



- For grounded or non-grounded live networks in land, marine and sub-sea installations
- True r.m.s. measurement not affected by heavily distorted Waveforms
- Non-resistive earth current offset function
- Restricted or Unrestricted earth fault detection
- Highest up meter reading on KPM362x, Pathfinder function identifies highest channel
- Analogue output proportional to meter reading (F-version)

## Specifications

### KPM162E/F & KPM162G/GF - KPM362E/F & KPM362G/GF

RTM102ZF & RTM102ZF-RT		
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### MML1501 & MML15010

System voltage:	100-240, 380-460 or 600-1000VAC
Dimension: (HxWxD)	MML 1501: 172 x 112 x 35mm MML 15010: 172 x 112 x 70mm
Weight:	0.3kgs and 0.5kgs

### Core Balance Current Transformer (CBCT)

Type:	Dimension: (WxH)	Inner area: (WxH)
IGT12 (Toroidal)	37 x 43mm	ø 12mm
IGT30 (Toroidal)	ø 55mm	ø 30mm
IGT60 (Toroidal)	ø 98mm	ø 60mm
IGT110 (Toroidal)	ø 154mm	ø 110mm
IGT160 (Toroidal)	224 x 220mm	ø 160mm
IGT200 (Toroidal)	265 x 260mm	ø 200mm
IGR2015 (Rectangular)	330 x 218mm	200 x 150mm
IGR3015 (Rectangular)	370 x 228mm	300 x 150mm
IGR3215 (Rectangular)	390 x 228mm	320 x 150mm
IGR3515 (Rectangular)	420 x 228mm	350 x 150mm
IGR4015 (Rectangular)	470 x 228mm	400 x 150mm
IGR5015 (Rectangular)	580 x 235mm	500 x 150mm

#### Note:

For Split Core transformers or other dimensions contact Megacon

## Application

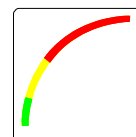
The digitally controlled KPM162x (1 channel) and KPM362x (3 channels) monitors flow of earth current between a non-grounded (IT) or grounded TN network and its protective earth. Unit can be used for either Restricted or Unrestricted earth fault detection.

The unit reads the level of earth leakage directly in mA. The standard range is 0-150mA. Larger scale values are available, typically 500mA, 1A, 2A, 5A and 10A. The 3-channel KPM362x automatically locks the meter to read the highest of the three channels.

An AC or DC auxiliary voltage is required for the unit. Start of monitoring function is inhibited when auxiliary power is switched on (default 2secs delay). In this way false tripping during power up, caused by initial charging of network spread capacitance, is avoided.

The meter and the triple-zone status LEDs give at a glance the clear safety message:

- ALARM (red zone)
- WARNING (yellow zone)
- HEALTHY (green zone)



## General

### RCD MEASURING PRINCIPLE

Earth current is measured by one (KPM162x) or three (KPM362x) IG-transformers (Core Balance Current Transformer, CBCT). The measuring technique is based on the principle that the sum of the phase currents in a fault free circuit is zero. If an earth fault is present, the sum of the phase currents is not zero. This current differential produces a signal from the IG transformer, which is proportional to the earth current. All loaded wires shall go through the CBCT.

### OUTPUTS

The unit has C/O relay outputs for Warning and Alarm. The Alarm relays are fail to safety configured. A trip LED flashes when the trip level is passed, the relay trips when the delay has elapsed. The timer resets if the fault is removed during countdown. Offset, trip levels and delays are settable on unit rear.

All F versions have an isolated **analogue output** proportional to meter reading. If output is used for remote meter reading, we recommend 0-1mA for the slave indicator.

### OFFSET FUNCTION

Only the resistive (ohmic) earth leakage current is a measure for the insulation condition between the AC supply and its protective earth. Any reading of leakage current in a fault free network will be caused by the network's spread capacitance. An offset potentiometer on the rear allows normal reactive (capacitive) currents to be ignored.

### "PATHFINDER" FUNCTION

The flashing pattern of the Warning or Alarm LED on the KPM362x identifies the highest-up channel producing the trip.

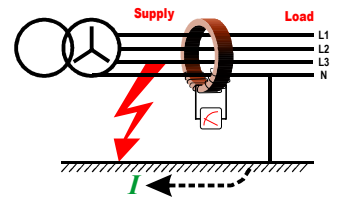
## General

The difference between restricted and unrestricted earth fault protection is the location of the neutral grounding point. When combined with a suitably rated CBCT the KPM162x or the KPM362x can be used in either application. The different TN-nets are described below:

### Restricted Earth Fault Detection

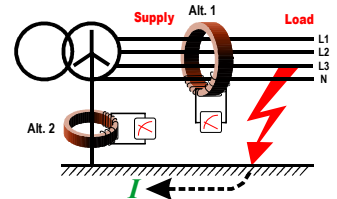
The neutral grounding is on the LOAD side of the CBCT. Any leakage to earth on the SUPPLY side of the CBCT will be seen as an imbalance situation, and will cause the Earth Leakage Guard to trip if leakage current exceeds the trip level settings. Faults on the LOAD side of the CBCT are not detected.

