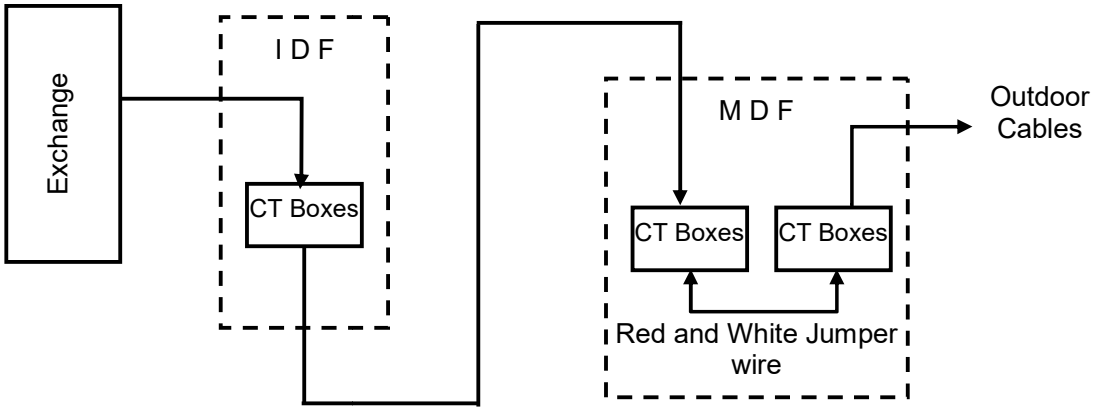
नाम Name : _____	प्राप्त अंक Marks Awarded
अनुक्रमांक Roll No : _____	
पाठ्यक्रम Course : _____	
दिनांक Date : _____	अनुदेशक का अध्यक्षर Instructor Initial

Objective: Study of IDF / MDF, Protective devices, Power Supply arrangement in Exchanges and Testing of IPM (Integrated Protection Module) used at IDF for Protection.

Equipments Required:
IDF, MDF cabinet, IDC modules, IDC connector tool, jumper wires (red/white - 0.5mm), Multimeter, 500V megger, rosette.

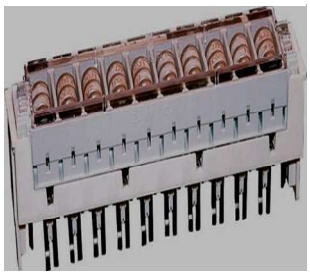


IDF: Intermediate Distribution Frame
This is the first distribution point fromTelephone Exchange to subscribers.
All the subscribers and trunk lines from exchange are terminated on top side of IDC Module in CT (Cable Termination) Box and from bottom side cables are routed to MDF.
It is the point where the protection arrangement is provided.
It is the place where frequent changing of cable pair is not done.

MDF: Main Distribution Frame
This is the second distribution point from the Telephone Exchange towards subscriber.
All the subscriber and trunk lines from IDF are terminated on CT Boxes (Exchange Side) and all the Field cables (Outdoor) are terminated on CT Boxes (line side) in MDF.
Internal jumpering is done between Exchange side and Line side CT Boxes. In MDF Red & White jumper wires are used to extend the connections.

IPM

Arrestor Magazine



IDC Module (krone make)

IDC Tool (Krone make)

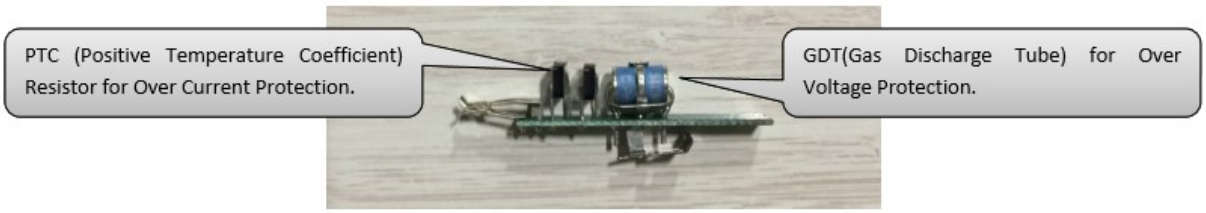
IDC Module (KRONE MAKE):

An IDC module supports wiring for ten pairs. Initial removing of insulation is not required for this module.

Wiring is done with a special tool called **Insulation Displacement Connector (IDC) Tool**.

