

Motor Condition Monitoring Device

K6CM-IS

Quantifying the status of a three-phase induction motor.

- The “insulation resistance” can be always monitored in live wire states.
- Simply attaching the ZCT to the control panel enables monitoring.
- The insulation resistance can be measured even when an inverter is used.
- The software tool (set-up and simple monitoring tool) is also provided.
- Supports Modbus TCP in addition to EtherNet/IP.



* ZCT (IRT) is compatible with UL Recognition



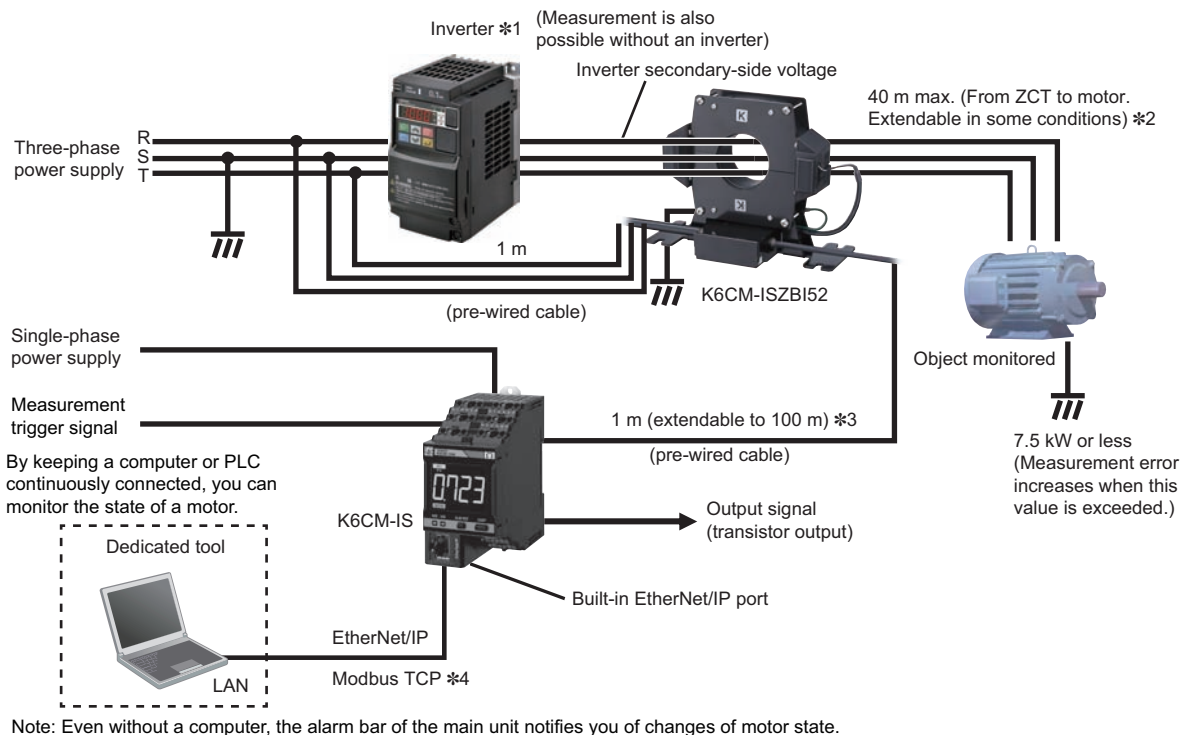
For the most recent information on models that have been certified for safety standards, refer to your OMRON website.

System Configuration

Basic Configuration

Insulation resistance type (K6CM-IS)

Three-phase, three-conductor, S-phase ground



*1. Measurement may not be possible depending on the drive frequency of the inverter. See the User's Manual (N219) for more information.

