



Operating Manual LIM2000plus™
Line Isolation Monitor LIM2000-1
LIM2000-1CB
LIM2000-3CB

ISOTROL / BENDER Medical Products
700 Fox Chase
Coatesville, PA 19320

Telephone: 1-610-383-9200
Fax: 1-610-383-7100
Tollfree: 1-800-833-6834

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1.1 Intended use



The Line Isolation Monitor (LIM) calculates the total hazard current in a single phase or three phase isolated power system. This is the maximum current that could flow through a person who made contact between an isolated conductor and ground.

Two separate ground connections are provided for added safety when wiring the LIM into an isolated power system. Each ground should be wired individually to the reference grounding bus. A break in either connection will cause the LIM to alarm (flashing red LED). Any other use, or any use beyond the foregoing, is deemed to be improper. The BENDER companies shall not be liable for any loss and damaging arising therefrom.

Correct use also includes

- compliance with all instructions from the operating manual
- adherence to any inspection intervals.

As a basic principle, our "General conditions of Sale and Delivery" shall apply. These are available to the operator not later than the time when the contract is concluded.

1.2 Warranty and liability

Warranty and liability claims in the event of injury to persons or damage to property are excluded if they can be attributed to one or more of the following causes:

- Improper use of the LIM.
- Improper assembly/fitting, commissioning, operation and maintenance of the LIM.
- Failure to take note of the operating instructions concerning transportation, commissioning, operation and maintenance of the LIM.
- Unauthorized structural modifications to the LIM.
- Failure to take note of the technical data.

- Improperly performed repairs and the use of spare parts or accessories which are not recommended by the manufacturer.
- Cases of disaster brought about by the effect of foreign bodies and force majeure.
- The assembly and installation of non-recommended combinations of devices.

This operating manual, and in particular the safety information, must be noted by all persons who work with the LIM. In addition, it is essential to comply with the rules and regulations on accident prevention which are valid for the place of use.

1.3 Personnel

Only appropriately qualified personnel may work on the LIM. "Qualified" means that such personnel are familiar with the installation, commissioning and operation of the LIM, and that they have undergone training or instructions which is appropriate to the activity. The personnel must have read and understood the safety chapter and the warning information in these operating instructions.

1.4 About the operating manual

This operating manual has been compiled with the greatest possible care. Nevertheless, errors and mistakes cannot be entirely ruled out. BENDER companies assume no liability whatsoever for any injury to persons or damage to property which may be sustained as a result of faults or errors in these operating instructions.

1.5 Hazards when handling the Line Isolation Monitor LIM2000-1, LIM2000-1CB and LIM2000-3CB

The LIM is constructed according to state of the art and the recognised safety engineering rules. Nevertheless, when it is

being used, hazards may occur to the life and limb of the user or of third parties, or there may be adverse effects on the LIM or on other



valuable property. The LIM must only be used

- for the purpose for which it is intended
- when it is in perfect technical condition as far as safety is

concerned

Any faults which may impair safety must be eliminated immediately. Impermissible modifications and the use of spare parts and additional devices which are not sold or recommended by the manufacturer of the LIM may cause fire, electric shocks and



injuries.

Unauthorized persons must not have access to or contact with the LIM.

Warning signs must always be easily legible. Damaged or illegible signs must be replaced immediately.

1.6 Inspection, transportation and storage

Inspect the dispatch packaging and the equipment packaging for damage, and compare the contents of the package with the delivery documents. In the event of damage during transportation, please notify the BENDER company immediately.

The LIM must only be stored in rooms where they are protected against dust and moisture, and spraying or dripping water, and where the indicated storage temperatures are maintained.

1.7 Important

Please check for correct system and supply voltage !

When insulation and voltage tests are to be carried out, the device must be isolated from the system for the test period.

In order to check the proper connection of the LIM, it is recommended to carry out a functional test, before starting the LIM.

Please check whether the basic setting of the devices complies with the system requirements.

Children or the public must not have access to the LIM.

