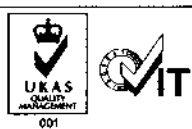# MINOLTA / LAND infrared

CYCLOPS 153/153A

INSTRUCTION MANUAL

0034

CE

Safety Symbols

The following symbols are used in this manual to prevent accidents which may occur as result of incorrect use of the instrument.

⚠ Denotes a sentence regarding safety warning or note.
Read the sentence carefully to ensure safe and correct use.

⚠ Denotes a sentence regarding safety precaution for risk of fire.
Read the sentence carefully to ensure safe and correct use.

🚫 Denotes a prohibited operation.
The operation must never been performed.

❗ Denotes an instruction.
The instruction must be strictly adhered to.

🚫 Denotes a prohibited operation.
The part must never be disassembled.

⚠ SAFETY PRECAUTIONS

- To ensure correct use of this Cyclops, read the following points carefully and adhere to them. After you have read this manual, keep it in a safe place where it can be referred to anytime a question arises.

⚠	**WARNING** (Failure to adhere to the following points may result in death or serious injury.)
🚫	Never aim the Cyclops directly at the sun and look through the viewfinder. Doing so can damage your eyes and the Cyclops.
⚠🚫	Do not dispose of batteries in fire, short their terminals, apply heat to them, or disassemble them. Also, do not recharge disposable batteries, such as alkaline batteries. Doing so may result in heating or explosion of the battery, fire, or injury.
🚫	If the Cyclops requires repair or emits, smoke or odors, halt use immediately, set POWER switch to O (off), and remove battery. Contact the nearest LAND distributor. Never disassemble the Cyclops or attempt to repair it yourself.
⚠🚫	Do not use this instrument in an explosive atmosphere such as one containing gasoline fumes. Use in such an area may result in an explosion.

⚠	**CAUTION** (Failure to adhere to the following points may result in injury or damage to the Cyclops or other property.)
⚠🚫	Do not use batteries other than those specified. Also, be sure to install the battery with the battery terminals positioned as shown inside the battery chamber. Use of other batteries or incorrect installation may result in battery explosion or leakage, fire, or injury.
🚫	Do not walk while looking through the viewfinder. Doing so may cause you to trip or bump something.

Minolta/Land Cyclops 153 and Cyclops 153A are portable infrared thermometer designed for non-contact temperature measurements. Both models feature a 1/3° measurement angle and can measure temperatures from 550 to 3200°C (or from 1000 to 5800°F). Measured temperatures are shown in a display inside the viewfinder, which allows measurements to be confirmed while viewing the subject, and also in an external display panel, which shows measuring or calculating mode and emissivity in addition to measured temperature. Three measuring modes are available: continuous display of measured temperatures, PEAK for display of the highest temperature measured, and VALLEY for display of the lowest temperature measured. In addition, three calculating modes are provided for determining the MAXIMUM, MINIMUM, or MEAN of a series of measurements. Emissivity can be easily adjusted to ensure exact temperature measurements. The wavelengths at which the thermometers operate were carefully chosen to minimize the effects of water vapour and carbon dioxide in the atmosphere on temperature measurements. Both models also feature dustproof, shock-resistant construction to withstand daily use in rugged conditions.

