

**LT 9213A**  
**LCD FLICKER CHECKER**  
**INSTRUCTION MANUAL**

**LEADER ELECTRONICS CORP.**

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## GENERAL SAFETY SUMMARY

### To Avoid Personal Injury

It is recommended that only qualified personnel with technical knowledge use this instrument only after reading and fully understanding all functions of the instrument described in this instruction manual.

This instrument is not designed and manufactured for consumers.




If you do not have enough knowledge on electricity, to avoid personal injury and prevent damage to this product, please be sure to use this product only under the supervision of an engineer who has sufficient knowledge about electronics.

### Precautions on Contents

Should you find the contents in this manual and any of its technical terms confusing, please feel free to contact your local LEADER agent.

### Symbols and Terms

Following terms and symbols indicate necessary warnings and cautions used in this manual and on the product are there for safe operation.

<p>&lt; Symbol &gt;</p> 	<p>The sections where this symbol is marked in this manual or instrument, if not correctly performed or practiced, could result in personal injury or cause serious danger to the instrument. Misuse could also produce unintentional movement to create an operational impediment on the instrument or other products that might be connected to it.</p> <p>Be sure to refer to the safety precautions in this manual to safely use the part of the instrument where the symbol is marked.</p>
<p>&lt; Term &gt;</p>  <b>WARNING</b>	<p>Warning statements identify warning conditions that if disregarded or not correctly performed or adhered to, could result in serious personal injury or even loss of life.</p>
<p>&lt; Term &gt;</p>  <b>CAUTION</b>	<p>Caution statements identify caution conditions that if disregarded or not correctly performed or adhered to, could result in personal injury or damage to the instrument.</p>

## GENERAL SAFETY SUMMARY

Review the following safety precautions to avoid operator's injury and loss of life and prevent damage and deterioration to this instrument. To avoid potential hazards, use this product as specified.



### WARNING

#### **Warnings on the Cases and Panels of the Instrument**

Operator should not remove any cases or panel for any reasons. If you touch inside the instrument it could result personal shock or fire hazard. Refrain from spilling any liquid on or inserting anything flammables or piece of metal into the ventilation of the instrument. Such actions could cause fire, shock, malfunction and be an accident hazard while the power is on.

#### **Warnings on Power Line**

**Make sure to connect only to the rated power line voltage. Excess voltage may cause fire.**

Confirm the voltage of the commercial power line before connecting the AC power cord. The power frequency of the power line should be 50/60 Hz.

#### **Warning on the Power Cord**

Use only the optional power cord that is attached to this instrument. The use of the power cord other than that attached could cause fire hazard.

If the attached cord is damaged stop using it and contact your local LEADER agent. Should you use a damaged cord, it could cause a shock or create a fire hazard. When you pull out the cord be sure to hold it by plug and pull from the socket not by holding the cord wire.

#### **Warning on Fuse**

When the fuse is melted the instrument stops operation. If the fuse melted, turn off the power switch and disconnect the power plug from the socket. If you change the fuse while the cord is connected to the socket, it could cause a shock hazard. Only use the specified type and rated current and voltage fuses.

If the cause for melting fuse is unclear or if you suspect there is damage to the instrument or if you have no proper fuse at hand please contact your local LEADER agent.

## GENERAL SAFETY SUMMARY



### WARNING

#### **Warning on Installation Environments**

##### **About the Operating Temperature Range**

Operate the instrument between the temperature range of 0 to 40 °C. Operating the instrument at higher temperatures could cause a fire hazard.

Rapid changes of temperatures from cold to warm can create internal moisture or condensation and could damage the instrument. If there is a possibility of moisture condensation allow the instrument to sit for 30 minutes without the power on.

##### **About the Operating Humidity Range**

Operating humidity range is  $\leq 80\%$  RH.

Do not operate the instrument with wet hands. This could cause a shock and fire hazard.

##### **About the Operation in the Presence of Gasses**

Operating the instrument in and near the presence or storage locations of flammable, explosive gasses or fumes could create an explosion and fire hazard. Do not operate the instrument anywhere near such environments.

##### **Avoid Insertions**

Do not insert metals or flammable objects or drop liquid on or into the instrument. To do so could cause fire, shock, malfunction and create a dangerous accident hazard.

#### **Warning while Operating**

While operating the instrument if smoke, fire, or a bad smell occurs, turn off the instrument at once for it could cause a fire hazard. When such a case occurs, turn off the power switch and pull the plug of the cord from the plug socket. Contact your local LEADER agent after confirming there is no fire.

#### **Warning about Ground**

The instrument has a ground terminal to avoid electric shock hazard and to protect the instrument from damage. Ensure that the product is properly grounded for safe operation.

## GENERAL SAFETY SUMMARY



### CAUTION

#### **Caution on Input/Output Terminals**

Input Terminals are rated with a maximum input. Do not supply an input over the specified rating in the standard section of the instruction manual. Also, do not supply external power to Output terminal, this could cause the instrument to malfunction.

#### **Caution when Not Using the Instrument for a Long Time**

Make sure to disconnect the power cord from the socket when you do not use the instrument for a long time.

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Please conform to the above warnings and cautions for safe operation. There are cautions in each area of in this instruction manual, so please conform to each caution. If you have any questions about this manual, please feel free to contact your local LEADER agent.

## 1. PRECAUTIONS

### 1.1 Supply Voltage and Fuses WARNING

Before connecting the AC power cord to the commercial power source, check the voltage. The supply voltages, working voltage range, and fuse rating of this product are indicated on the right side of the product.

Always use the product within the working voltage range at 50 or 60 Hz.

When replacing the fuse, turn off the power switch and unplug the power cord in advance.

Use a fuse of the specified rating.

Standard	Working voltage range	Fuse rating Time-lag	Spare fuse Parts number of LEADER
100 V	90 to 110 V	BET 200 mA	436 3530 009
115 V	104 to 126 V	BET 200 mA	436 3530 009
230 V	207 to 250 V	BET 100 mA	436 3515 003



### CAUTION

#### 1.2 Maximum Allowable voltage on input Terminal

The accessory sensor or silicon photodiode sensor can only be connected to the INPUT connector.

Applying external voltage to the INPUT connector may damage the instrument.

#### 1.3 Shorting the Output Connectors, Revers signal

- Shorting the output connectors

Do not short any output connectors to prevent damage to the instrument.

- Reverse signal

Do not apply reverse signal to the output connectors to prevent damage to the instrument or connected units.

#### 1.4 Installation Environment

Do not use the product in the following environments:

- High temperature area

Do not place product on an area exposed to the direct sunlight for a long time or near a heater.

