

FORM 4.1b Testing LKAT with Metering Unit Tester (MUT) Date:

HEAD: Serial# A half _____ Serial# B half _____ P1= _____ mm P2 = _____ mm

METERING UNIT: Serial# _____ Type: LKAT+ / LKAT2 Std / Sigma / OEM

Main Measurement Full Scale _____ kA : Output _____ Trip1@ _____ kA

Optional PE Measurement FS _____ kA : Output _____ Trip2@ _____ kA Trip3@ _____ kA

Parameter	DC DMM (+) probe	DC DMM (-) probe	ACCEPTABLE RANGE	Data As Found	Data As Found	Data Rescaled
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This section for BASIC SYSTEM condition

System IC Supply	P4-1	P4-2	LKAT+ +5V (±0.5V) LKAT2 +12V (±0.75V)	V	V	V
System +15V supply	P4-3	P4-4	+15V (±0.5V)	V	V	V
System -15V supply	P4-6	P4-5	-15V (±0.5V)	V	V	V

This section for MEASUREMENT DATA on “Dead/0kA” and “Live/#kA” bus bar

Bus kA: <input type="checkbox"/> from LKAT Head <input type="checkbox"/> from MUT <input type="checkbox"/>				kA	kA	kA
Channel A1	P1-1	P1-2	±25mV of A2	mV	mV	mV
Channel A2	P1-3	P1-2	±25mV of A1	mV	mV	mV
xA	P2-4	P2-2	0.3V@20°C ±1mV/°C	mV	mV	mV
Channel B1	P2-1	P2-2	Typical ±25mV of B2	mV	mV	mV
Channel B2	P2-3	P2-2	Typical ±25mV of B1	mV	mV	mV
xB	P2-4	P2-2	0.3V@20°C ±1mV/°C			
Average Ch. V	Calculate		(A1+A2+B1+B2) / 4	mV	mV	mV
Average Ch. mV/kA	Calculate / confirm which is used for tests below		<input type="checkbox"/> Avg.Ch.V / kA <input type="checkbox"/> from table 4.1 <input type="checkbox"/> from factory data	mV	mV	mV
Main Output Set SW6 mA:all off 10V:off.off.on.on	P3-1	P3-2	mA burden or V-out ≤ 10.2V	mA V	mA V	mA V
PE Output Set PE SW5 mA:all off 10V:off.off.on.on	P9-1	P9-2	mA burden or V-out ≤ 10.2V	mA V	mA V	mA V
Display	Visual read of LCD		±2% of “Main Output”	_____.	_____.	mV

TRIP POINT AS FOUND

TRIP POINT ADJUSTMENT

As-Left

Trip1 _____ Ave.Ch.V x Ave.Ch.mV/kA= _____ kA	Calc Trip1: _____ kA x Avg.Ch.mV/kA=set to _____ mV	mV
Trip2 _____ Ave.Ch.V x Ave.Ch.mV/kA= _____ kA	Calc Trip2: _____ kA x Avg.Ch.mV/kA=set to _____ mV	mV
Trip3 _____ Ave.Ch.V x Ave.Ch.mV/kA= _____ kA	Calc Trip3: _____ kA x Avg.Ch.mV/kA=set to _____ mV	mV

AFTER RESCALING/ADJUSTMENT

MU: Serial# _____ MU type _____
 HEAD: Serial# A half _____ Serial# B half _____ P1= _____ mm P2 = _____ mm
 Main Measurement Full Scale _____ kA : Output _____ Trip1@ _____ kA
 Optional PE Measurement FS _____ kA : Output _____ Trip2@ _____ kA Trip3@ _____ kA

4.12 Rescaling LKAT using LKAT Tester 'MUT'

The section outlines the steps required to re-scale an LKAT and document results on Form 4.1b. This is to be used together with the LKAT Tester Manual 045808 and its drawings.

NOTE : The LKAT MUT is NOT a calibration tool.

Rescaling LKAT systems using the LKAT MUT is effective and moderately accurate, However, it will NOT realize 'datasheet' measurement performance and accuracy.

