MotoSafe®

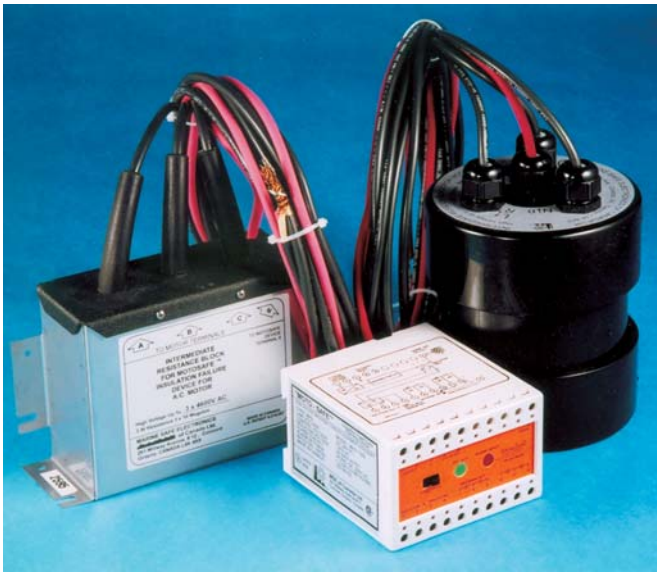
MSE of Canada Ltd.

MEDIUM VOLTAGE AC ELECTRICAL MACHINES INSULATION MONITOR MODEL MHV

Type MHV Insulation Monitors are designed to monitor Medium Voltage AC motor installations for insulation deterioration whenever they are not energized. In such installations personnel safety is paramount and Type MHV Monitors incorporate features to maximize that safety. They are entirely automatic in operation and are CSA Certified and UL Listing as High Voltage Industrial Control Devices.

FEATURES:

- ✓Easy Installation
- ✓Two models cover voltages to 7.2 KV AC
- ✓Surge capacitor discharge delay included
- ✓Residual voltage forced discharge circuit
- ✓Vacuum contactor rated
- ✓Low test voltage for personnel safety
- ✓Completely automatic operation
- ✓Solid state circuitry
- ✓High / Low alarm selection
- ✓LED local alarm / remote alarm capability
- ✓Local/Remote reset capability
- ✓Actual resistance reading output
- ✓Small footprint DIN rail mounting



APPLICATION:

MotoSafe Insulation Monitors are designed to provide safe monitoring of the electrical insulation integrity of electrical machines and equipment whenever they are not in use. Their primary use is to monitor machines which are in intermittent service, to give early warning of the insulation deterioration which precedes failure, as starting and stopping machines causes micro cracking of the insulation with consequent degradation of its properties.

The Type MHV Insulation Monitor is intended for use with medium voltage motors to 7.2 kV, such as used to power chippers in pulp mills. To maximize personnel safety they use a low DC voltage to sense insulation resistance and they are connected to the motor circuit through the star point of a high resistance Intermediate Resistor Block (IRB). Under normal circumstances this ensures that the Sense terminal is at ground potential and should a ground fault occur on the motor supply, the impedance of the Intermediate Resistor Block limits the Sense terminal voltage to a safe level.

Type MHV monitors incorporate features to allow the complete discharge of surge capacitors and the dissipation of residual charge in motor cabling, to eliminate possible nuisance alarms. The monitor is equipped with analogue output which provides the actual value of the insulation resistance in the range of 0 to 40 Megohm.

To eliminate the hazard to personnel, the connection between the Intermediate Resistor Block in the high voltage compartment and the MHV monitor unit in the low voltage compartment of the motor control gear, is current limited by the high internal impedance of the Intermediate Resistor Block to a maximum of 1.4 milliamperes, i.e. 28% of the mandated GFCI trip level. This maximum current flows through the “Sense” line (the red conductor of the IRB) to terminal 10 of the MHV monitor unit only if terminal 10 is shorted to ground when a ground fault exists on one phase of the motor supply.