Do not subject the product to a sudden change of temperature as moving if from a cold area to a hot area.

Operating temperature range : 0 to 40

- Humid area

Do not place the product in a humid environment such as in the bathroom or near a humidifier.

Operating humidity range : ≤80 %RH

- Dusty area



### **1.5 Mechanical Shock**

To prevent precision parts damage, be careful not to expose the instrument to other forms of severe mechanical shock.

### **1.6 Calibration**

This instrument is produced under the strictest quality controls at the factory, but accuracy may gradually deteriorate due to worn components. Therefore, periodic calibration should be performed. When service or calibration is required, contact your local LEADER agent.

### **1.7 Routine Maintenance**

When cleaning the instrument, do not use such solvents as thinner or benzol which will remove paint or damage the plastic surface. Use a soft cloth dampened with neutral detergent.

Do not drop water or detergent, or insert metal object into the instrument while cleaning. Otherwise, you run the risk of electrical shock or fire.

## 2. SPECIFICATION

### 2.1 General

The LT 9213A LCD Flicker Checker is designed to adjust LCD panel flicker using the simple meter indication.

Since the bottom level and magnitude of flicker are indicated on the meter, this unit can quantify the LCD panel flicker and it is easy to operate by non-experience persons.

For reducing equipment investment cost, LT 9213A is also cheaper than the expensive spectrum-analyzer method.

Note: This instrument indicates a relative flicker value detected from unbalance components of LCD V-com voltage; it does not measure the absolute value conforming to VESA or EIAJ standards.

### 2.2 Features

- Wide range of brightness measurement

By switching 2 ranges on rear panel with provided sensor, brightness of LCD panel can be measured in range of 0.5 cd/m<sup>2</sup> to 300 cd/m<sup>2</sup>.

- Amplitude compressor for easy flicker bottom adjustment

For easy bottom adjustment, an amplitude compressor compresses large flicker to obtain greater resolution for small flicker indication.

- Reduces equipment investment for flicker adjustment

Unlike an expensive spectrum-analyzer method, this dedicated model greatly reduces cost.

- Bandpass filter eliminates noise and harmonic interference

Since a variable frequency bandpass filter selects flicker components and eliminates noise and harmonic interference, this model can be used for various LCD panels.

- DC AGC for relative flicker measurements

DC AGC uses a normalizing technology to automatically compensate for dispersion in backlight brightness and displays differences by using evaluation patterns.

Therefore, a relative flicker value conformed to the VESA305-5 standard (obtained by "small modulation amplitude formula") will be indicated.

- User-friendly design

A large meter for easy and accurate reading in the compact cabinet provides user-friendly operation.

- The sensor is supplied as standard accessory

## **2.3 Specifications**

### **2.3.1 System**

Indication of brightness variation

Variable frequency bandpass filter provided to select flicker component

### **2.3.2 Functions**

- Input section  
Abnormal brightness (too bright, too dim) indicator, input level adjustor
- DC AGC normalizes brightness dispersion
- Meter sensitivity adjustor
- Variable frequency bandpass filter provided to select flicker component
- Flicker indication compressor (COMPRESSION / LINER, selectable)
- GO / NO-GO judgement and output
- DC output in proportion to the meter indication
- Flicker waveform monitor output

### **2.3.3 Flicker Measurement**

2.3.3.1 Measurement Range: 0 to 30 %, 2 ranges  
(LINEARITY: LINER, SENSITIVITY: FIX)

2.3.3.2 Panel Brightness Range when a provide sensor is used.

Switchable LOW/HIGH by BRIGHTNESS RANGE SWITCH on rear panel.

LOW: 0.5 cd/m<sup>2</sup> to 50 cd/m<sup>2</sup>, include Brightness level adjustor

HIGH: 30 cd/m<sup>2</sup> to 300 cd/m<sup>2</sup>, include Brightness level adjustor

The brightness is measured when the sensor is fully contacted to the LCD panel.

2.3.3.3 Brightness Range Indicator: Indicates abnormal brightness (too bright, too dim)

### **2.3.4 Measurement Accuracy**

± 10 % of full scale (LINEARITY: LINER, SENSITIVITY: FIX)

### **2.3.5 Sensitivity Adjustor**

0.3 to 2 times (refer to FIX)

### **2.3.6 Meter Indication**

Average responding

### 2.3.7 Built-In Filter

#### Variable Filter

Type:	Single-resonance bandpass filter
Center Frequency:	20 Hz to 100 Hz, variable
Selectivity:	$Q = 3$
	*Typical attenuation characteristics: 20 dB at 60 Hz (20 Hz tuning frequency)
Frequency Response (30 Hz ref.)	
20 Hz to 60 Hz:	$\pm 0.5$ dB
60 Hz to 100 Hz:	$\pm 1$ dB

#### Fixed Filter

Type:	RC low-pass filter, 6 dB/oct
Attenuation:	-3 dB at 400 Hz

### 2.3.8 DC Output

Output Signal:	Proportion to meter indication
Output Voltage:	1 V $\pm$ 50 mV at full scale, into open
Output Resistance:	1 k $\approx$ approx.
Connecting Cable Length:	$\leq 10$ m

### 2.3.9 Monitor Output

Output Signal:	Flicker component normalized with DC ACG
Output Voltage:	0.1 Vp-p/ % approx.
Output Resistance:	600 $\approx$ approx.
Connecting Cable Length:	$\leq 10$ m

### 2.3.10 GO/ NO-GO Function

Method:	Preset on the meter
Setting:	Judgement value in preset mode
Indicator:	LED (GO: Green, NO-GO: red)
Output:	TTL level, fun out: 1 GO: LO, NO-GO or not judged: HI

### 2.3.11 Accessory Sensor

Type:	Silicon photodiode
Model:	S2281-01 (manufactured by Hamamatsu Photonics K.K.)
Connecting Cable Length:	$\leq 3$ m

### 2.3.12 General Specifications

#### Environmental Conditions

Operating Temperature:	0 to 40
Operating Humidity:	≤80 % RH (Without condensation)
Spec-Guaranteed Temperature:	10 to 35
Spec-Guaranteed Humidity:	≤80 % RH (Without condensation)

Power Requirements:	100 V/ 115 V/ 230 V, ± 10 % (250 V max.) 50/60 Hz
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Dimensions and Weight:	132(W) x 148(H) x 250(D) mm, 2.4 kg
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Accessories:	Sensor..... 1 BNC - BNC cable.....1 Power cord..... 1 Instruction manual..... 1
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Sensor and BNC - BNC cable as accessories

