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The COMP Series

Towards smarter switchboards

LARSEN & TOUBRO

ABOUT L&T

Larsen & Toubro is India's leading engineering, construction and manufacturing organisations, a technology-driven company that infuses engineering with imagination.

L&T's Electrical & Automation Group offers a wide range of advanced solutions through its state-of-the-art technology and systems. Backed by world-class in-house capabilities in technology development and customer support, L&T's products and systems are geared to offer complete customer satisfaction.

ABOUT COMP Relays

L&T offers an extensive range of Control Metering Protection (COMP) relays – a complete industrial package for Electrical Protection, Control, Metering Electrical Parameters and Monitoring Fault data of Air, Vacuum or Gas-Insulated Circuit breaker operated feeders in Medium and Low Voltage Switchgear assemblies.

FCOMP
Feeder Control Metering Protection, for Incomer & Outgoing feeder

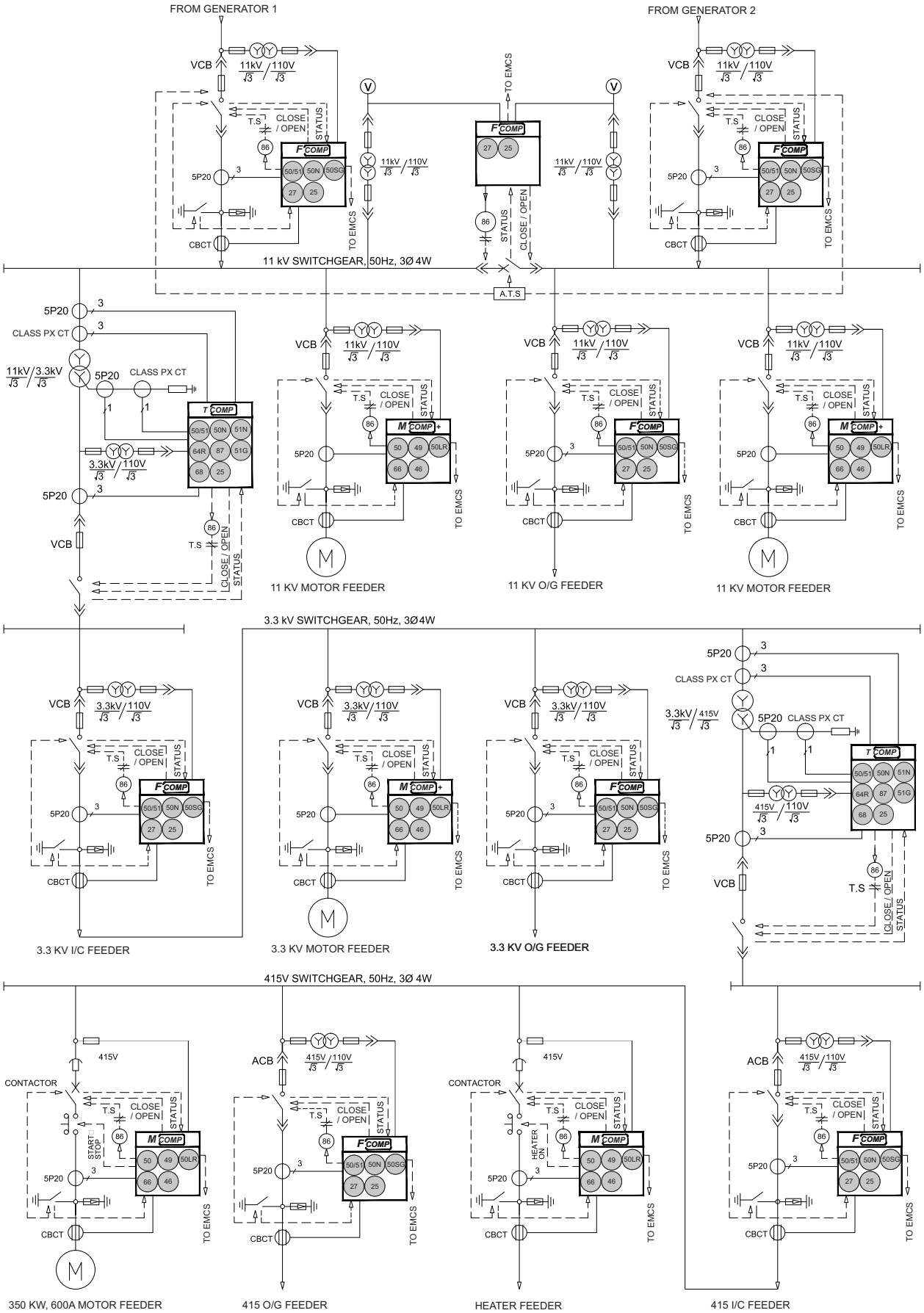
MCOMP+
Advanced Motor Control Metering Protection, for Motor Feeder

TCOMP
Transformer Control Metering Protection, for Transformer Feeder

The COMP series combines conventional and advanced protection functions, annunciation, metering, monitoring and communication into one, easy-to-configure module.

It incorporates a versatile overlay with a large colour display, numerical keypad, 18 user-configurable LEDs and 6 pushbuttons that make the device user-friendly.

APPLICATION OF COMP FAMILY IN POWER SYSTEM



PNO certified Profibus. IEC 61850 edition-2 compliant
In compliance with IP65 and IP20

Conformally coated PCBs are resistive to corrosive environment Unsurpassed protection of cables, wires, motors and transformers

A complete solution for feeder, motor and transformer management

Highy modular COMPLogic reduces the hardwiring required for complex schemes

Equipped with standard industrial communication protocols like Modbus TCP/IP, IEC 61850, Profibus, for efficient control & monitoring

Daisy chain connection in Modbus TCP/IP makes the DCS /SCADA cost-effective

ABOUT COMP Relays

With its rugged, scalable and modular hardware, comprehensive protection features, extensive communication protocols, built-in metering, real-time monitoring, user-friendly HMI, the COMP series provides an effective integrated solution to electrical systems.

The relay is designed with conformal coating on its hardware making it suitable for installation in dusty and corrosive environment, such as process industries and petrochemical complexes. This ensures that product operation does not require a conditioned operation as a pre-requisite.

USER-FRIENDLY OPTIONS AND FEATURES

Modular design

Modularity ensures ease of configuration. Common form factor and hardware bolster ease of maintenance, user-familiarity and spare part handling. The basic module includes current protection and MODBUS RTU communication. The user can select from a wide offering of optional features that include voltage protection, additional IO and communications.

Universal Operating Environment

Power supply range of 80 – 264 VAC / 110 – 250 VDC. It operates at industry's ambient temperature range from -20^{0}C to 70^{0}C. Storage temperature range is from -40^{0}C to 85^{0}C.

Protection Features

Features current based protections extended to voltage-based protections built in a single unit with multiple stages in each protection type and four protection set groups, which cater to the need of switching of stages/groups with varying fault intensities/variable load demands.

Communication

The extensive range of standard industrial communication protocols includes Modbus RTU, Modbus TCPIP, Profibus, IEC 61850 protocol featured with Dual RS-485 Serial, USB & Ethernet (copper & fibre) port options complying to the modern communication architecture requirements.

Detailed Fault Analysis

Intricate analysis of faults can be facilitated by a bank of 1024 event records with 1 ms resolution, 64 oscillographic records with user-selectable 128 / 64 / 32 samples/cycle, and a 16-channel data recorder.

COMPfigurator

User-friendly interface software COMPfigurator features device configuration, communication settings, protection settings, Online Metering & monitoring, Fault analysis, Event recording and Disturbance recording, COMPLogic. It allows both online and offline creation of setting files and uploading and downloading from the relay. COMPLogic function allows the user to build a equation using gate logic, latches, timers.

Highly scalable IO

Universal control supply range of 24 – 48 VDC or 110 / 220 VAC/VDC and a default configuration of 2DI/2DO – compassed up to 29DI/23DO in the same unit itself. Relay has optional RTD / PTC inputs and Analog IO.

Built-in Metering

Includes RMS, fundamental, minimum & maximum values of three-phase, neutral & ground current and three-phase voltages & phase to phase voltages, frequency, power, energy, power factor, harmonics and temperature.

PRODUCT CONFIGURATION

Features	FCOMP	MCOMP+	TCOMP	MCOMP
Protections				
High impedance motor differential		O		
Low impedance motor differential		O		
Transformer differential			O	
High impedance REF			O	
Low impedance REF			O	
Phase overcurrent	✓	✓	✓	✓
Neutral overcurrent	✓	✓	✓	✓
Ground overcurrent	✓	✓	✓	
Sensitive ground overcurrent	✓	✓		✓
Negative sequence overcurrent	✓	✓	✓	✓
Undercurrent	✓	✓	✓	✓
Directional Phase overcurrent	O		O	
Directional Ground overcurrent	O		O	
Directional Neutral overcurrent	O		O	
Thermal Overload	✓	✓	✓	✓
Phase Overvoltage	O	O	O	✓
Phase sequence monitoring	✓	✓	✓	✓
Residual Overvoltage	O		O	
Undervoltage	O	O	O	✓
Non-directional Power	O	O	O	
Directional Power	O		O	
Power factor	O			
Frequency	O	O	O	✓
Frequency gradient	O	O	O	
Inrush restraint	✓		✓	
Overexcitation			✓	
Load jam		✓		
Locked rotor protection		✓		✓
Excessive start time		✓		✓
Ancillary Functions				
Max. starts per hour		✓		✓
Anti-backspin timer		✓		
Re-acceleration		✓		✓
Synchronism check & Synchronizing	✓			
Emergency Start		✓		
Input/Output Options				
Digital Inputs & Outputs(basic model)	2/2	2/2	2/2	6/4
Digital Inputs & Outputs (Add-on)	i	i	i	e
Current inputs	5	7	7	e
Voltage inputs	O	O	O	✓
Sync voltage inputs	O			
RTD/PTC inputs	O	O	O	O
Analog Input & outputs	O	O	O	✓(Output only)
Communication Protocol				
Modbus RTU	✓	✓	✓	✓
Modbus TCP/IP	✓	✓	✓	O
Profibus	O	O	O	O
IEC 61850	O	O	O	
Front port (USB)	✓	✓	✓	✓

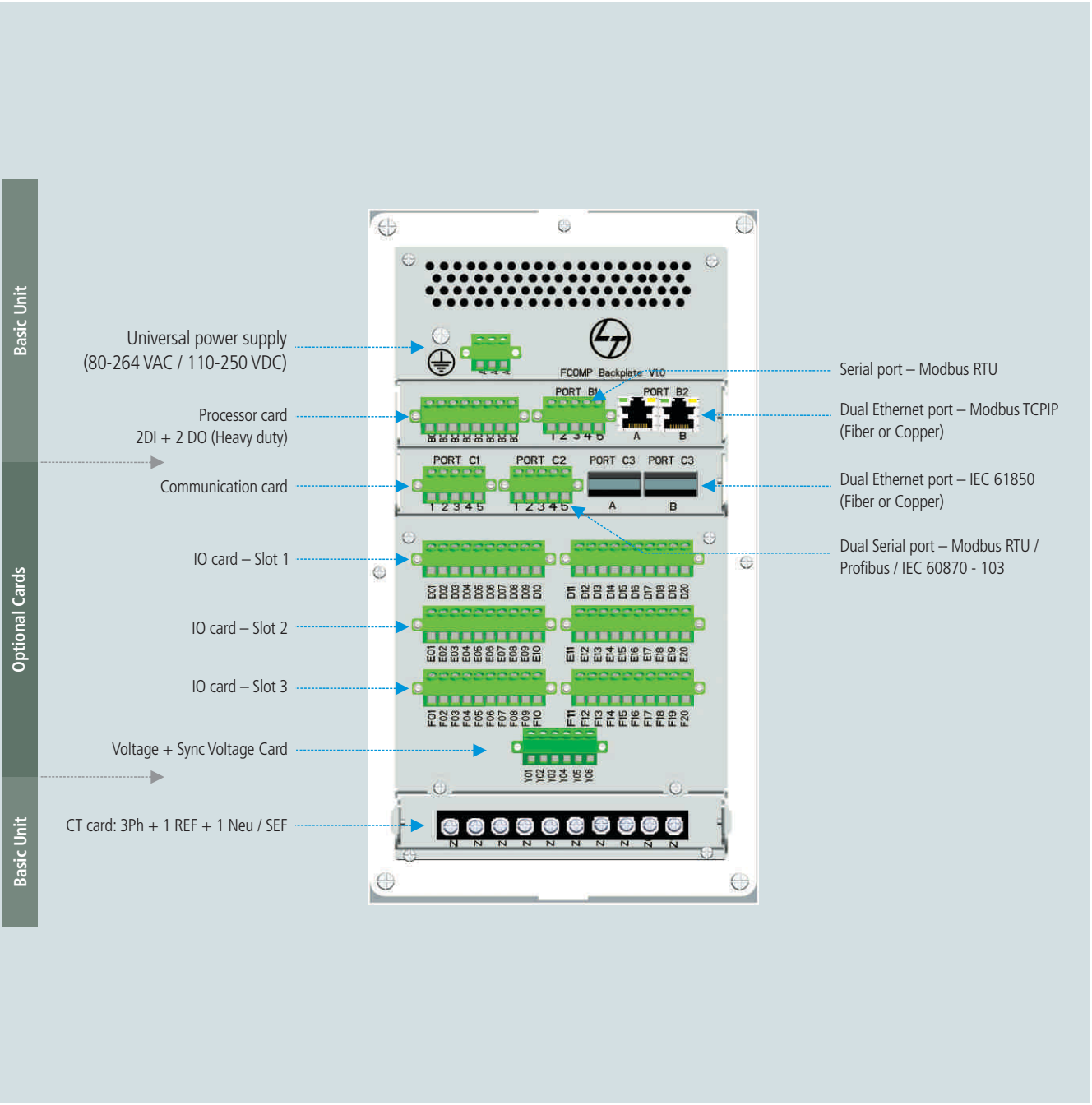
✓= Available by Default I O = Optional I i = Add-on inside the main module. I e = External to the main module.