- It includes a scissor-action cutter that is designed to cut off surplus wire after the termination. This occurs automatically as part of the punch-down action.
- It is provided with a folded-out metal hook for removing the wires from the terminals.

Integrated Protection Module (IPM) is made up of 3 Pole GDT (Gas Discharge Tube) and PTC (Positive Temperature Coefficient) Resistors**.** As shown in the below figure.



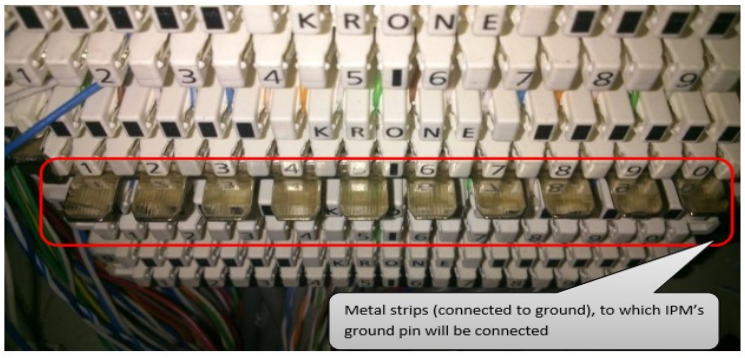
How IPM safeguards our LINE and PBX?

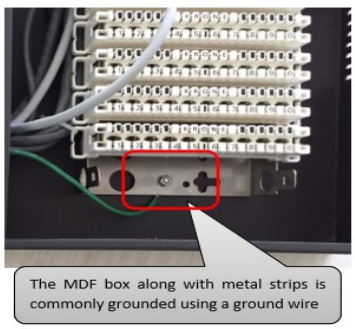
There are two cases possible where IPM serves as a protection:

- **Over Voltage Protection**: Under normal operating conditions, GDT offers high insulation resistance has virtually no effect on the system to be protected. As soon as the voltage to the GDT exceeds the spark over voltage, an arc is formed in the GDT and discharges the surge to earth through it, thereby circuit is protected. Once the spark over voltage reduces to normal, GDT extinguishes and the internal resistance immediately returns to a very high value.
- **Over Current Protection:** A PTC consists of a piece of polymer material loaded with conductive particles (usually carbon black). Under normal operating conditions the polymer is in a semi crystalline state and the conductive particles touch each other, forming multiple conductive paths and providing low resistance. As soon as the current to the PTC exceeds the rated trip current (I_{trip}), the PTC heats up suddenly. The polymer changes to an amorphous state and expands, breaking the connections between the conductive particles. This causes the resistance to increase rapidly by several orders of magnitude and reduces the current to a low (leakage) value just sufficient to keep the PTC in the high-resistance state. When the power is shut off, the device cools down and returns to its normal low-resistance state.

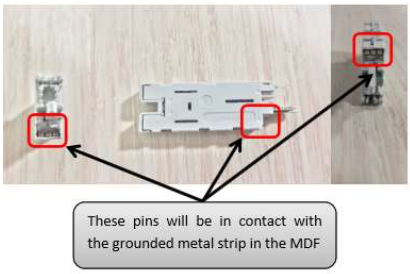
How to install IPM?

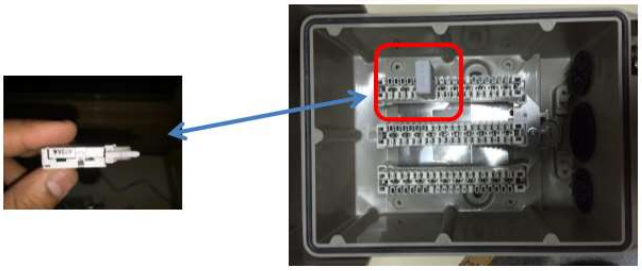
1. The MDF box is provided with a grounded metal strip to which ground pin of IPM is connected**.**





2. Insert the IPM in the Krone Module and it is mandatory to ground the IPM from its ground pin using a metal strip in the MDF.