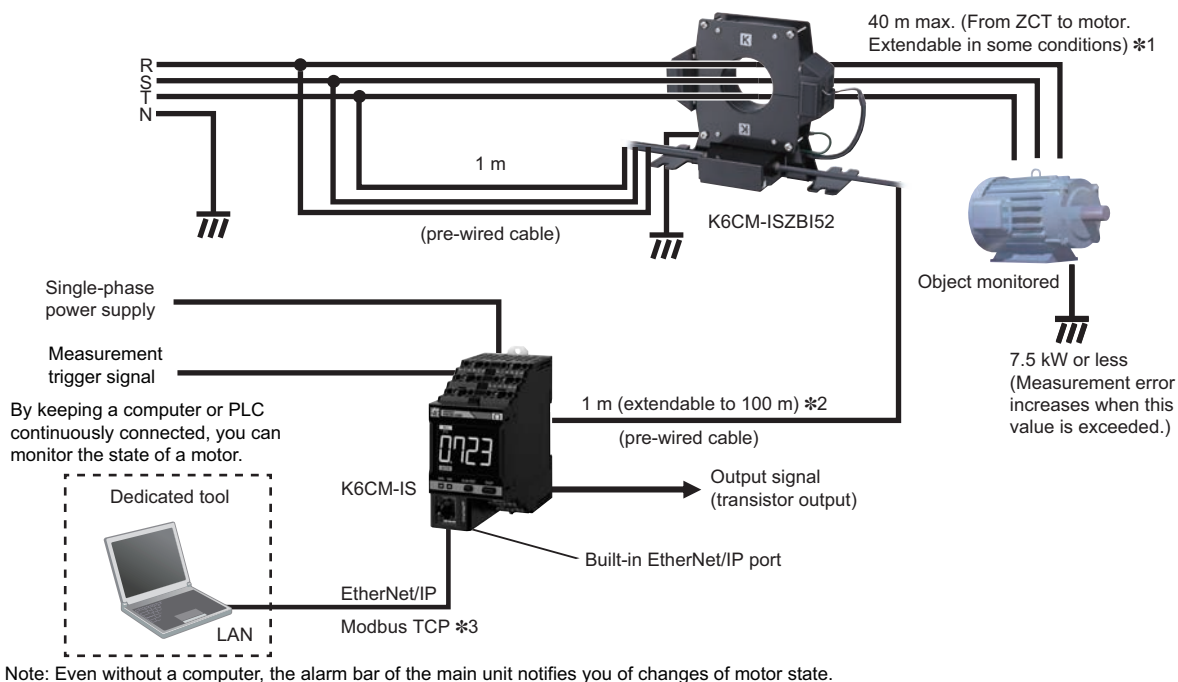
*2. For details, refer to the technical data on page 36.

*3. For extension cable, use shielded twisted pair cable with wire gauges of AWG24 to 16.

*4. Can be used only with EIP CPU version 1.2 or higher.

Three-phase, four-conductor, N-phase ground

Note: When an inverter is used with three-phase, four-conductor, N-phase ground, correct measurement is not possible



*1. For details, refer to the technical data on page 36.

*2. For extension cable, use shielded twisted pair cable with wire gauges of AWG24 to 16.

*3. Can be used only with EIP CPU version 1.2 or higher.

Ordering Information

List of Models

Monitoring type	Power supply voltage	Model
Insulation resistance type	100 to 240 VAC	K6CM-ISMA-EIP
	24 VAC/VDC	K6CM-ISMD-EIP

ZCT (IRT) (Order separately)

Rated voltage	Through hole dia. (mm)	Applicable Relay	Model
200 to 480 VAC	52 dia.	K6CM-IS	K6CM-ISZBI52

Note: One sensor is combined with one main unit.

ZCT (IRT) is the abbreviation for Zero Current Transfer (Insulation Resistance Transfer).

A cable for connection is provided with the ZCT (IRT).

EtherNet/IP communications cable recommended parts

Use a Category 5 or higher STP cable (shielded twisted pair cable).

Cable with Connectors

Item	Recommended manufacturer	Cable length (m)	Model
Wire Gauge and Number of Pairs: AWG26, 4-pair Cable Cable Sheath material: LSZH #2	OMRON	0.3	XS6W-6LSZH8SS30CM-Y
		0.5	XS6W-6LSZH8SS50CM-Y
		1	XS6W-6LSZH8SS100CM-Y
		2	XS6W-6LSZH8SS200CM-Y
		3	XS6W-6LSZH8SS300CM-Y
		5	XS6W-6LSZH8SS500CM-Y
Wire Gauge and Number of Pairs: AWG22, 2-pair Cable	OMRON	0.3	XS5W-T421-AMD-K
		0.5	XS5W-T421-BMD-K
		1	XS5W-T421-CMD-K
		2	XS5W-T421-DMD-K
		5	XS5W-T421-GMD-K
		10	XS5W-T421-JMD-K

*1. Cables with standard RJ45 plugs are available in the following lengths: 0.2 m, 0.3 m, 0.5 m, 1 m, 1.5 m, 2 m, 3 m, 5 m, 7.5 m, 10 m, 15 m, 20 m.

Cables with rugged RJ45 plugs are available in the following lengths: 0.3 m, 0.5 m, 1 m, 2 m, 3 m, 5 m, 10 m, 15 m.

For details, refer to the *Industrial Ethernet Connectors Catalog* (Cat. No. G019).

*2. The lineup features Low Smoke Zero Halogen cables for in-cabinet use and PUR cables for out-of-cabinet use.

*3. Cable colors are available in yellow, green, and blue. The last character of the model changes to "-G" or "-B".

Cable/Connector

Part name	Manufacturer	Model
Cable	Hitachi Metals, Ltd.	NETSTAR-C5E SA 0.5 × 4P *
RJ45 connector	Panduit Corporation	MPS588-C *

* It is recommended to use the cable and connector in combination described above.

