

**FEEDER PROTECTION RELAY TYPE A22F**

Introduction:

ASHIDA has designed economical & reliable Multifunction A22F Protection & Control System. The simple and compact construction of A2 Series, A22F relay provides integrated Protection, Control and Monitoring functions for Over head Transmission Lines, Underground cables, and Distributed Feeders.

Functional Overview:

Key Protection & Control Functions:

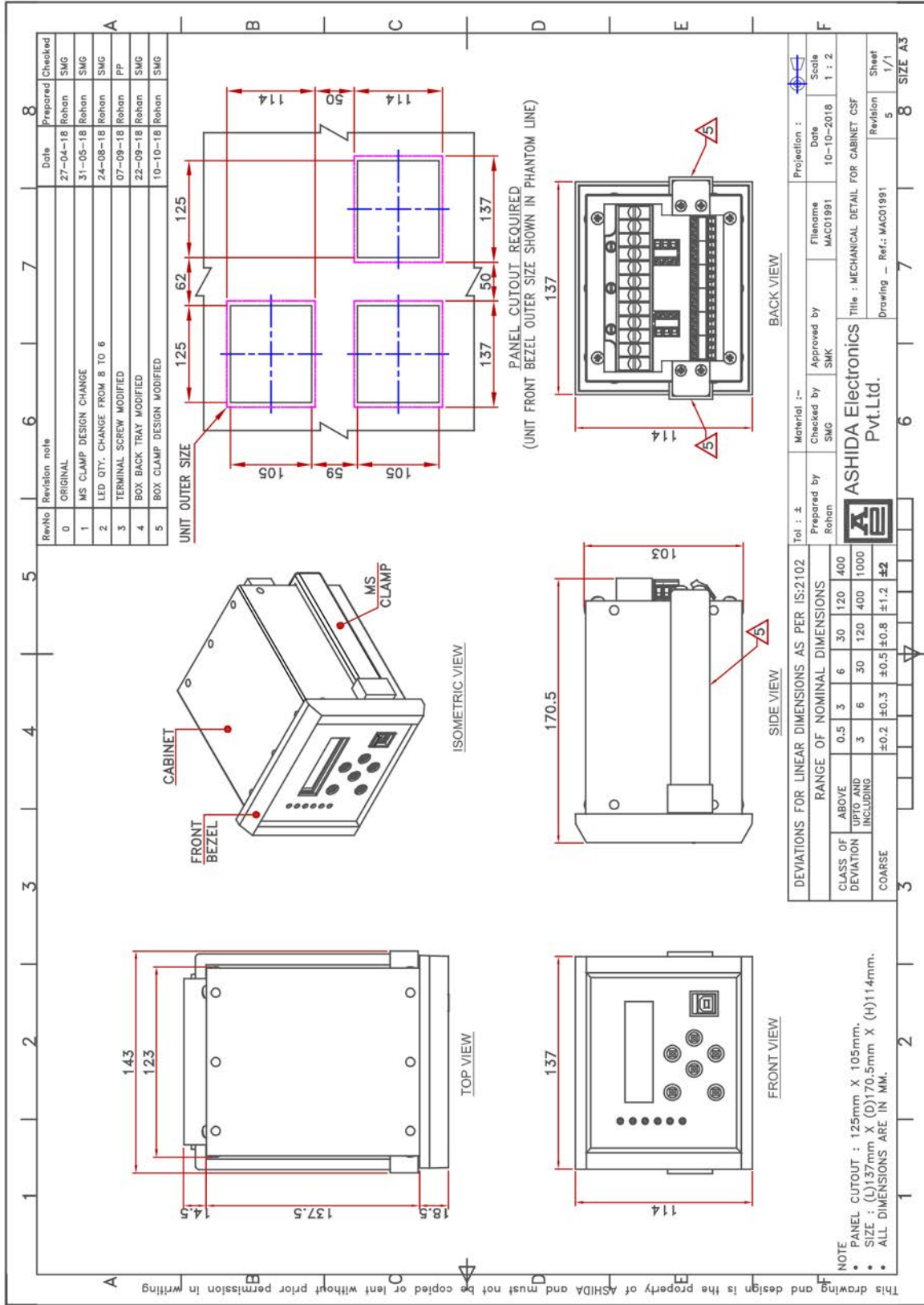
- Two Independent Settings Groups
- Thermal Overload Protection (49)
- Non Directional Phase & Ground Over Current Function (50/51/51N/50N)
- Three Independent Stages for Non Directional Phase Over Current Protection.
- Three Stages of Non Directional Ground Over Current Protection
- Internally Derived / Externally measured Ground Over Current (3I0>) Protection.
- Inverse time Over Current Protection (IEC & IEEE curves)
- Harmonic blocking and unblocking feature.
- Cold load pick up
- High Impedance Restricted Earth Fault Protection (64R).
- Inverse & Definite time Negative Sequence Over Current Protection (46)
- Broken Conductor Protection (46BC)
- Breaker Failure detection (50BF)
- Trip circuit supervision function
- Programmable Inputs & Outputs
- Watchdog Contact.
- Programmable & Target LEDs for indication with dual colours (6 nos.)
- Self Supervision of relay
- Metering function.