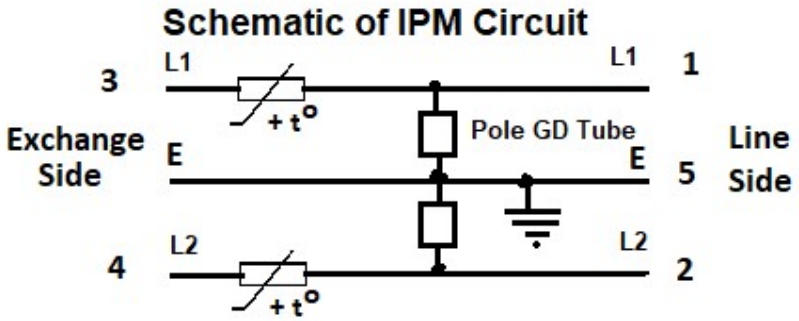


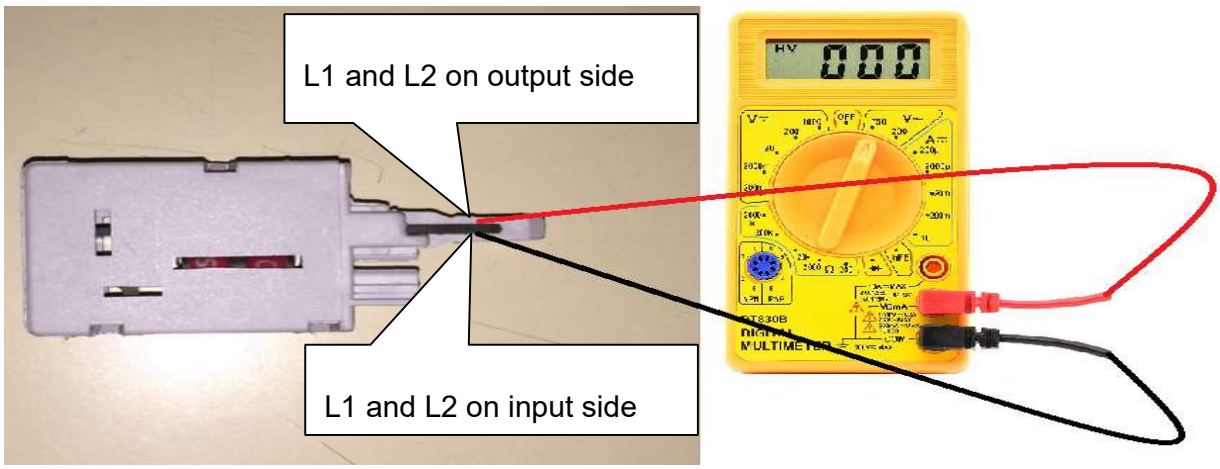
Testing of IPM:

Testing of Positive Temperature Coefficient (PTC) Resistor

Once the PTC gets faulty, you will not get dial tone on the port connected to the line because there will not be any connectivity between System & Field Cabling.The following steps should be followed to identify that PTC is working or not.

1. Remove the IPM from the krone module and check if there is any dirt accumulated on the connectors. If yes, remove the dirt.
2. Check for the continuity between L1 and L2 on the exchange side to L1 and L2 on the line side as shown in the diagram using multimeter.





3. If continuity is there between exchange side and line side for both L1 and L2, it means PTC Resistor is working, insert the IPM back into the Krone module else replace it with a new one.

Testing of GD (Gas Discharge) tube

Once the GD tube gets faulty, there will be short between L1 and L2, L1 to EARTH or L2 and EARTH on the port connected to the line.
The below steps should be followed to identify that GD tube is working or not.

1. Check the insulation resistance between the L1 and L2 using 100V and 500V insulation tester.
2. Check the insulation resistance between the L1 and Earth using 100V and 500V insulation tester.
3. Check the insulation resistance between the L2 and Earth using 100V and 500V insulation tester.