### 3. PANEL DESCRIPTION

#### 3.1 Front Panel

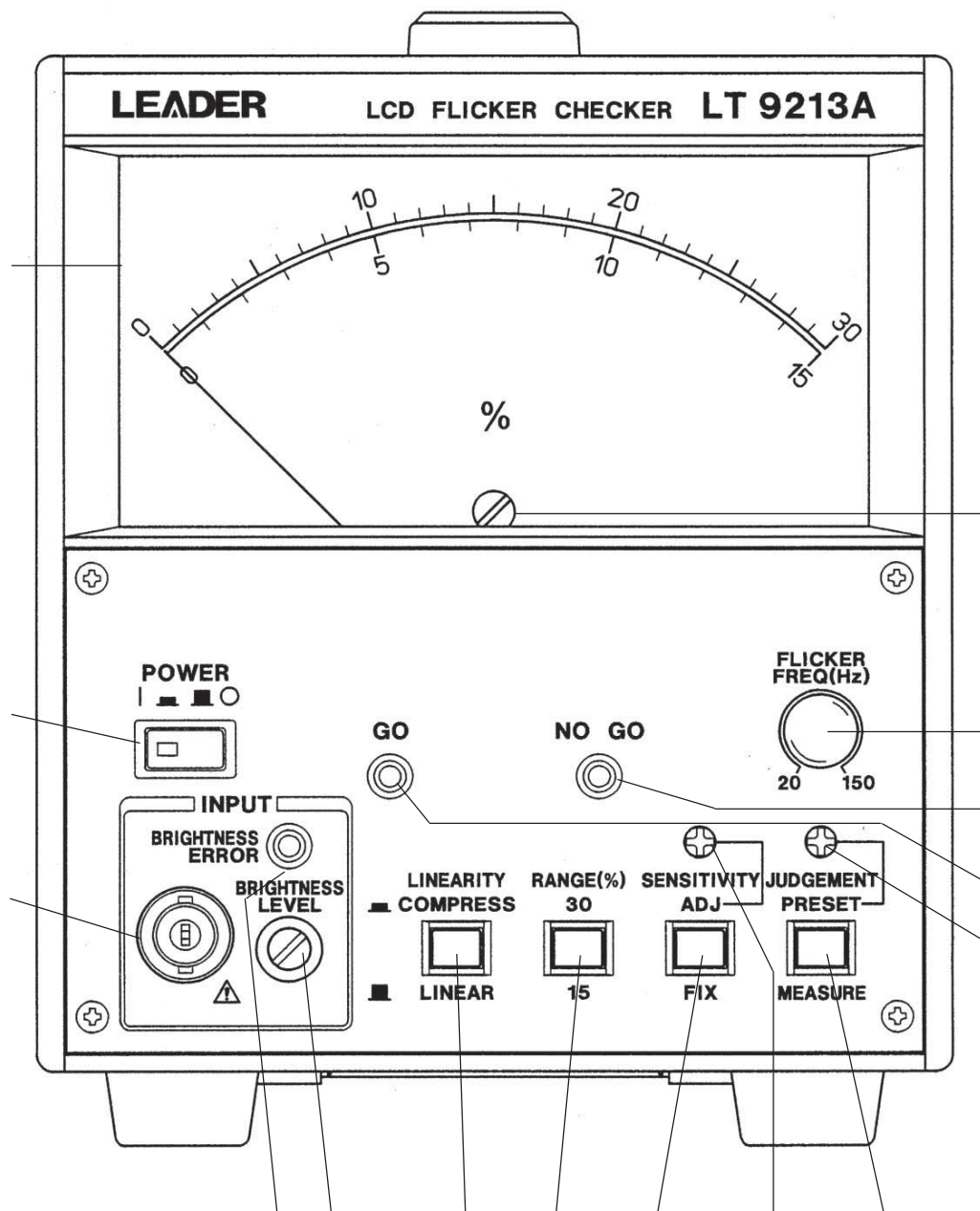





Figure 3.1 Front panel

## Meter

Indicates flicker value.

The meter is also used to preset the judgement reference value in JUDGEMENT mode.



The scale is only enabled when the SENSITIVITY switch is set to , LINEARITY switch to .

When using the upper scale (i.e., 30 % full scale), set the RANGE switch to .

When using the lower scale (i.e., 15 % full scale), set the RANGE to .

POWER (ON   OFF)

Power switch.

Press this switch (  ON) to turn power on; release the switch (  OFF) to turn power off. The green key LED lights when the instrument is powered on.

INPUT (BNC connector)

Connect the accessory sensor or silicon photodiode sensor.

Refer to Section 4.6, "Sensor" for the sensor.

INPUT BRIGHTNESS ERROR (red LED)

Warning lamp.

This indicator lights when the LCD brightness exceeds the specifications.

When measuring the flicker, adjust the INPUT BRIGHTNESS LEVEL adjuster so that the indicator goes off. The meter indication, DC output, and GO/NO GO mode are disabled during this indicator lights.

INPUT BRIGHTNESS LEVEL (adjuster)


Use this adjuster depends on LCD module brightness (e.g., type of LCD, type of test pattern). Set this adjuster so that the INPUT BRIGHTNESS ERROR indicator goes off.



 CAUTION

When making adjustment, use a suitable screwdriver for the adjuster to prevent damage the adjuster.

LINEARITY ( ,  COMPRESS)


Selects meter response.

When  LINEAR is selected, the meter indication and DC output level are in proportion to the flicker.

When  COMPRESS is selected, larger flicker is compressed; smaller flicker is indicated as being relatively larger at almost the same full scale as  LINEAR.

Refer to Sections, 4.2.1, "Setting Meter Response" and 5.1, "Bottom Adjustment" for detail.

When  COMPRESS is selected, meter indication should be ignored.

Select  LINEAR to obtain the flicker value

RANGE (%) ( ,  30)



Selects full scale.

The  15 indicates 15 % full scale;  30 indicates 30 % full scale.

#### SENSITIVITY ( FIX, ADJ)

Adjust the meter sensitivity.

When the ADJ is selected, sensitivity can be adjusted from 0.3 to 2 times with respect to FIX mode by using the SENSITIVITY adjuster .

- \* When  ADJ is selected, meter indication should be ignored. Select  FIX to obtain the flicker value.

#### SENSITIVITY (adjuster)

Adjusts sensitivity when the SENSITIVITY switch is set to  ADJ.

#### CAUTION


When making adjustment, use a suitable screwdriver for the adjuster to prevent damage the adjuster.

#### JUDGEMENT ( MEASURE, PRESET)

Presets the judgement value in GO/NO GO JUDGEMENT mode.

To preset the judgement value, select  PRESET, then set the value on the meter by using the JUDGEMENT PRESET adjuster .