			<p>: AC voltage dip: 10, 20ms without loss of protection for AC 50ms, 100ms, 200ms, 0.5s, 5s with temporary loss of protection</p>
11.	Conducted & Radiated frequency Emission Test	IEC60255-25	<p>: Conducted 0.15MHz - 0.5MHz, 79dB (microV) Q-Peak, 66dB (microV) for average 0.5MHz - 30MHz, 73dB (microV) Q-Peak, 60dB (microV) for average</p> <p>Radiated (3mtr) 30MHz - 230MHz, 50dB (microV) Q-Peak, 230MHz - 1GHz, 57dB (microV) Q-Peak,</p>
Insulation Tests:			
12.	High Voltage Test	IEC60255-27	: At 2kV 50Hz between all terminal connected together and earth for 1 minutes
13.	Impulse Voltage Test	IEC60255-27	<p>: Test voltage: 5KV (peak) 1.2 / 50us, : Energy :0.5 J, : Polarity : + Ve and - Ve : Nos. of impulses : 3 positive and 3 negative impulse : Duration between Impulses : 5 sec.</p>
14.	Insulation Resistance	IEC60255-27	: $\geq 100M\Omega$ @ 500V DC
Environmental tests:			
15.	Cold test		: IEC-60068-2-1
16.	Dry heat test		: IEC-60068-2-2
17.	Damp heat test, steady state		: IEC-60068-2-78
18.	Change of Temperature		: IEC-60068-2-14
19.	Damp heat test, cyclic		: IEC-60068-2-30
20.	Enclosure Protection Test (IP52)		: IEC 60529
CE compliance			
21.	Immunity		: IEC-60255-26
22.	Emissive Test		: IEC- 60255-26
23.	Low voltage directive		: EN-50178
Mechanical tests			
24.	Vibration Endurance Test		<p>: IEC 60255-21-1 class 2 : Frequency Range = 10Hz - 250Hz , acceleration. = 2gn : Sweep rate 1 octave/min; 20 cycle in 3 orthogonal axis.</p>
25.	Vibration Response Test		<p>: IEC 60255-21-1 class 2 : Frequency Range = 10Hz - 150Hz , acceleration. = 1gn : Sweep rate 1 octave/min; Displacement =0.075mm, in 3 orthogonal axis.</p>

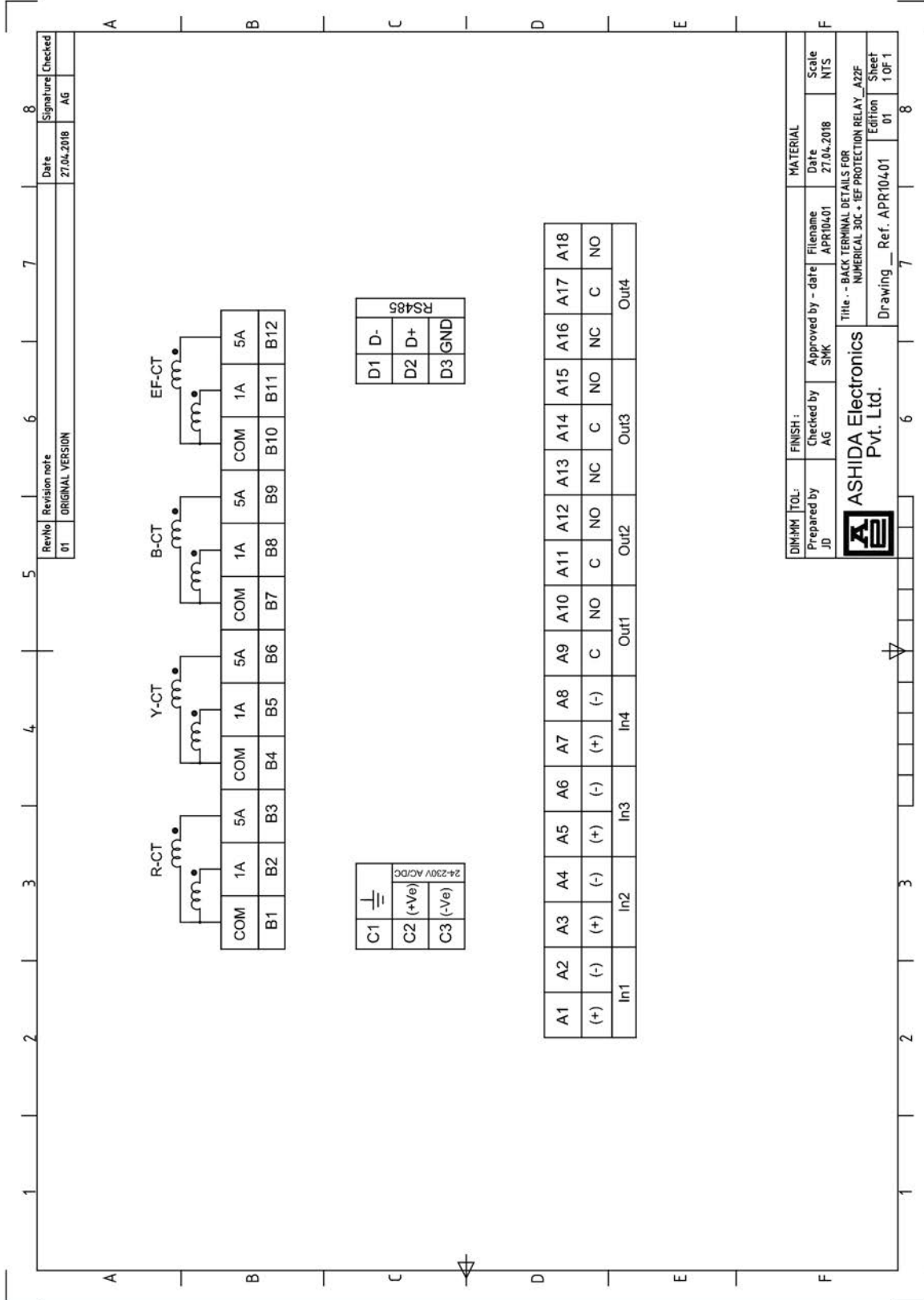
26.	Bump Test	: IEC 60255-21-2 Class-2 : 1000 bumps / direction of 20gn peak acceleration and 16ms pulse duration in each of the two opposite direction per axis as per No. of axes. 3.
27.	Shock Withstand Test	: IEC 60255-21-2 Class-2 : 3 shocks of 30gn peak acceleration and 11ms pulse in each of two opposite direction. No. of axis : 3
28.	Shock Response Test	: IEC 60255-21-2 Class-2 : 3 shocks of 10gn peak acceleration and 11ms pulse in each of two opposite direction. No. of axis : 3
29.	Seismic Test	: IEC 60255-21-3 Class-2 : Sweep 1/Axis (@a sweep rate of 1 octave/minute) vibration in the frequency range (1-35 Hz) at displacement X-axis: 7.5mm, Y-axis: 3.5mm amplitude of 3.5mm with acceleration of X-axis: 2gn, Y-axis: 1gn.