Industrial switching hub (recommended parts)

Product name	Appearance	Specifications			Model
		Function	No. of ports	Failure detection function	
Industrial switching hub		Priority control (QoS): EtherNet/IP control data priority Failure detection: Broadcast storm / LSI failure detection 10/100BASE-TX, Auto-Negotiation	3	No	W4S1-03B
	5		No	W4S1-05B	
			5	Yes	W4S1-05C

Ratings and Specifications

List of Models

Ratings

Power Supply	Power supply voltage		K6CM-□□MA: 100 to 240 VAC, 50/60 Hz K6CM-□□MD: 24 VAC, 50/60 Hz, 24 VDC
	Allowable operating voltage range		85% to 110% of power supply voltage
	Power supply frequency range		45 to 65 Hz
	Power consumption		24 VAC/24 VDC: 3.7 VA/2.0 W max. 100 to 240 VAC: 6.2 VA max.
Input	Insulation resistance (ZCT (IRT))	Rated input voltage	(Line voltage) 200 to 480 VAC, 50 Hz/60 Hz
		Rated path current	300 AAC
Applicable motor type			Three-phase induction motor (Rated voltage 480 V or less) *
Outputs	Output form		Transistor output
	Output capacity		3-point
	Output rating		Rated voltage: 24 VDC Max. current: 50 mA, DC
Ambient operating temperature			-10 to +55°C (with no condensation or icing)
Storage temperature			-20 to +65°C (with no condensation or icing)
Ambient operating humidity			25% to 85% RH (with no condensation)
Storage humidity			25% to 85% RH (with no condensation)
Case color			Black
Case material			Polycarbonate UL94-V0
Altitude			2,000 m max.
Applicable wires			Stranded wires, solid wires, or ferrules
Applicable wire size			0.25 to 1.5 mm ² (AWG24 to 16)
Wire insertion force			8 N max. (AWG20)
Screwdriver insertion force			15 N max.
Wire stripping length			8 mm
Recommended flat-blade screwdriver			XW4Z-00B (Omron)
Current capacity			10 A (per pole)
Number of insertions			50 times
Weight			Approx. 200 g
Mounting			Mounts to DIN Track screw mounting
Dimensions			45 (W) × 90 (H) × 90 (D) mm
Setting method			Communications settings from a dedicated tool via EtherNet/IP
Other functions			Display value selection, self-diagnosis error output, setting value initialization, operation integration
Accessories			Operation manual, CD-ROM (Motor condition monitoring Tool)

* Motors other than three-phase induction motors (synchronous motors, single phase motors, servo motors, and stepping motors) are excluded.

Characteristics

Measurement range		Insulation resistance: 0.000 M to 1.000 M Ω , Leakage current: 0.0 mA to 200.0 mA
Measurement absolute accuracy	Insulation resistance	$\pm 35\%$ rdg ± 2 digit (when the insulation resistance is 0.2 M Ω max.), when a 200-V/7.5-kW max. motor is used *1 $\pm 35\%$ rdg ± 2 digit (when the insulation resistance is 0.4 M Ω max.), when a 400-V/7.5-kW max. motor is used *1
Sampling cycle		Normal mode: 10 s, Inverter special measurement mode: 60 s
Moving average frequency		1, 2, 4, 8, 16, 32 times
External trigger *2	External contact input specification	Short-circuit: Residual voltage 1.5 V max. Open: Leakage current 0.1 mA max.
	Current during short-circuiting	Approx. 7 mA
Transistor output		Contact configuration: NPN open collector Rated voltage: 24 VDC (maximum voltage: 26.4 VDC) Max. current: 50 mA, DC
Alarm	Parameters that can be output	Degradation level, current
	Expression method	Transistor output, alarm bar
	Setting value	Insulation resistance: 0.000 M to 9.999 M Ω
	Hysteresis	10% width of setting value
	Reset method	Manual reset/automatic reset (switchable) * Manual return method: Press the ALMRST button
LCD display		7-Segment digital display and single-shot display Font height 14 mm
Applicable standards	Conforming standards	EN61010-2-030 Installation environment: Pollution degree 2, overvoltage category II, measurement category II
	EMC	EN61326-1 (EMI: Class A EMS: Industrial Location) Acceleration $\pm 0.1G$, Velocity $\pm 2.25\text{mm/s}$, Temperature $\pm 6^\circ\text{C}$, insulation resistance $\pm 35\%$ rdg
	Safety standards	UL61010-2-030 (listing) Korean Radio Waves Act (Act 10564) RCM EAC
Insulation resistance		20 M Ω min. Between all external terminals and the case Between all power supply terminals and all other terminals Between all sensor connection terminals and trigger input terminal + output terminal + all EtherNet/IP ports
Dielectric strength		2,000 VAC for 1 minute Between all external terminals and the case Between all power supply terminals and all other terminals Between all sensor connection terminals and trigger input terminal + output terminal + all EtherNet/IP ports
Vibration resistance		Vibration frequency 10 to 55 Hz, slice amplitude 0.35 mm in each of X, Y, Z directions 5 minute $\times$ 10
Shock resistance		100 m/s ² , 3 times each in 6 directions along 3 axes
Degree of protection		IP20
LED display	Alarm bar	Red/Yellow/Green
	MS, NS *3	Red/Green
Ethernet communications *4	Number of ports	1
	Physical layer	Ethernet: Connector RJ45
	Type	100BASE-TX
	Transmission distance (Maximum cable length)	100 m (Between hub and node)
	Topology	Star type
	Protocol	EtherNet/IP Modbus TCP *5

*1. For details, refer to the technical data on page 36.