Before using the Cyclops for the first time, take a moment to read these operating instructions carefully and keep them with the Cyclops for future reference.
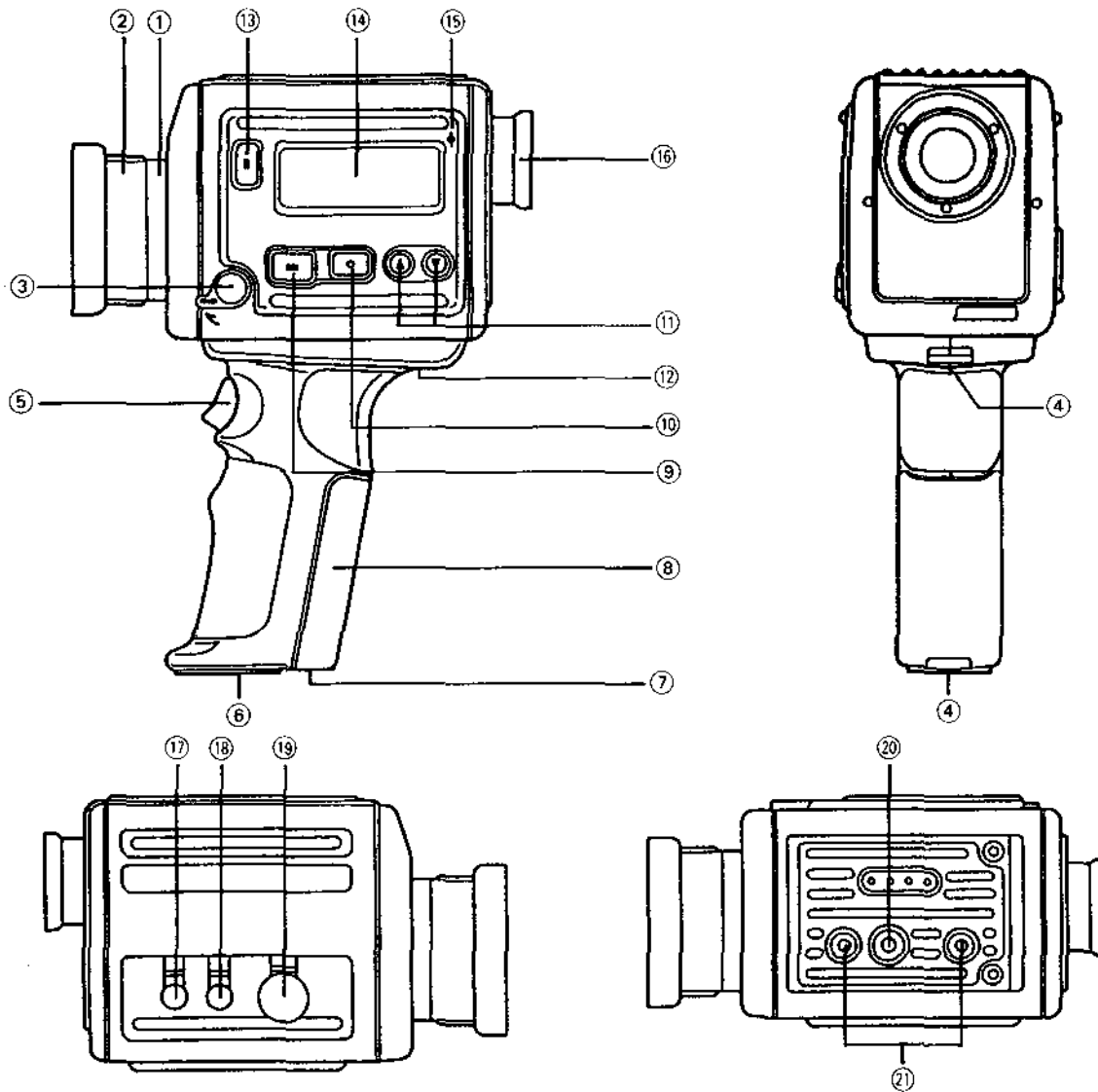
Caution

- Do not use the Cyclops in areas with ambient temperatures of less than 0°C (32°F) or higher than 50°C (120°F).
- After use, set the power switch to OFF and cover the lens with the lens cap.
- Never attempt to disassemble the Cyclops. Any necessary repairs should be done only by an authorized Land service technician.