Note: Type test report is available on request

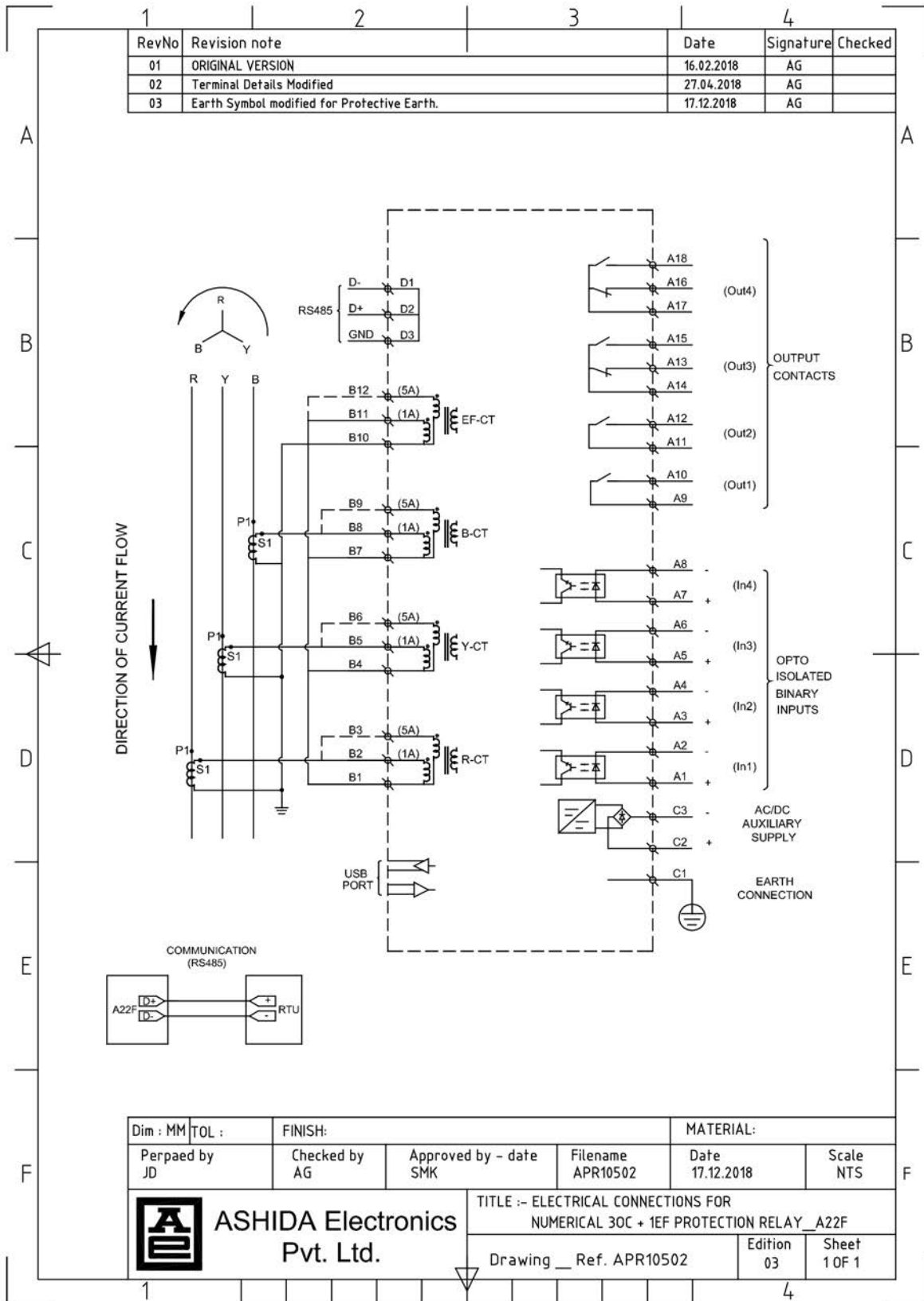
Mechanical Details



Back Terminal Details



Electrical Connection Details



General Specifications:

AC Current Inputs:

1A Nominal

5A Nominal

Continuous Thermal Rating:

100 X In for 1s

50 X In for 3s

4 X In for Continuous duty for Phase
and Ground

Dynamic Thermal rating

200X In for dynamic timing

Burden Rating:

< 0.2VA for current(In)

System Frequency:

50Hz / 60Hz

Frequency Tracking: 45 – 55Hz for
50Hz and 55 – 65 for 60Hz

Power Supply:

Range: 24 to 50Vac/dc or

100 to 230Vac/dc

Burden: < 10watts for DC

Digital Outputs:

Continuous carry: 5A

Make: 30A for 0.5s & 15A for 3s

Breaking capacity: 1250VA @

250Vac, 100 watts @ 250Vdc

resistive, 50 watts @ 250Vdc

inductive (L/R = 45ms)

Digital Inputs:

Operating range:

For 24 – 50Vdc Aux.: 18 -54Vdc

For 100 – 230Vdc Aux.:77 – 250Vac/dc

Communication Ports:

Front Port – USB

Rear Ports – RS485

Operating Temperature:

-25°C to +65°C

Storage Temperature: -25°C to +70°C

Humidity: 95% RH

Weight: < 3.4kg

Ordering Information												
	1 -- 4	5	6	7	8	9	10	11	12	13	14	15
Model	A22F	X	X	X	X	X	X	X	X	X	X	X
Example	A22F	B	0	0	1	0	0	0	0	1	0	B
Cabinet Details												
Basic Version	B											
Software Details												
Standard		0										
Language												
English			0									
Protocol												
IEC 103					0							
IEC 103 & MODBUS					1							
CT & PT												
PH & EF CT: 1/5 Amp Selectable						0						
DO												
Default - (B - 4DO)							0					
DI												
Default - (B - 4DI)								0				
DI Setting												
18VDC									0			
77VDC / 75VAC										2		
Auxiliary Supply												
24V - 50V DC											1	
100V - 230V AC/DC												3
Case Detail												
Non Draw out												0
Communication Port												
Disable / NO rear port												0
RS 485 rear port												B

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- Disturbance Recording (5 nos.)
- Event Recording (512 nos.)
- Fault Recording on HMI display (5nos.)
- Non-Volatile memory
- Fully communicable with IEC standard open protocol IEC60870-5-103, & MODBUS
- Separate communication port for SCADA Communication
- PC front port communication for convenient relay settings
- User friendly local operation with key pad
- Liquid crystal display (16x2) with backlight
- Password Protection.
- Measurement of current magnitude, symmetrical components, Thermal state, Breaker operating time, Breaker operating counter, Trip counter

Software Support:

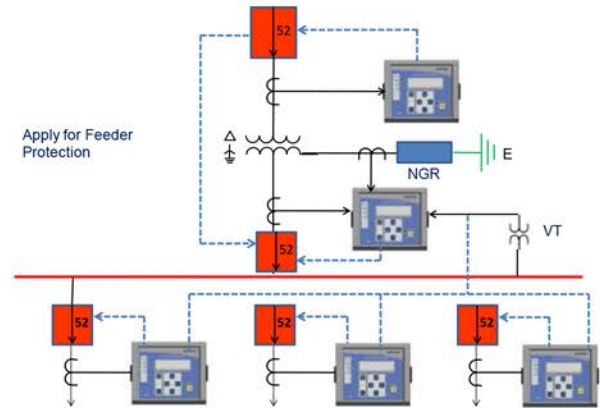
- Setting Editor.
- Programmable scheme logic Editor.
- Settings upload / download.
- Offline Settings Editor.
- Online Measurement.
- Disturbance analysis.
- Relay Assistant Tool.

Applications:

A22F numerical multifunction relay designed for Transmission line protection, Underground cable & feeder protection, Machine protection, and shunt capacitor bank protection applications. Relay

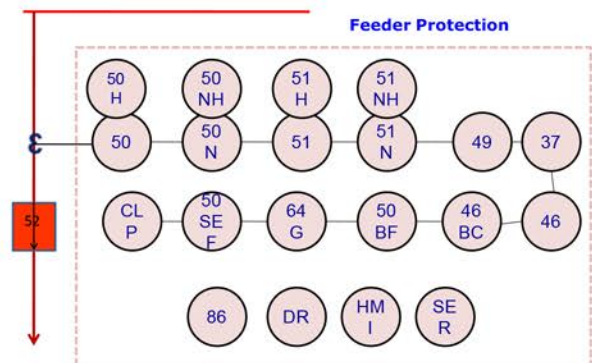
designed with fast and selective tripping ensures the stability and availability of electrical power system.

A22F relay apply for protection, control & monitoring of radial and ring main feeder to achieve sensitivity and selectivity on phase and ground faults.



Radial feeder application

The functional overview of A22F:



Protection functions Overview

ANSI Code	Description
CLP	Cold load pick up
37	Under current Protection
46	Negative Phase Sequence Protection
46BC	Broken Conductor Detection
49	Thermal overload Protection

50	Instantaneous/Definite Time Phase Over current Protection
51	Inverse Time Phase Over current Protection
50N	Instantaneous/Definite Time Ground Over current Protection
50SEF	Sensitive Ground Over current Protection
51N	Inverse Time Ground Over current Protection
64G	High Impedance Restricted Earth Fault Protection
50BF	Breaker Failure
86	Lockout (Trip command)

independently settable with inverse time or definite time characteristic. The following tripping characteristics are available;

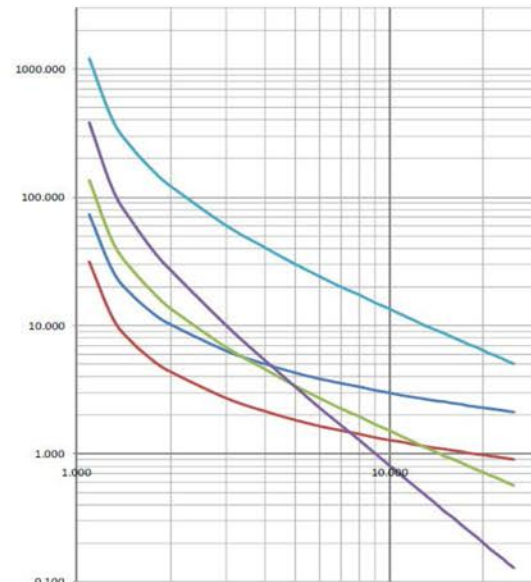
$$t = T * \left(\frac{K}{\left(\frac{I}{I_s} \right)^\alpha - 1} + L \right)$$