#### JUDGEMENT PRESET (adjuster)

To preset the GO/NO GO judgement value, set the JUDGEMENT switch to  PRESET, then set the desired value on the meter by using this adjuster.

Set this adjuster fully clockwise when no judgement operation is required.

#### CAUTION

When making adjustment, use a suitable screwdriver for the adjuster to prevent damage the adjuster.

#### GO indicator (green LED)

#### NO GO indicator (red LED)

When the meter indication is the preset value or less, GO indicator lights; when the indication exceeds the preset value, NO GO indicator lights.

The GO/NO GO judgement mode is disabled during the INPUT ERROR indicator lights.

#### FLICKER FREQ (Hz) control

Adjusts the built-in bandpass filter center frequency to obtain the flicker components. Refer to Section 4.1.6, "Selecting FILTER FREQ and RANGE" for detail.

This control is capped to protect settings against accidental operation. Remove the cap when making adjustment.

#### CAUTION

When making adjustment, use a suitable screwdriver for the adjuster to prevent damage the adjuster.



### 3.2 Rear Panel

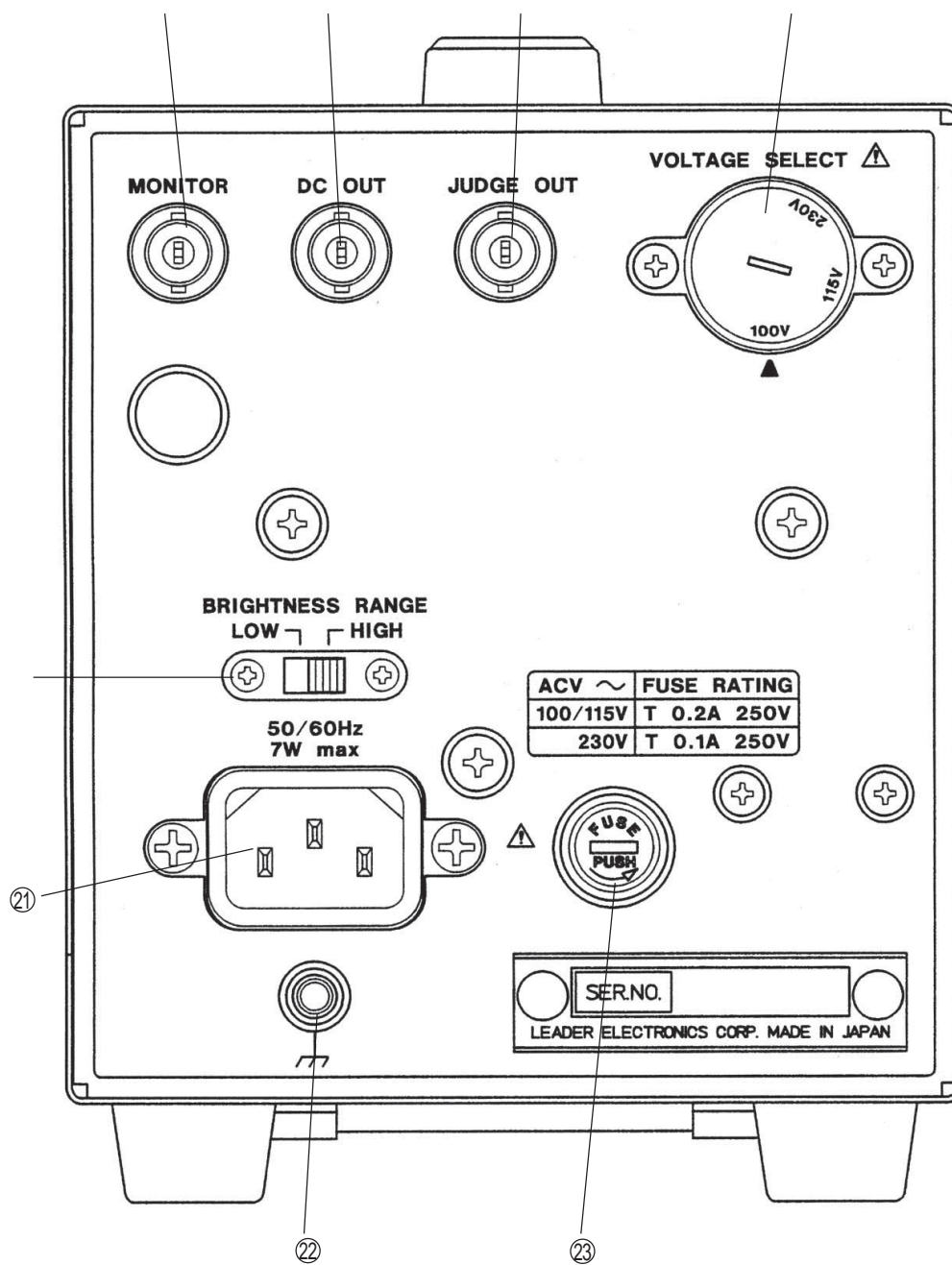


Figure 3.2 Rear panel

#### Meter mechanical zero adjustment

Turn the power off, then confirm that the pointer indicates zero. If not, rotate zero adjustment screw clockwise or counterclockwise so that the pointer indicates exactly zero. Use a flat-head screwdriver.

#### MONITOR (BNC connector)

Outputs flicker components.

Output voltage is about 0.1 V<sub>p-p</sub>% into open circuit. Output impedance is about 600 Ω.

#### DC OUT (BNC connector)

Outputs DC voltage in proportion to the meter indication. Output voltage is 1 V ± 50 mV (into open circuit) at full scale indication.

Output resistance is about 1 kΩ.

#### JUDGE OUT (BNC connector)

Outputs GO/NO GO results indicated by the GO or NO GO indicator.

Output level is a TTL: LO state for GO, HI state for NO GO.

The level is forcibly set to HI state when the INPUT ERROR indicator lights.

#### VOLTAGE SELECT

Selects the power line voltage.

Confirm that the setting is correct for your country or region before connecting the power plug to the mains.

#### WARNING

When changing the VOLTAGE, the fuse and power cord must be replaced.

Contact your local Leader agent.

#### BRIGHTNESS RANGE switch

Select LOW or HIGH according to the LCD Module.

The measurable panel surface brightness range when using the accessory sensor is as follows:

LOW: 0.5 cd/m<sup>2</sup> to 50 cd/m<sup>2</sup>

HIGH: 30 cd/m<sup>2</sup> to 300 cd/m<sup>2</sup>

#### ②① AC inlet

To connect the power line cord.

#### ②② Ground terminal


The chassis must be grounded by using this screw.