This method is commonly used to protect generators, with trip level typically set at approximately 10% of machine output rating.



### Unrestricted Earth Fault Detection

The neutral grounding point is on the SUPPLY side of the Core Balanced Current Transformer (CBCT). Any leakage to earth on the LOAD side of the CBCT will be seen as an imbalance situation, and will cause the Earth Leakage Guard to trip if leakage current exceeds the trip level settings. Faults on the SUPPLY side of the CBCT are not detected. This method is used for general protection.



### PROTECTIVE EARTH (PE) GROUNDING

In grounded supply systems the earth current measuring method must be selected on the principle of grounding used; i.e. distributed or centralised PE-grounding.

A distributed system may have multiple PE-connections, and consequently all loaded wires must be CBCT monitored, shown as **alternative 1**. In a centralised system the CBCT monitors the resultant earth current flow through the one and only PE grounding link from a generator, a transformer or a section of a switchboard, shown as **alternative 2**. This method is not recommended for paralleled generators sharing a common load.

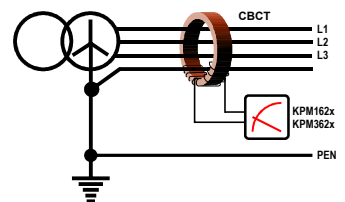
### TN-S Network

In a TN-S Network the PE and Neutral are separated all the way from the supply side. PE and N **must** not be connected together at any point after the distribution point.

L1, L2, L3 and N feed in a 4-wire cable to the consumer and PE is separate.

Either all loaded wires or just the non-loaded main ground shall be fed through the CBCT.

PE form thus a continuous ground electrode.

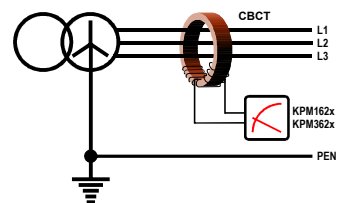


### TN-C Network

In a TN-C Network the PE-wire acts as a combined earth and Neutral wire. It is described as a "PEN-conductor" (Protective Earth Neutral). In this net there is limited human protection against the earth fault. A rarely used system.

To overcome this you can split the PEN wire into two parts, one wire will be the Neutral and the other the PE wire (TN-C-S Network).

Either all loaded wires or just the non-loaded main ground shall be fed through the CBCT.

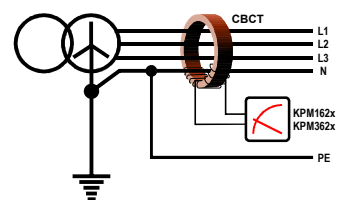


### TN-C-S Network

TN-C-S Network is almost identical in structure to the TN-C, except that in the TN-C-S the PEN conductor is split at the distribution point to a N-wire and a PE wire.

Also known as Protective Multiple Earthing (PME) or as Multiple Earthed Neutral (MEN).

Either all loaded wires or just the non-loaded main ground shall be fed through the CBCT.



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**KPM162x or KPM362x in an IT or TT Network****TT Network**

In a TT Network the Neutral point is grounded at the transformer but the ground connection is not wired to the consumer. The consumer is grounded locally. On an earth fault the earth current will depend on the resistance (R) of the return path to the transformer.

There can be a long distance between the transformer ground and the local ground, an earth current **can** be high.