CONTENTS

NAMES OF PARTS

(Illustration shows Cyclops 153A)

① Distance scale
② Focusing ring
③ Neutral-density filter lever
④ Wrist/neck strap eyelet
⑤ Measuring trigger
⑥ Tripod mounting socket
⑦ Battery-chamber lock

⑧ Battery-chamber cover
⑨ **MODE** button
⑩ **CALCULATE** button
⑪ **EMISSIVITY** buttons (▲ and ▼)
⑫ Grip-attaching screws (2)
⑬ **POWER** button
⑭ External display panel

⑮ Focal-plain indication
⑯ Eyepiece
⑰ AC-adapter input socket
⑱ Analog-output socket (Cyclops 153A only)
⑲ Digital-output socket
⑳ Tripod mounting socket (1/4-20)
㉑ ISO (φ5mm) mounting sockets

Standard accessories: Lens cap, protective filter, battery holder, 6 AA-size batteries, case, wrist strap, subminiature plug (Cyclops 153A only)

FUNCTIONS OF CONTROLS

POWER button

Switches power on and off.

Sets monitor mode if pressed to switch power on while measuring trigger is held pressed.

Neutral-density filter lever

Moves neutral-density (ND) filter into the viewfinder optical path when moved in the direction of the arrow.

Removes filter from viewfinder optical path when moved in opposite direction from arrow.

MODE button

Changes measuring mode in the following order when pressed:

CONT.	Temperature of object presently being viewed is displayed.
PEAK	Highest temperature measured while trigger was held pressed is displayed.
VALLEY	Lowest temperature measured while trigger was held pressed is displayed.

Changes calculating mode in the following order if pressed while **CALCULATE** is held pressed:

MAX.	Highest temperature stored in memory is displayed.
MEAN	Average of all temperatures in memory is displayed.
MIN.	Lowest temperature stored in memory is displayed.

CALCULATE button

Causes calculating modes to be selected if held pressed when **MODE** is pressed.

EMISSIVITY buttons (▲ and ▼)

Sets emissivity of target being measured. Emissivity can be set from 0.10 to 1.30 in 0.01 steps. Pressing ▲ once increases the emissivity value by 0.01; holding ▲ pressed increases the emissivity value rapidly. Pressing ▼ once decreases the emissivity value by 0.01; holding ▼ pressed decreases the emissivity value rapidly.

Measuring trigger

Performs measurement when any of the three measuring modes is selected; measurement will be performed continuously while trigger is held pressed. When trigger is released, latest measured value will be held in the display and stored in memory.

Sets monitor mode if held pressed while **POWER** is pressed to switch power on and any of the three measuring modes is selected.

Causes displayed value to reappear when unit has entered standby mode (when "- - - - -" is shown in the external display; see p. 10).

VIEWFINDER

Measurement area

Temperature display
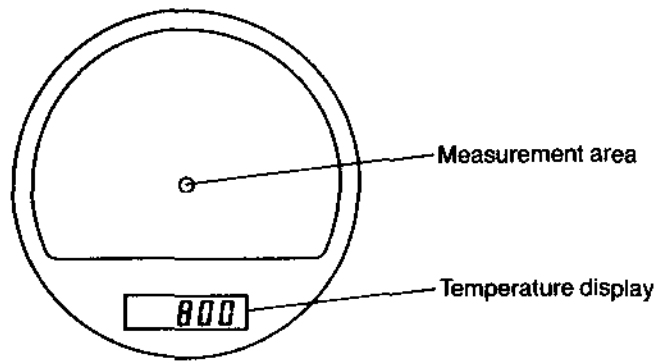
* When taking measurements, ensure that the subject completely fills the measurement area. If the subject does not fill the measurement area, measured temperature will not be correct.