*2. The external trigger function can be used only when the insulation resistance type is EIP CPU version 1.1 or higher.

*3. MS: Product status display, NS: Network status display.

*4. A tag data link timeout may occur with products manufactured on or before April 30, 2019, over a network system including nodes set for multicast communications. Use the multicast blocking function of the switching hub to prevent multicast packets from reaching the K6CM.

*5. Can be used only with EIP CPU version 1.2 or higher.

ZCT (IRT)

Ratings and Specifications

Item	Model	K6CM-ISZBI52
Construction		Indoor split type
Rated path current		300 A
Through hole dia.		52 mm dia.
Rated voltage		200 to 480 VAC, 50 Hz/60 Hz three phase
Measurement range		Specified in main unit "Characteristics"
Measurement accuracy		Specified in main unit "Characteristics"
Voltage input terminal		3-terminal lead wire, Length: 1m (pre-wired cable)
Output terminal		4-terminal lead wire, Length: 1m (pre-wired cable) Available wire length 100 m max. *
Applicable standards	Conforming standards	EN 61010-2-030 Installation environment: Pollution degree 2, overvoltage category II, measurement category II
	EMC	EN 61326-1 (EMI: Class A EMS: Industrial Location)
	Safety standards	UL 61010-2-030 (Recognition) + CSA C22.2 No. 61010-2-030 RCM EAC
Insulation resistance		Between Mounting bracket - Secondary winding: 100 MΩ min.
Dielectric strength		Between Mounting bracket - Secondary winding: 2000 VAC, 1 minute
Ambient operating temperature		-10 to +55°C (with no condensation or icing)
Ambient operating humidity		25 to 85% (with no condensation)
Weight		Approx. 2.3 kg (including cables)
Degree of protection		IP20

* When extending the cable on the pre-amplifier side, use shielded twisted pair cable with wire gauges of AWG24 to 16.

Motor condition monitoring Tool (Software included with main unit)

Operating Environment

Element	Specification
Supported OS	Windows 7, Windows 8.1, Windows 10 (32 bit/64 bit) (Japanese/English)
.NET	.NET Framework 4 and .NET Framework 3.5
CPU	1 GHz or more, 32 bit or 64 bit processor
Memory	1 GB or more, or 2 GB or more (for 64 bit)
HDD	Available space of 16 GB or more, or 20 GB or more (for 64 bit)
Others	Since this software is provided on a CD-ROM, a CD-ROM reading device must be available. If data is to be collected, a LAN I/F must be available.

Functions/Specifications (For more details, refer to the catalog of each product.)

Item	Specification
Project	Number of files that can be created
Log file	No limit
Monitoring cycle	CSV data format
Number that can be registered in one project	5 second to 366 days
Number of motors (device groups)	10
	Number of devices per motor (device group)
Graphic display	3 *1
Type of graph	Line graph
Display period *2	1 hour, 1 day, 1 month, 1 year

*1. One vibration and temperature type, one insulation resistance type, and one current comprehensive diagnosis type can be set for one motor.