#### ②③ Fuse

Rotating the cap counterclockwise with a Phillips screwdriver can remove the fuse with a cap.

#### WARNING

Use only the fuse of correct type and rating for replacement.

Refer to Section 1.1, "Supply Voltage and Fuses  WARNING" for detail.

## 4. OPERATING PROCEDURE

Table 4.1 shows the basic operating procedure of the LT 9213A.

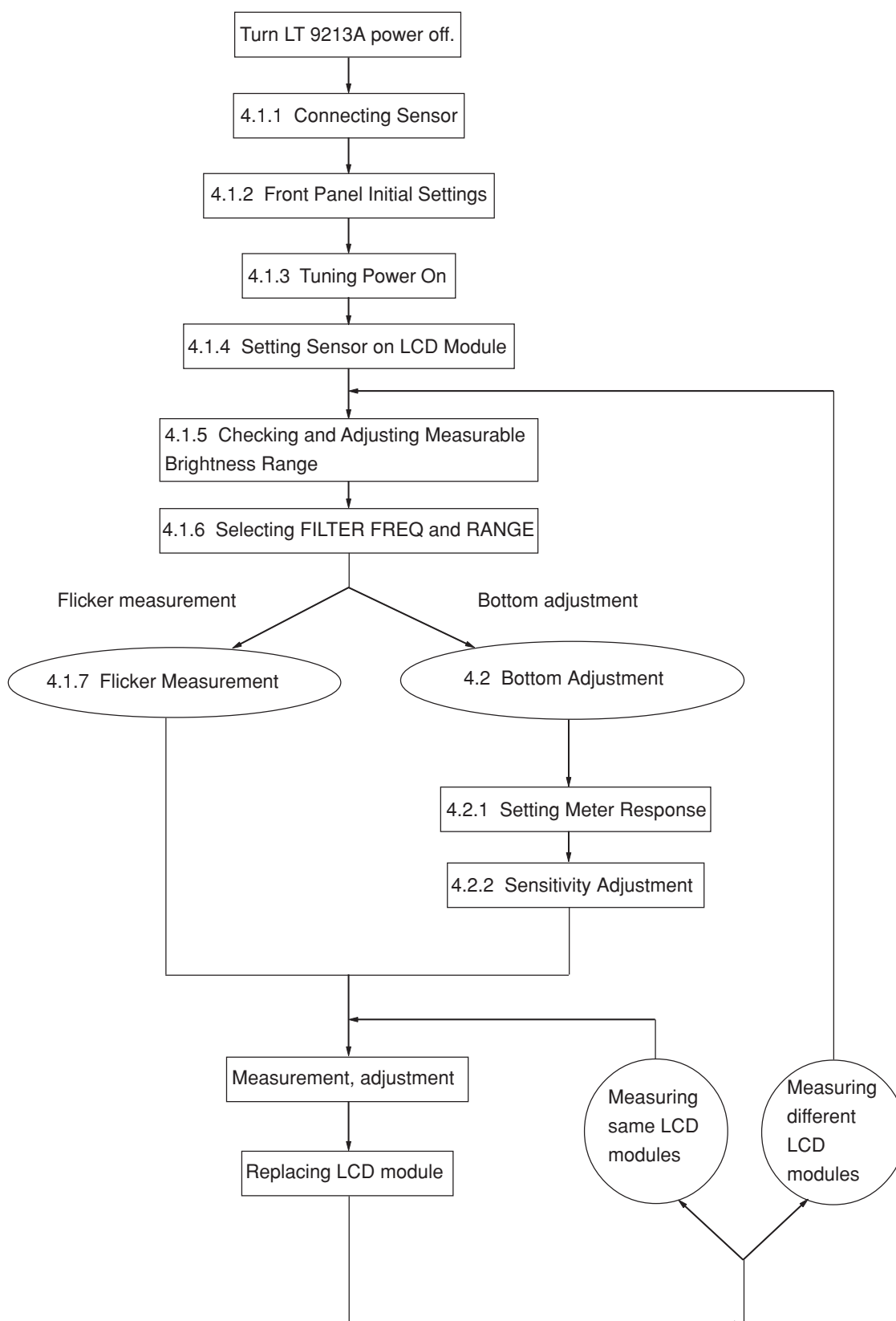


Figure 4.1 Basic operating procedure

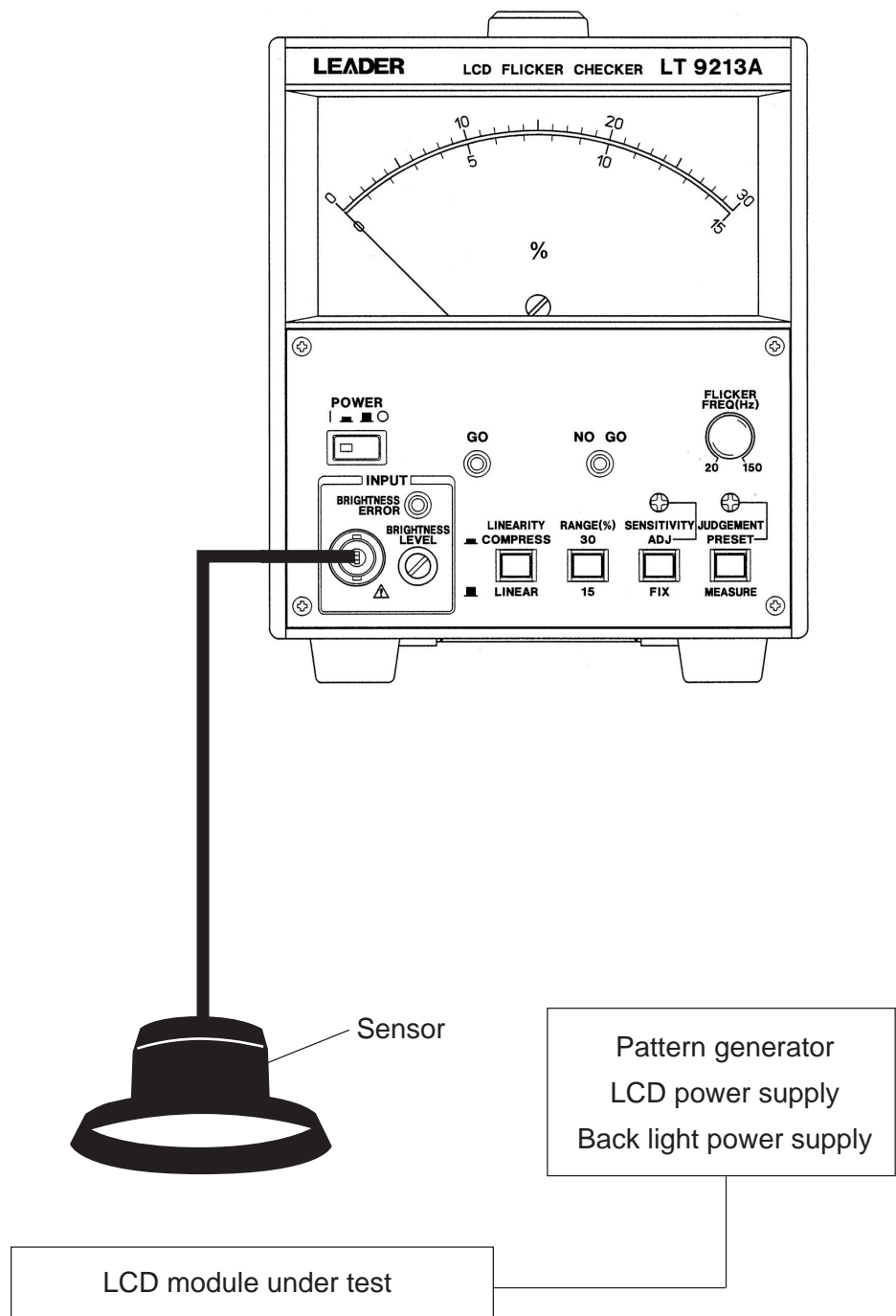



Figure 4.2 Basic setup

4.1 Basic Operating Procedure

This section describes the basic operating procedure to obtain the flicker value. See Figure 4.1.

4.1.1 Connecting Sensor

Connect the sensor to the INPUT connector .  
When using other than the accessory sensor, confirm that the polarity is correct as shown in Figure 4.3. Reverse connection disables measurement.  
Refer to Section 4.6, "Sensor" for detail.

 **CAUTION**  
When connecting or disconnecting the sensor, the instrument must be powered off.

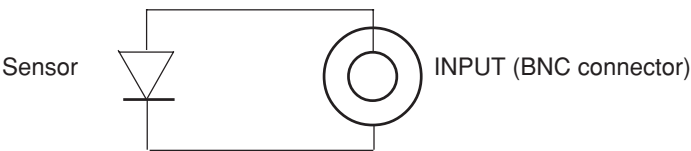


Figure 4.3 Polarity of sensor to be connected

4.1.2 Front Panel Initial Settings

When the instrument is first powered on after purchase, use the factory settings.  
Tables 4.1 and 4.2 show the factory settings.

• Key





Key	LINEARITY	RANGE	SENSITIVITY	JUDGEMENT
Setting	 LINEAR	 30	 FIX	 MEASURE

Table 4.1 Factory settings (Keys)

• Control/Adjuster

Control/Adjuster	LEVEL	SENSITIVITY	JUDGEMENT	FLICKER FREQ
Setting	Center	Center	Fully clockwise	30 Hz

Table 4.2 FLICKER settings (Control/Adjuster)

This control is capped to protect settings against accidental operation. Remove the cap when making adjustment.

#### 4.1.3 Tuning Power On

Connect the accessory power cord to the inlet, then connect the plug to the mains.

Pressing the POWER switch turns the instrument on. The POWER switch LED lights.



#### WARNING

The instrument must be connected to the rated power line voltage. Excessive voltage can cause fire or damage the instrument.

#### 4.1.4 Setting Sensor on LCD Module

Set the sensor on the LCD module under test. Set the sensor as close as possible to avoid the effects of external light.

Do not touch the sensor on the LCD module. Otherwise, the module may be scratched.

