



- 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 KCM362x, Pathfinder function identifies highest channel
- Up to two individual very fast analogue output signals (<50mS), (optional)
- DIN96 Slave Indicator with full current scale (optional)

Specifications

Standard Auxiliary Voltage:	100-120V, 200-240V, 380-415V, 440-460V, 480VAC, 40-70Hz (Fuse 0,5A)
Optional Auxiliary Voltage:	24-60VDC (Fuse 0,5A) 110-220VDC (Fuse 1A)
Supply tolerance:	+10%, -20%
Power rating:	5VA
Contact rating:	AC: 100VA -250V/2A max. DC: 50W -100V/1A max.
Scale range:	0-150mA as standard (Other range on request)
Adjustments:	See page 4
Ampere range:	Any % of the CT value
Analogue output 1: (see page 5 for available outputs)	mA: Up to 20mA, max 500R V: Up to 10V, min 100kohm (other on request)
Analogue output 2: (see page 5 for available outputs)	mA: Up to 20mA, max 500R V: Up to 10V, min 500R (other on request)
Accuracy:	Class 0,5
Temperature:	-20 to +70°C
Humidity, relative:	0-95%
Weight:	0.6kgs
Front protection:	IP21
Flammability:	UL94-V0

The unit meets EN 60255-27 Cat. III, Pollution degree 2 and the relevant environmental and EMC tests specified in EN 60255-26 to comply with the requirements of the major Classification Societies.

Related information:
The KCM162x & KCM362x series are also available for panel mounting as KPM162x & KPM362x series.

Description

The digitally controlled KCM162x (1 channel) and KCM362x (3 channels) monitor 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.

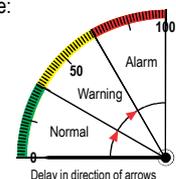
The unit reads the level of earth leakage directly in mA. The standard range is 0-150mA. Larger scale values are available, typically 500mA, 1A, 2A, 5A and 10A. The 3-channel KCM362x automatically locks the meter to read the highest of the three channels.

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:

LED status		
Power	Warning	Alarm
●	●	●
Normal	Alarm	Alarm

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



General

RCD MEASURING PRINCIPLE

Earth current is measured by one (KCM162x) or three (KCM362x) 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 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

Up to two individual very fast analogue output signals (optional) proportional to meter reading. If output is used for remote meter reading, we recommend 0-1mA for the slave indicator.

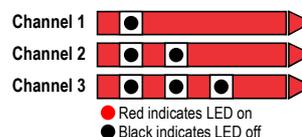
The unit has C/O relay outputs for Warning and Alarm. The Alarm relays are fail to safety configured. A trip LED flashes when the trip level is passed, the relay trips when the delay has elapsed. The timer resets if the fault is removed during countdown. Offset, trip levels and delays are settable on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

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 networks 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 KCM362Gx identifies the highest-up channel producing the trip.



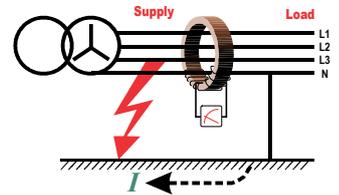
General

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 KCM162x or the KCM362x 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.



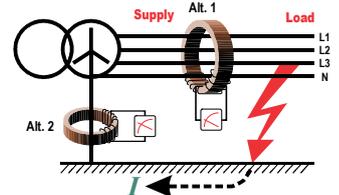
Unrestricted Earth Fault Detection

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 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.



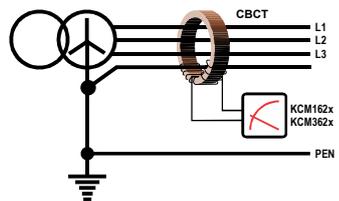
TN-S Network

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 wired or just the non-loaded main ground shall be feed through the CBCT.

PE form thus a continuous ground electrode.

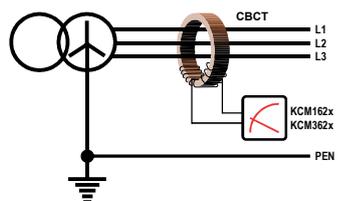


TN-C Network

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 wired or just the non-loaded main ground shall be feed through the CBCT.

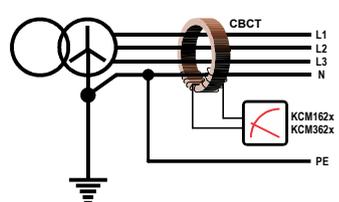


TN-C-S Network

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 wired or just the non-loaded main ground shall be feed through the CBCT.