CONFIGURATION

Front Panel: 5" LCD, 6 Nos. of Configurable Pushbuttons, 12 Nos. of Configurable LEDs, USB communication Port

Basic Unit: Power Supply, 2 DI + 2 DO, Modbus RTU, 1Amp / 5 Amp Phase CT + REF + Neu / SEF

Optional Unit: 3 slots for add-on IO, Voltage Input, Dual Modbus RTU, Dual Modbus TCP/IP, Profibus, Dual IEC 61850



**Note:
(1) MCOMP+: 3 Phase CTs + 1 Neutral CT + 3 Differential CTs (High Impedance Differential)
(2) TCOMP: 3 Phase CTs + 3 Phase CTs + 1 REF CT (Low Impedance Differential)

IO OPTIONS

Digital Input Output Card variants:

- 7 Digital input + 2 Digital output (Form C**)
- 4 Digital input + 2 Digital output (Form C) + 3 Digital output (Form A*)
- 9 Digital input
- 6 Digital input + 2 Digital output (Form C) + 1 Digital Output (Form A)
- 6 Digital output (Form C) + 1 Digital output (Form A)

Analog Input Output Card / RTD/PTC card variants:

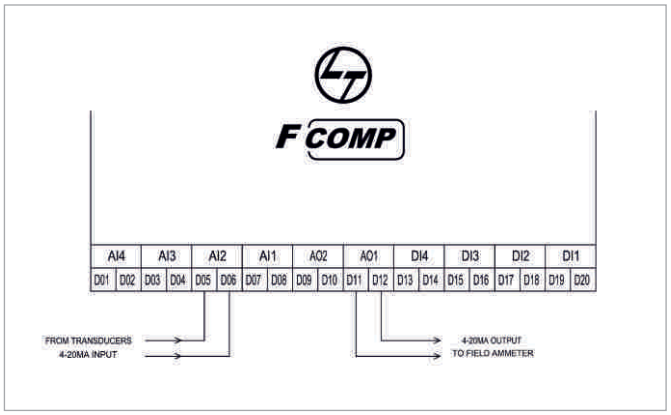
- 3 Analog input + 2 Analog output + 5 DI (230/110 V AC/DC)
- 6 Channel RTD/PTC + 4 DI (230/110 V AC/DC)
- 10 Channel RTD/PTC

Specifications:

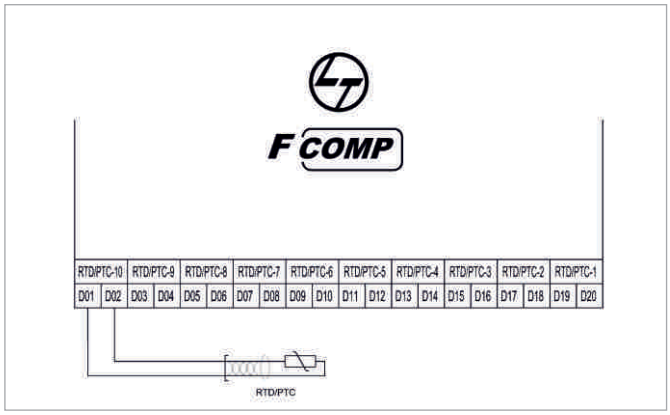
- Input voltage option in DI:24–48 VDC or 110 VAC/VDC or 230 VAC/VDC (Selectable thru COMPfigurator)
- Output contact rating of DO:8A at 250VAC and 5A at 30VDC, 0.2A at 100VDC Maximum operating rating (AC): 2000VA
- Input Option in AI: (+) 10 V or (+) 20 mA input 2 wire PT100 input, 0 - 2500C

Note:
*Form A: Two point contact – Common and NO (Normally Open)
**Form C: Three point contact – Common, NO and NC (Normally Closed)

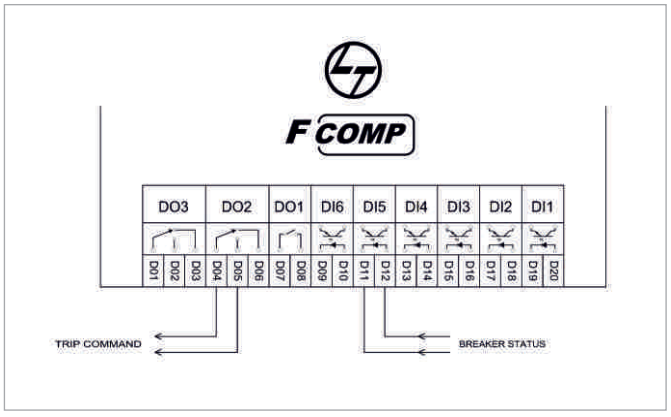
AIO connection wiring diagram



RTD/PTC connection wiring diagram



DIO connection Wiring Diagram



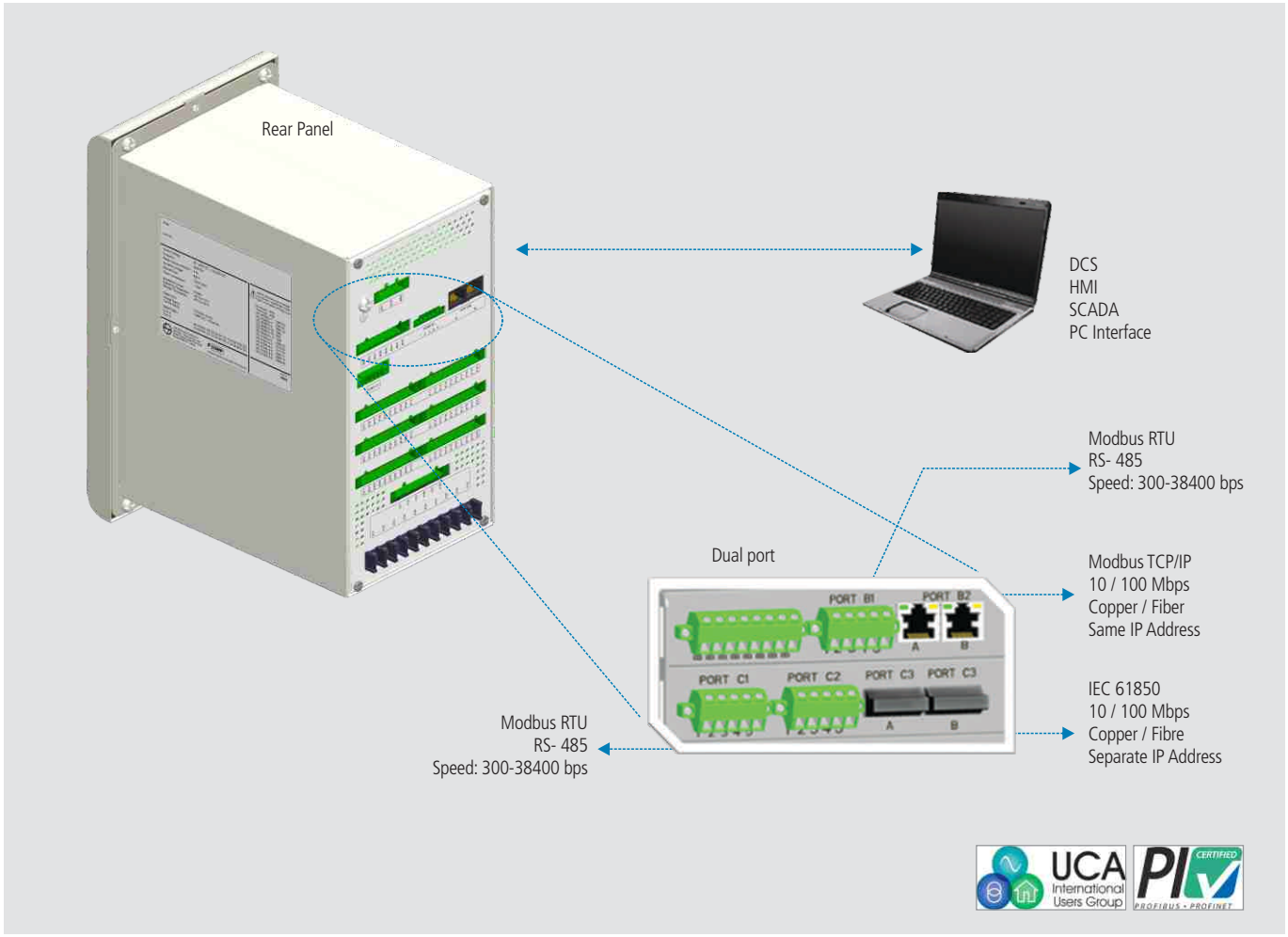
COMMUNICATION

The relay consists of multiple ports for communication. The front port is the local configuration utilized to communicate with COMPfigurator. This communication is carried out on Modbus RTU protocol. The rear ports are to communicate with the system on a higher level, such as EWS/DCS/SCADA. In this case, communication is carried out on Modbus RTU, Modbus TCP/IP, Profibus/IEC 60870-103, IEC 61850 protocols.

Communication interface is the physical connection on a device. Once the physical connection is established, the relay communicates with the master on a protocol.

Communication Interface	Protocol	Connector Type	Location
Serial	Modbus RTU	USB	Front
Serial	Modbus RTU	RS 485, 5-Pin Screw terminal	Rear - CPU card
Serial 5-Pin screw	Profibus / Modbus	1 no. 9-Pin D Connector / Dual Rs-485, 5-Pin screw terminals	Rear - COMM
Ethernet	Modbus TCPIP	Dual RJ45/1 no.	Rear - CPU card
Ethernet	IEC 61850	FODual RJ45/ Dual FO	Rear - COMM card

**Note:
(1) The communication protocol and interface port in the relay will depend on the selection of Relay configuration at the time of ordering the relay.
(2) USB (on relay front) and RS 485, Dual RJ45/Single FO (on relay processor card) ports are the types of configuration ports available in basic relay unit.



METERING

METERING	SPECIFICATIONS			
Current	**Phase & Neutral CT** **In (Nominal current) 1A** Rated Range: 0.02–20.00 A Continuous Rating: 4 A 1 Second Thermal: 100 A **In (Nominal current) 5A** Rated Range: 0.1–100.00 A Continuous Rating: 20 A 1 Second Thermal: 500 A	**REF CT** **In (Nominal current)1A** Rated Range: 0.02–1 A Continuous Rating: 1 A 1 Second Thermal: 2 A **In (Nominal current) 5A** Rated Range: 0.1–6 A Continuous Rating: 5 A 1 Second Thermal: 10 A	**SEF CT** Rated Range : 2.5mA–1.6A Continuous Rating: 1 A 1 Second Thermal: 10 A	Measurement Range: 0 to 20 In Accuracy: ± 0.25% of reading REF Current: ±1 % Ig using CBCT: 1% Instantaneous demand current: Yes Max/Min demand current: Yes Avg value of all 3 phase current: Yes Rated Frequency: 50 / 60 + 5 Hz
Voltage	Rated Continuous Voltage: 300 Vac 10 Second Thermal: 600 Vac Rated Frequency: 50/60 ±5 Hz	Phase to phase – RMS, Max and Average Phase to N - RMS, Max and Average	Range: 0.1 – 2 · VNOM Accuracy: 0.5% of reading Max/Min voltage : Yes Avg voltage : Yes	
Power / Energy	Phase-wise & total Active, Re-active & Apparent power / Energy Accuracy :1%			
Power Factor	Phase-wise & total Range: +1 to -1(Lag to Lead) Resolution: 0.01 Accuracy : ± 2% of Reading			
Harmonics	Harmonics measurement up to: 25th component Current & Voltage Harmonics THD measurement			
Freq	Range: 40 to 70 Hz Accuracy :± 0.01Hz			
Temp	Measurement Range : 0° to +250° C RTD protection (Optional PTC available)			
Sequence	Voltage and Current (Positive, Negative and Zero Sequence Components) - Accuracy : 1%			

MONITORING

Oscillography

Oscillography capture waveforms of preset relay data at a predefined sampling rate and the trigger point which defines the pre-trigger post-fault recording.

8 configurable channels for analog or digital signals with 32 configurable trigger causes for recording

Total No. of Records: 64 records with 8 channels each.

Oscillography sampling rate: 16 cycles / 32 cycles (64 Samples per cycle), 64 cycles / 128 cycles (32 samples per cycle)

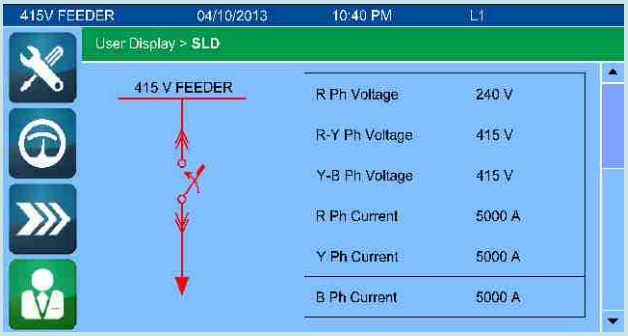
Event record

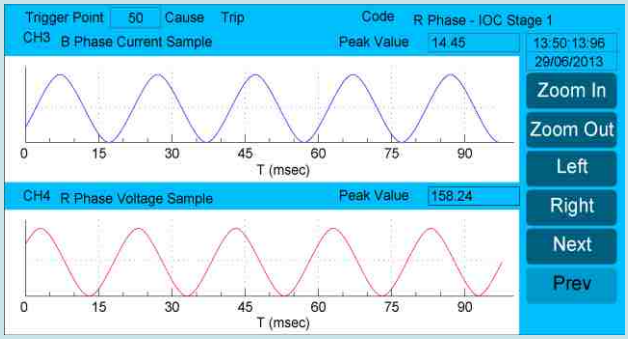
Relay can record events on any change in status of protection elements and digital, analog or contact inputs. It can be programmed to record trip and alarm events. It incorporates 32 configurable trigger causes for event recording. It also displays the value of 8 configurable analog and digital parameters recorded at the time of event in event log detail.

Maximum of 1024 events can be stored in relay and can be viewed through COMPfigurator. The last 20 event records are available on the relay display.

Data recorder

It records various analog data like energy, demand, current, voltage, etc. at pre-defined data logging rate. This feature is very useful to monitor the daily load demand and consumption. COMPfigurator provides the graphical plot of the recorded data.





COMPfigurator

The COMPfigurator is specialised software designed to interface with COMP Relays.
COMPfigurator provides flexibility to the user to work in online mode (relay connected) or offline (Relay disconnected) mode. Through COMPfigurator, the user can meter relay parameters, monitor fault data, control input outputs, configure protection settings and gate logic, maintain and troubleshoot the operation of relay functions. The user-friendly parameterization and online monitoring are the highlights of this software.

With COMPfigurator, the user can:

Meter Actual Value: Phase Voltages, Phase, Ground & Neutral current, Frequency, Phase Sequence, Current & Voltage Harmonics, and Current Demand & Parameters related to Power and Energy

Modify the Settings: System, security, communication and protection settings.

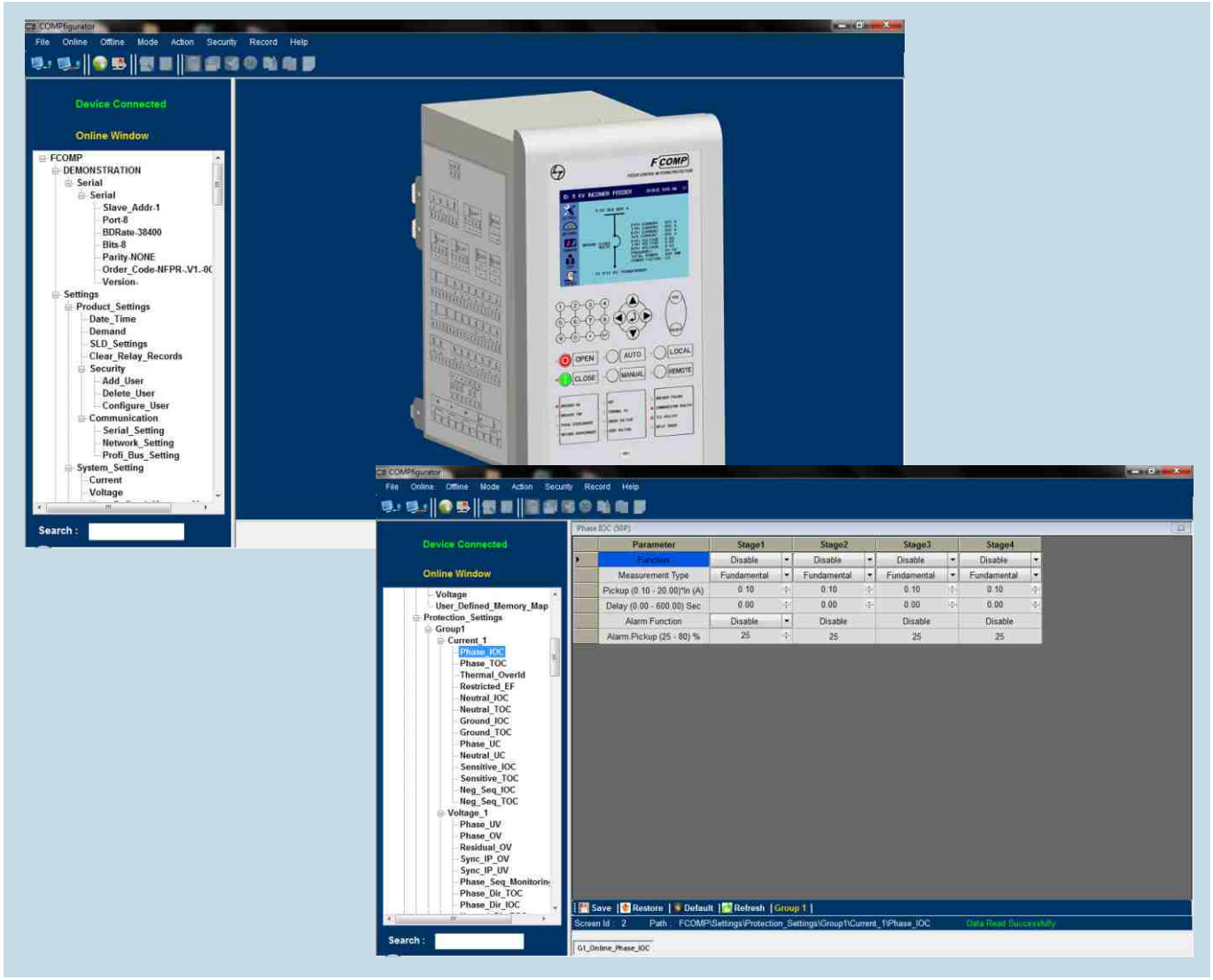
View Actual Status: Input/output status of relay.