1.8 Explanation of symbols and notes

The following designations and symbols for hazards and warnings are used in BENDER documentation.



This symbol means a possible threat of danger to the life and health of human beings.

- Failure to comply with these warnings means that death, serious physical injury or substantial damage to property may ensue if the relevant precautions are not taken.



This symbol means a possible dangerous situation.

- Failure to comply with these warnings means that slight physical injury or damage to property may ensue if the relevant precautions are not taken.



This symbol gives important information about the correct handling of the LIM.

- Failure to comply with this information can result in faults on the LIM or in its environment.



Where you see this symbol, you will find application hints and other particularly useful information.

- This information will help you to make an optimal use of the LIM.

1.8 Directions of installation

2.1 The fundamental functions

The LIM function is to calculate the max. value of the total hazard current that would flow through a solid connection between the isolated current carrying conductor associated with the higher impedance and ground. The total hazard current is displayed on a 7-segment LED display and an analog bargraph with 16 LEDs. The level will increase as additional loads are connected to the system or when a ground fault is slowly developing or has occurred.

The bargraph has two scales, one for 2mA and one for 5 mA alarm setting. The two yellow LEDs on the left near the bargraph indicate, which alarm setting is selected and which scale is valid.

There is a visual and audible alarm when the total hazard current exceeds the setting of either 2 or 5mA. The visual alarm remains during duration of the fault, the buzzer can be muted at any time. When muted, the yellow LED inside the mute button comes on to indicate a muted condition.

Activating the test button starts the following procedures:

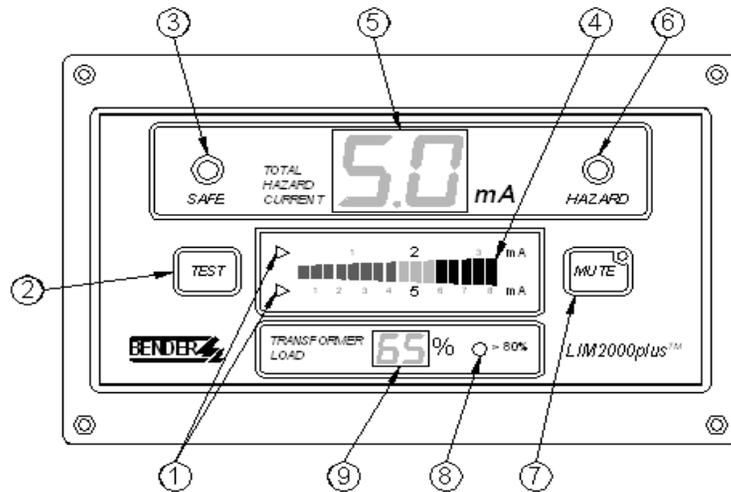
- Audible alarm check
- Illumination of the analog LED bargraph
- Illumination of the 7-segment LED displays of the total hazard current and the optional transformer load
- Internal hardware check and self calibration by using internal faults (the numeric Display of the optional transformer load indicates CH or CL depend on 120 or 240V).

If these tests are successful, the LIM goes in the operating condition, otherwise the LIM displays an errorcode. After the fault of the error has abolished it works again in the operating condition, when the internal tests are finished.

The LIM also performs an internal hardware check and a self-calibration after 3 hour and then every 12 hours. If this checks aren't successful the LIM displays an error-code too.

The LIM has provisions for connecting one or two remote indicators with or without meter or digital display. Relay output contacts are also available which can be wired into a circuit to trigger an external alarm.

2.2 Display



1. Amber THC setting LEDs - indicates the current "THC" setting
2. "TEST" button - checks functions of the LIM
3. Green "SAFE" LED - bright unless LIM is in alarm mode
4. LED Analog Bar Graph - displays Total Hazard Current
5. Total Hazard Current Red LED Display - displays Total Hazard Current
6. Red "Hazard" LED - indicates "THC" $\geq 5\text{mA}$ (2mA)
7. Amber "MUTE" LED button silences alarm buzzer
8. Amber "Transformer Load" LED indicates transformer load over 80% (optional)
9. Transformer Load (TL) Red LED Display - displays transformer load (optional)

2.3 Menu

To enter the menu the TEST button and the MUTE button must be pushed simultaneously for approximately 1 second till the buzzer begins to beep. The numeric display indicates set Point (SP).