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



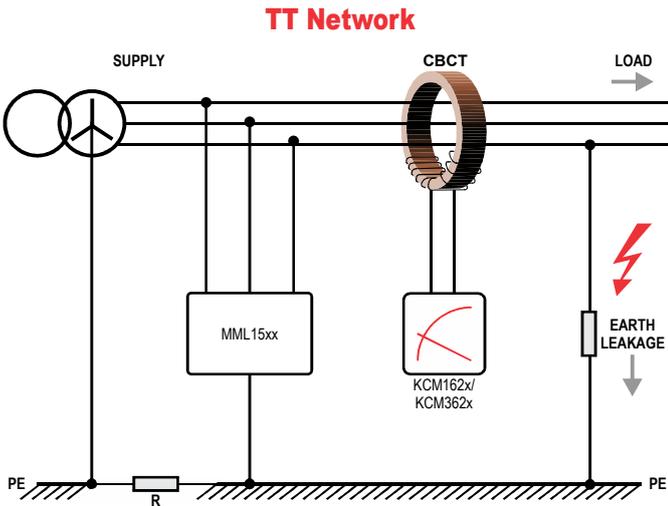
KCM162x or KCM362x in an IT or TT Network

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 (MML15xx) for the return path to secure uniform detection of an earth fault.



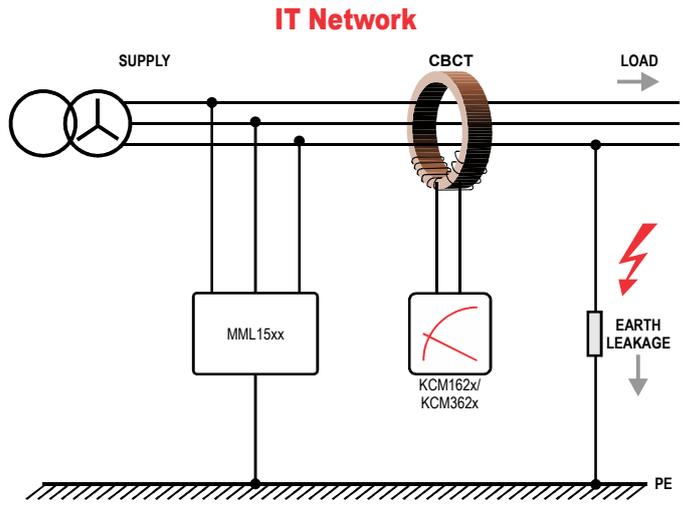
Principle drawing for 3-wire three phase system

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 KCM16x. However the use of a constant impedance module (MML15xx) gives the possibility to provide individual earth fault monitoring of each consumer.

The MML15xx 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.



Principle drawing for 3-wire three phase system

Impedance module



MML15xx

MML15xx provides a normalised earth fault leakage current return path in TT and IT-networks.

The DIN-rail mounted MML15xx is used in non-grounded (isolated) AC supply systems, where loads/branches are to be selectively earth fault-monitored. By providing a normalised earth fault leakage current return path, MML15xx improves accuracy and sensitivity of a earth fault monitoring system.

MML15xx is connected from each line voltage (R/S/T) to protective earth (PE). Current load is depending of harmonic frequencies.

NB! MML15xx must be inserted on the supply side of the residual current transformer (T1).

More than 3 channel monitoring?



ISOPAK100 series

Megacon recommends ISOPAK1xx series - Universal AC Earth Fault Protection System

The digitally controlled ISOPAK1xx 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 **LIVE AC** networks.

Highest up function gives peace-of-mind

The purpose of ISOPAK1xx 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.

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Models

Models	Channel	Latch	O/P 1	O/P 2	Pathfinder
KCM162E	1	-	-	-	-
KCM162FA	1	-	X	-	-
KCM162FB	1	-	X	X	-
KCM162G	1	X	-	-	-
KCM162GFA	1	X	X	-	-
KCM162GFB	1	X	X	X	-
KCM362E	3	-	-	-	-
KCM362FA	3	-	X	-	-
KCM362FB	3	-	X	X	-
KCM362G	3	X	-	-	X
KCM362GFA	3	X	X	-	X
KCM362GFB	3	X	X	X	X

Adjustments **Trip level** **Delay**
 ALARM: 0-100% FSD 0-3secs
 WARNING: 0-100% FSD 0-30secs
 Offset: Min - Max