EXTERNAL DISPLAY PANEL

Calculating mode indication   Temperature unit indication

Measured temperature

Emissivity

Battery power indication

Display hold indication

Measurement mode indication
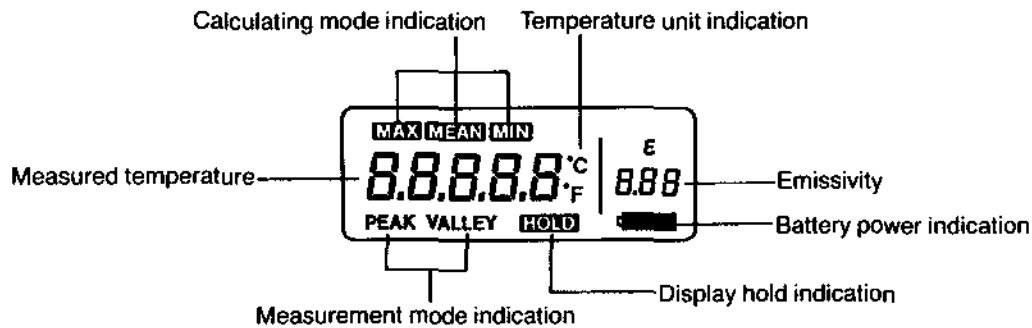
DISPLAYS

The Cyclops 153 and Cyclops 153A show measured temperatures from 550 to 3200°C (or from 1000 to 5800°F) in 1°C (or 1°F) increments in both the external display panel and viewfinder display.

Viewfinder display
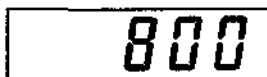
External display panel

If the measured temperature is slightly outside the measurement range (between 500°C/930°F and 549°C/999°F or between 3201°C/5801°F and 3250°C/5900°F), the displayed value will blink as shown below.

Viewfinder display
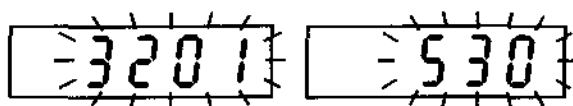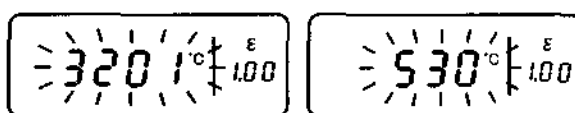
External display panel

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If the measured temperature in any of the measurement modes or the value in MAX or MIN calculating mode is over 3250°C (or 5900°F), "-O-" will blink in the displays as shown below.
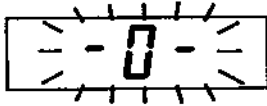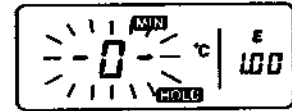
Viewfinder display

External display panel

If the measured temperature in any of the measurement modes or the value in MAX or MIN calculating mode is under 500°C (or 930°F), "-U-" will blink in the displays as shown below.

Viewfinder display
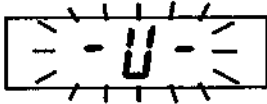
External display panel
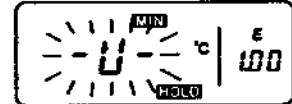
If any of the values stored in memory is under 500°C (or 930°F) or over 3250°C (or 5900°F) and MEAN calculating mode is selected, three dashes will blink in the displays as shown below.

Viewfinder display

External display panel

When the automatic standby function of the Cyclops 153/Cyclops 153A has been activated, the display shown below will appear in the external display panel, Nothing will be shown in the viewfinder display.

External display panel

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PREPARATIONS

Power

The Cyclops can be powered by six AA-size batteries, by the optional AC Adapter AC-A10, or by a d.c. power supply connected to the digital-output socket.

• For information on connecting a d.c. power supply to the digital-output socket, see p. 24.

INSTALLING BATTERIES

1. Check that the power switch is at OFF.

POWER button

Battery-chamber cover

Battery-chamber lock

2. Remove the battery-chamber cover by sliding the battery-chamber lock toward the front of the Cyclops and then sliding the battery-chamber cover down as shown.
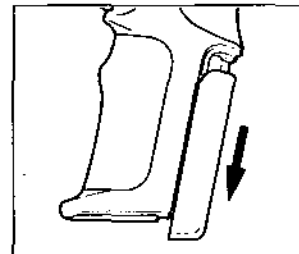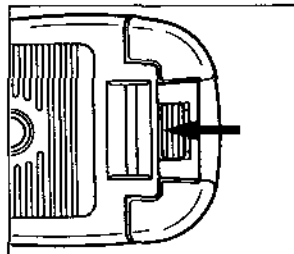
3. Slide the battery holder out of the battery chamber.

4. Install six AA-size alkaline-manganese or carbon-zinc (1.5V) or nickel-cadmium (1.2V) batteries in the battery holder with the battery terminals positioned as indicated on the holder.