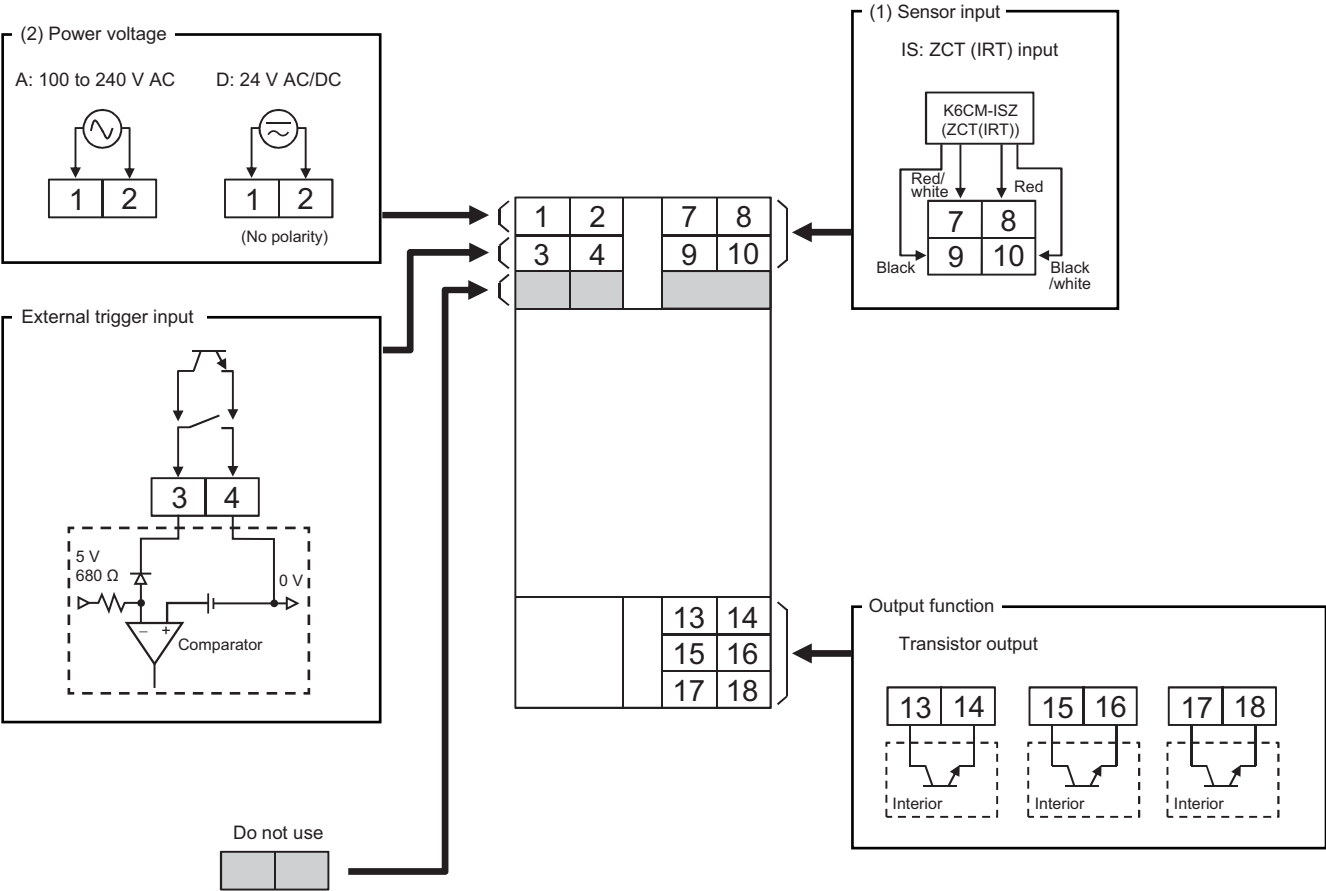
*2. In the software tool version 1.2.0.0 and earlier, the graph display period can be set by selecting the tabs (1 hour, 1 day, 3 months, 6 months, 1 year, 2 years, 5 years, 10 years, 20 years).

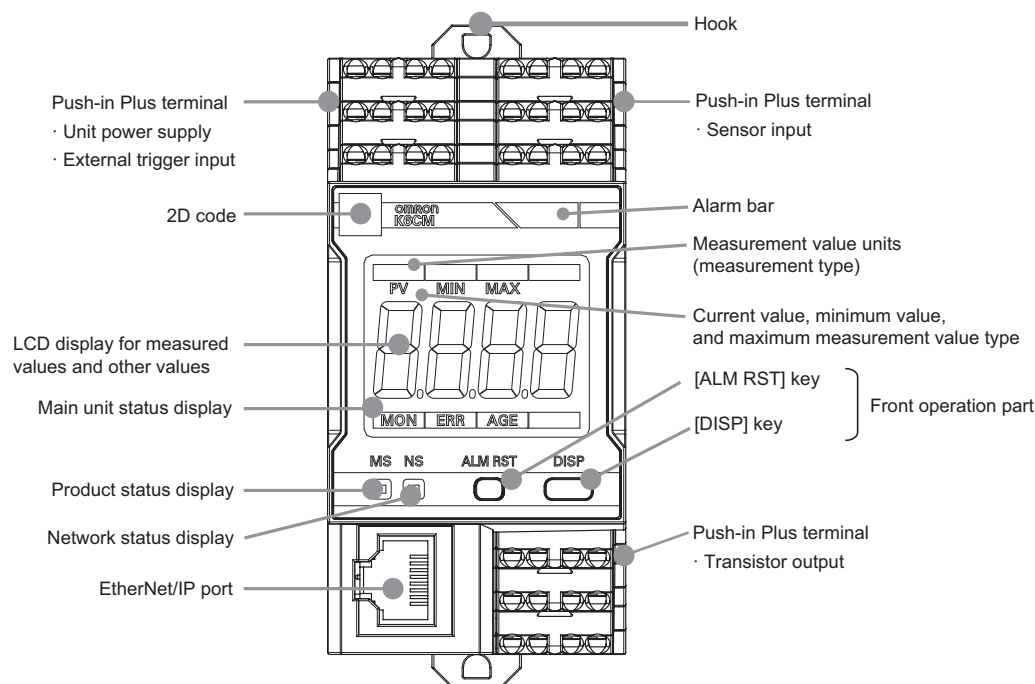
In the software tool version 1.2.0.0 and later, you can move the graph in the time axis direction using the graph time axis movement.