A shade should be used to shutout external light (especially for a florescent lamp with flicker components).

Turn the LCD module on, then display the flicker adjustment pattern. Use the 50 % gray or reverse line pattern, for example.

#### 4.1.5 Checking and Adjusting Measurable Brightness Range

For the BRIGHTNESS RANGE switch, measurable brightness range is as follows: Select LOW or HIGH according to the LCD module.

LOW: 0.5 cd/m<sup>2</sup> to 50 cd/m<sup>2</sup>

HIGH: 30 cd/m<sup>2</sup> to 300 cd/m<sup>2</sup>

Confirm that the INPUT BRIGHTNESS ERROR LED goes off.

If the LED lights, measurement cannot be performed.

Use the BRIGHTNESS RANGE switch and INPUT BRIGHTNESS LEVEL adjustment so that the LED goes off.

This instrument is designed based on panel surface brightness of the latest LCD models. If the LED does not go off even when the BRIGHTNESS RANGE switch and INPUT BRIGHTNESS LEVEL adjustment are adjusted, follow the procedure below:

- Change LCD backlight brightness.
- Change the test pattern for the suitable brightness range.
- Replace the sensor.
- Attach a filter to the sensor to reduce excessive brightness.

#### 4.1.6 Selecting FILTER FREQ and RANGE

Produce a flicker with a flicker adjustment function of the LCD module.

Adjust the FLICKER FREQ control for the maximum meter indication.

Set the RANGE switch according to the flicker value to be measured.

#### 4.1.7 Flicker Measurement

Now, the flicker can be measured.

Use the scale selected with the RANGE switch to read the flicker value.

## 4.2 Bottom Adjustment

Steps 4.1.1 through 4.1.6 can be used for bottom adjustment, however, this instrument provides the following two additional functions suitable for bottom adjustment.

### 4.2.1 Setting Meter Response

For flicker bottom adjustment, set the LINEARITY switch to **COMPRESS**. With this setting, larger flicker is compressed; smaller flicker is indicated as being relatively larger for easier reading.

Figure 4.4 shows an image of the meter response when **COMPRESS** is selected. Refer to Section 5.1.1, "Finding the Bottom Level" for using **COMPRESS**.

When **COMPRESS** is selected, the flicker value and meter indications are different. To read the flicker value, **LINEAR** should be selected (same as the factory setting).