Description	Standard	K	α	L
IEC S Inverse	IEC	0.14	0.02	0
S Inverse 1.3 Sec	---	0.06	0.02	0
IEC V Inverse	IEC	13.5	1	0
IEC E Inverse	IEC	80	2	0
UK LT Inverse	UK	120	1	0
IEEE M Inverse	IEEE	0.0515	0.02	0.114
IEEE V Inverse	IEEE	19.61	2	0.491
IEEE E Inverse	IEEE	28.2	2	0.1217
US Inverse	C08	5.95	2	0.18
US ST Inverse	C02	0.02394	0.02	0.01894

Non Directional Over Current Protection (50/50N/51/51N):

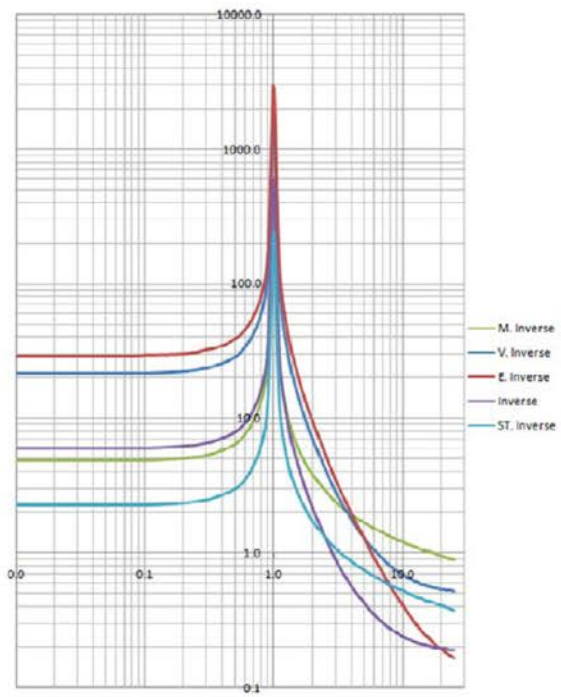
The core functionality of A22F relay is equipped with multi function feeder protection. The relay provides Non Directional phase and ground over current protection with multiple settings (Three stages for phase over current and ground over current) for various power system applications and wide range of protection settings. The function is equipped with digital filter algorithms, providing the rejection of higher harmonics & DC offset. Selectable IEC / IEEE inverse time curves with non directional over current protection will be providing greater selectivity, flexibility and sensitivity to users for better relay co-ordinations.

A22F relay provides inverse time over current characteristic for phase and ground over current elements. Each stage of phase and ground over current elements are



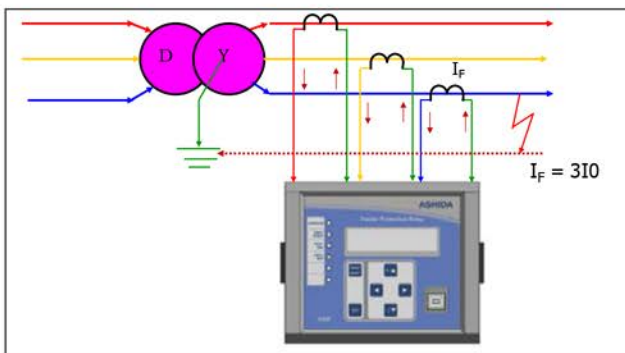
IEC/IEEE Inverse curves for tripping of over current elements

A22F relay provides the inverse time dropout characteristic (electromechanical relay reset) for IEEE curves. The output of protection function shall be reset after dropout time delay.



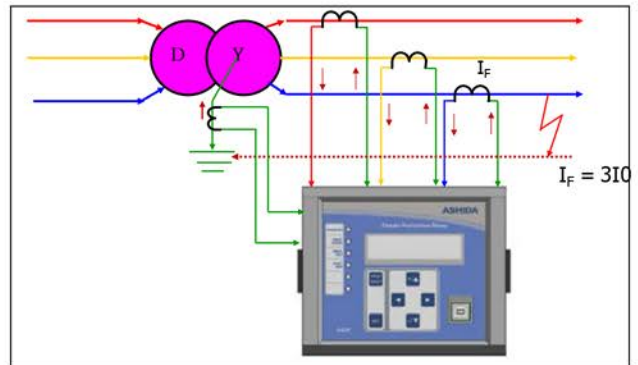
IEC/IEEE Inverse curves for resetting of over current elements

A22F relay provides three stages of definite time/inverse time internally derived zero sequence over current ($3I_0 >$) protection to detects asymmetrical faults in electrical network. It can apply to over head transmission line, underground cable, and feeder. The ground current ($3I_0 >$) calculated from three line currents.