ORDERING INFORMATION

a) Refer to the specifications and include the line and control voltage required. Example: for 7.2kV max. motor with 120V control, order MHV-7200-120. (The correct IRB will be shipped as part of the order).

b) Installation Kit IK-MHV includes: Explanatory and Warning labels, the DIN-MHV bracket, the flashing alarm light, a Test Resistor, hook-up wire, wire connectors, Ty-wraps and mounting screws sufficient to install the unit. The MHV-7200 Kit also includes mounting accessories for the IRB.

SPECIFICATIONS

MotoSafe Model MHV Medium Voltage Insulation Monitors

Parameter \ Model	MHV-4600 MHV-7200	IRB 4600	IRB 7200
Line voltage max.	N/A	4.6 kV AC	7.2 kV AC
Control voltage*	120 or 220, ± 20% 50/60Hz	N/A	
Control power	3 VA	N/A	
Isolation voltage	24-300V AC/DC	N/A	
Factory Setpoints** Low / High	2.5 / 5.0 MΩ 7.0 / 10.0 MΩ	N/A	
Contacts rating	5A, 250V Resistive	N/A	
Isolation time	0.5ms.	N/A	
Dimension (mm) WxHxL (in)	103x68x112 4.05x2.67x4.4	180x115x65 7.1x4.5x2.6	125∅x165 4.9∅x6.5
Weight (kg) / (oz)	0.36 / 12.7	1.9 / 67	1.2 / 42

* For other supply voltages contact factory.

**Set points in the range to 10 MW available - contact factory.

- Available for monitoring on-line equipment - contact factory
- All units suitable for DIN Rail Mounting.
- Max. short circuit current: 1 microampere.
- Temperature: operating -20°C to +50°C; storage -40°C to +100°C.

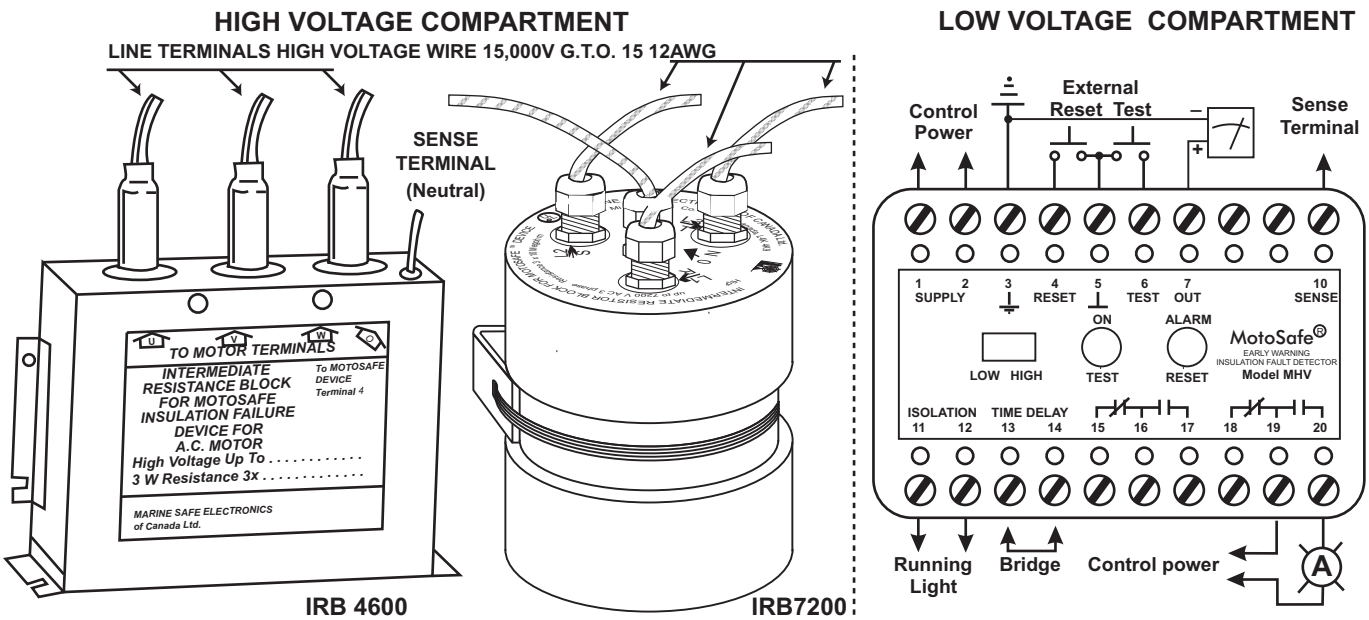
Environment: max. 95% relative humidity, non-condensing.