Models

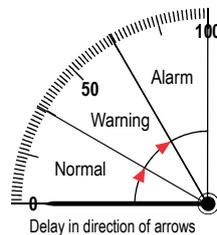
Models	Channel	Latch	O/P 1	O/P 2	Pathfinder
KCM162E3	1	-	-	-	-
KCM162FA3	1	-	X	-	-
KCM162FB3	1	-	X	X	-
KCM162G3	1	X	-	-	-
KCM162GFA3	1	X	X	-	-
KCM162GFB3	1	X	X	X	-
KCM362E3	3	-	-	-	-
KCM362FA3	3	-	X	-	-
KCM362FB3	3	-	X	X	-
KCM362G3	3	X	-	-	X
KCM362GFA3	3	X	X	-	X
KCM362GFB3	3	X	X	X	X

Adjustments **Trip level** **Delay**
 ALARM: 0-100% FSD 0-2secs
 WARNING: 0-100% FSD 0-2secs
 Offset: Min - Max

Relay Configurations

Relay	Warning	Alarm	Fail Safe	Latch
R1	X			*X
R2		X	X	*X
R3	X	X	X	*X

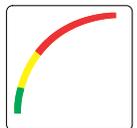
Relays shown de-energised.
 R2 & R3 are fail-safe and energises when unit is powered.
 *X) See the table above for models with latch function



Settings

Coloured sectors show recommended areas of settings:

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



Toroidal and Rectangular Residual Current Transformers

The transformer range are used as sensors to detect earth leakage current in Megacon Earth Fault Systems for selective monitoring and protection.

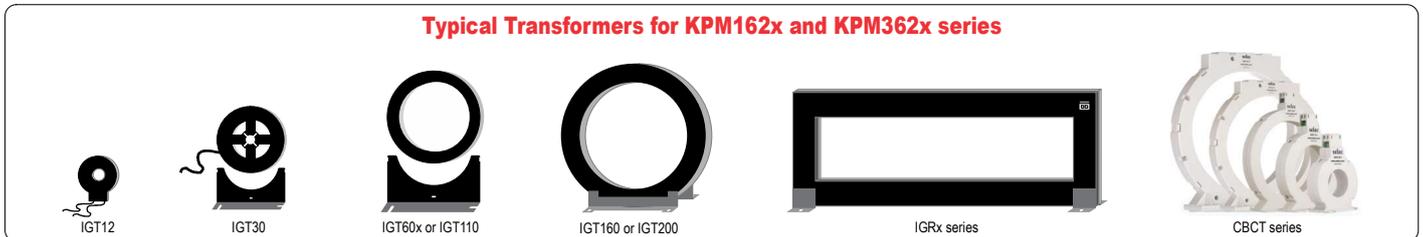
The transformers' measuring accuracy and repeatability is high and is not influenced by the relative position of the individual conductor passing through the transformer core.

Nominal measuring range is 50 to 400Hz. Maximum ambient temperature +70 °C. The lower earth current sensitivity limit is in the region of 3 to 5 mA for the IGTx series and 5-10mA for the IGRx series.

The recommended maximum distance between a residual current transformer and the Earth Current Monitoring Unit is generally 50 meters. If the distance exceeds 3 meters, or the connecting cable is exposed to heavy stray electromagnetic fields, the cable (minimum 1mm²) should be shielded.