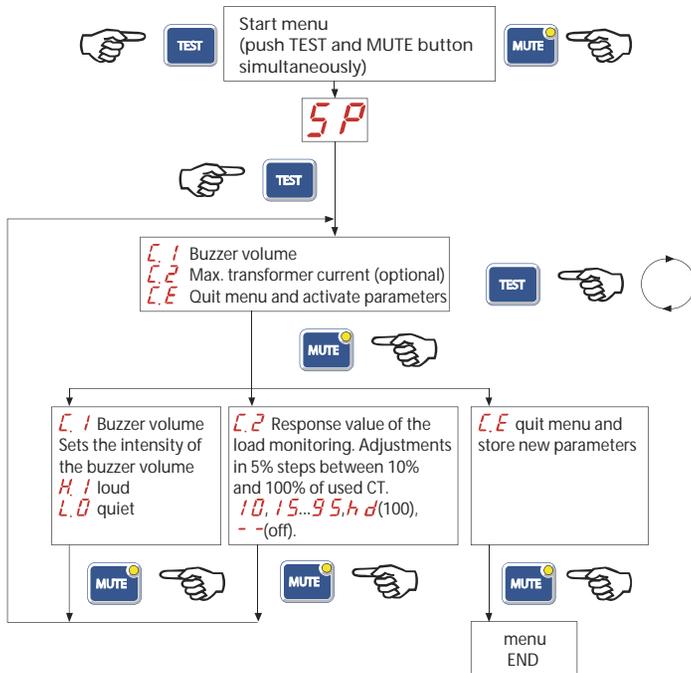
Now the TEST button has the function to swap upwards in the menu. The MUTE button has the function to confirm or to activate the selected parameters.

In the menu the following functions can be selected:

- Sound intensity of buzzer (hi or lo)
- Max. transformer load (100% of the transformer current)

After setting the parameters, they are stored and after leaving the menu the LIM performs a new self test.

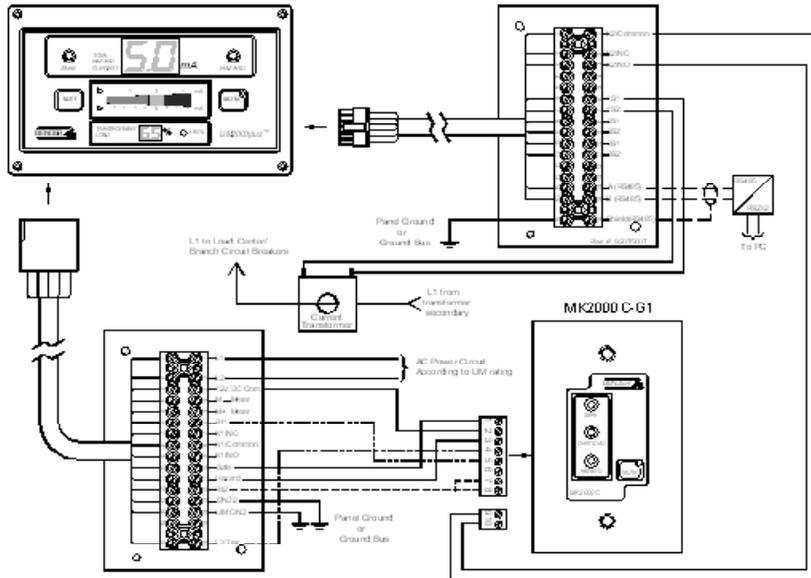
2.3.1 Menu instructions for the LIM2000plus™