• Do not mix battery types or use old batteries with new ones.
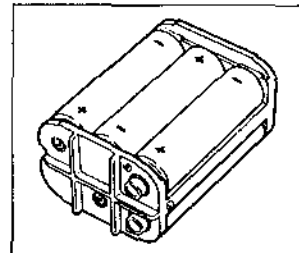
5. Position the battery holder with the terminals at the upper front and slide the battery holder into the battery chamber. The battery holder should slide easily into the battery chamber; do not force it into the chamber.
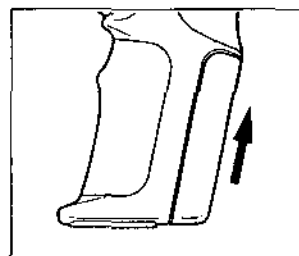
6. Replace the battery-chamber cover by realigning it and sliding it towards the top of the meter until the battery-chamber lock snaps it securely in place.

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BATTERY CHECK

After installing batteries, press **POWER** to switch on the Cyclops. The Cyclops will check the battery power.

If the battery-power indication is lit and is entirely black, the batteries contain full or almost full charge. The battery-power indication will disappear after approximately five seconds.
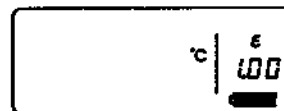
If the battery-power indication is lit but only half of it is black, the batteries have been partially used but there is still sufficient power for operation and the batteries do not need to be replaced yet. The battery indication will remain lit.
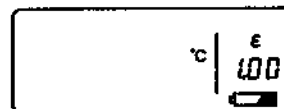
If the battery-power indication blinks, battery power is low and batteries should be replaced with new batteries.

- Even if battery power is low (battery-power indication blinks), the Cyclops may be used until the other values in the display will no longer light.
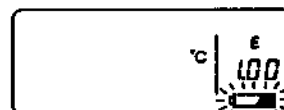
If the viewfinder display and external display panel are blank, batteries are completely exhausted or are installed incorrectly. Check that the batteries are installed correctly. If they are and no display appears, replace batteries or use an AC adapter or d.c. power supply.

Meaning of Battery-Power Indication Displays
(When using alkaline-manganese batteries)

Displayed indication	▬▬	◁▭	◁▭ (blinking)	(No other displays shown)
Maximum remaining period of operation in hours	95 (77)	15 (13)	5 (4)	0 (0)

- Figures in parenthesis ( ) are for Cyclops 153A.
- Above figures are approximate and depend on the manufacturer and type of battery.

USING OPTIONAL AC ADAPTER AC-A10

When using the Cyclops for a long time or without the grip attached, the optional AC Adapter AC-A10 can be used to supply power.

1. Switch off the Cyclops.

2. Insert the output plug of the AC adapter into the AC-adapter input socket of the Cyclops.

3. Plug the AC adapter into an AC wall outlet.

- When using the Cyclops with the AC adapter for a long period of time, it is recommended that the batteries be removed to avoid the possibility of corrosion due to battery leakage.

- AC adapters other than the AC Adapter AC-A10 should not be used.