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

Typical Transformers for KPM162x and KPM362x series

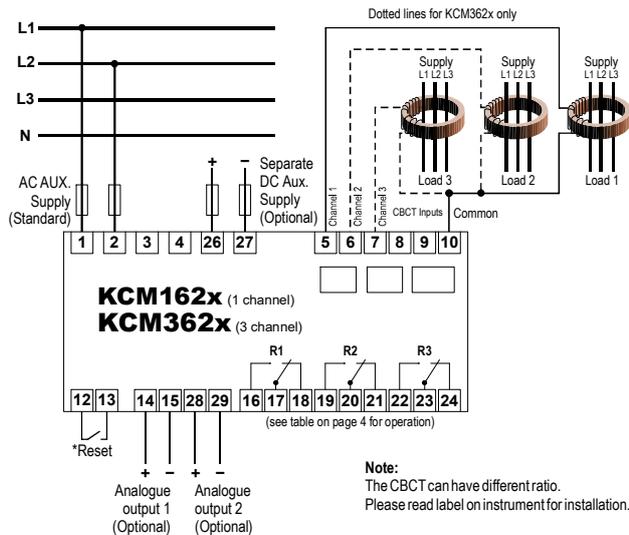


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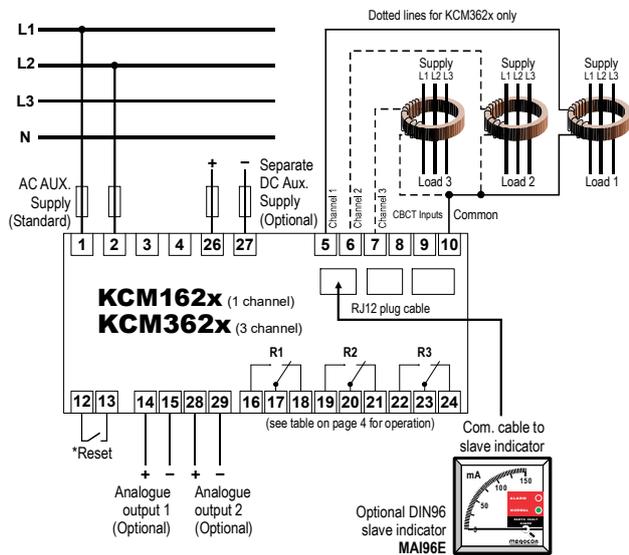


Connection Diagram

Connection Diagram without optional slave instrument



Connection Diagram with optional slave instrument



***Reset**
Any latched relay is reset by linking terminals 12 and 13 or by interrupting the auxiliary voltage supply.

Analogue Output

The output signals are proportional to the meter reading (see page 4 for an overview of models and functions).

The signal is specifically intended as an input to a control system for monitoring or control.

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

Outputs 1

O/P1	0 - 10mA
O/P2	0 - 20mA
O/P3	4 - 20mA
O/P4	N/A
O/P5	N/A
O/P6	N/A
O/P7	N/A
O/P8	0 - 10V
O/P9	0,2 - 10V
O/P10	4,3 - 20mA

Outputs 2

O/P11	0 - 10mA
O/P12	0 - 20mA
O/P13	4 - 20mA
O/P14	N/A
O/P15	N/A
O/P16	N/A
O/P17	N/A
O/P18	0 - 10V
O/P19	0,2 - 10V
O/P20	4,3 - 20mA

Relay Contacts

Burden on supply	: 170mW per relay
Switching voltage (Max)	: 400V AC, 300V DC
Switching voltage (Rated)	: 250V AC, 30V DC
Max I continuous	: 6A RMS, 6A DC
Max breaking capacity	: 1500VA AC, 18-120W DC
Dielectric strength across open contacts	: 1000V RMS

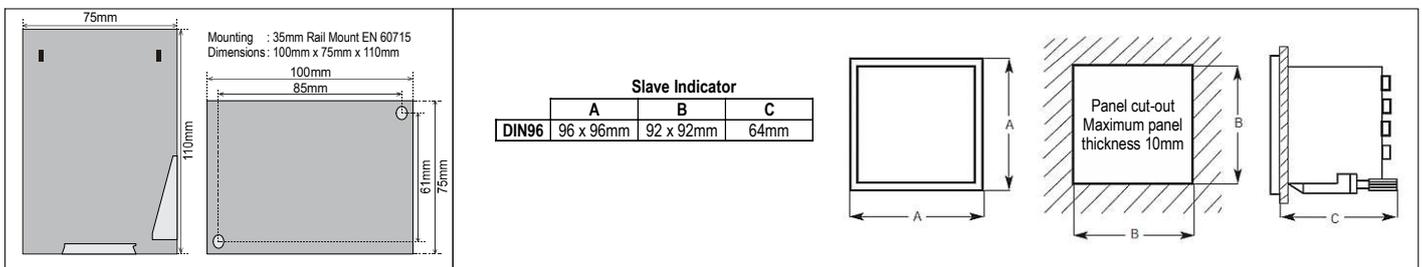
Connection

Terminal type	: Terminal Clamp and Screw
Wire max.	: T1-T4, T26-T27: AWG 24-14, T5-T10: AWG 12, other terminals: AWG 24-12
Screw Torque	: 0.5Nm

Overload

Voltage	: 1.2 x Un continuous 2 x Un for 10secs
Current	: 2.5 x In continuous 5 x In for 1secs (max 25A)

Dimensions



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ORDERING INFORMATION		
Type	: KCM162FB	Optional Separate Aux. Supply:
Aux. Supply	: 200-240VAC	Add -SD for models with
Range	: 0-150mA	Separate DC Aux. Supply.
Input Current C.T.	: IGT30	(Example: KCM162FB-SD)
Analogue output 1	: O/P3: 4-20mA	
Analogue output 2	: O/P18: 0-10VDC	