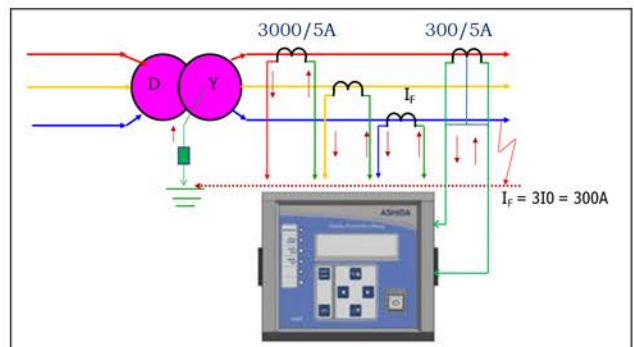


Internally derived residual over current application

A22F relay provides three stages of externally ground over current protection. A22F relay measures ground fault current through neutral CT input. Externally ground CT input can also apply for high impedance restricted earth fault protection or sensitive ground fault protection through CBCT.



Externally measured ground over current through neutral CT

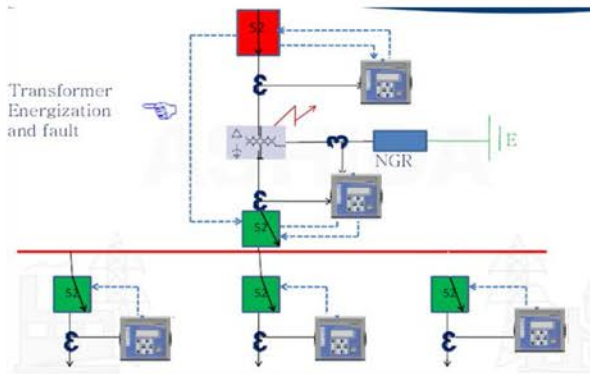


Externally measured ground over current through CBCT

Harmonic blocking / Unblocking for Over Current Protection (50H/51H/50NH/51NH):

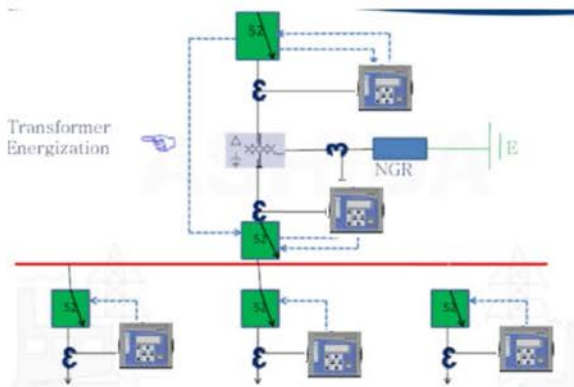
Harmonic blocking / unblocking feature equipped in A22F relay provides stability on inrush current during transformer energization. Harmonic blocking/unblocking feature is independent for each

stage of phase and ground over current protection.



Additional Functions (CLP & SOTF):

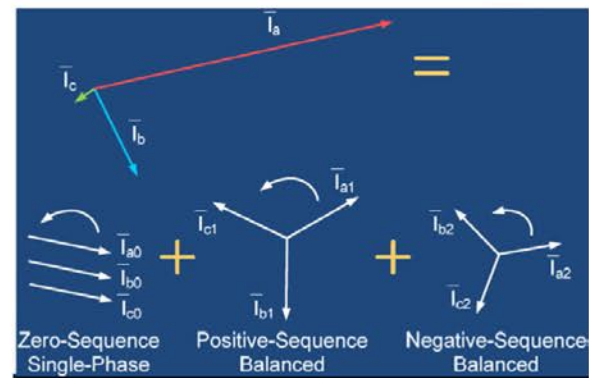
A22F provides the cold load pick up (CLP) and switch on to fault (SOTF) as additional functions. User can select the one of this function for application. Cold load pick up function provided in relay for multiple applications. The application of this feature can be use to avoid wrong operation on inrush current during transformer energization without compromising sensitivity of over current protection.



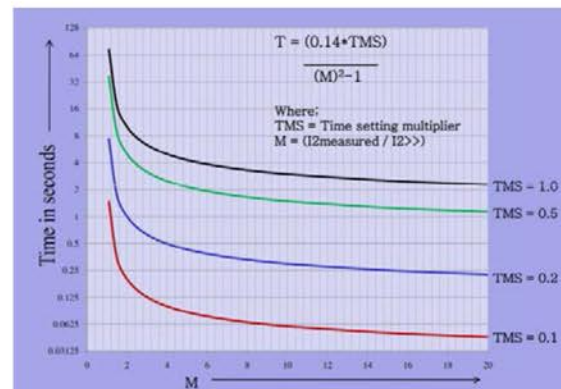
The A22F provides SOTF function to protection feeder against switch on to fault condition during feeder/transformer energization.

Negative Phase Sequence Over Current Protection (46):

Three independent stages of Definite and Inverse time Negative sequence over current protection will be providing back up protection of over head transmission line / underground cable / feeder against unbalanced faults, very high resistive phase/ground faults and unbalanced loads. Protection can also apply in condition when there is a very high resistive ground fault and ground element may not sense the fault current.



The negative phase sequence over current element can be programmed as IDMT or definite time characteristic. A22F relay provides ten selectable IEC / IEEE inverse curves for each stage.



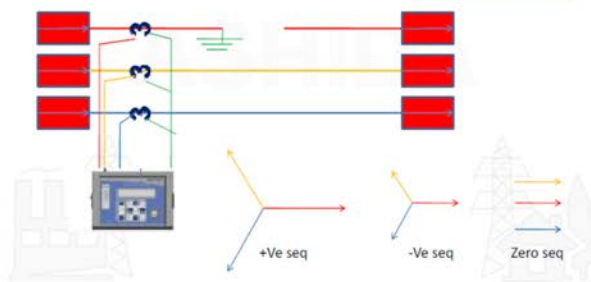
Broken Conductor Protection

(46BC):

A22F equipped with broken conductor detection protection. Broken conductor condition can be detected by ratio of Negative sequence current to Positive sequence current (I_2/I_1) provides higher sensitivity on High resistive fault.