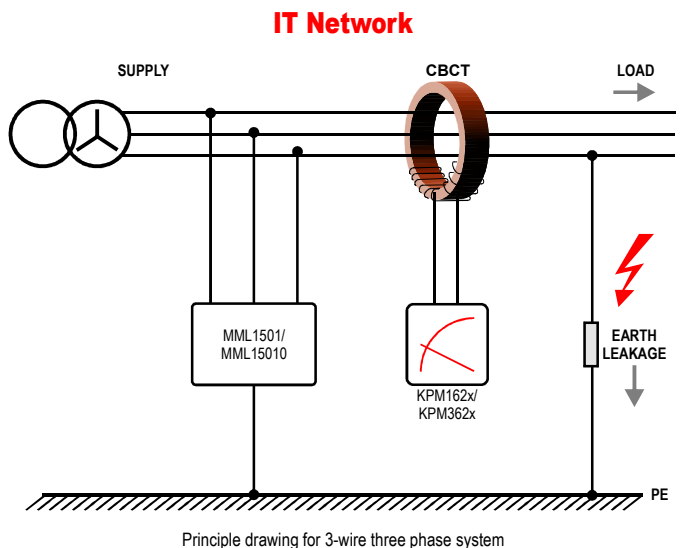
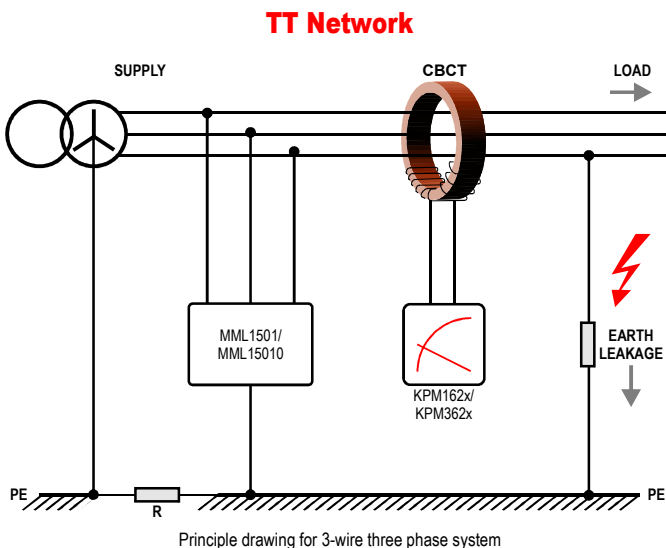
An earth current will **normally** be detected by a CBCT but it is recommended to install a constant impedance module (MML1501 or MML15010) for the return path to secure uniform detection of an earth fault.

**IT Network**

In an IT Network the distribution system has no connection to earth or it has a high impedance connection. The preference for these systems is to use an insulation monitoring unit like KPM16x. However the use of a constant impedance module (MML1501 or MML15010) gives the possibility to provide individual earth fault monitoring of each consumer.

The MML provides a normalised return path for earth current detection. This principle will only work in networks with small spread capacitance.

IT networks are preferred on vessels, offshore and hospital to provide the highest possible personnel safety.

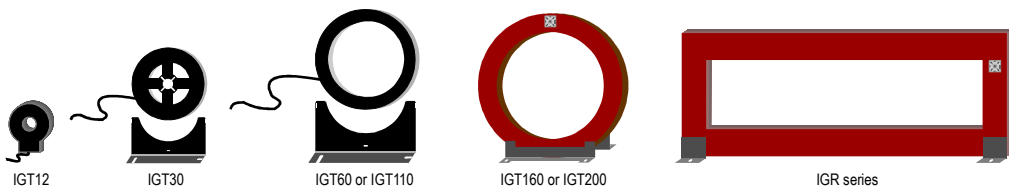
**TOROIDAL AND RECTANGULAR RESIDUAL CURRENT TRANSFORMERS (IGT, IGR series)**

The transformer range are used as sensors to detect earth leakage current in Megacon Earth Fault Systems for selective monitoring and protection. The transformers' measuring accuracy and repeatability is high and is not influenced by the relative position of the individual conductor passing through the transformer core.

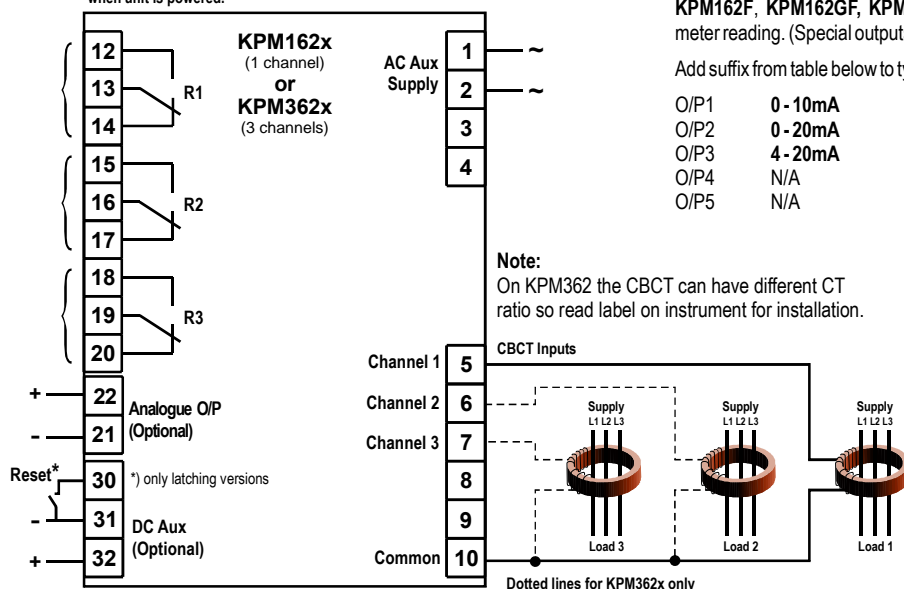
Nominal measuring range is 50 to 400Hz. Maximum ambient temperature +70 degrees C. The lower earth current sensitivity limit is in the region of 3 to 5mA.