CSA certified, UL listed.

The MHV monitor available in two versions of the analogue output voltage in relation to the resistance:

R_L MΩ	0	1	2	3	5	7	10	12	15	17	20	25	30	35	40
$U_{7ver.1}$ V	0	0.88	1.66	2.35	3.52	4.46	5.59	6.20	6.69	7.38	7.93	8.65	9.21	9.66	10.0
$U_{7ver.2}$ V	10.0	9.12	8.34	7.65	6.48	5.54	4.41	3.80	3.04	2.62	2.07	1.35	0.79	0.34	0

INSTALLATION / CONNECTION DIAGRAM



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MOTOSAFE^{TM} MONITOR MODEL MHV; INSTALLATION.

IMPORTANT: READ THE FOLLOWING INSTRUCTIONS BEFORE INSTALLING THE MONITOR.

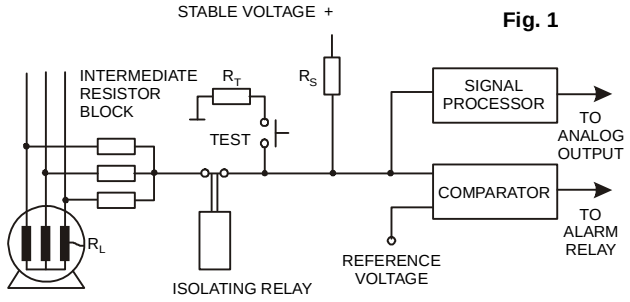
MotoSafe INSULATION MONITOR TYPE MHV FOR DIRECT ON-LINE A.C. MOTORS UP TO 7.2kV.

The MotoSafe device continuously monitors the insulation resistance of idle machines and operates an alarm relay when the resistance falls below a set value. The recommended value for “Low” setting is 1Megohm per 1kV of the motor line voltage. The “High” setting should be higher for the purpose of early warning. For example the standard settings for MHV-7200 would be 7 & 10 Megohm.

THE INTERMEDIATE RESISTOR BLOCK

The Intermediate Resistor Block contains three high voltage resistors connected in star to form an artificial neutral. The three black leads connect the free ends of the resistors to the motor terminals and the red lead is used to connect the star point, which, under normal conditions, is at ground potential to the sense terminal (#10) of the MHV monitor. Should a ground fault occur on one of the phases, the star point potential increases to 57.7% of the phase voltage (4.16 kV for 7.2 kV system), but the high resistance of the Intermediate Resistor Block limits the current which flows if terminal 4 becomes grounded to a maximum of 1.25 mA., which is not dangerous to personnel.

Fig. 1



When the motor is idle, the isolating relay contacts are closed, as shown in Fig. 1.This connects the motor windings to a stable voltage source through the series resistor R_S. The series resistor and the generator windings leakage resistance R_L form a voltage divider with a comparator connected to the R_S / R_L junction. The voltage seen by the comparator is therefore a function of the value of the leakage resistance R_L which is indicated continuously at the analog output. When this resistance falls below the set value, the comparator voltage falls below the reference voltage and the alarm relay is activated.