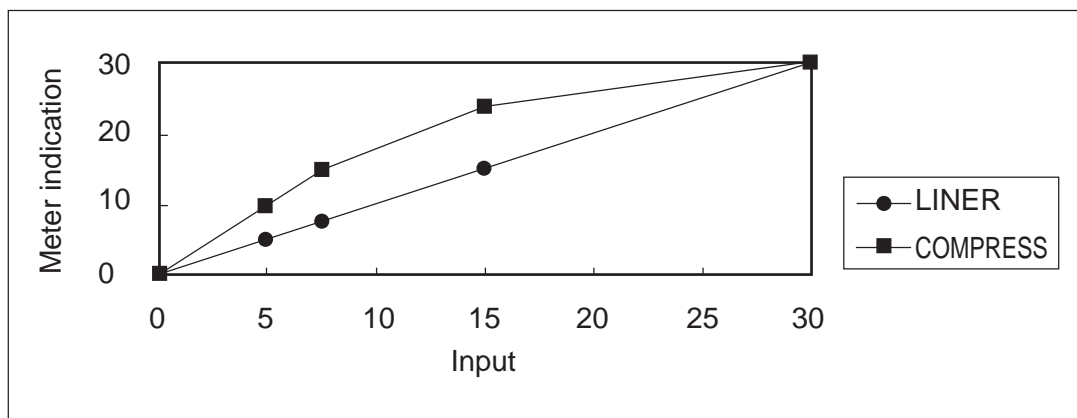


Figure 4.4 Image of meter response

### 4.2.2 Sensitivity Adjustment

The meter sensitivity can be adjusted by setting the SENSITIVITY switch to **ADJ** when adjusting the bottom.

Adjustable range is 0.3 to 2 times in **FIX** mode.

Refer to Section 5.1.1, "Finding the Bottom Level" for detail.

When **ADJ** is selected, meter indication should be ignored. Select the **FIX** (i.e., initial settings) to obtain the flicker value.

### 4.3 Using Judgement Mode

The instrument performs GO/NO GO judgement after the judgement value is preset on the meter.

#### 4.3.1 Presetting Limit

Set the JUDGEMENT switch to PRESET.

Adjust JUDGEMENT adjuster to obtain the desired limit on the meter .

The judgement capability depends on meter indication.

When the LINEARITY , RANGE , or SENSITIVITY switch is changed., set the limit again.

#### 4.3.2 Judgement Indication

When the meter indication is the preset value or less, GO indicator lights; when the indication exceeds the preset value, NO GO indicator lights.

#### 4.3.3 Judgement Output

The JUDGE OUT connector outputs judgement results indicated by the GO or NO GO indicator .

The output level is TTL. Fan out is 1.

The level is forcibly set to HI state regardless of the judgement value when the INPUT BRIGHTNESS ERROR indicator lights.

### 4.4 Using DC OUT

The DC OUT connector outputs the DC voltage in proportion to the meter indication. Output voltage is  $1\text{ V} \pm 50\text{ mV}$  (into open circuit) at full scale indication.

Refer to Section 5.2, "Automatic Adjustment" for application.

Since the output impedance is  $1\text{ k}\Omega$ , note that the input impedance is suitable for accepting the signal.

### 4.5 Using MONITOR Output

The MONITOR connector outputs flicker components. Use an oscilloscope to observe the flicker waveform. Since the level is normalized, precise measurement can be performed.

Refer to Section 5.3, "Precise Flicker Measurement" for detail.

This function is only effective when the INPUT BRIGHTNESS ERROR indicator goes off.

The flicker waveform is directly output; it is not passed through a bandpass filter.

Since the output impedance is about  $600\text{ }\Omega$  , note that the input impedance is suitable for accepting the signal.



## **4.6 Sensor**

### **4.6.1 Usable Sensor**

A silicone photodiode sensor can only be used.

When using other than the accessory sensor, the following specifications should be satisfied. Optical sensitivity: 0.1 A/W approx. (at 200 nm wave length)

### **4.6.2 Accessory Sensor**

Description	Silicone photodiode
Model	S2281-01
Manufacturer	Hamamatsu Photonics K.K.

### **4.6.3 Using Other Type of Sensor**

When using other than the accessory sensor or silicone photodiode sensor, contact your local LEADER agent.

## 5. APPLICATIONS

### 5.1 Bottom Adjustment

#### 5.1.1 Finding the Bottom Level

On the production line, finding the bottom level or judging the acceptable level of quality is more important than simply obtaining the flicker value.

This instrument provides several functions suitable for these purposes.

(1) Set the standard LCD module.

Apply Sections 4.1.1 through 4.1.6 for setting measurement conditions.

(2) Adjust flicker of the LCD module for the maximum flicker.

(3) Set the SENSITIVITY switch to **■** ADJ, then adjust the SENSITIVITY adjuster for the maximum meter indication within the full scale.

Sensitivity is about doubled by this setting.

(4) To increase sensitivity at the bottom when flicker is relatively small, set the LINEARITY switch to **■** COMPRESS.

Sensitivity is about doubled in comparison with **■** LINEAR.

By performing Steps (1) through (4), sensitivity at the bottom can be increased up to four times within a full scale indication even when the LCD module is replaced.

#### 5.1.2 Adjustment Based On Acceptable Level

Use the GO/NO GO judgement mode to obtain results on the GO indicator (green LED) and save labor.

When the flicker value is relatively small, the value is derived from the following formula:

$$\text{Flicker value} = \frac{V_{p-p} \text{ (brightness variation)}}{V_{dc} \text{ (LCD surface brightness) ----- (prescribed in VESA305-05)}}$$

According to the formula above, the flicker may be incorrect due to backlight dispersion even when the same  $V_{p-p}$  values are obtained from multiple LCD modules under test. Therefore, the current adjustment method (e.g., visual method, using a spectrum analyzer) must match the bottom levels of multiple LCD modules since acceptable level was difficult to determine.

To resolve this problem, this instrument uses DC AGC normalizing technology to obtain a constant  $V_{dc}$  value even when the LCD modules are replaced. With this method, bottom adjustment can be managed by the flicker values.

Therefore, determine the acceptable level of flicker by using the standard LCD module to save labor. On the production line, adjust the LCD module to satisfy the acceptable level.

## 5.2 Automatic Adjustment

### 5.2.1 Using DC OUT

The DC OUT capability is provided for automatic flicker adjustments.

Connect this instrument to the feedback loop and perform adjustment to minimize the DC voltage output from the DC OUT connector .

### 5.2.2 Combining JUDGE OUT

For automatic adjustment, setting the acceptable level and using the JUDGE OUT connector reduce tact time.

### 5.2.3 Numerical Management of Flicker Values

The flicker values can be numerically managed by performing A/D conversion of DC voltage output from the DC OUT connector .

## 5.3 Precise Flicker Measurement

### 5.3.1 Difference between VESA305-05 and LT 9213A

This low cost instrument is designed for production line application. The built-in filter, detector, and flicker calculation method differ from the procedure prescribed in VESA or EIAJ standards. Therefore, the measurement results differ from those obtained by VESA or EIAJ standards. See Table below.

(Data can be managed, however, since relative values are obtained.)