View Event Log: Recent 1024 trip records and causes for the trip.

Create COMPlogic Equation: The user can create or edit COMPlogic equation according to the required output.

Study Oscillography: It is possible to check the current and voltage signal waveform at the time of trip, which is stored in the event log using oscillographic view.

In offline mode, setting files can be created and saved for any future use, without connecting the relay. At any instant, the user can download the setting for the connected relay. In online mode, the user can communicate with the relay, which can be programmed for required settings in real-time.



COMPLogic

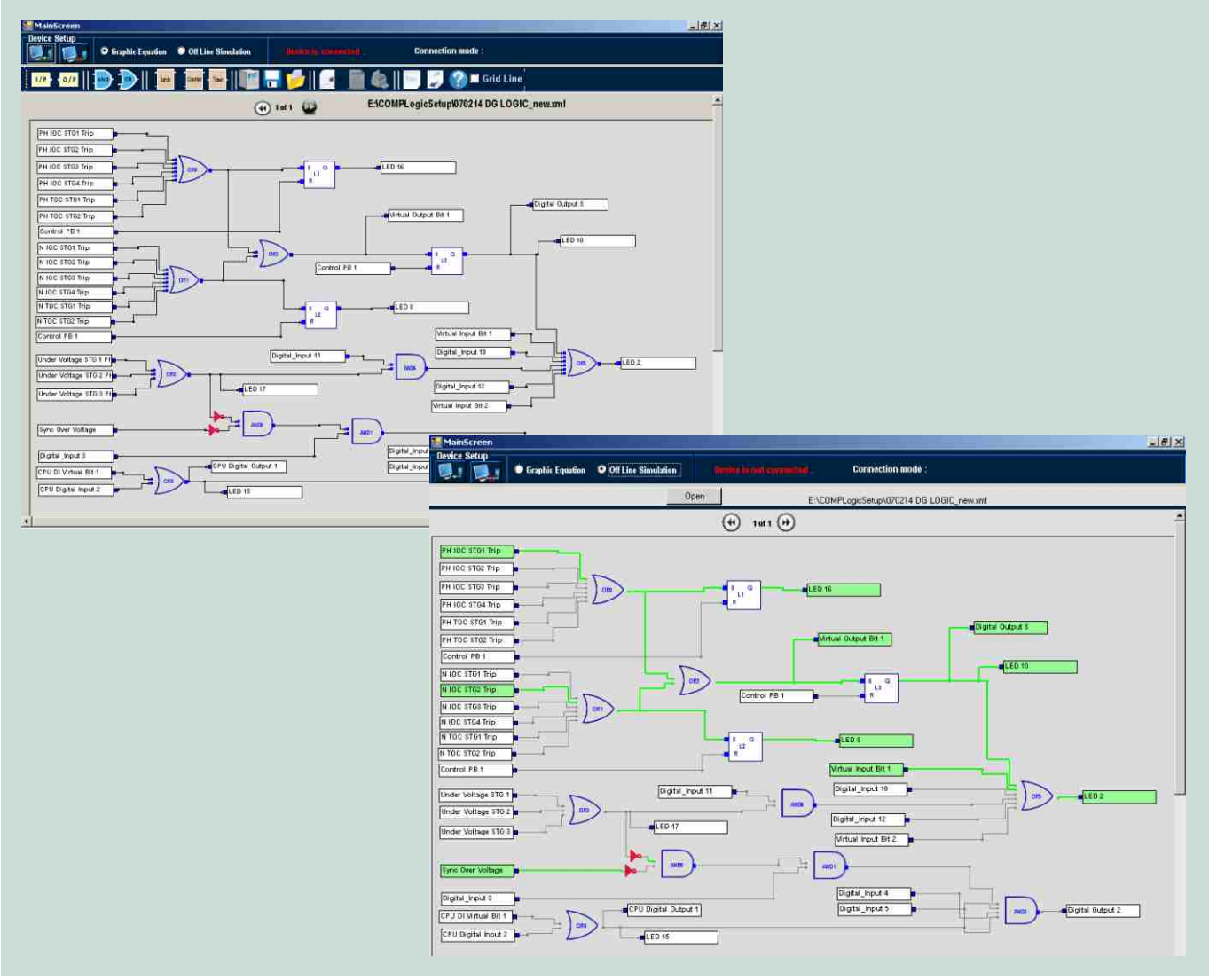
COMPLogic provides flexibility to the user to design the programmable logic using different input and output elements (operands) with basic AND, OR and NOT gates (operators). For complex logic functions, other operators such as Timers, Latches, Up/Down Counters can be utilised, along with the logic gates.

COMPLogic includes:

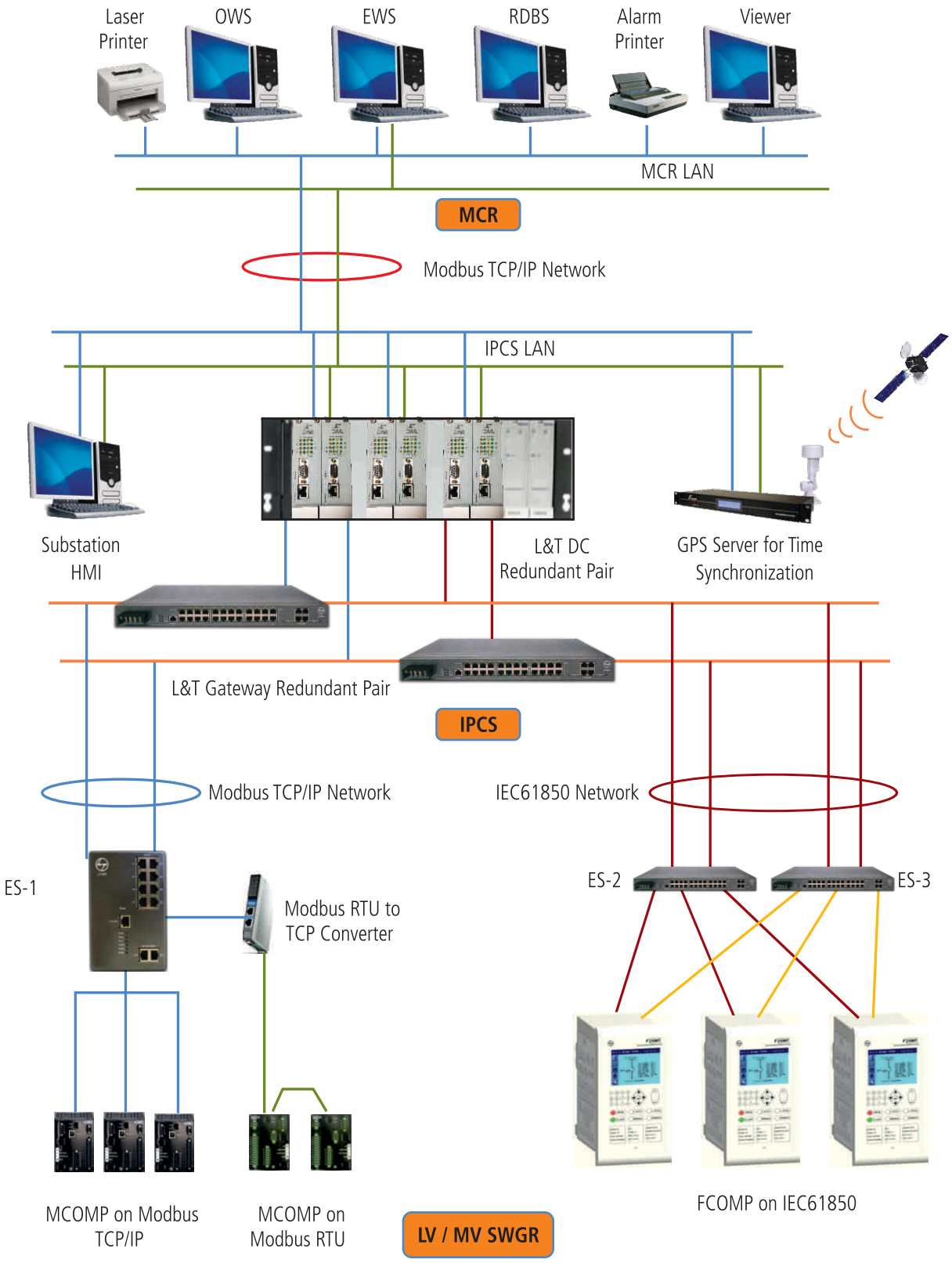
- COMPLogic Gates: Basic Logic Gates (AND, OR, NOT)
- COMPLogic Editor: To develop and edit COMPlogic equation
- COMPLogic Timer: To set pickup delay and dropout time for timers
- COMPLogic Counter: To set Up and Down counters
- COMPLogic Elements: To edit settings for COMPlogic elements such as pickup delay, hysteresis, direction type, reset delay, etc.
- Non-volatile Latches: Non-volatile latches are used to hold the output of the equation as per the requirement
- Drag & Drop: This feature provides flexibility to the user to design the logic and also provides online monitoring function to ensure correctness and proper functionality of the logic.

Logic gate operation of inputs, Arithmetic Operation (Addition, Subtraction, Comparison) of analog values, Timed delayed operation of Output or LEDs, Latched Operation of Output or LEDs are possible to configure through COMPLogic.

It provides graphical representation of the total logic diagram.

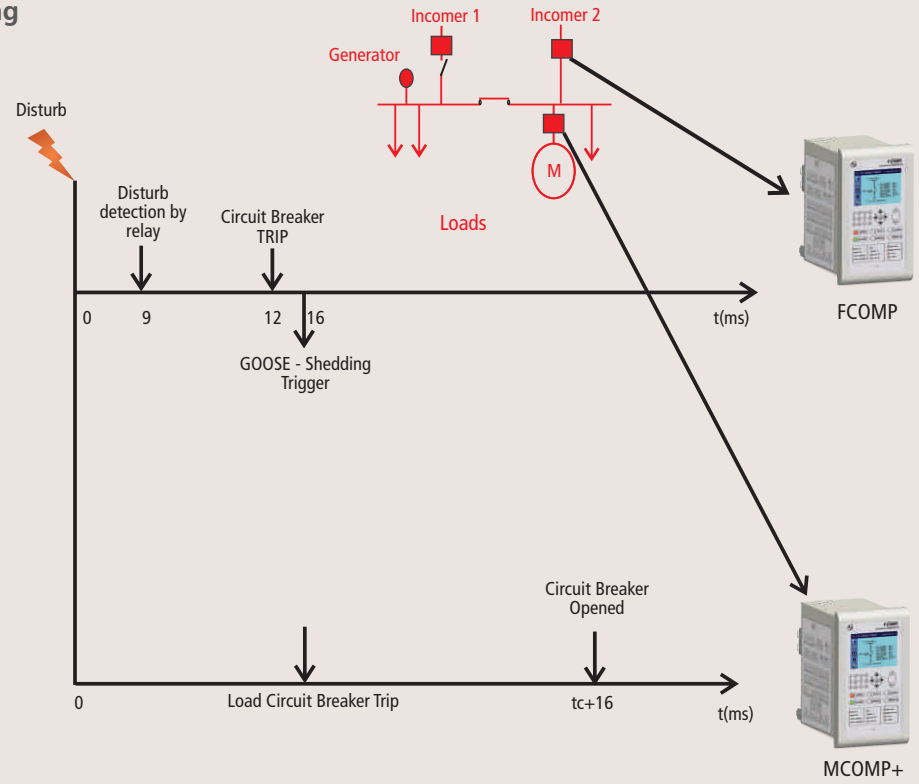


COMP RELAYS IN SUBSTATION AUTOMATION SYSTEM

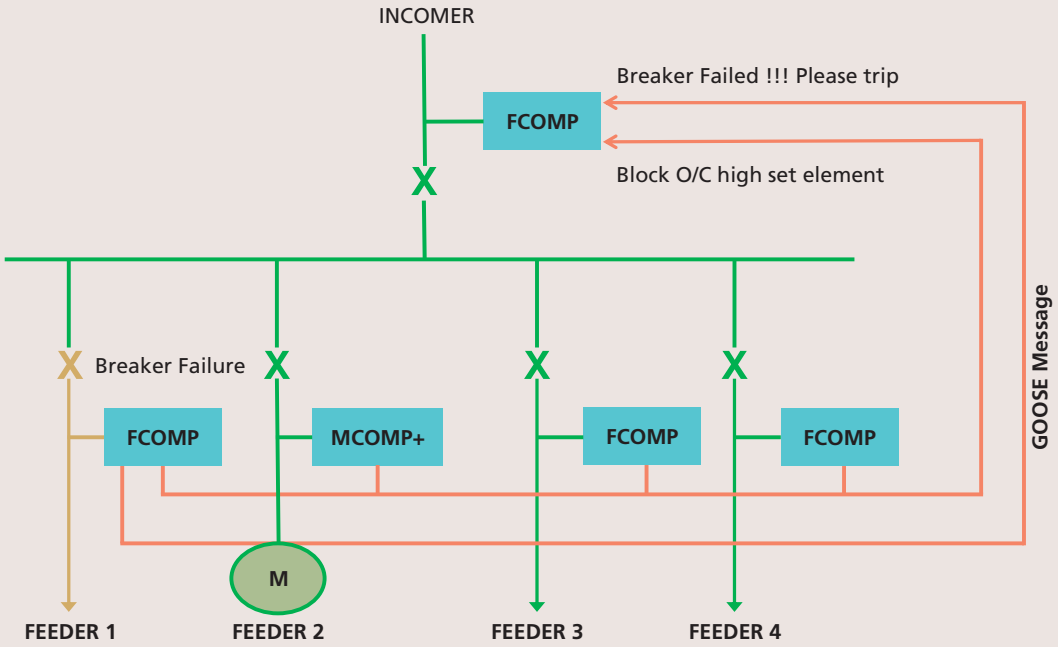


IEC 61850 GOOSE

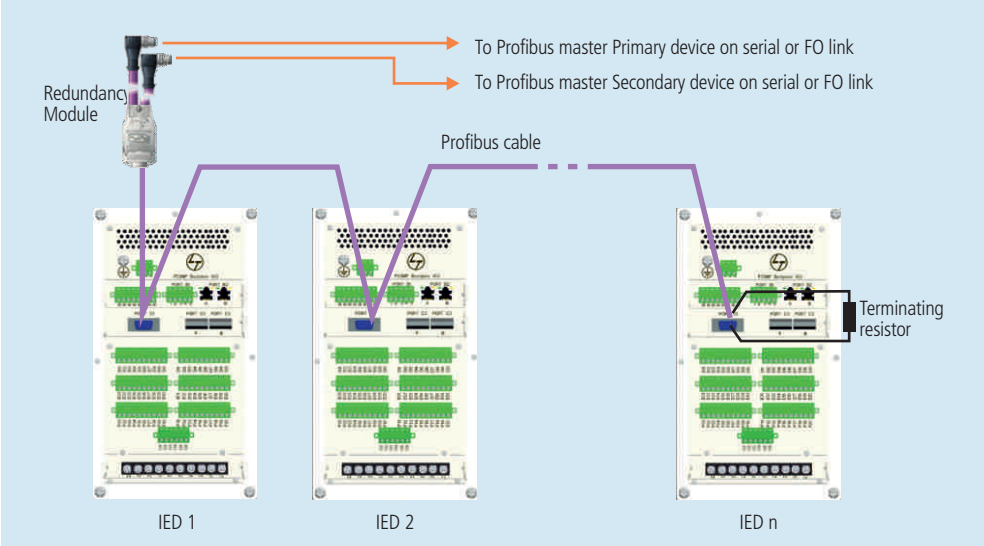
Load Shedding



Reverse Interlock Scheme

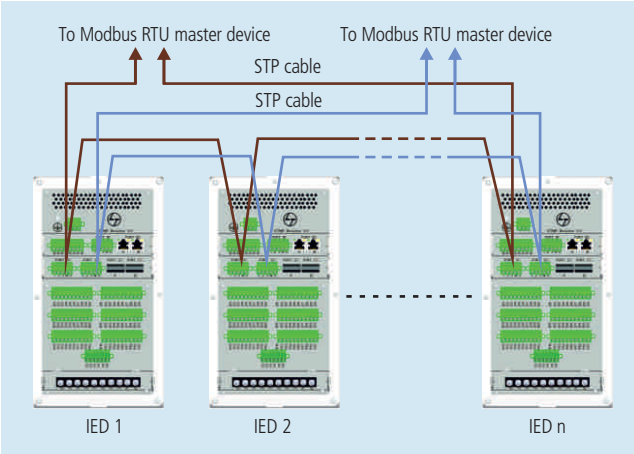


COMMUNICATION ARCHITECTURE



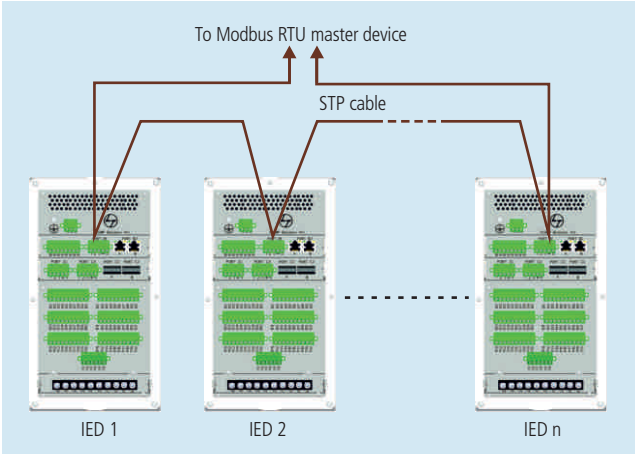
PROFIBUS – DAISY-CHAIN COMMUNICATION CONNECTION