INSTALLATION INSTRUCTIONS

To install the MotoSafe device in the low voltage (instrumentation) compartment and the Intermediate Resistor Block in the high voltage compartment of the motor control enclosure:

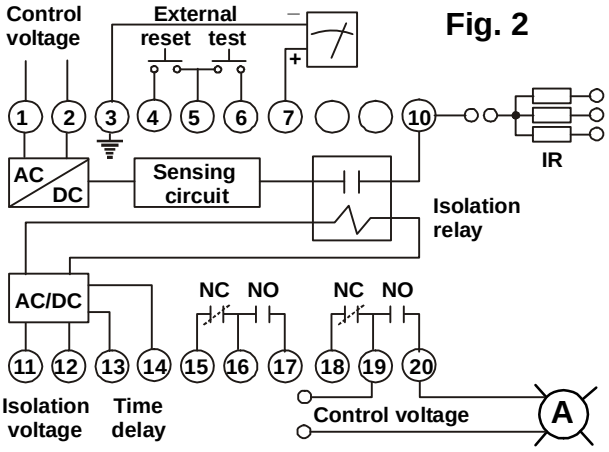
1. Disconnect the power from the enclosure.
2. Fasten the monitor mounting bracket in place with the screws supplied. Clip the device securely to the bracket. If required (and regulations permit), install the long-life local alarm lamp (supplied) on the motor control front panel close to the hinges and affix the warning label around the lamp.
3. Install I R Block in the high voltage compartment using the mounting means provided.

WIRING INSTRUCTIONS

CAUTION: OBSERVE SAFETY PRECAUTIONS - DO NOT WORK ON LIVE CIRCUITS!

1. Disconnect the supply and control voltages.
2. Connect terminals 1 & 2 of the MotoSafe MHV device to the control voltage supply as marked, terminals 11 & 12 across the breaker coil, auxiliary relay coil or running light (input may be AC or DC 24-300V), terminal 3 to ground and the common red lead on the Intermediate Resistor Block to terminal 10.
3. Connect the three line leads of I.R. Block firmly and directly to the lines between the contactor and the motor, according to high voltage safety practice and local regulations. Protect them from mechanical damage.
4. If a local alarm light is required, connect terminal 2 to 19 and the lamp between terminals 1 and 20. (Fig. 2)
5. Reconnect the supply and control voltages.

Fig. 2



Note: Terminals 5 & 6 may be used to test the device and 4 & 5 to reset the alarm using external, NO push button switches. Terminals 13 & 14 are time delay terminals. Bridged, as shipped, the unit senses the motor phases 50 seconds after the motor is stopped. Unbridged, there is a 7 minutes time delay before sensing begins. Terminals 7 & 3 may be connected to the external meter or PLC I/O.

TESTING

1. Ground one of the motor phases momentarily via the test resistor. The red LED should light and the external alarm circuit be activated after a delay of 10 seconds. Reset the monitor with the RESET button. Repeat this test with two other phases.
2. Start the motor. The red LED should NOT light and the external alarm devices should NOT operate.
3. Stop the motor. If the insulation resistance is satisfactory the alarm should not operate.

Note: The green LED indicates "Power ON" and the red LED is the alarm indicator. Should the alarm indicator light but the external alarm device does not, recheck the connections. If the connections are correct, test the contacts used for the external alarm (Wiring Instruction #4) with a low range ohmmeter. If the results are not correct, replace the unit.

MotoSafe MHVdevices withstand the high voltage (to 2500V DC) applied by a Megger™ Tester. For testing with higher voltages disconnect the Sense terminal 10 from the IRB.

Megger is the trademark of Megger Instruments Ltd.