The recommended maximum distance between a residual current transformer and the Earth Current Monitoring Unit is generally 100 metres. If the distance exceeds 5 metres, or the connecting cable is exposed to heavy stray electromagnetic fields, the cable (minimum 0,5mm<sup>2</sup>) should be shielded.

The shield should be grounded to protective earth (PE) only at the end closest to the monitoring unit.

**Typical IGT-Transformers for KPM162x and KPM362x series****Impedance module**

Relays shown de-energised,  
a fail-safe relay energises  
when unit is powered.



## Analogue Output

KPM162F, KPM162GF, KPM362F and KPM362GF have an analogue output proportional to meter reading. (Special outputs are available on request)

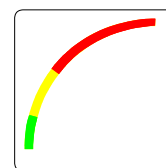
Add suffix from table below to type designation to specify output required:

O/P1	0 - 10mA	O/P6	N/A
O/P2	0 - 20mA	O/P7	N/A
O/P3	4 - 20mA	O/P8	0 - 10VDC
O/P4	N/A	O/P9	N/A
O/P5	N/A	O/P10	4,3-20mA

## Settings

Coloured sectors show recommended areas of settings:

- Red indicates alarm trip zone
- Yellow indicates warning trip zone
- Green indicates healthy zone



## Relay Operation

Model	Latch	Output
KPM162E	-	-
KPM162F	-	X
KPM162G*	X	-
KPM162GF*	X	X
KPM362E	-	-
KPM362F	-	X
KPM362G*	X	-
KPM362GF*	X	X

	Warning	Alarm	Fail safe	Latch
R1	✓			*✓
R2		✓	✓	*✓
R3	✓	✓	✓	*✓

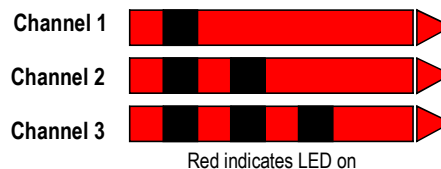
\*All G-versions have latching relays.  
The standard is non-latching relays.

### Relay Reset

Any latched relay is reset by linking terminals 30 and 31.

## Pathfinder Function

When a warning or alarm trip has operated on a KPM362x, the relevant LED will flash in the following pattern to indicate the channel producing the trip.



## More than 3 channel monitoring?

### Megacon recommends ISOPAK100 series - Universal AC Earth Fault Protection System

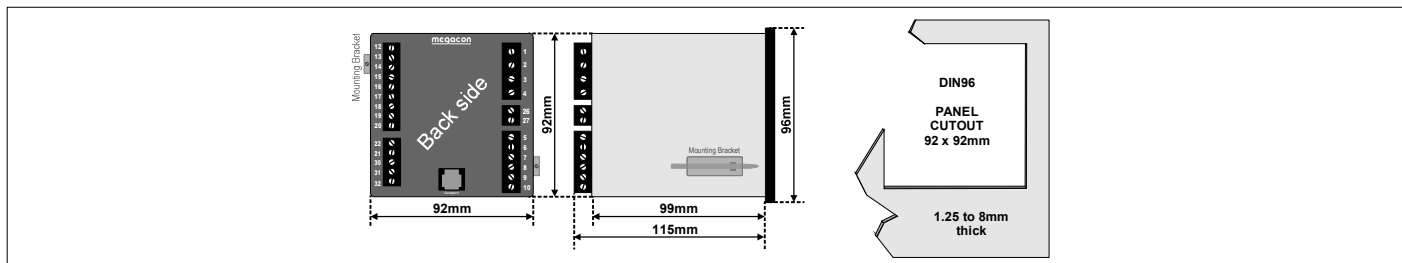
The digitally controlled ISOPAK100 adds to Megacon's wide range of ISOGUARD products for insulation and earth fault monitoring and protection. Up to 24 channel earth leakage monitoring of LIVEAC networks.

### "Highest up function" gives peace-of-mind

The purpose of ISOPAK100 is to selectively detect and address earth faults in live 50 or 60Hz networks. An intelligent highest up function highlights the highest level of hazard in the system, and only alerts the operator when conditions for an impending danger are present.



## Dimensions



The unit meets IEC60092-504 and the relevant environmental and EMC tests specified in IEC60068/60092 and IEC61000/60533 respectively, to comply with the requirements of the major Classification Societies.

The MEGAcon policy is one of continuous improvement, consequently equipment supplied may vary in detail from this publication.

### ORDERING EXAMPLE:

Type:	KPM362GF
Aux. Supply:	200-240VAC
Network Voltage:	690VAC
RCT	3 x IGT200
Analogue O/P:	(O/P3) 4-20mA
Range:	0-500mA

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