DUAL DAISY CHAIN

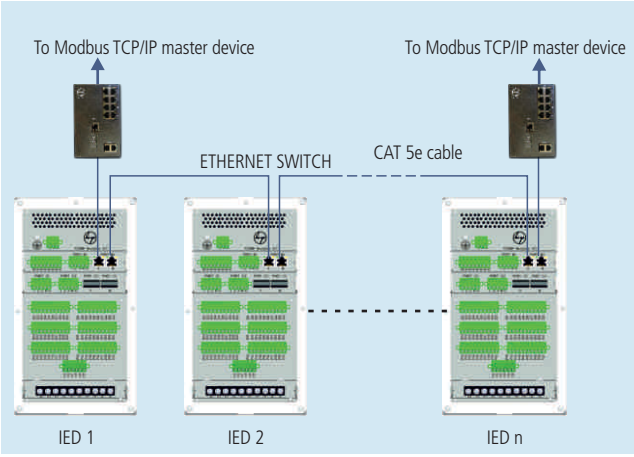


MODBUS RTU – DUAL DAISY-CHAIN REDUNDANT COMMUNICATION CONNECTION

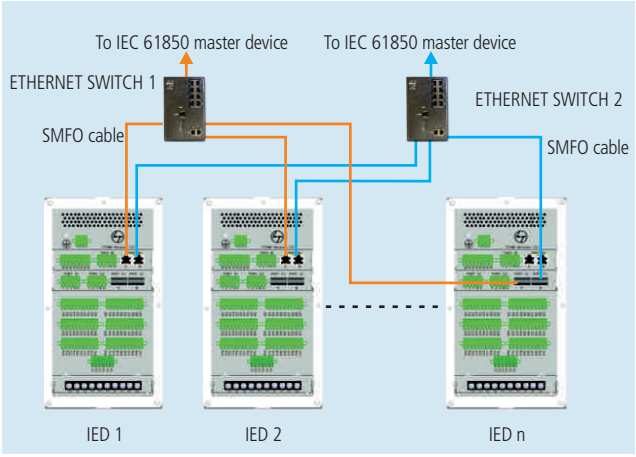
DAISY CHAIN



MODBUS RTU – DAISY-CHAIN REDUNDANT COMMUNICATION CONNECTION

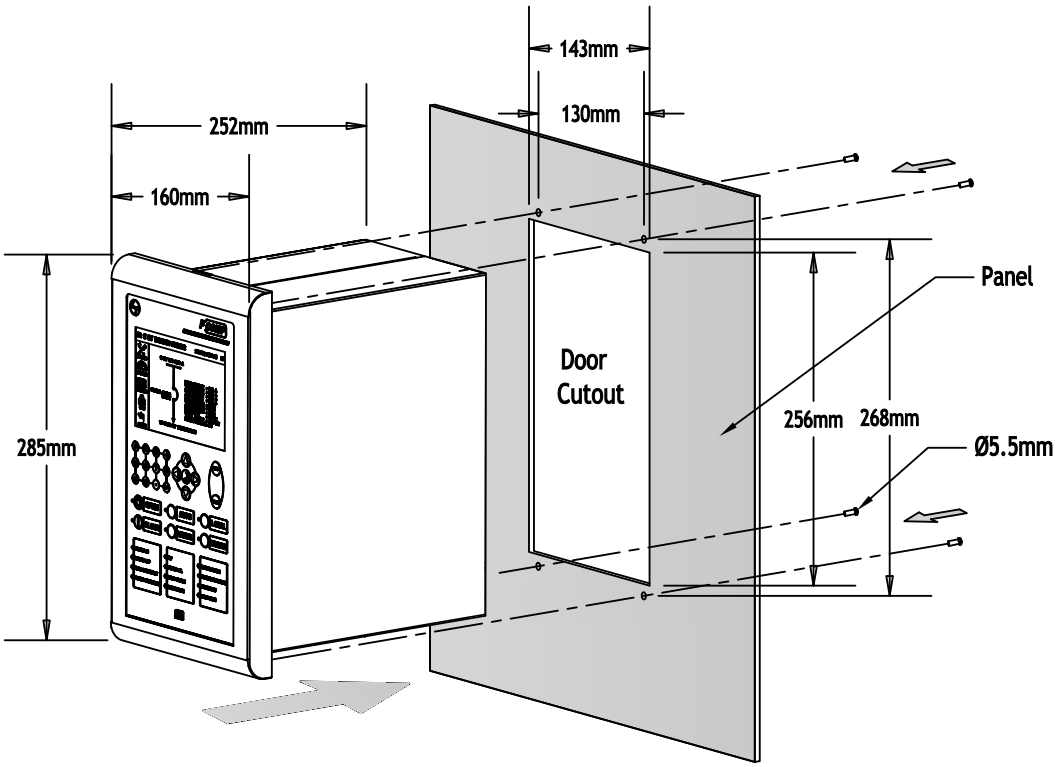


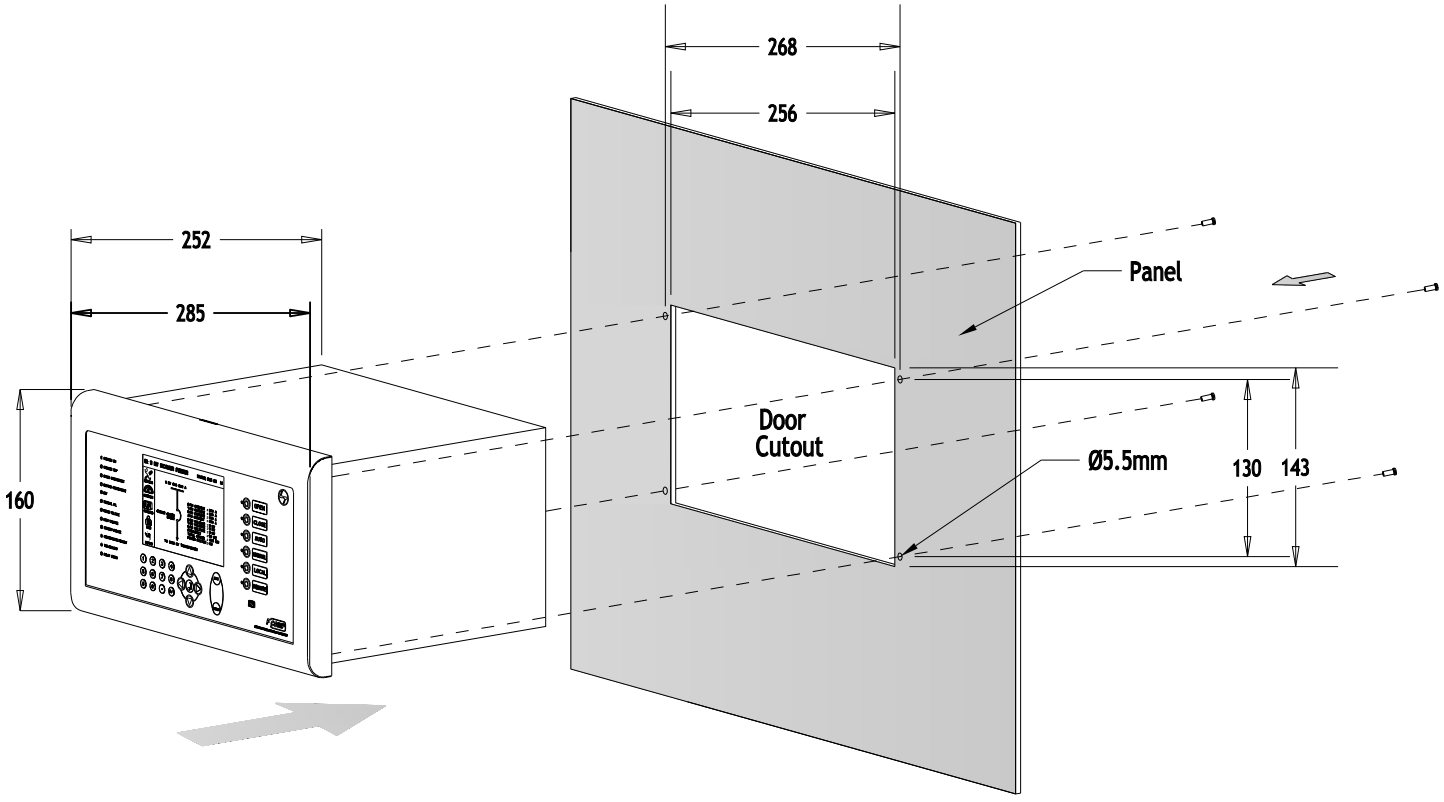
MODBUS TCP/IP – DAISY-CHAIN COMMUNICATION CONNECTION



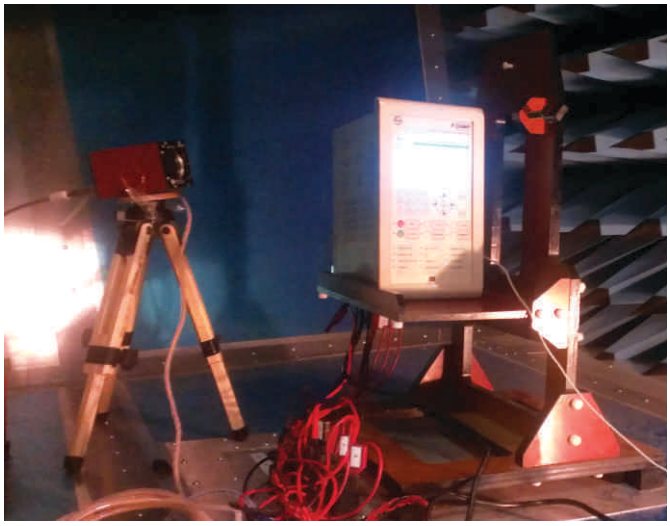
IEC61850 – STAR REDUNDANT COMMUNICATION CONNECTION

DIMENSIONAL DETAILS





COMPLIANCE



Comp Relays are certified for IEC standard type tests of protection relays from NABL (National Accreditation Board for Testing and Calibration Laboratories) certified test facilities.

Mechanical
Enclosure protection: IEC 60529:2001, IP65 for front panel, IP 20 for terminals

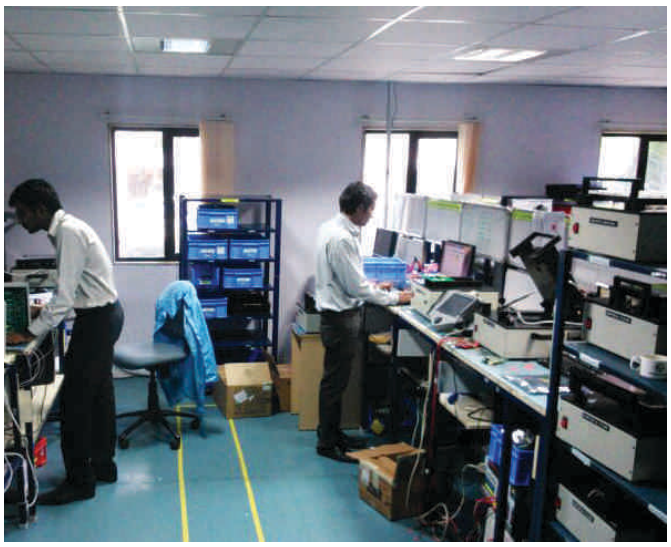
Environmental
Vibration test: IEC 60068-2-6:1995, IEC 60255-21-1:1988-Class1
Shock test: IEC 60255-21-2:1988, Class 1
Cold test: IEC 60068-2-1:1990
Damp Heat (Steady State): IEC 60068-2-78:2001
Temperature cyclic test (with humidity): IEC 60068-2-30:1980

Dielectric strength and Impulse test
Dielectric (HIPOT): IEC 60255-5:2000, IEEE C37.90-1989
Impulse: IEC 60255-5:2000

RFI and Interface test
ESD immunity: IEC 61000-4-2:2001, Level - 4
Radiated RF immunity: IEC 61000-4-3:2002, Level - 4
EFT immunity: IEC 61000-4-4:2001, Level - 4
Surge immunity: IEC 61000-4-5:2001, Level - 4
Surge withstand capability immunity: IEC 60255-22-1:1988
Conducted RF immunity: IEC 61000-4-6:2003
Magnetic field immunity: IEC 61000-4-8:2001
Conducted emissions: CISPR 22
Radiated emissions: CISPR 22

Communication Protocol
Profibus – DP-V0 – PNO-certified
IEC 61850 - Edition 2 level A - UCA (CPRI)-certified

MANUFACTURING FACILITY



COMP Relays are manufactured at our in-house manufacturing facility at Mysore, an ISO 9001:2008, ISO14001:2004, ISO18001:2007 and ISO 27001:2005 certified facility.

The quality of the product is ensured by an automated process of PCB assembly and testing. L&T's precision manufacturing facilities are tailored to achieve high accuracy levels.

State-of-the-art technology in product testing and calibration process ensures product reliability and functionality. The test setup integrates LAB view environment with highly calibrated sources like Omicron 256 Plus and Meggar that enables automated testing of assembled product.