Connection Diagram

Terminal Diagram (Main Unit)

K6CM- IS M A -EIP
(1) (2)





Name		Meaning	
Alarm bar		A bar on which the color of the emitted light changes according to the alarm status.	It is indicated in the following colors during measurement/monitoring. Green: Alarm status (normal) Yellow: Alarm status (Warning) Red: Alarm status (Critical) The alarm bar is lit out in each of the following states: When the power is OFF, when measurement is not being performed, and when a self-diagnosis error has occurred, etc.
Measurement type		Indicates the type of the measured value being displayed. The type can be switched each time the [DISP] key is pressed on the front operation part.	"MΩ": Insulation resistance, "mA": Leakage current
Front operation part	[ALM RST] key	Releases the latched alarm state.	The main use of this key is to release the latched and fixed alarm state after returning from the fault state to the normal state.
	[DISP] key	Switches the type of the measured value being displayed. You can switch between display-fixed mode and display auto switching mode by long-pressing for 3 seconds. *1	
	Others	If two keys are simultaneously pressed and held for 5 seconds or longer, all settings of the main unit are reset to factory defaults.	
Main unit status display		The status of the main unit is indicated by lighting of the LCD characters.	"MON": Measurement / monitoring is being performed "ERR": A self-diagnosis error has occurred "AGE": Running Time notification (it is recommended to replace the product main unit)
Transistor output	13-14	Output of the alarm status (Warning). Can be set to Normally Closed or Normally Open.	When measurement/monitoring is in progress, and the output method is Normally Closed ON = Comprehensive alarm: Normal / OFF = Comprehensive alarm: Warning or Critical and the output method is Normally Open OFF = Comprehensive alarm: Normal / ON = Comprehensive alarm: Warning or Critical
	15-16	Output of the alarm status (Critical). Can be set to Normally Closed or Normally Open.	When measurement/monitoring is in progress, and the output method is Normally Closed ON = Comprehensive alarm: Warning or Normal / OFF = Comprehensive alarm: Critical and the output method is Normally Open OFF = Comprehensive alarm: Warning or Normal / ON = Comprehensive alarm: Critical
	17-18	Self-diagnosis error output.	OFF: A self-diagnosis error has occurred ON: Other than the above
External trigger input	3-4	Input of the external contact signal to control measurement timing.	You can use "Trigger Type" to specify whether measurement/monitoring continue for a set time after starting by the rise or fall of the external contact, or are executed while the external contact is ON. You can also specify settings to enable selection of a trigger mode other than external trigger. *2

Note: Warning: Indicates that it is time for maintenance.

Critical: Indicates that it is time for replacement.

*1. Can be used only with EIP CPU version 1.2 or higher.

*2. Trigger modes other than external trigger

Always: Trigger is not used. Measurement/monitoring are performed continuously after the power of the K6CM unit is turned on.

Internal trigger: Measurement/monitoring starts based on the relation between the measured value and set value (trigger level).

You can use "Trigger Type" to specify whether measurement/monitoring start and continue for a set time when the measured value is over, or under, the set value (trigger level), or are executed while the measured value exceeds the set value (trigger level).

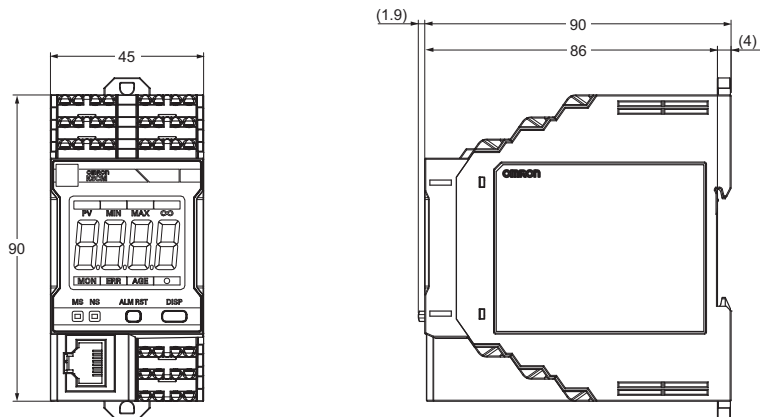
Also, the external trigger function can be used only when the insulation resistance type is EIP CPU version 1.1 or higher.