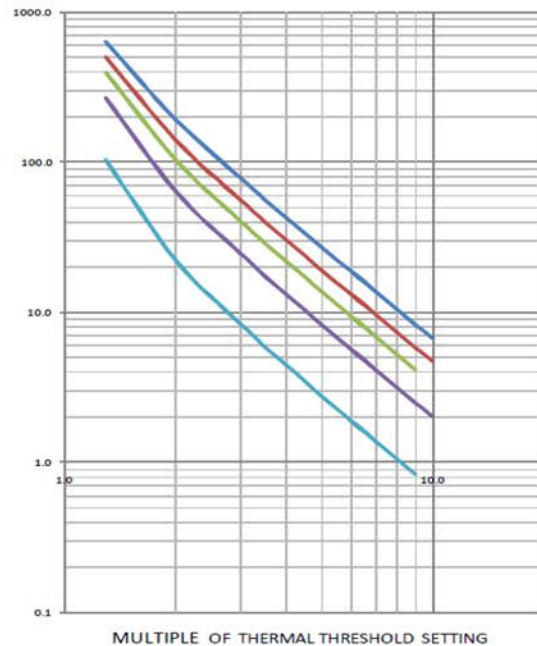
High resistive faults or Broken conductor can be detected by Ratio (I_2/I_1)

I₂/I₁: 0.2 - 1*I_n
DT time delay



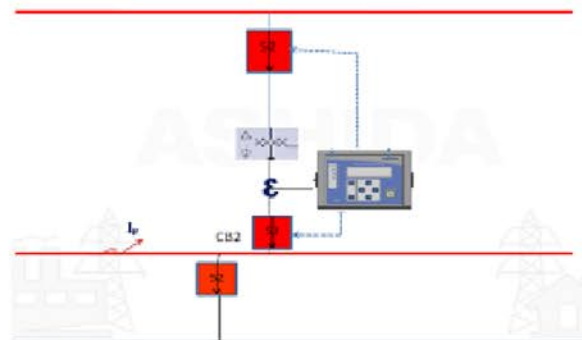
Thermal overload Protection (49):

A22F relay provides thermal over load protection of transformer against over load conditions. Relay estimate thermal contents and initiate alarm & tripping if the thermal contents are higher than the preset value. Trip time of relay follows the according to the thermal time constant value set in to relay.



Breaker Failure detection (50BF):

If the fault current is not interrupted after a time delay expired, circuit breaker failures detected, and execute trip command to upstream circuit breaker. A22F relay incorporates circuit breaker failure protection to detect failure of tripping command execution due to mechanical or electrical problems in circuit breaker.



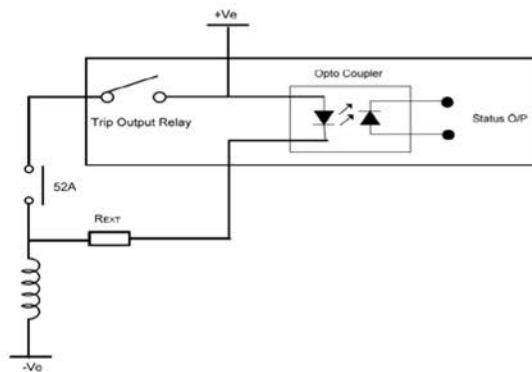
Under current detection (37):

A22F relay provides under current protection with definite time delay characteristic option.

Trip circuit supervision (74T):

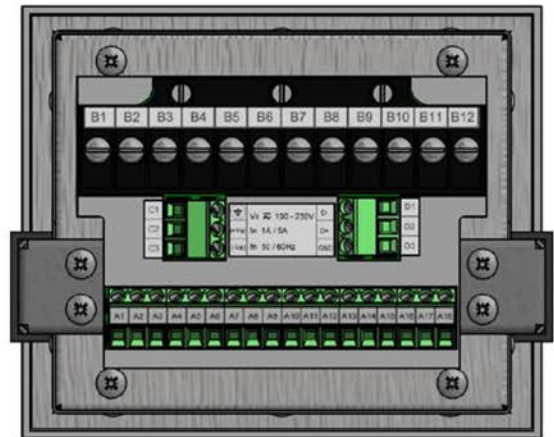
Any binary inputs for circuit breaker poles can be used for monitoring the circuit breaker trip coils including connecting cables. Relay initiate alarm whenever the circuit breaker control/DC circuitry gets interrupted.

The A22F is having 4 nos. of digital inputs and any one shall be assigned/used to continuously monitor healthiness of trip-circuit.



Programmable Inputs, Outputs & Logic:

The A22F relay equipped with 4 nos. of programmable digital outputs and 4 nos. of optically isolated digital inputs. Any digital input shall be configured for trip circuit supervision monitoring and remaining 3 nos. are the programmable digital inputs to be configured for desired applications. All the 4 nos. of digital outputs are programmable with logic equation.



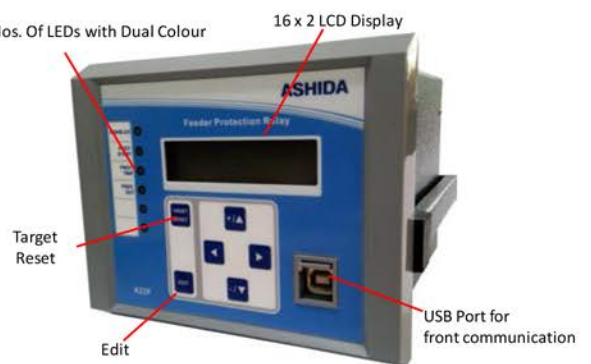
Backside Terminals

Programmable LEDs and Pushbuttons:

The A22F relay provides total 6 nos. of target & programmable LEDs with dual colors indication. 4 nos are target & 2 nos. are programmable (i.e. L5 & L6). The LEDs can be programmed either through HMI or through PC software (RTV2 software).