L&T is committed to total customer satisfaction. The products meet customer expectations as well as all relevant codes and standards. Each stage of manufacture is controlled by a meticulously implemented quality assurance programme. L&T's quality assurance and quality control capabilities are benchmarked to global standards:

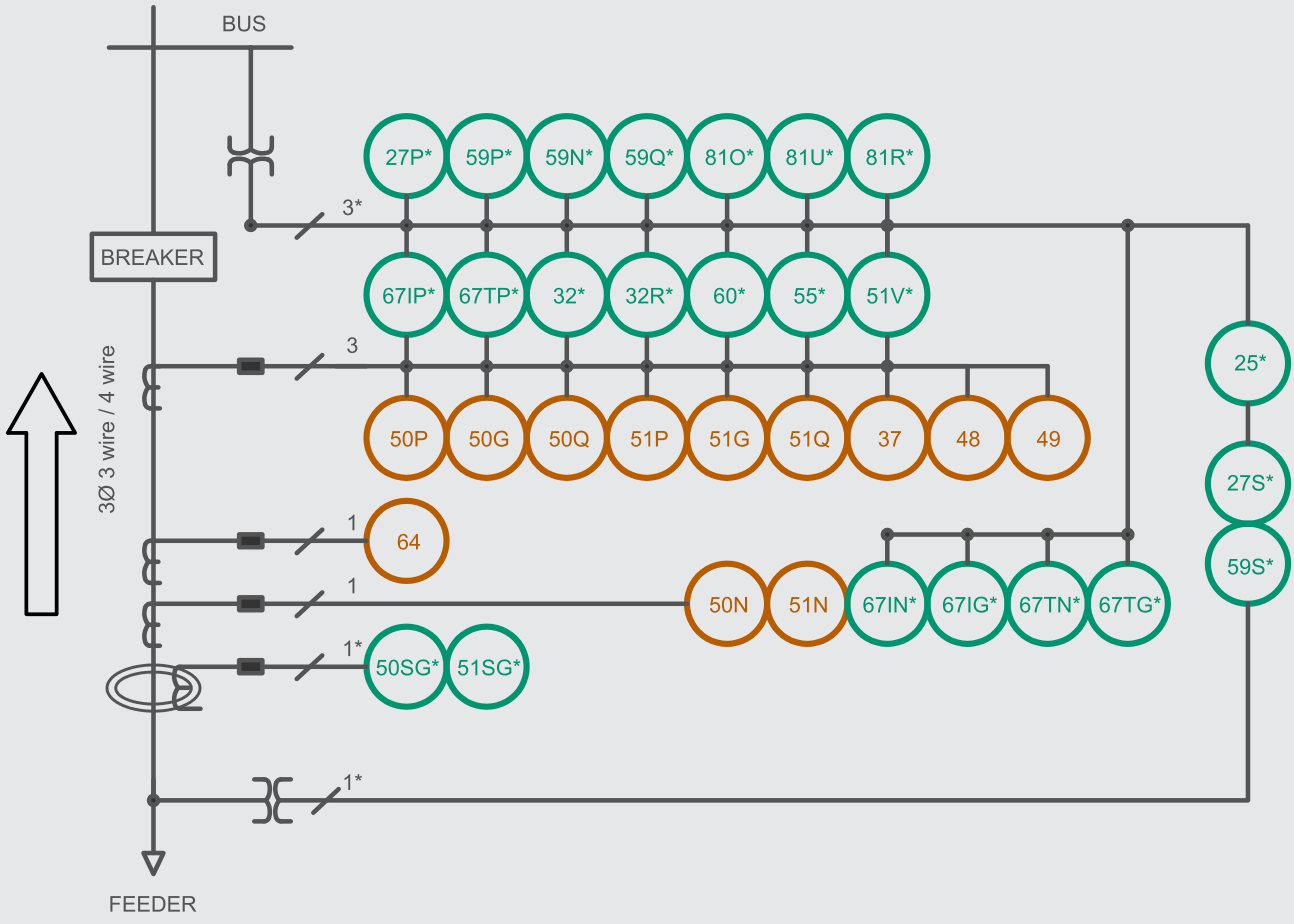
- Calibration Center
- NABL (National Accreditation Board for Testing and Calibration Laboratories) certified Test Facilities

FCOMP - FEEDER CONTROL METERING PROTECTION

The basic protection function of this relay includes multiple stages of phase, ground, and neutral time and instantaneous overcurrent elements for coordination with upstream and downstream devices. In addition, the device provides essential feeder breaker control features such as cold-load-pick-up, blocked overcurrent, zone selective interlock, breaker failure and auto-reclose and voltage-based protections, synchronism check and synchronizing elements.

The FCOMP makes user workflow processes more efficient and simplifies engineering tasks such as configuration, wiring, testing, commissioning, and maintenance. This cost-effective relay also offers enhanced features such as fault diagnostics, preventative maintenance and security.

Protection block diagram

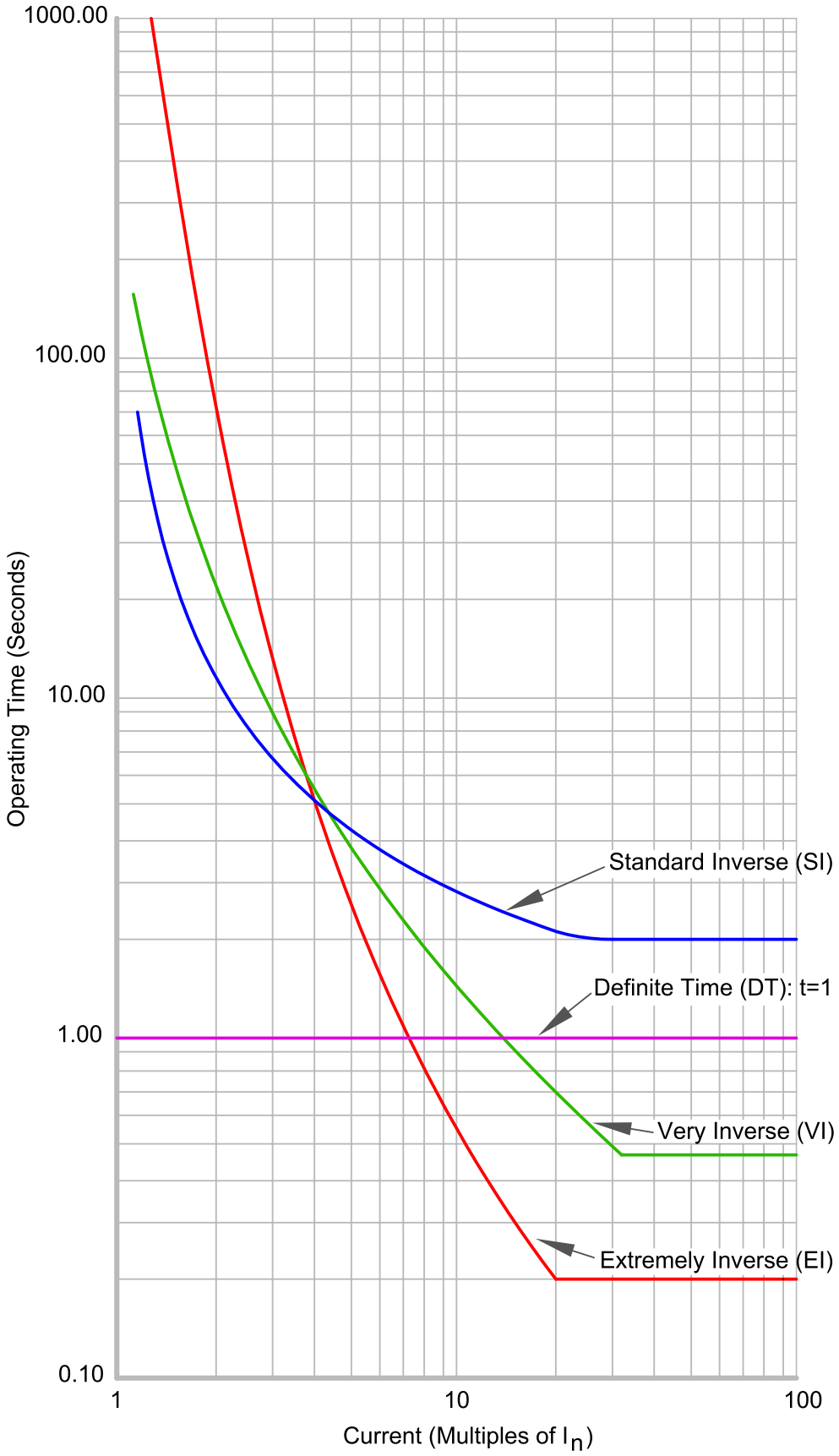


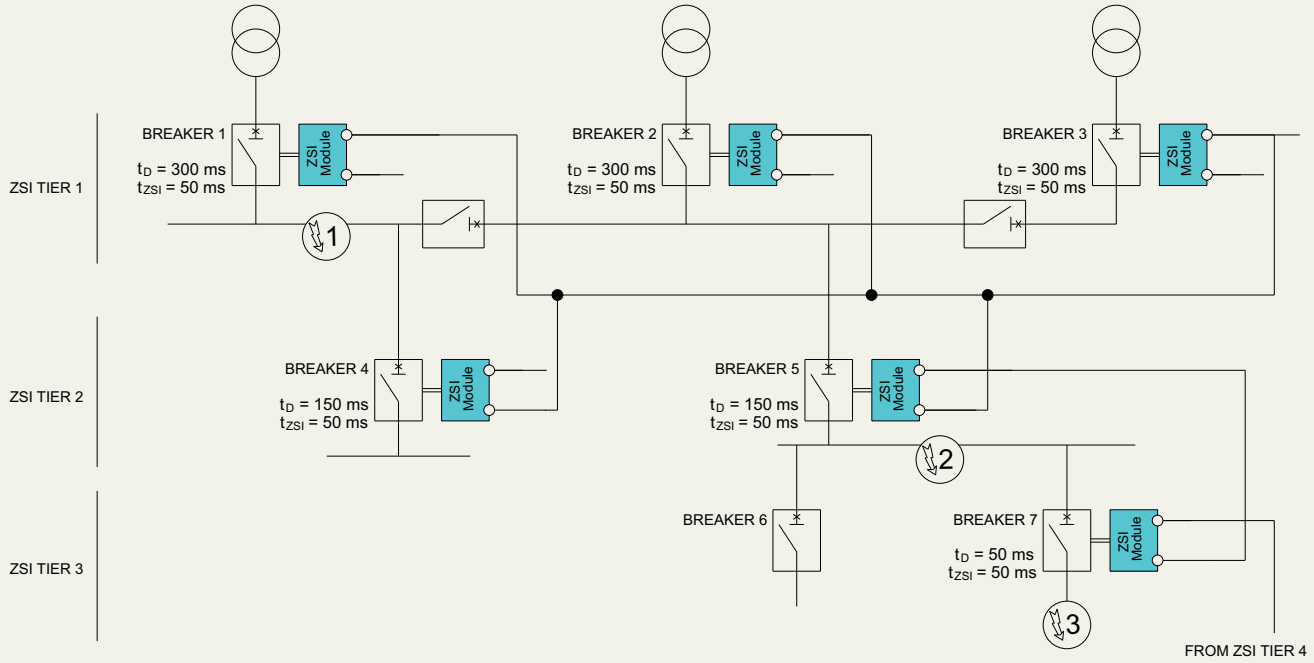
PROTECTION FUNCTIONS

Protection Function	ANSI Code	Variable	Range	Step Size
Instantaneous Phase Over Current Instantaneous Neutral / Ground OC Negative-Sequence Instantaneous OC	50P 50N, 50G 50Q	Pick Up Time Delay Pick Up Accuracy	0.10 - 20.00 In 0 - 600 Sec ± 2% of setting	0.01 0.01 -
Timed Phase Over Current Timed Neutral / Ground OC Negative-Sequence Timed OC	51P 51N, 51G 51Q	Pick Up TMS Curves	0.10 – 3.20 In 0.05 - 3 IEC, IEEE	0.01 0.01 -
Under Current	37P	Pick Up	0.10 – 3.20 In	0.001
Restricted Earth Fault	64	Pick Up Time Delay	0.02 – 1 In 0 – 1 Sec	0.01 0.01
Sensitive Ground Fault	50SG	Pick Up Time Delay	0.0025 – 1.6 A 0.01 – 100 Sec	0.001 0.01
Auto Reclosure & Lockout	79, 86	Max no. of shots Dead Time	1 - 4 0.00 – 100 Sec	1 0.1
Breaker Failure	50BF	Ph current supervision Alarm Delay	0.01 - 5.00 In 10 - 1000 Sec	0.01 0.01
Phase Sequence Monitoring	47	Time Delay	0 – 100 Sec	0.01
Voltage *	27P, 27S 59P, 59S,59N	Pick Up	0.02 - 1.2 Vn 0 – 600 Sec	0.01 0.01
Sequence Over voltage *	47 O-, 47 O+	Pick Up Time Delay	0.02 - 1.2 Vn 0 – 600 Sec	0.01 0.01
Frequency *	81U, 81O	Pick Up Time Delay	20-70 Hz 0 - 100 Sec	0.01 0.01
Frequency Gradient *	81R	Pick Up Time Delay Direction	0.01 - 20 Hz/Sec 0 – 100 Sec Forward, Reverse	0.01 0.01 -
Directional Phase and Neutral /Ground OC **	67P, 67N, 67G - IOC	Pick Up Time Delay Characteristic Angle	0.10 – 20.00 In 0 – 600 Sec -180 - +180 Deg (for 67P) -90 - +90 Deg (for 67N/67G)	0.01 0.01 1
Directional Phase and Neutral -/Ground OC **	67P,67N,67G TOC	Direction Pick Up TMS Characteristic Angle	Forward, Reverse 0.10 – 3.20 In 0.05 - 3 180 - +180 Deg (for 67P) -90 - +90 Deg (for 67N/67G)	- 0.1 0.01 1
Power *	32, 32R	Pick Up 1A CT Pick Up 5A CT	0.2 – 1300 VAR, KW 1 – 6500 VAR, KW	0.1 1
Power Factor *	55	Pick Up Time Delay	0.05 - 0.95 1 – 240 Sec	0.01 1
Voltage Restraint for Phase Timed OC *	51V	Function	On / Off	-
VT Fuse Failure *	60	Function	On / Off	-
Synchro Check **	25	Voltage difference Angle difference Frequency difference	0 - 50 V 0 - 120 Deg 0 - 3 Hz	1 1 0.01

Note: *Basic voltage based protections are enabled upon selection of the FCOMP with voltage card.
**Advanced voltage base protections are enabled when options are so chosen at the time of ordering.

IDMT CHARACTERISTICS





Schematic diagram of an installation designed for multiple supplies with zone selective interlocking

ADVANCE BREAKER MONITORING FUNCTION

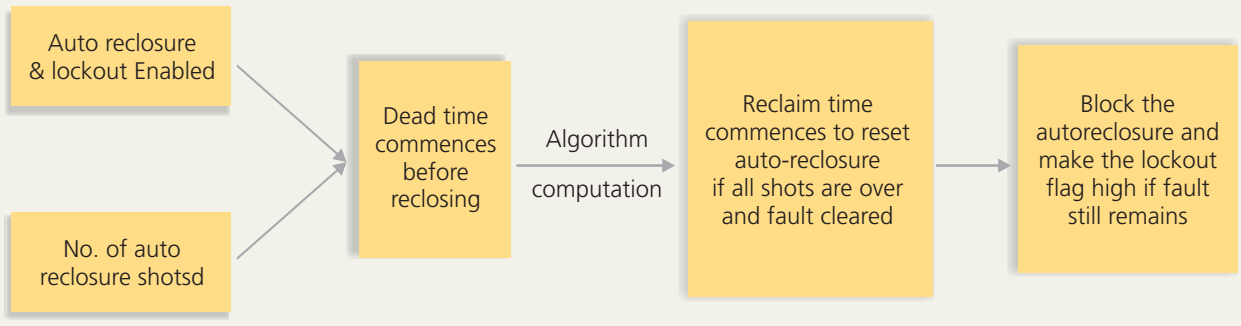
- Breaker arcing current
- Breaker re-strike
- Breaker contact wear monitoring