Dimensions

(Unit: mm)

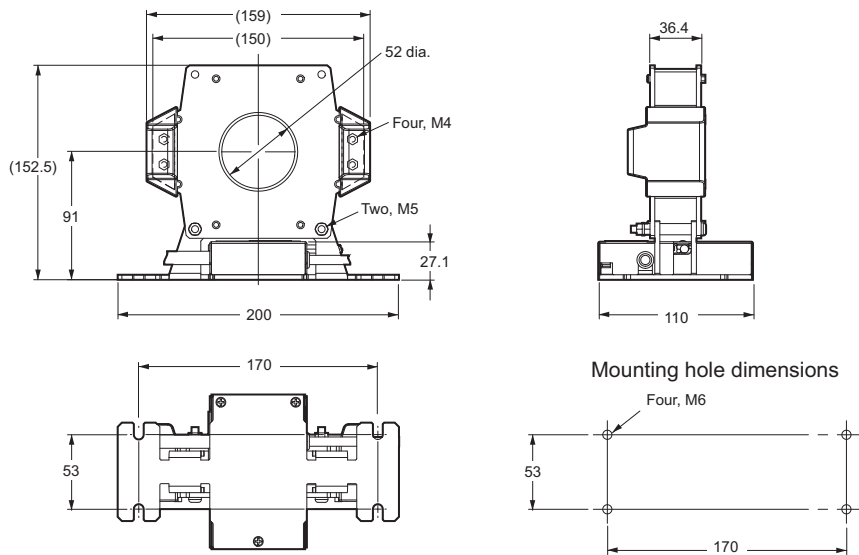
List of Models

K6CM-IS



ZCT (IRT)

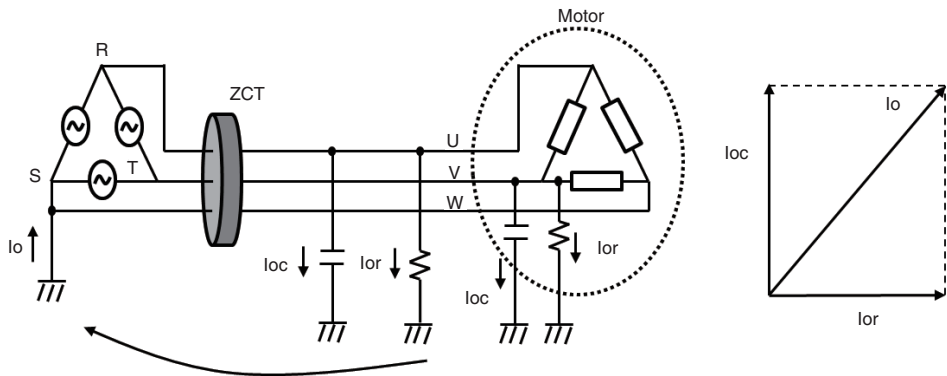
Indoor split type
K6CM-ISZBI52



Insulation Resistance Type Technical Data (Reference)

Method of measuring the value on the insulation resistance meter

Leakage current includes two types, namely capacitive leakage current (loc) that flows through the earth capacity, and resistive leakage current (lor) that flows due to the degradation of wiring and devices, and is the cause of electric shock and fire. The leakage current is determined by detecting the value of the zero-phase current Io, which is the combined component of loc and lor. (See the figure below)

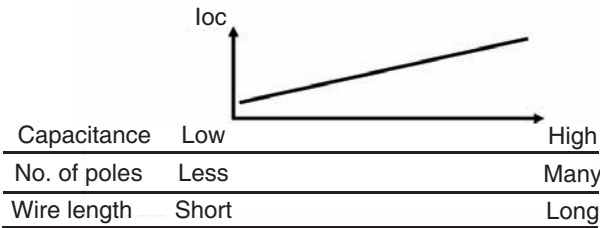


About changes in the measurement accuracy

If there is almost no insulation deterioration in the motor, almost the entire constituent of Io becomes loc, and the measurement accuracy of lor declines. Further, if the loc based on the motor-specific electrical capacitance is larger than lor, then the measurement accuracy will similarly decline. Particularly, if the electrical capacitance increases in proportion to the capacitance of the motor, the measurement accuracy changes depending on the motor capacitance.

The following items are the possible parameters affecting the measurement accuracy.

- Increase in loc Type of motor (manufacturer, structure), capacitance, number of poles, and the length of wire between ZCT (IRT) and the motor
- Other noise components..... Through-current, through-position
- External factors..... Voltage imbalance



[Effect of residual current]

Another noise component is the residual current* (hereinafter, specified as Ir). Ir increases in proportion to the through-current.

* Residual current

Residual current refers to the error that occurs as a result of an imbalance in the magnetic flux of each phase inside the core due to the arrangement of the through-wire of ZCT. Errors also occur as a result of the imbalance in the magnetic circuit of ZCT.

Ir combines with Io, and is output to the secondary side of ZCT. Ir is the same frequency component as lor, and the amount of current or the phase difference with respect to lor changes depending on the through-position of the power line passing through ZCT. Therefore, isolation from lor, which must essentially be detected, becomes difficult.