Front View details:

The A22F relay;



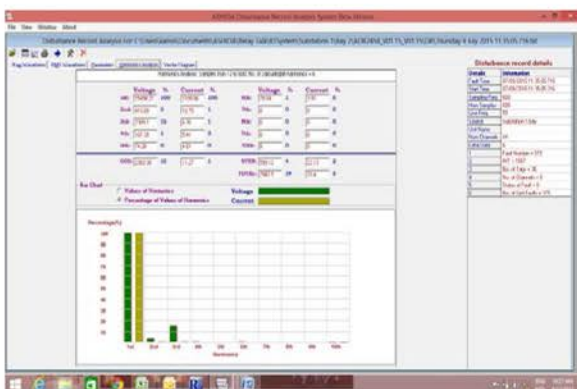
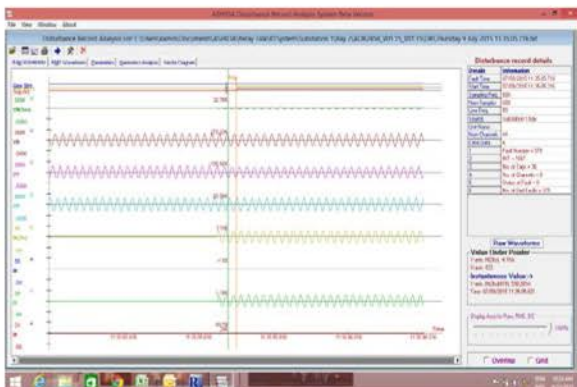
Event recording:

A22F relay is providing feature to record and store 512 nos. Of events in non-volatile memory through internally by protection and control functions and

externally by triggering of digital inputs, and can be extracted using communication port or viewed on front of LCD display. The event shall be trigger on time stamp through time synchronization or internal clock setting.

Disturbance recording:

A22F relay is provides built in disturbance recording facility for recoding of analogue and digital channels. Relay records 5 nos. of disturbances and store in to non-volatile memory. Disturbance records can be saved in IEEE COMTRADE format and same can be analyzed in disturbance analysis software.



Fault recording:

A22F relay is providing fault record facility. The fault records can be display either on HMI display or in RTV2 software. The relay can records 5 nos. of fault records in non-volatile memory.

Metering:

Online metering feature of A22F relay is providing metering of parameters (i.e. current magnitude, symmetrical components, I2/I1 etc.) on HMI display or in RTV2 software.

Independent Protection settings groups:

A22F relay provides two independent settings groups to allow operate relay on different power system operating conditions.

IEC 60870-5-103 Protocol:

A22F relay provides internationally standardized protocol for communication via RS485 port of protection relays. IEC 60870-5-103 protocol used worldwide and supported by relay manufacturers.

Typical Tests Information:

The Relay Confirm to following standard			
Electromagnetic Compatibility Type Test:			
Sr. No.	Standard		Test
1.	High Frequency Disturbance Test	IEC60255-22-1	: Frequency : 1MHz Damped Oscillatory : Longitudinal :2.5 KV Common Mode, 1 KV Differential Mode : Duration: sec duration 2 sec. : On Mains Port.
2.	Electrostatic Discharge Test-Direct Application	IEC60255-22-2	: IEC 61000-4-2. : Contact discharge: 2, 4, 6 & 8 KV, : Air discharge: 2, 4 8 & 15 KV : Polarity: both +ve and -Ve polarities.
3.	Fast Transient Disturbance Test	IEC60255-22-4	: Class A : 4KV; 5/50ns; 5KHz & 100KHz: Repetition rate 300ms; Both polarities; Ri = 50Ω; duration 1 min.
4.	Surge Immunity Test	IEC60255-26 & IEC61000-4-5	: Differential Mode = 2kV : Common Mode = 4kV : 1.2/50μs, 8/20μs 5 surges of each polarity
5.	Power Frequency Immunity Test	IEC60255-22-7	: Class-A
6.	Pulse Magnetic Field Immunity Test	IEC61000-4-9	: TEST LEVEL 5, TEST specifications = 1000A/m field applied in all planes
7.	Radiated Electromagnetic Field Disturbance Test	IEC60255-22-3 & IEC61000-4-3	: 10V/m, Performance Class-A : 10V/m, freq = 80MHz to 1GHz, 1.4 – 2.7 GHz and 30 V/m, freq = 800 – 960 MHz , 1.4 – 2 GHz SPF = 80, 160, 380, 450, 900, 1850 & 2150 MHz 80% AM at 1kHz.
8.	Conducted Disturbance Induced By Radio Frequency Field	IEC60255-26	: Freq. 150kHz – 80MHz, Amplitude 10 V, Modulation 80% AM @ 1 KHz. SPF = 27 and 68 MHz
9.	Power Frequency Magnetic Field Immunity Test	IEC61000-4-8	: 1000A/m FOR 3s, 100A/m for 1minute.
10.	Power Supply Immunity Test	IEC60255-11 & IEC61000-4-11	: DC voltage dip: 40% dip 200ms and 70% for 500ms for DC 10 & 20ms without loss of protection for DC 30ms, 50ms, 100ms, 200ms, 300ms, 0.5s, 1s and 5s with temporary loss of protection for DC