ADVANCED PROTECTION FUNCTIONS

- 2nd harmonic blocking
- Cold load pick-up
- CT supervision

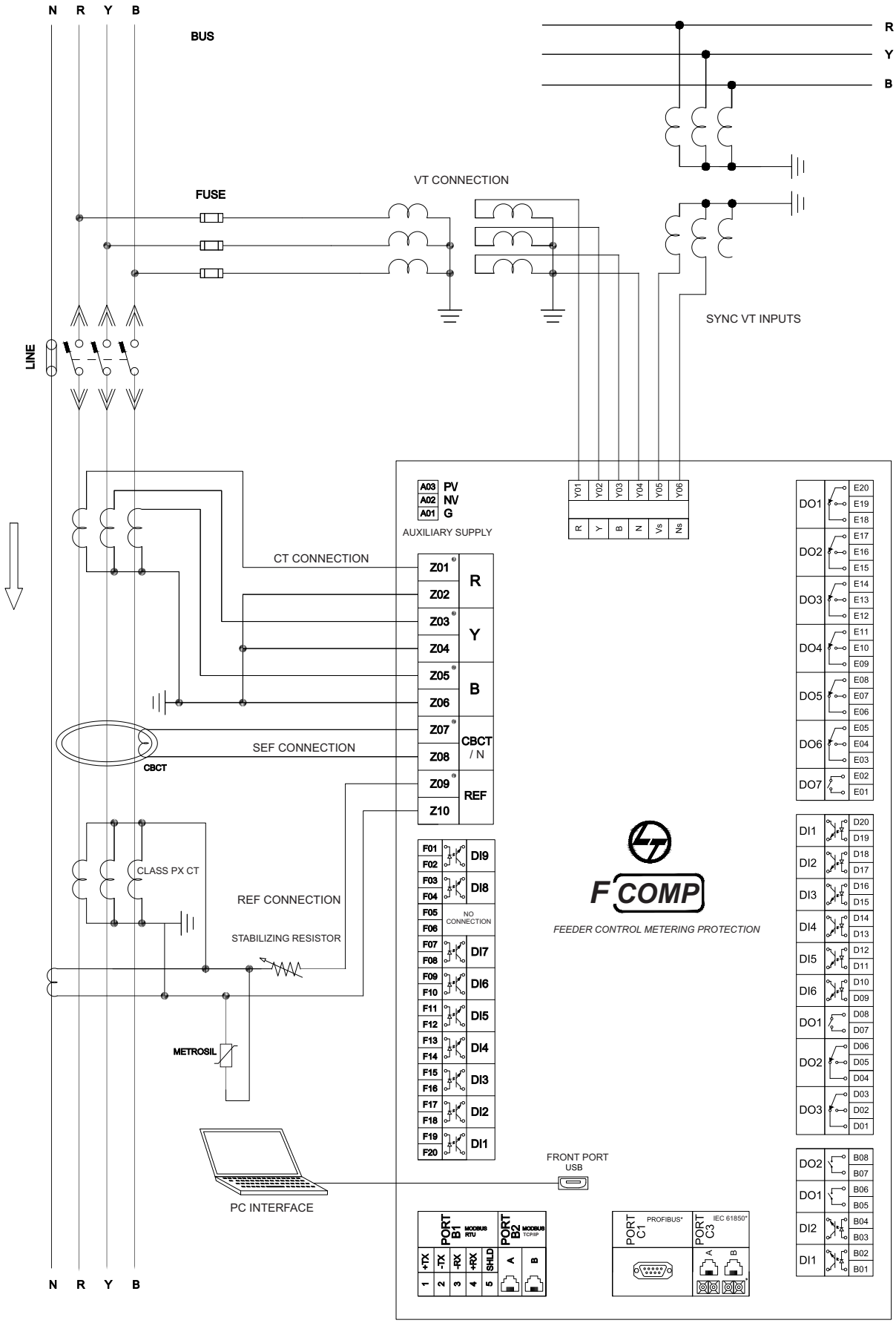
BUILT-IN LOGICAL SCHEMATICS

- Auto recloser
- Load shedding & restoration
- Trip / close logic
- Blocked overcurrent
- Selective overcurrent
- Zone selective interlock



Auto recloser & lockout

TYPICAL WIRING DIAGRAM



ORDER CODE

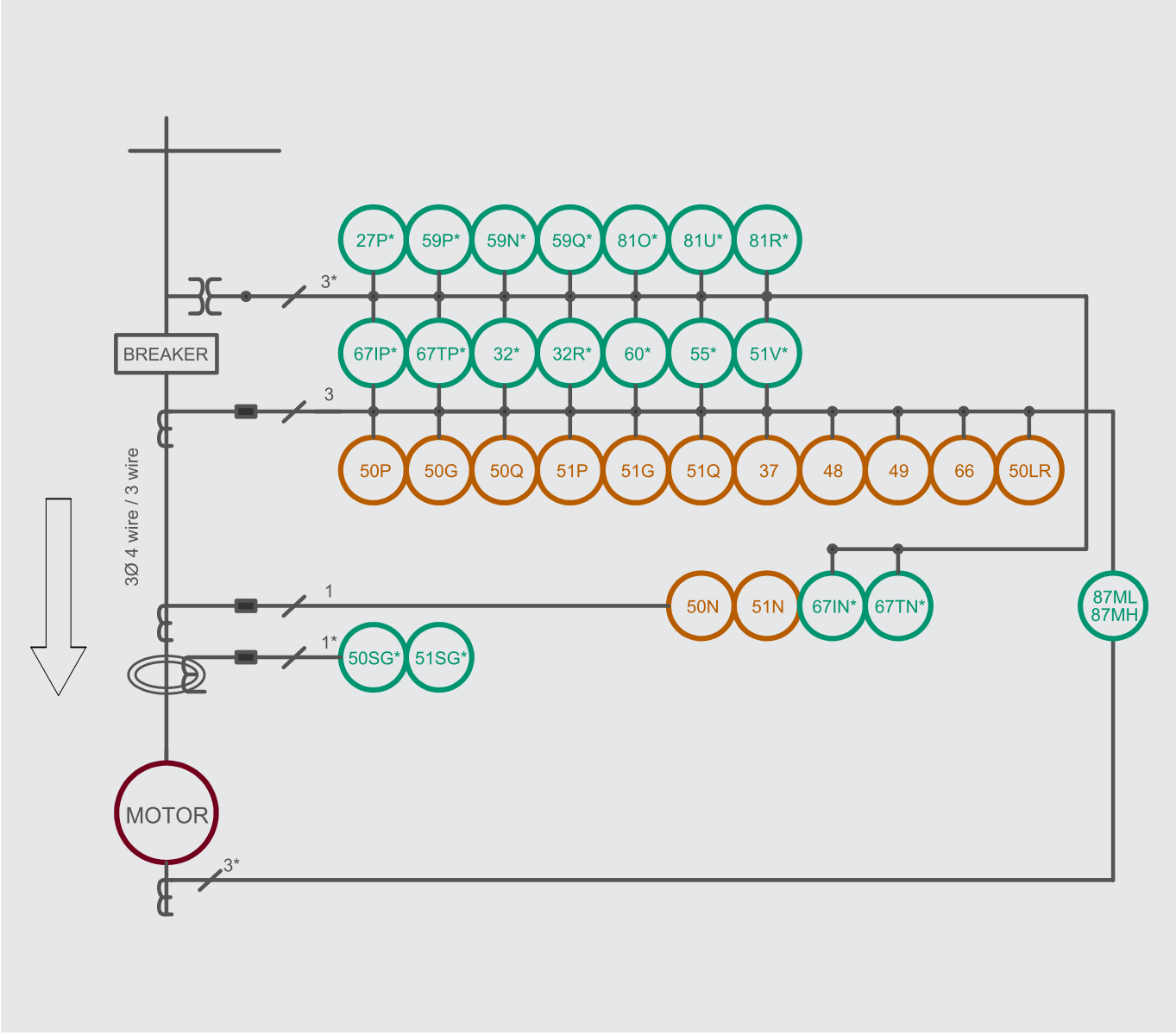
FCOMP PART NO SELECTION OPTIONS																	FCOMP PART NO
	PSU	CPU		COMM		IO1		IO2		IO3		VT	CT				
FCOMP	A	B	XXX	X	XXX	1XX	X	2XX	X	3XX	X	XX	C1				FCOMPABXXXXXXX1XXX2XXX3XXXXXC1
AUX. I/P	A																85-265VAC@50/60Hz,110-250VDC
PROCESSOR CARD		B															1 RS485,Modbus RTU+2DI+2DO
PROCESSOR ADD-ON			XXX														No Modbus TCP/IP
			ETH														2 RJ-45,Modbus TCP/IP
			FOC														1 FO,Modbus TCP/IP
COMM CARD (SERIAL)				X													No Card
				P													1 RS485,Profibus
COMM CARD (ETHERNET)					XXX												No card
					ETH												2 RJ-45,IEC61850
					FOC												2 FO,IEC61850
IO SLOT						1XX	X	2XX	X	3XX	X						No Card
						1D1		2D1		3D1							24V AC/DC I/P(DIO Card)
						1D2		2D2		3D2							230/110V AC/DC I/P(DIO Card)
							1		1		1						7DI+2DO Form C
							2		2		2						4DI+2DO Form C+3DO Form A
							3		3		3						9DI
							4		4		4						6DI+2DO Form C+1DO Form A
							5		5		5						6DO Form C+1DO Form A
						1A1		2A1		3A1							Analog IO Card
							1		1		1						4AI+2AO+4 DI,230/110VAC/DC
						1R1		2R1		3R1							RTD Input Card
							1		1		1						5RTD+5DI,230/110VAC/DC
							2		2		2						10RTD
VOLTAGE I/P												XX					No Card
												V1					3 Ph Volt+Vsync,10-132VAC
												V2					3 Ph Volt+Vsync,90-300VAC
CURRENT I/P													C1				1A (R,Y,B)+N+REF
													C2				5A (R,Y,B)+N+REF
													C3				1A (R,Y,B)+CBCT +1A REF
													C4				5A (R,Y,B)+CBCT +5A REF

M COMP + - ADVANCED MOTOR CONTROL METERING PROTECTION

The MCOMP+ is a comprehensive Motor Control Metering Protection controller designed for complete protection of circuit breaker operated motors in low-voltage and medium-voltage switchgear assemblies. The basic protection function of this relay includes overcurrent protections, adaptive thermal overload function, and locked rotor and load jam protection. The relay has motor ancillary functions like re-acceleration function, anti-backspin timer, maximum starts per hour, emergency start function. It provides an optional feature of high impedance motor differential or low impedance motor differential function and temperature inputs of 10RTDs/10PTCs with an internal card.

The adaptive thermal model is applicable to all types of motor and various loads. It adapts to the motor starting and running characteristics thereby utilising the motor to its full potential without compromising on protection from thermal overload during starting.