If the position of ZCT and the through-wire is fixed once, the phase of Ir does not change. Moreover, by fixing the through-wire in the center of ZCT, Ir can be reduced. Fix and install the through-wire in the center as much as possible. Use the following holder to fix the through-wire in the center of ZCT.

Part name	Manufacturer	Model
Rubber holder	Midori Anzen Co. Ltd.	HZ-25

List of Parameters

Setting values

Parameter	Content
Insulation resistance alarm threshold value (Critical and Warning)	0.000 to 9.999 MΩ
Main unit IP address	Sets the IP address of the main unit. The default value is "192.168.250.10" (common to all models)
Software reset	Restarts the K6CM. Used to enable the settings after changing the setting values. 0 → 1: Execute
MAX/MIN reset	Initializes the MAX/MIN value. 0 → 1: Execute
Display value type	Sets which measurement value to display in the 7-segment display at the front of the main unit. 0: PV (Present Value), 1: MIN, 2: MAX
Trigger mode *1	Sets the trigger mode. 0: At all times, 1: External trigger, 2: Internal trigger
Trigger type	Sets Rise, Fall, or Level in the case of an internal trigger or external trigger. 0: Rise, 1: Fall, 2: Level
Trigger level	Sets the trigger level when "Internal trigger" and the trigger type "Level" have been selected.
Monitoring time	Sets the time for continuing measurement or monitoring in the case of an internal trigger or external trigger, when the trigger type is either Rise or Fall. Setting value: 0.1 to 600.0 s
Alarm latch	Sets whether to enable or disable the alarm latch function. 0: Disable (no latch), 1: Enable (latched)
Use Running Time	Sets whether or not to use the main unit residual amount function. 0: OFF (Do not use), 1: ON (Use)
Moving average times	Performs the averaging process for the past n-times of data including the sampling data of that time, each time sampling of the measurement value is performed. 0: OFF, 1: 2 times, 2: 4 times, 3: 8 times, 4: 16 times, 5: 32 times
Circuit topology	Sets the Circuit topology. 0: Three-phase, three-conductor, S-phase ground 1: Three-phase, four-conductor, N-phase ground, load-side Δ connection
Using inverter	Sets the Using inverter. 0: OFF (without inverter), 1: ON (with inverter)
Inverter special measurement	Sets the inverter special measurement. 0: OFF, 1: ON (Refers to the special calculation performed when the inverter frequency and commercial frequency are close.)
Transistor output method *2	0: Normally Closed/1: Normally Open
Monitoring delay time *3	Set the delay time from the trigger input to the start of measurement. Set value: 0.0 to 600.0 seconds.

*1. The external trigger function can be used only when the insulation resistance type is EIP CPU version 1.1 or higher.

*2. Can be used only with EIP CPU version 1.1 or higher.

*3. Can be used only with EIP CPU version 1.2 or higher.

Measured values / Status data

Parameter	Content
Insulation resistance (Present value, MIN, MAX)	0.000 to 1.000 MΩ
Leakage current Ior (Present value, MIN, MAX)	0.0 to 200.0 mA
Leakage current Ioc (Present value)	0.0 to 200.0 mA
Ior status	Bit 00: Present value measurement status Bit 01: Present value input error Bit 04: MAX value measurement status Bit 05: MAX value input error
Ioc status	Bit 08: MIN value measurement status Bit 09: MIN value input error Bit 12: Individual alarm threshold value (Warning) setting Bit 13: Individual alarm threshold value (Critical) setting
Measurement CPU version	Measurement unit version
Main CPU version	Main unit version
EIP CPU version	EtherNet/IP unit version
Measurement status	1: Measurement/monitoring in progress, 0: Measurement/monitoring stopped
Running time status	The product of the operation time and internal temperature is integrated, and ON is set if it reaches the design life. 1: Reached (Operation integration has reached 100%) 0: Not reached (Operation integration has not reached 100%)
Trigger input	Status of external trigger input. 1: ON, 0: OFF
TR1 (Transistor 1 output status)	Status of transistor 1. 1: ON, 0: OFF
TR2 (Transistor 2 output status)	Status of transistor 2. 1: ON, 0: OFF
TR3 (Transistor 3 output status)	Status of transistor 3. 1: ON, 0: OFF
Running time	Coefficient showing the extent of life of the main unit based on the product of the operation time and internal temperature. Incremented in units of 10% starting from 0%. 0000 hex to 0064 hex (0 to 100)
Trigger frequency	Total integrated number of external triggers and internal triggers. Incremented by 1 after every 100 times. 0 to 65535
Threshold value setting of integrated alarm (Warning)	State when the measurement value is "Warning".
Threshold value setting of integrated alarm (Critical)	State when the measurement value is "Critical".
Insulation resistance alarm (Critical and Warning)	ON, OFF