2.4 Error-Codes Listing

- ER 1.0 Ground error LIM-GNDor GND interrupted
- ER 2.0 AD converter calibration failed; hardware failed error
- ER 3.0 Measuring circuit test failed; hardware mistake
- ER 4.0 Tolerance between actual system voltage and calibrated system voltage has been increased
- ER 4.5 Tolerance between actual signal voltage and calibrated system voltage has been increased
- ER 5.0 Hardware defect; missing system trigger
- ER 6.0 Program sequence interrupted; EMI interference
- ER 6.5 Program sequence interrupted; stack point indication too high
- ER Error in the current measuring circuitry

2.5 External Connections

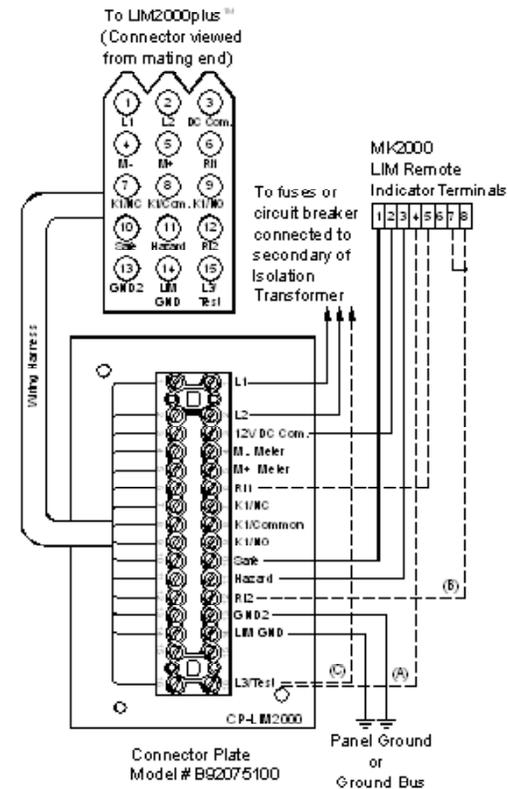


2.5.1 Connector assembly (CP-LIM2000)

Connections between the LIM, the Remote Indicator and the isolated power supply are made via this cable assembly, designed for integration into panels, headwalls and other equipment.

The terminal strip works best with 18 ga. wire.

The multiconductor harness has a length of 20".



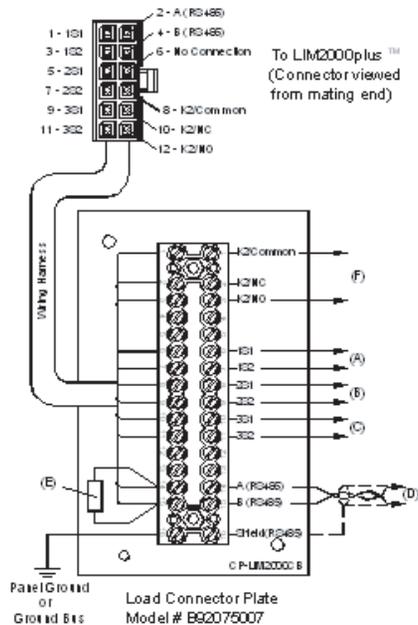
- (A) test function with RII (C) three phase system
 (B) optional for system muting (test function not available)

2.5.2 Connector assembly (CP-LIM2000CB)

Connections between the LIM, the Remote Indicator, the load monitoring CT and the RS485-Interface are made via this cable assembly, designed for integration into panels, headwalls and other equipment.

The terminal strip works best with 18 ga. wire.

The multiconductor harness has a length of 20”.



- (A) To Load Monitoring CT (Current Transformer) for L1
- (B) To Load Monitoring CT (Current Transformer) for L2
- (C) To Load Monitoring CT (Current Transformer) for L3
- (D) Shielded, Twisted Pair Cable for RS485 Communication to MK2000CBM Remote Indicator (If required)
- (E) 120 ohm, 1/4 Watt Termination Resistor (Resistor also required at MK2000CBM Remote Indicator)
- (F) To MK2000C Remote Indicator (Overload Indicator)

2.5.1 Remote Indicator

The MK2000 Remote Indicator series permanently mounts into standard one- to xxx-gang electrical boxes. Low voltage wiring connects them via the connector assembly CP-LIM2000 to the Line Isolation Monitor.