Protection block diagram

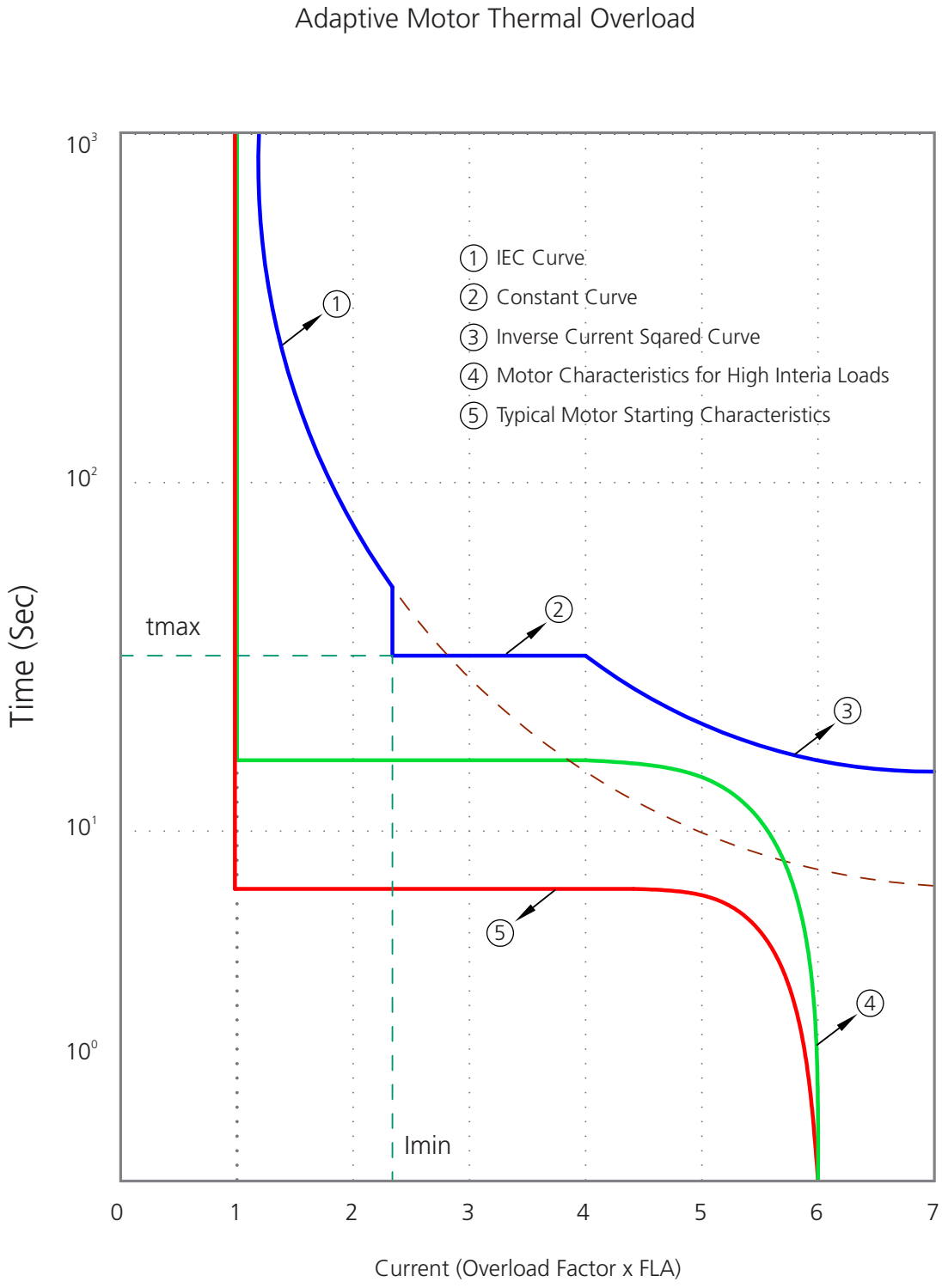


PROTECTION FUNCTIONS

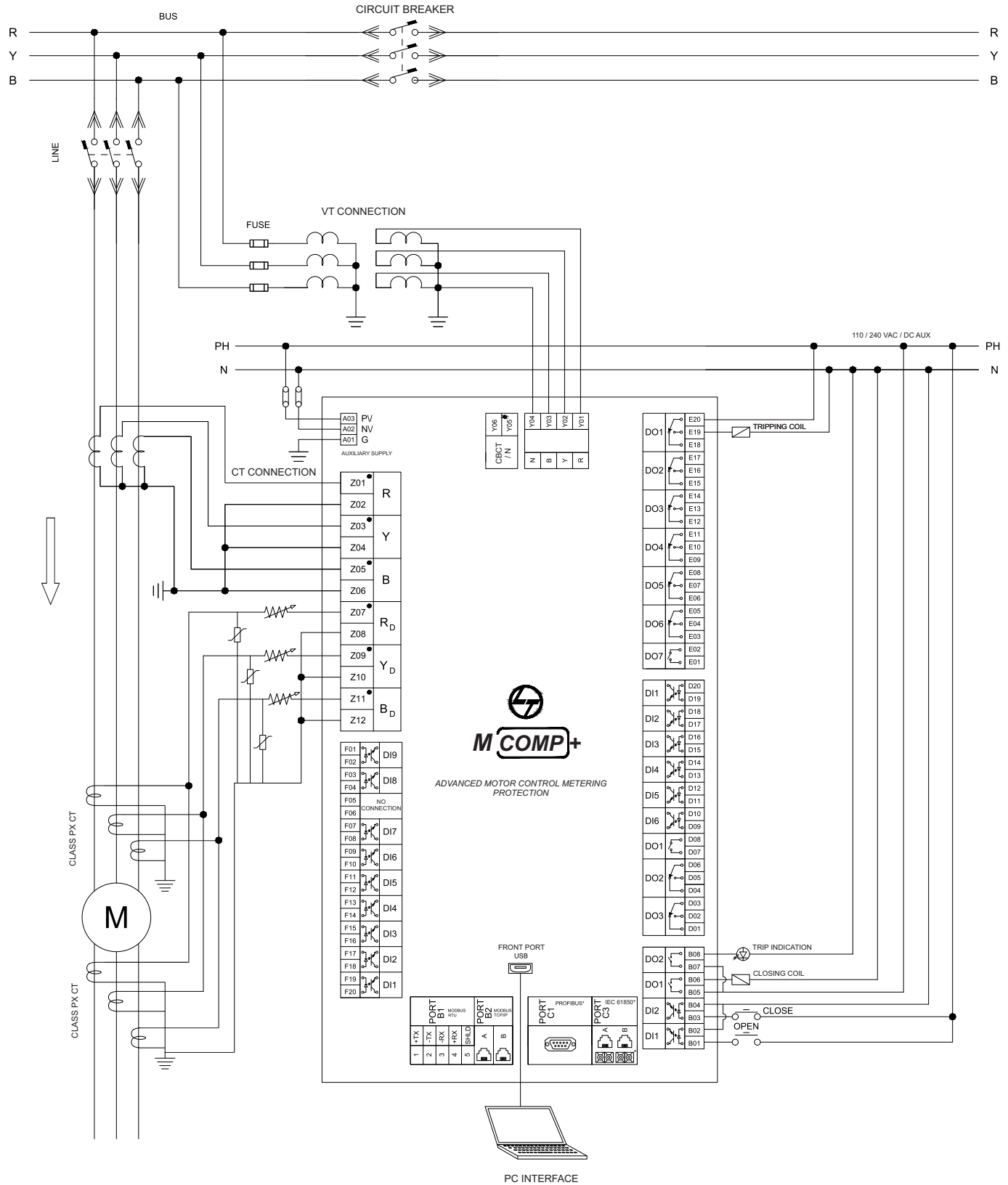
Protection Function	ANSI Code	Variable	Range	Step Size
Instantaneous Phase Over Current	50P	Pick Up	0.10-20.00 In	0.01
Instantaneous Neutral / Ground OC	50N, 50G	Time Delay	0-600 Sec	0.01
Negative-Sequence Instantaneous OC	50Q	Pick Up Accuracy	± 2% of setting	-
Timed Phase Over Current	51P	Time Accuracy	± 30ms	-
Timed Neutral / Ground OC	51N, 51G	Pick Up	0.10 – 3.20 In	0.01
Negative-Sequence Timed OC	51Q	Time Delay	IEC, IEEE Curves	0.01
		Curve Selection	IEC, Custom Curve	-
Thermal Overload	49	Pick Up	0.1 to 0.4 In	0.1
		K Factor	1.05 - 2.5	0.01
		TMS	60 – 30000 Sec	1
Under Current	37P	Pick Up	0.10 – 3.20 In	0.001
		Time Delay	0 - 600 Sec	0.01
Sensitive Ground Fault	50SG	Pick Up	0.0025 – 1.6 A	0.001
		Time Delay	0.01 – 600 Sec	0.01
Reacceleration	27LV	Voltage Dip	20 - 90%	1%
		Voltage Restoration	20 - 95%	1
		Restart Time	4 - 6 Sec	1
		Restart Delay	0.2 - 60 Sec	0.1
		Reference Period	1 - 300 min	1
Maximum Number of Starts Protection	66	Inhibit period	1 - 120 min	1
		No. of starts	1 - 30	1
		Time between 2 starts	0.5 - 300 min	0.5
Excessive Start time Protection	-	Mode	Enable/Disable	-
		DI selection	CPU DI1, CPU DI2, DI1 to DI29	-
Locked Rotor Protection	14	DI active	0 -1	1
		Alarm Function	Enable/Disable	-
		Trip delay	0 - 240 Sec	1
Breaker Failure	50BF	Ph current supervision	0.01 - 5.00 In	0.01
		Alarm Delay	10 - 1000 Sec	0.01
Phase Sequence Monitoring	47	Time Delay	0 - 100 Sec	0.01
Voltage *	27P, 27X	Pick Up	0.02 - 1.2 Vn	0.01
	59P, 59X. 59N	Time Delay	0.600 Sec	0.01
Negative Sequence Over voltage *	47 0-	Pick Up	0.02 - 1.2 Vn	0.01
		Time Delay	0 - 600 Sec	0.01
Frequency *	81U, 810	Pick Up	20 - 70 Hz	0.01
		Time Delay	0 - 100 Sec	0.01
Frequency Gradient *	81R	Pick Up	0.01 - 20 Hz/Sec	0.01
		Time Delay	0 - 100 Sec	0.01
Power *	32, 32R	Pick Up 1A CT	0.2 - 1300 VAR, KW	0.1
		Pick Up 5A CT	1 - 6500 VAR, KW	
Power Factor *	55	Pick Up	0.05 - 099	0.01
		Time Delay	1 - 240 Sec	1
Voltage Restraint for Phase Timed OC *	51V	Function	On, Off	-
VT Fuse Failure *	60	Function	On / Off	-
Differential Protection	87MH	Ipickup	0.05 - 8A	0.01
		Delay	0 - 60s	0.01

Note: *Basic voltage based protections are enabled upon selection of the MCOMP+ with voltage card.
**Advanced voltage base protections are enabled when options are so chosen at the time of ordering.

ADAPTIVE MOTOR THERMAL MODEL



TYPICAL WIRING DIAGRAM



ORDER CODE

MCOMP+ PART NO SELECTION OPTIONS																		MCOMP+ PART NO
	PSU	CPU		COMM		IO1		IO2		IO3		VT	CT					
MCOMP+	A	B	XXX	X	XXX	1XX	X	2XX	X	3XX	X	XX	C1					MCOMP+ABXXXXXXX1XXX2XXX3XXXXXC1
AUX. I/P	A																	85-265VAC@50/60Hz,110-250VDC
PROCESSOR CARD		B																1 RS485,Modbus RTU+2DI+2DO
PROCESSOR ADD-ON			XXX															No Modbus TCP/IP
			ETH															2 RJ-45,Modbus TCP/IP
			FOC															1 FO,Modbus TCP/IP
COMM CARD (SERIAL)				X														No Card
				P														1 RS485,Profibus
COMM CARD (ETHERNET)					XXX													No card
					ETH													2 RJ-45,IEC61850
					FOC													2 FO,IEC61850
IO SLOT						1XX	X	2XX	X	3XX	X							No Card
						1D1		2D1		3D1								24V AC/DC I/P(DIO Card)
						1D2		2D2		3D2								230/110V AC/DC I/P(DIO Card)
							1		1		1							7DI+2DO Form C
							2		2		2							4DI+2DO Form C+3DO Form A
							3		3		3							9DI
							4		4		4							6DI+2DO Form C+1DO Form A
							5		5		5							6DO Form C+1DO Form A
						1A1		2A1		3A1								Analog IO Card
							1		1		1							4AI+2AO+4 DI,230/110VAC/DC
						1R1		2R1		3R1								RTD Input Card
							1		1		1							5RTD+5DI,230/110VAC/DC
							2		2		2							10RTD
VOLTAGE I/P												XX						No Card
												V1						3 Ph Volt,10-132VAC
												V2						3 Ph Volt,90-300VAC
												V1						3 Ph Volt,10-132VAC + 1 A NEU CT
												V2						3 Ph Volt,90-300VAC + 5 A NEU CT
CURRENT I/P													C1					1A (R,Y,B,N) + 3 Differential I/P
													C2					5A (R,Y,B) + 3 Differential I/P
													C3					1A (R,Y,B) + CBCT / 1A N
													C4					5A (R,Y,B) + CBCT / 5A N

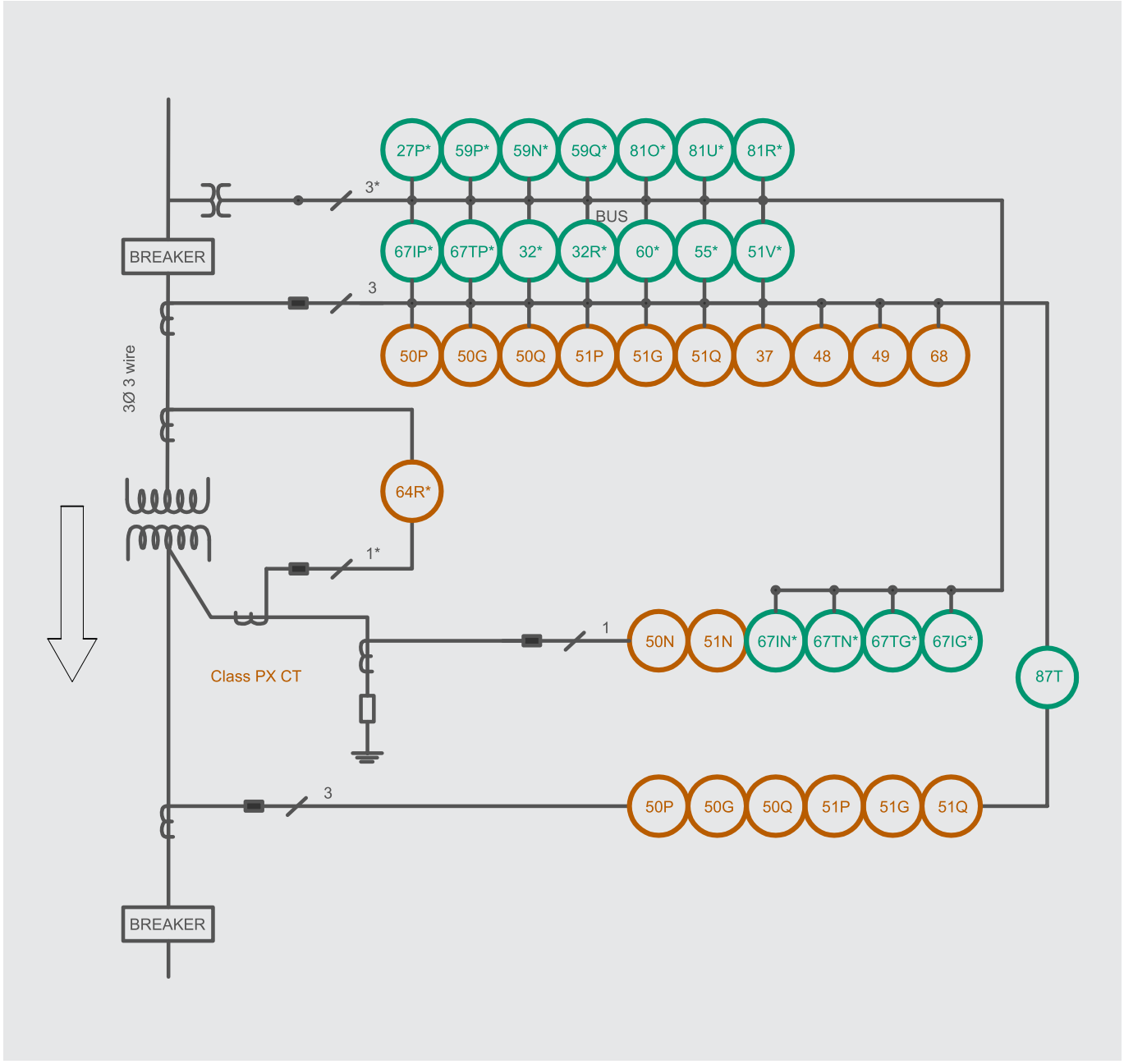
T COMP - TRANSFORMER CONTROL METERING PROTECTION

The basic model includes transformer differential and neutral time and instantaneous overcurrent elements for medium voltage transformer protection. In addition, the device provides inrush restraint that prevents the overcurrent and low impedance differential element from tripping due to in-rush conditions.

It also offers optional features such as voltage-based protections, directional overcurrent protections, high-impedance-restricted earth-fault protection.

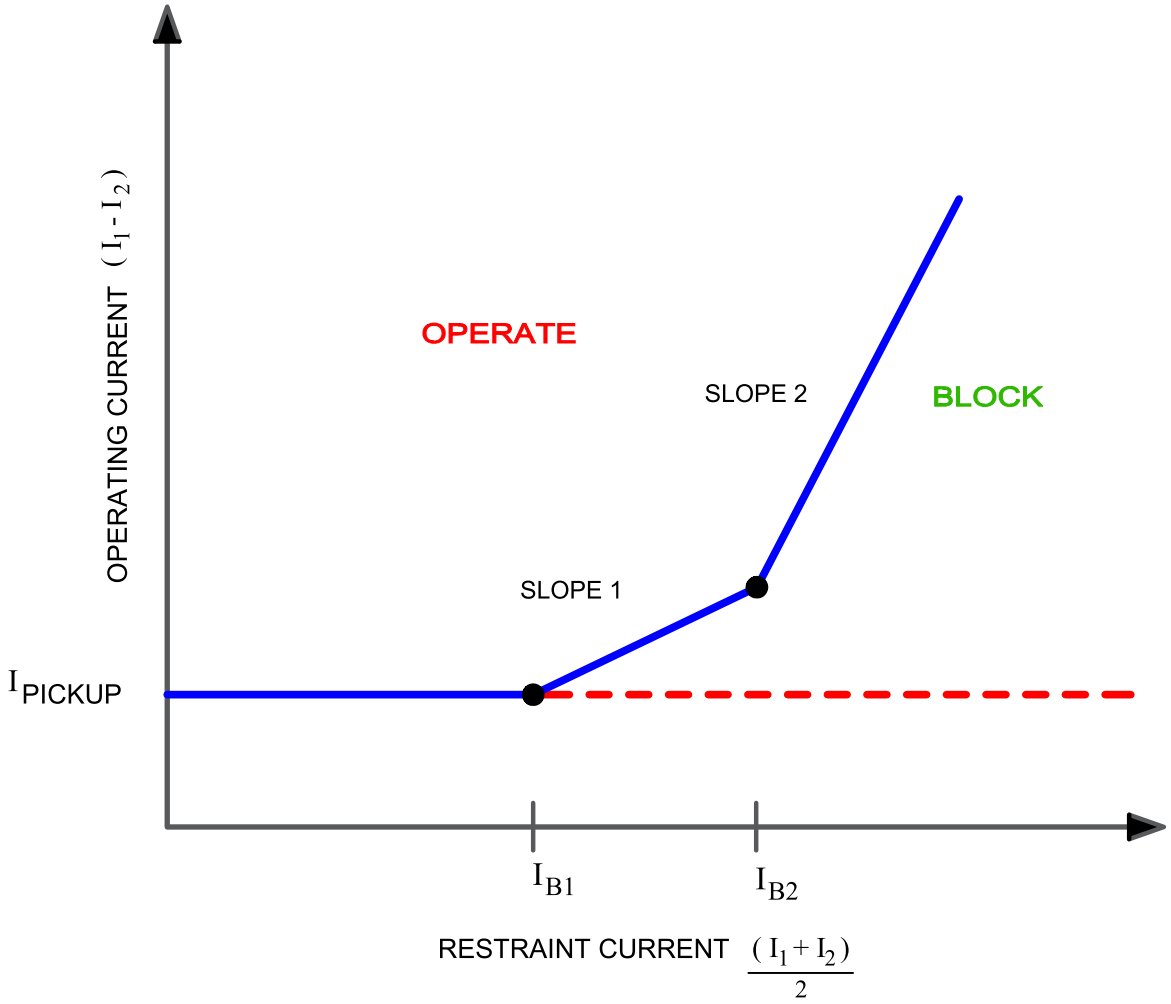
To monitor the ambient and equipment temperature throughout the substation, the optional feature of temperature inputs of 10 RTDs/10 PTCs are available with an internal card.

Protection block diagram



TRANSFORMER DIFFERENTIAL

TCOMP protects the transformer against the inter-winding faults, internal phase-to-phase faults and phase-to-ground faults which normally cause large fault current. TCOMP takes into account a variety of factors in order to ensure reliable operation of protection function. The principle includes phase-shift correction, filtering of zero-sequence currents, ratio-error correction and compensates for the effect of magnetizing inrush and overfluxing.

