks

The VIM series of switch module components are a modular building system for easy tailored switches for different qualified solutions. The base is a Vacuum Interrupter Module as can take a multiple selection of options. The Air break Switch option and Earth Switch option can not be combined on the same VIM.

AIRBREAK SWITCH

The air break switch gives visible open points of all three phases for extra safety. The air break switch is synchronised with the vacuum interrupter and can not be open or closed when the vacuum interrupter is closed.

EARTH SWITCH

The earth switch is synchronised with the vacuum interrupter and can not be closed when the vacuum interrupter is closed.

PHASE CURRENT TRANSFORMERS

The Vacuum Interrupter module can be fitted with a combination of two or three phase current transformers with different winding ratios and with multiple tappings. It can also be supplied without phase current transformers.

COREBALANCE CURRENT TRANSFORMER

An addition to the phase current transformers is the core balance current transformer to measure and detect extreme low earth currents. It is suitable for all networks with isolated neutral point.
This solution gives a secure detection of extreme low earth currents as the CCT unit combines all three phases in one winding.

Description	ACR 120	ACR 120	ACR 240	ACR 240
Rated maximum voltage	12/15kV	12/15kV	24/27kV	24/27kV
Rated basic impulse level, P>P	85kV	85kV	145kV	145kV
Rated basic impulse level, P>E	75kV	75kV	125kV	125kV
Power frequency withstand, Dry	50kV	50kV	65kV	65kV
Power frequency withstand, Wet	45kV	45kV	79kV	79kV

Description	12/15kV	12/15kV	24/27kV	24/27kV
Rated continuous current	630A	1250A	630A	1250A
Rated fault breaking current	20kA	31.5kA	20kA	25kA
Rated fault making current	50kA	50kA	50kA	63kA
Cable charging current	30A	35A	30A	35A
Line charging current	10A	25A	10A	25A
Rated fault duration time	4s	4s	4s	4s
Contact resistance, VCB	< 35μΩ	< 35μΩ	< 35μΩ	< 35μΩ
Contact resistance, ABI	< 60μΩ	< 60μΩ	< 65μΩ	< 65μΩ
Network frequency	50/60Hz	50/60Hz	50/60Hz	50/60Hz

Description	Winding 1	Winding 2	Winding3
Phase CT type 1	200/1	400/1	600/1
Phase CT type 2	75/1	100/1	150/1
Phase CT type 3	50/1	100/1	150/1
Core balance CT (12kV)	20/1		

Description				
Design min mechanical/electrical	20.000	20.000	20.000	20.000
Mass (weight) without air break switch – kg	75	75	90	90
Mass (weight) with air break switch – kg	98	98	120	120

Description				
Ambient temperature C (F)	-45 - +70C	(-49 - + 158F)	-45 - +70C	(-49 - + 158F)
Humidity	100% at 25C	100% at 25C	100% at 25C	100% at 25C
Bushing type	Epoxy core with silicone surface			
Creep distance to ground(air break switch isolator)	400mm	400mm	800mm	800mm
Creep distance to ground,(interrupter isolator)	650mm	650mm	1250mm	1250mm
Max installation altitude at rated BIL	3000M	3000M	3000M	3000M

Description				
Rated operation voltage	220VAC	110VDC	48VDC	24VDC
Rated power	40W	40W	40W	40W
Design specification	IEC 62271-111			
Marking specification	IEEE std C37.60			
Operational sequence, no charge :	30ms per operation			

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Specializes in the research and development, manufacture of low and medium voltage switchgear assemblies, autorecloser and low loss transformer products for the electrical utility industry.

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