	VESA305-05	LT 9213A
Filter	30-Hz fc, 40 dB/oct high-pass	Variable band-pass, Q = 3
Detection Method	Peak-to-peak value	Average value
Calculation Method	$V_{p-p}/V_{dc}$	$V_{ave}/V_{dc}$

Table 5-1 Difference between VESA305-05 and LT 9213A

### 5.3.2 Application of MONITOR Output

To obtain the flicker value, multiply the detector output or oscilloscope reading by 10.  
See formula below.

$$\text{Flicker value (\%)} = 0.1 \text{ V} / \%$$

To perform flicker measurements conforming to VESA305-05, the flicker component is directly output (i.e., not passed through a bandpass filter) from the MONITOR connector .

When measuring flicker conforming to VESA305-05 standards, use a filter conforming to VESA305-05 and a peak-to-peak detector or oscilloscope.

The flicker is obtained as follows in this case:

$$\text{Flicker value (\%)} = V_{p-p} \text{ (V)} / 10 \text{ (V)}$$

where

$V_{p-p}$  = amplitude obtained by a peak-to-peak detector or oscilloscope

10 V =  $V_{dc}$ , normalized level of this instrument

This formula is only applicable to a flicker value up to 13 %.

(VESA305-05)

## 6. THE PRINCIPLE OF THE ABSOLUTE VALUE MEASUREMENT OF THE LT 9213A

When the flicker value of the LCD panel is small the value is derived from the following formula:

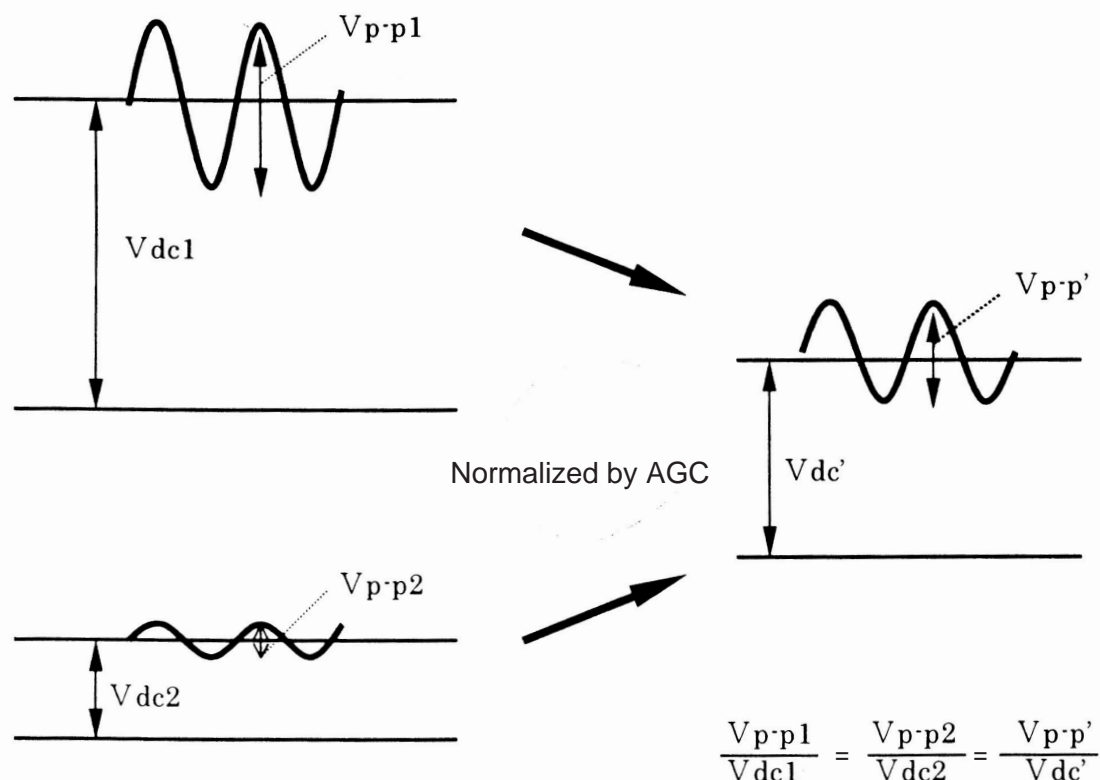
Flicker Value =  $V_{p-p}(\text{brightness variation}) / V_{dc}(\text{LCD surface brightness})$ ----(prescribed in VESA305-05)

As the above formula shows, the actual flicker may differ according to the differences of individual panel surface brightness caused by the back light dispersion even when the same  $V_{p-p}$  dummy values are obtained from LCD modules under test. Accordingly, the conventional adjustment method like a visual method using a spectrum analyzer consumes time to measure an absolute value measurement.

The LT 9213A resolves this problem by adopting new method which is realized direct readable meter of the flicker value without being affected by the dispersion of the back light.

This method measures the absolute value keeping the  $V_{dc}$  always constant by level normalizing the direct current which is equivalent to the brightness by AGC as shown in the Figure 6.1.

This technology makes it possible to manage the bottom adjustment by flicker value and enables to measure the absolute value disregarding the brightness differences caused by individual differences of each device under test.



$V_{dc1, 2}$  : panel surface brightness component

$V_{p-p1, 2}$  : brightness variation

$V_{dc'}$  : normalized panel surface brightness component

$V_{p-p'}$  : normalized brightness variation

Figure 6.1 Waveforms which show AGC Circuit Operation

## **7. MAINTENANCE**

When calibration or service is required, contact your local LEADER agent.

# 所含有毒有害物质信息

部件号码：LT 9213A



此标志适用于在中国销售的电子信息产品, 依据 2006 年 2 月 28 日公布的《电子信息产品污染控制管理办法》以及 SJ/T11364-2006 《电子信息产品污染控制标识要求》，表示该产品在使用完结后可再利用。数字表示的是环境保护使用期限，只要遵守与本产品有关的安全和使用上的注意事项，从制造日算起在数字所表示的年限内，产品不会产生环境污染和对人体、财产的影响。产品适当使用后报废的方法请遵从电子信息产品的回收、再利用相关法令。详细请咨询各级政府主管部门。

产品中有毒有害物质或元素的名称及含量

部件名称 Parts	有毒有害物质或元素      Hazardous Substances in each Part					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr (VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
实装基板	×	○	○	○	○	○
主体部	×	○	×	○	○	○
电表	×	○	○	×	○	○
电源变压器	○	○	○	○	○	○
线材料一套	○	○	○	○	○	○
外筐	○	○	○	○	○	○
附件	×	○	○	○	○	○
包装材	○	○	○	○	○	○
<b>备注)</b> ○：表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T11363-2006 规定的限量要求以下。 ×：表示该有毒有害物质或元素至少在该部件的某一均质材料中的含量超出SJ/T11363-2006 标准规定的限量要求。						