1) TAKE AND RECORD 'BASIC SYSTEM' AND 'MEASUREMENT DATA'

Document the system information on the top of Form 4.1b using data from the LKAT system labels on the metering unit.

Measure and record LKAT system 'As-Found' data in the 'BASIC SYSTEM' and 'MEASUREMENT DATA' sections of Form 4.1b.

Best practice is to use the first data column to record data at 0kA with the LKAT head connected to the metering unit. The head can be on a 'dead' bus or the head can be removed from the bus if needed. Use the second data column to record data with the head connected to the metering unit and mounted on a live bus at a known kA level.

Make sure to record the bus bar kA level for each column and check the box to confirm the source.

After measuring and recording the information,

Calculate the Average Ch.V and the Average Ch.mV/kA and record them on Form 4.1b.

Be sure to check the box to indicate the source of the Avg.Ch.mV/kA you are going to use.

The best source is your calculation.

The second best source is the factory information (you must contact DynAmp to get this).

The third best source is the Table 4.1 in the MUT manual.

For this example to rescale LKAT2 for 20kA:

6.31mV/kA	Avg.Ch.mV/kA from table 4.1 in MUT manual
<u>x 20kA</u>	the new desired rescaled full scale
126.20mV	Avg.Ch.V @ 20kA full scale

2) RESCALE OUTPUT : MAKE CONNECTIONS TO ALLOW RESCALING

Disconnect mains power from the LKAT system

Connect the MUT head cables to the LKAT metering unit head input connectors

Disconnect the normal LKAT system output cable and DO NOT connect MUT output cable.

Connect DMM-1 to the MUT banana jacks and set it to measure DC mV

Connect DMM-2 to the LKAT main measurement output at the LKAT PCB edge connector.

+ lead to P3-1

- lead to P3-2

If the LKAT measurement output is mA, and DMM can accurately measure 20 mA,

All should be OK, set the DMM to measure 20mA

If the measurement output is configured for mA, but DMM cannot measure mA accurately, temporarily change the measurement output to 10V full scale using SW6 on the PCB

Now set the DMM to measure 10V

(for this example, we will assume that the DMM can accurately measure 20mA)

Re-connect mains power to the LKAT system

2.1) RESCALE OUTPUT : 1st GAIN RE-ADJUSTMENT

Using the controls on the MUT, adjust so DMM-1 reads 126.20mV

(the MUT is now simulating a head on a 20kA bus bar)

Observe the measurement on DMM-2.

Adjust the 10 turn "GAIN" potentiometer on the main PCB to realize exactly 20mA on DMM-2.

If this is not possible, move the GAIN potentiometer to approximately center of the 10 turns, then use SW3 to adjust 'coarse' gain to get as close to 20mA as possible.

(SW3 position 1 has the lowest effect while position 10 has the greatest effect).

After using SW3, use the GAIN potentiometer again to realize exactly 20mA on DMM-2.

2.2) RESCALE OUTPUT : 1st ZERO RE-ADJUSTMENT

If you calculated 'Avg.Ch.V at 0kA' on Form 4.1b,

use the controls on the MUT to adjust so DMM-1 reads this Average Channel Voltage.

If you did not calculate Avg.Ch.V at 0kA, simply adjust MUT so DMM-1 reads 0mV.

(the MUT is now simulating a head on a 0kA bus bar)

Observe the measurement reading on DMM-2

If the LKAT system is configured for -20mA...0mA...+20mA, DMM-2 should read 0mA

If the LKAT system is configured for -16mA...+4mA...+20mA, DMM-2 should read 4mA

If the LKAT system is configured for +4mA...+12mA...+20mA, DMM-2 should read 12mA

(this general zero offset can be set/changed via SW2 on the LKAT2 main PCB)

Adjust the 11 turn "BIAS" potentiometer on the LKAT2 main PCB to try to realize exactly 0 or 4 or 12mA as needed on DMM-2.

2.3) RESCALE OUTPUT : 2nd GAIN CHECK / ADJUSTMENT

Gain must be checked again after any zero adjustment

Using the controls on the MUT, adjust so that DMM-1 reads 126.20mV again

(the MUT is again simulating a head on a 20kA bus bar)

Observe the reading on DMM-2.