The analog output provides actual readings of the insulation resistance converted to 0 to 10V DC scale. Voltage at terminal 7 may be either zero for full ground and 10V for resistance over 40Megohm (option 1) or 10V for full ground and zero resistance over 40Megohm (option 2) depending on the option ordered. The relation between output voltage and resistance is:

for option 1 $U_7 = 24(4.33+R_L)/(14.33+R_L)/1.23-5.9$

and for option 2 $U_7 = 15.9-24(4.33+R_L)/(14.33+R_L)/1.23$

where R_L is the insulation resistance

The accuracy of the alarm settings and the analog output is $\pm$ 5%

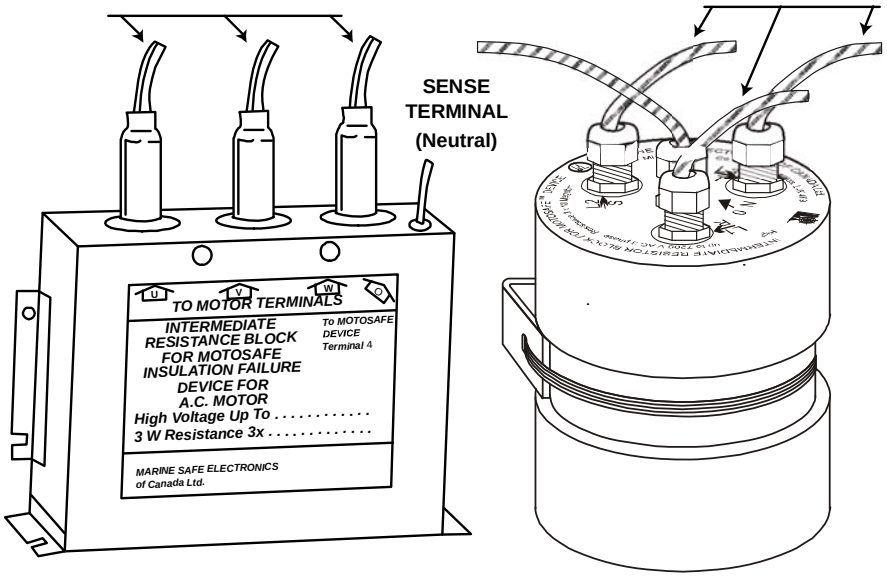
Analog output voltage to resistance relation

R_LMeg.	0	0.5	1	2	3	5	7	10	12	15	17	20	25	30	35	40
$U_{7opt.1}$V	0	0.45	0.88	1.66	2.35	3.52	4.46	5.59	6.20	6.96	7.38	7.93	8.65	9.21	9.66	10.0
$U_{7opt.2}$V	10.0	9.55	9.12	8.34	7.65	6.48	5.54	4.41	3.80	3.04	2.62	2.07	1.35	0.79	0.34	0

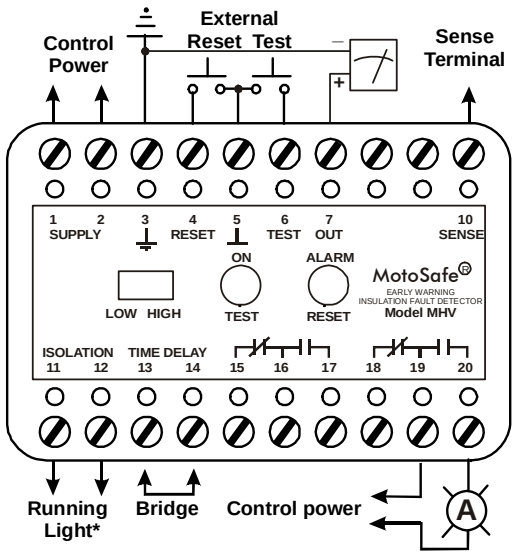
Connection Diagram Model MHV 4600 / 7200

HIGH VOLTAGE COMPARTMENT **LOW VOLTAGE COMPARTMENT**

LINE TERMINALS HIGH VOLTAGE WIRE 15,000V G.T.O. 15 12AWG



IRB 4600 **IRB7200**



***Not connected in on-line applications**

The Intermediate Resistor Block contains three high voltage precision resistors, connected in Star (WYE) configuration. During normal operation the neutral terminal will be close to ground potential. The resistors are protected by total encapsulation. This method of connection complies with all applicable codes and is approved by CSA and UL.

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