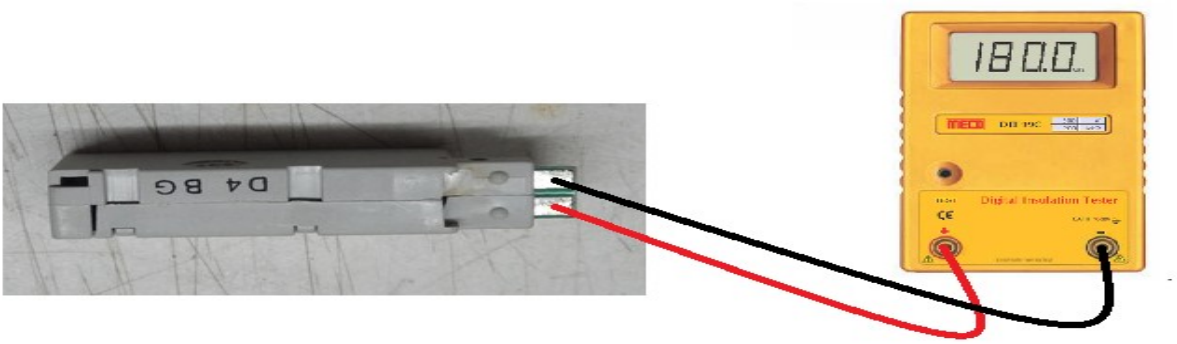


Table for testing the IPM

Terminals for Testing	With Multimeter (Resistance)	With Megger (100V)	With Megger (500V)
Between 1 and 3	Short (approx. 6 to 25Ω)	-	-
Between 2 and 4	Short (approx. 6 to 25Ω)	-	-
Between 1 and 5	Open	Intial open and than Short	Short
Between 2 and 5	Open	Intial open and than Short	Short
Between 1 and 2 or 3 and 4	Open	Open	Short

If the IPM passes both the above tests than the IPM is said to be in Good Condition

Specification of IPM

Max. Operating Voltage (a/b-e, a-b)	- 180 V (volts)
Normal DC spark-over voltage	- 180~300 V (volts)
Impulse spark-over voltage @1kV/ micro sec	- < 900 V (volts)
Nominal arrestor surge current (8/20 micro sec)	- 5kA
Nominal arrestor alternating discharge current	- 5A (rms)
Fail safe response time	- < 5 seconds
Max. Operating current (a-a', b-b')@25 c	- 120 mA (milli amps)
Rated line resistance (a-a', b-b')@145mA, 25c	- 6~25 Ω
Resistance balance	- < 1 Ω
Max. Switching current of PTC @230V rms	- 3A (rms)
Max. Switching time PTC @1A (rms)	- 2.5 seconds
Insulation Resistance	- >1000 M Ω

Power Supply Arrangement:

Telephone exchanges require un-interrupted power source. For this, a float cum boost SMPS charger is used to power the exchange and to feed power during mains failure a battery bank is connected in parallel to the SMPS charger. This arrangement is called **Float Charging**.

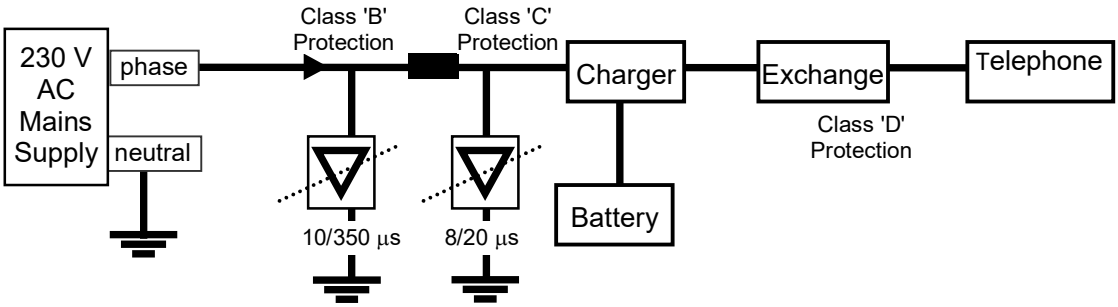
In this system when mains supply is available, SMPS charger feeds power to the exchange and also charges the battery.

The capacity of the SMPS installed in this lab is 1+2 SMR module each of 25A.

Battery Bank:

Telephone exchange works on -48V DC. For this a battery bank of 24 cells are connected in series. Each cell is of 2V.

The nominal load current of the exchange is < 10 A.
The capacity of the battery installed in this lab is 300Ah.



Surge Protection Devices:

Devices that shield electrical and other electronic devices from surges in electrical power or transient voltage, that flow from the power supply are termed as SPD.

A surge protector works by channeling the extra voltage into the outlet's grounding wire, preventing it from flowing through the electronic devices while at the same time allowing the normal voltage to continue along its path.

Devices for class - B (Spark gap), Class - C (MOV - Metal Oxide Varistor) and class - D (Gas Discharge Tubes) are used to protect the electrical and electronic devices under use. Class B, C & D protections are as shown in the above figure.

Review Questions

1. Observe and draw the IDF / MDF wiring in the exchange?

2. Draw the power supply arrangements made for telephone exchanges with ratings?

3. Draw the front panel diagram of Float charger.

4. What are the Surge Protection arrangements made in the exchange?

5. Mark the connections in the following wiring?