Adjust the 11 turn "GAIN" potentiometer on the LKAT2 main PCB to try to realize exactly 20mA on DMM-2.

2.4) RESCALE OUTPUT : 2nd ZERO CHECK / ADJUSTMENT

Zero must be checked again after any gain adjustment

Using the controls on the MUT, adjust so that DMM-1 reads Avg,Ch.V at 0kA or 0.0mV

(the MUT is now simulating a head on a 0kA bus bar)

Observe the measurement on DMM-2

Adjust the 11 turn "BIAS" potentiometer on the LKAT2 main PCB to try to realize exactly 0 or 4 or 12mA on DMM-2.

2.5) RESCALE OUTPUT : FINALIZE MEASUREMENT ADJUSTMENTS

Repeat steps 2.3 and 2.5 as needed until no additional adjustments are required.

If you changed output type for rescaling, remember to reset SW6 back to the desired output.

Record all results in the 'Rescale' section of Form 4.1b

3) CHECK/ADJUST TRIP SETPOINT

Anytime measurement Gain or Zero is adjusted, Trip points must be checked/adjusted afterwards.

When checking or adjusting the trip point, only consider trip points and voltages when you are moving from a 'green / no-trip' condition to a 'red / tripped' condition. This is important to eliminate any hysteresis around the trip point.

3.1) CHECK/ADJUST TRIP SETPOINT : PREPARE AND CHECK

Connect the MUT head cables to the LKAT metering unit

This time, also connect the MUT output cable to the LKAT metering unit.

Connect DMM-1 to the MUT banana jacks and set it to measure DC mV.

Using the MUT controls, adjust so that the LKAT PCB and MUT Trip LEDs are green (no-trip).

Then slowly adjust the MUT controls until LKAT PCB and MUT Trip LEDs are red (tripped).

Note the mV reading on DMM-1 and record on Form 4.1b "As-found"

This as-found mV reading x Avg.Ch.mV/kA = the existing kA trip point.

3.2) CHECK/ADJUST TRIP SETPOINT : ADJUST IF NEEDED

Use the same Avg.Ch.mV/kA to calculate what the Avg.Ch.V should be at desired trip point.

LKAT2 example :

6.31mV / kA from Form 4.1b

x -2.0kA desired Trip1

-12.62mV the Avg.Ch.V at the desired -2kA trip point

Using the controls on the MUT, adjust so DMM-1 reads the desired trip point of -12.62mV
(the MUT is now simulating a head on a bus bar with -2.0kA reverse current)

There are two potentiometers on the LKAT2 main PCB, noted at "TRIP1" as "M" and "F".

"M" is the course/rough adjustment, "F" is the fine adjustment.

Adjust "M" until the LEDs just change color from green to red (Trip1 is now tripped)

Next, adjust "F" until the LEDs just change color from red to green (Trip1 is now 'not-tripped')

Now adjust "F" again until the LEDs just change color from green to red to simulate the bus current going from a non-tripped/OK condition to a tripped/ALARM condition.

Now, use the controls on the MUT to change the 'bus current' and check the actual trip point.

In this example,

Adjust the MUT to move DMM-1 voltage closer to zero than the calculated trip point

The LEDs will change from red to green

Then slowly adjust the MUT to move the voltage farther from zero until

the LEDs change to red noting the actual voltage on DMM-1 where the trip occurred.

The existing trip point in kA is calculated as (DMM-1 voltage) X (Avg.Ch.mV/kA).

Repeat this process, adjusting "F" (and if needed, "M") to realize the desired trip point.

Record final Trip Ave.Ch.V on Form 4.1b

4) WRAP UP AND DOCUMENT

Record all final information in the 'RESCALE' area of Form 4.1b including and changes of metering unit and/or heads used by serial number at the bottom of the form

E-mail one copy to help@DynAmp.com for the following purposes

DynAmp will create and send a new system label to be applied to the Metering Unit

DynAmp will update our internal records to note the changes made

NOTE: If form is not sent to DynAmp, any active warranty coverage will be VOID.

Keep one copy for your records.