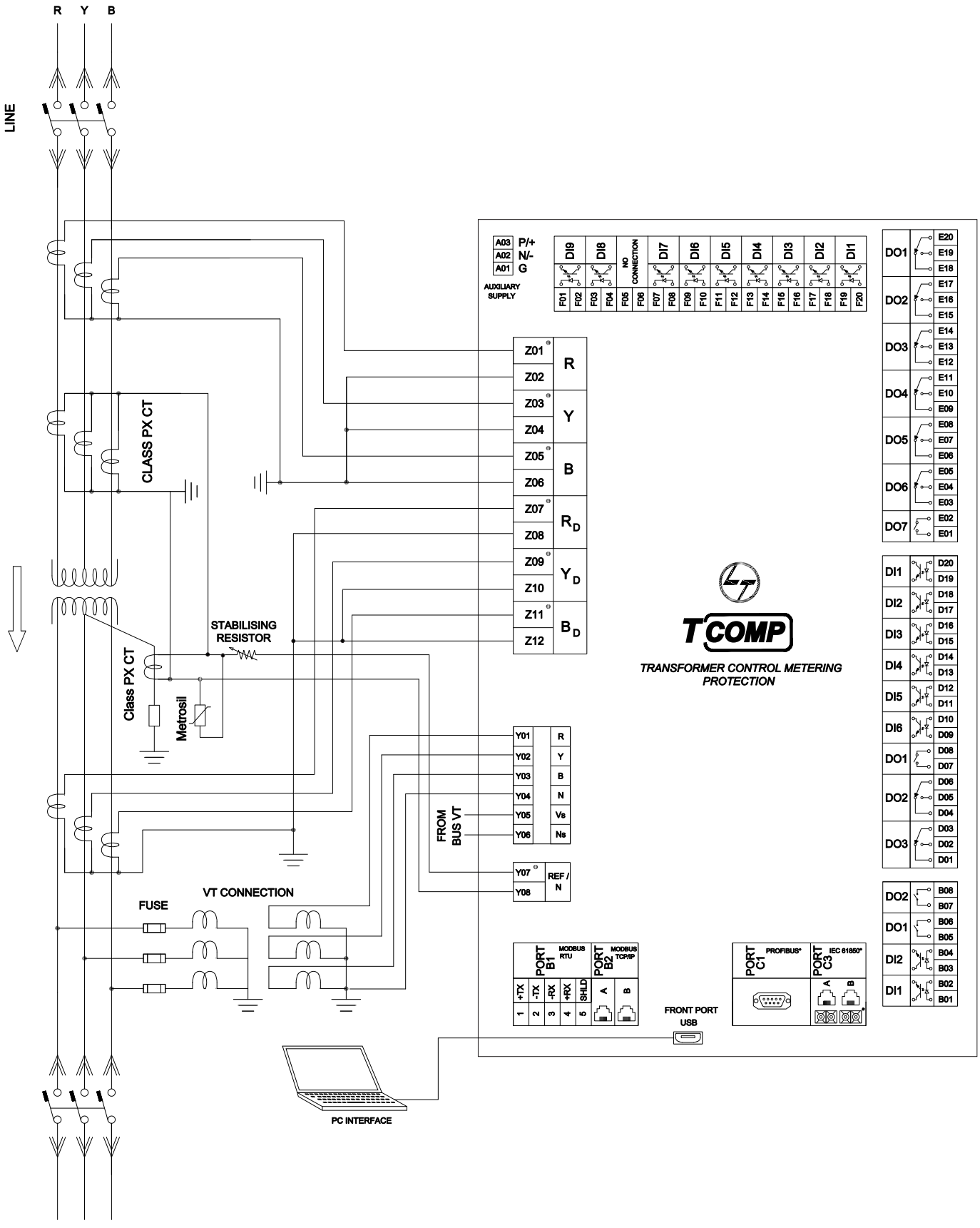


PROTECTION FUNCTIONS

Protection Function	ANSI Code	Variable	Range	Step Size
Instantaneous Phase Over Current	50P	Pick Up	0.10 - 20.00 In	0.01
Instantaneous Neutral / Ground OC	50N, 50G	Time Delay	0 - 600 Sec	0.01
Negative-Sequence Instantaneous OC	50Q	Pick Up Accuracy	± 2% of setting	-
Timed Phase Over Current	51P	Pick Up	0.10 – 3.20 In	0.01
Timed Neutral / Ground OC	51N, 51G	TMS	0.05 - 3	0.01
Negative-Sequence Timed OC	51Q	Curves	IEC, IEEE	-
Under Current	37P	Pick Up	0.10 – 3.20 In	0.001
Sensitive Ground Fault	50SG	Pick Up	0.0025 – 1.6 A	0.001
		Time Delay	0.01 – 100 Sec	0.01
Auto Reclosure & Lockout	79, 86	Max no. of shots	1 - 4	1
		Dead Time	0.00 – 100 Sec	0.1
Breaker Failure	50BF	Ph current supervision	0.01 - 5.00 In	0.01
		Alarm Delay	10 - 1000 Sec	0.01
Phase Sequence Monitoring	47	Time Delay	0 – 100 Sec	0.01
Voltage *	27P, 27S	Pick Up	0.02 - 1.2 Vn	0.01
	59P, 59S,59N		0 – 600 Sec	0.01
Sequence Over voltage *	47 O-, 47 O+	Pick Up	0.02 - 1.2 Vn	0.01
		Time Delay	0 – 600 Sec	0.01
Frequency *	81U, 81O	Pick Up	20-70 Hz	0.01
		Time Delay	0 - 100 Sec	0.01
Frequency Gradient *	81R	Pick Up	0.01 - 20 Hz/Sec	0.01
		Time Delay	0 – 100 Sec	0.01
Power *	32, 32R	Pick Up 1A CT	0.2 – 1300 VAR, KW	0.1
		Pick Up 5A CT	1 – 6500 VAR, KW	1
Power Factor *	55	Pick Up	0.05 - 0.95	0.01
		Time Delay	1 – 240 Sec	1
Voltage Restraint for Phase Timed OC *	51V	Function	On / Off	-
VT Fuse Failure *	60	Function	On / Off	-
		Frequency difference	0 - 3 Hz	0.01
Different Protection	87 T	Pickup	0.05 In - 2 In	0.001
		Trip Delay	0 - 60 s	0.1
		Slope 1 Pickup	15 - 100%	1
		Slope 2 Pickup	50 - 100%	1
		Break 1, Ib1	0 - 2 In	0.1
		Break 2, Ib2	0 - 10 In	0.1
		I Unrestrained	0.5 In - 35 In	0.001
		Trip Delay(Unrestrained)	0 - 60 Seconds	0.1
		Start Factor	01 - 02	0.01
		2nd Harmonic Blocking	10 - 80%	5%
		5th Harmonic Blocking	10 - 80%	5%

Note: *Basic voltage based protections are enabled upon selection of the TCOMP with voltage card.
**Advanced voltage base protections are enabled when options are so chosen at the time of ordering.

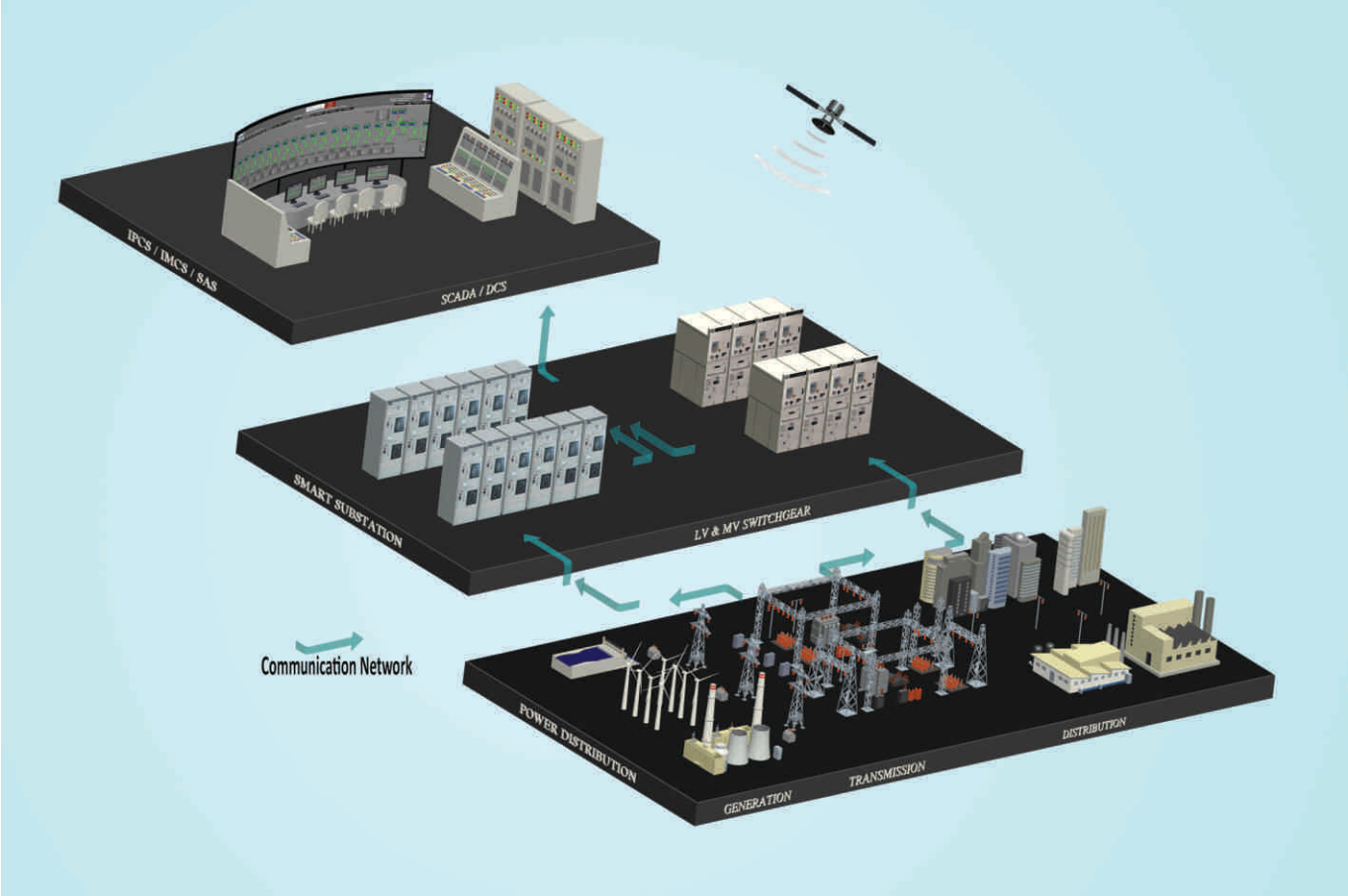
TYPICAL WIRING DIAGRAM



ORDER CODE

TCOMP PART NO SELECTION OPTIONS																	TCOMP PART NO
	PSU	CPU		COMM		IO1		IO2		IO3		VT	CT				
TCOMP	A	B	XXX	X	XXX	1XX	X	2XX	X	3XX	X	XX	C1				TCOMPABXXXXXXX1XXX2XXX3XXXXXC1
AUX. I/P	A																85-265VAC@50/60Hz,110-250VDC
PROCESSOR CARD		B															1 RS485,Modbus RTU+2DI+2DO
PROCESSOR ADD-ON			XXX														No Modbus TCP/IP
			ETH														2 RJ-45,Modbus TCP/IP
			FOC														1 FO,Modbus TCP/IP
COMM CARD (SERIAL)				X													No Card
				P													1 RS485,Profibus
COMM CARD (ETHERNET)					XXX												No card
					ETH												2 RJ-45,IEC61850
					FOC												2 FO,IEC61850
IO SLOT						1XX	X	2XX	X	3XX	X						No Card
						1D1		2D1		3D1							24V AC/DC I/P(DIO Card)
						1D2		2D2		3D2							230/110V AC/DC I/P(DIO Card)
							1		1		1						7DI+2DO Form C
							2		2		2						4DI+2DO Form C+3DO Form A
							3		3		3						9DI
							4		4		4						6DI+2DO Form C+1DO Form A
							5		5		5						6DO Form C+1DO Form A
						1A1		2A1		3A1							Analog IO Card
							1		1		1						4AI+2AO+4 DI,230/110VAC/DC
						1R1		2R1		3R1							RTD Input Card
							1		1		1						5RTD+5DI,230/110VAC/DC
							2		2		2						10RTD
VOLTAGE I/P												XX					No Card
												V1					3 Ph Volt, 10-132VAC + 1 A NEU CT
												V2					3 Ph Volt, 10-132VAC + 5 A NEU CT
CURRENT I/P													C1				1A (R,Y,B) + 3 Differential I/P
													C2				5A (R,Y,B) + 3 Differential I/P

SYSTEM ARCHITECHTURE



Automation in a Process Plant involved its Controls to be exercised from multiple locations, whereas the Monitoring was done away from the Switchboard at a centralized location, using electromechanical relays to cater specific protection requirements in the switchgear. This was a complex system involving separate component for each function along with extensive cabling. The problems in testing & troubleshooting a complicated wiring network substantially added to the time & Cost factors. Over the years, electrical substations have grown in complexity for improved protection, control and monitoring possibilities over the field.

An advanced microprocessor technology that has made it possible to combine the efficiency of integration, control, protection and monitoring into one system- IPCS (Integrated Protection & Control System). L&T's IPCS solution is also known as Integrated Power Management System (IPMS), Power Management System (PMS), Electrical Monitoring & Control System (EMCS), Substation Control & Monitoring System (SCMS), Electrical Network & Monitoring System (ENMS), Electrical Instrumentation Control System (ELICS).

The sub-systems of the IPCS that play a key role in substation infrastructure are the Data Concentrator and Central Control Unit (CCU). Either of these integrates IED's/ Relays with the centralized control system. Based on the information received from remote stations, automated or operator-driven supervisory commands can be pushed to remote station control devices, which are often referred to as field devices. The field devices control local operations such as opening and closing of contactors and circuit breakers, collecting data from sensor systems, and monitoring the local environment for alarm conditions.

IPCS, in general is a housing of software and hardware devices for control and supervision the electrical power generation and distribution of the system. It is a fully customizable / configurable, user friendly, integrated solution for reliable and accurate substation automation.
L&T IPCS panel can be designed in a modular structure, with all the components having substation hardened hardware platform. IPCS is capable of communicating power system values and data via Serial connectivity, Ethernet communication for a combination of devices.

M COMP - A COMPLETE SOLUTION FOR MOTOR PROTECTION

MCOMP has been designed as a reliable building block for low voltage, contactor-controlled motor starter feeders in switchgear assemblies.

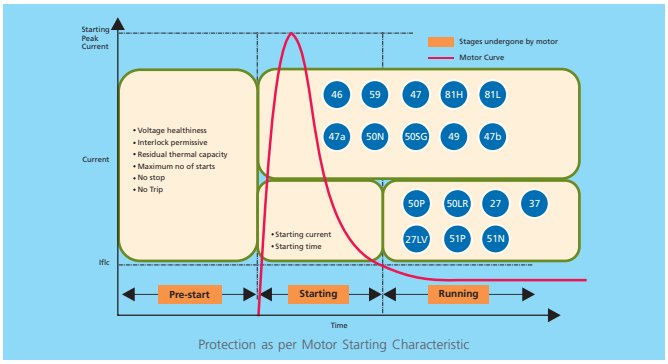
MCOMP is provided with current and voltage based metering and protection in a single compact unit. MCOMP is equipped with external Current module, expansion module for DIOs and optional compact display module. This offers flexibility to the user to customize the product according to one's needs thereby resulting in cost reduction.

KEY FEATURES

- In-built voltage module: enables power measurement & Motor Re-acceleration.
- Suitable for 50/60Hz system
- Universal auxiliary supply: 80 to 240 VAC and optional 24 VDC.
- 6 digital Input and 4 changeover digital outputs in base unit.
- Wide digital input sensing range: 60 to 240 VAC / VDC, 240 VAC / VDC, 110 VAC / VDC, 24 VDC.
- Digital Input /Output scalable upto 26DI/6DO, 30DI/4DO, 14DI/8DO thru external DIO module.
- OLED Display: 170° viewing angle, longer life than LCD.
- Communication options: Modbus RTU serial, Modbus TCP/IP, Profibus DP-V1.
- Inbuilt 4-20mA output and RTD/PTC inputs: eliminates transducer and add-on module
- Conformal coating on hardware makes the product suitable for the dusty and corrosive environments.
- Certified as per IEC 61000-4, CISPR22, IEC 60068, IEC 60255
- With COMPLogic, complex schemes can easily be simplified using the truth tables, timers, other Boolean modules.

PROTECTION

MCOMP provides all basic current, voltage and frequency protection. It also provides motor specific-protections like thermal overload, locked rotor, number of starts, excessive start time, phase reversal, and phase loss and advanced features like motor re-acceleration, temperature protection, communication failure.



Protection as per Motor Starting Characteristic

METERING AND MONITORING

MCOMP meters actual values of voltage, current frequency, phase sequence, power & energy, power factor, temperature, thermal capacity used. Monitoring includes event record, hour meter, start/ stop/trip counter, starting curve, starting time, starting peak current & DIO status.

COMMUNICATION

MCOMP can be connected to plant control system (SCADA/DCS) through Modbus RTU , Modbus TCP/IP and Profibus DP communication protocol. Both cyclic and acyclic communications are available in case of Profibus protocol.

For more details: please visit
http://www.larsentoubro.com/lntcorporate/uploads/product/MCOMP%20Product%20catalog.pdf

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