The remotes can duplicate the audible and visible “SAFE”, “HAZARD” and “OVERLOAD” (optional) signals of the LIM. A “MUTE” button can either silence the remote buzzer (local muting) or all buzzers in the system (system muting). The optional “TEST” button can remotely perform a function test of the LIM.



2.5.2 Digital Remote Indicator

The MK2000CB Digital Remote Indicator permanently mounts into standard two- to xxx-gang electrical box. Low voltage wiring connects it via the connector assembly CP-LIM2000 to the Line Isolation Monitor.

The remote can duplicate the audible and visible “SAFE”, “HAZARD” and “OVERLOAD” (optional) signals of the LIM. A “MUTE” button can either silence the remote buzzer (local muting) or all buzzers in the system (system muting). The optional “TEST” button can remotely perform a function test of the LIM.

Additional to that there are two 7-segment-displays indicating the Total Hazard Current and the Transformer Load current.



The Line Isolation Monitor is based on the superimposition of a measuring signal on the isolated power system. The signal is very small and near the frequency of the power line making it compatible with all electrical equipment due to its low EMI. This signal is connected between each of the lines and ground and flows through the system leakage impedances producing an interference (beat frequency) pattern. The difference frequency produces an envelope directly proportional to the system leakage. This is extracted from the power line and processed. The resulting measurement is a very accurate determination of the total leakage current on the isolated power system.

The BENDER LIM (US Patent #4,472,676) meets or exceeds all applicable U.S. and Canadian standards.

It complies with NEC Article 517, NFPA 99, UL 1022, and is recognized under UL and CUL File No. E224808 (Listee: BENDER Inc.).



3. Technical Description

Technical Data

Rated insulation voltage	300 V
Insulation class in acc. to UL1022	
Dielectric voltage-withstand test	1500 V
Rated service rating	continuous operating
Rated mains voltage of VN	see nameplate
Frequency range of VN	50...60 Hz (+/- 5%)
Operating range of VN	85...110% of rated voltage
Max. power consumption	22 VA
Measuring current	max. 20 µA
Monitor hazard current 120V / 208V (1Ph) / 208V (3Ph)	max. 35 / 62 / 68 µA
Min. internal impedance at 1Ph / 3Ph (60 Hz)	3.5 / 3.2 MΩ
Nominal response value	2 mA changeable to 5 mA
Response tolerance	1.8...2 mA or 4.5...5 mA
Response retardation	< 4 sec.
Response hysteresis	20% of response value
Output contact assemblies	one voltage-free SPDT and one 12 V DC, 200mA contact
Rated contact voltage	250 V AC / 24VDC
Make capacity	4A AC / 4A DC
Break capacity at 24 V DC and L/R = 0	4 A
Switching life (220 V AC / 60 Hz)	2 x 10 ⁵ cycle
Operation mode	continuous
LIM overload protection	built-in thermal overload with automatic reset
Ambient temperature when operating	10°C...50°C, 50°F...122°F
Ambient temperature when stored	-20°C...50°C, 10°F...122°F
Mounting orientation	any
Connector	15 pin Molex, type 03-09-2152
Weight	approx. 1.1 lb (493gr.)

Information Request



Information Request

Questions or Comments? Just call!

Tollfree: 1-800 833-6834
 Customer Service, Sales and Technical Support:
 1-610-383-9200
 Fax: 1-610-383-7100

For further information please write down:

Model:.....

Article No.:.....

Serial No.:.....

Voltage:.....

Date Purchased:.....

Notes:

Thank you for purchasing a BENDER Line Isolation Monitor.
We appreciate your business.