AC adapter

to AC wall outlet

Output plug

9
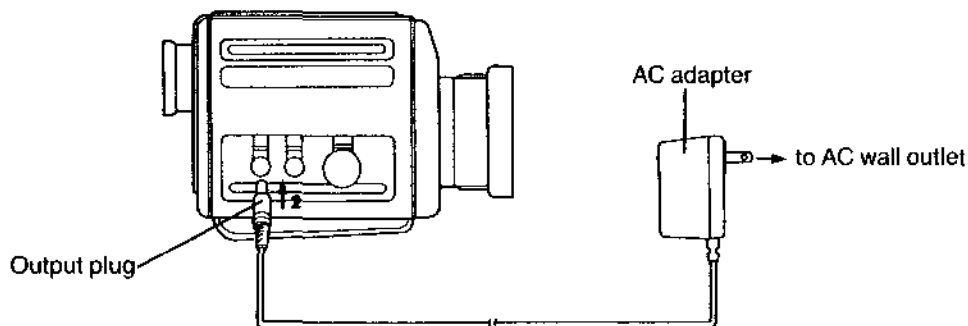
AUTOMATIC STANDBY FUNCTION

The Cyclops features an automatic standby function to conserve power. When the Cyclops is used in any mode except monitor mode, the values and settings shown in the external display panel are automatically switched off approximately six minutes after the last operation has been performed (after the measuring trigger or the last key used has been released) and replaced by the display shown at right. Pressing the measuring trigger will cancel standby mode and recall the measurement display which was shown before standby mode was entered.
Pressing the measuring trigger again will start measurements.

- The values previously stored in memory will not be affected and will remain in memory.
- If the Cyclops was set to a calculating mode before the Cyclops switched to standby, the calculating mode will be cancelled and the Cyclops will return to the display which was shown before the calculating mode was selected.
- When the Cyclops is in standby mode, only the measuring trigger or **POWER** can be used. Other switches will not have any effect.
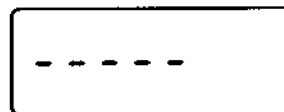
Eyepiece Adjustment

To adjust the eyepiece to match the user's eyesight, turn the ring of the eyepiece until the measurement area in the viewfinder appears sharp. Adjustable diopter range is +2.0 to −3.50.
- If the eyepiece is not correctly adjusted, focus on the subject will be incorrect even if focus appears correct in the viewfinder and the measured temperature will also be incorrect.
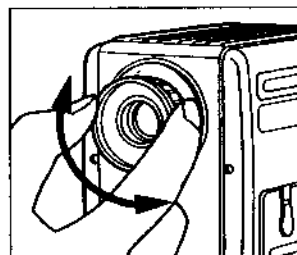
Neutral-Density Filter

The Cyclops 153/Cyclops 153A is equipped with an internal neutral-density filter which can be moved into or out of the viewfinder optical path. The neutral-density filter allows bright, high-temperature objects to be viewed more comfortably when taking measurements.

- The neutral-density filter is inserted into only the viewfinder optical path, not into the measurement optical path. Therefore, insertion of the neutral-density filter will not affect measured values.

To move the neutral-density filter into the viewfinder optical path, move the neutral-density filter lever in the direction of the arrow.

To move the neutral-density filter out of the viewfinder optical path, move the neutral-density filter lever in the direction opposite to that of arrow.

Neutal-density
filter lever
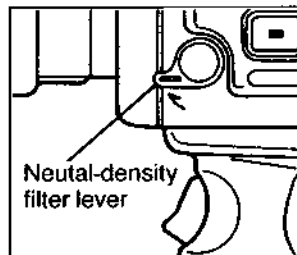
Attaching Wrist Strap

The wrist strap can be attached to the Cyclops 153/Cyclops 153A according to the diagram below.
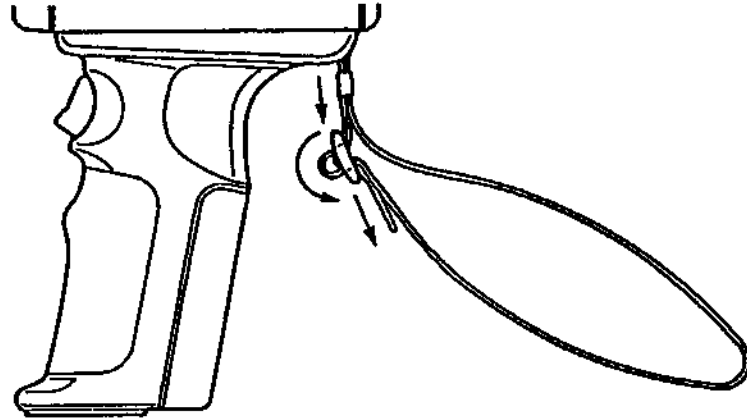
Attaching Neck Strap

The neck strap (optional accessory) can be attached to the Cyclops 153/Cyclops 153A according to the diagram below.
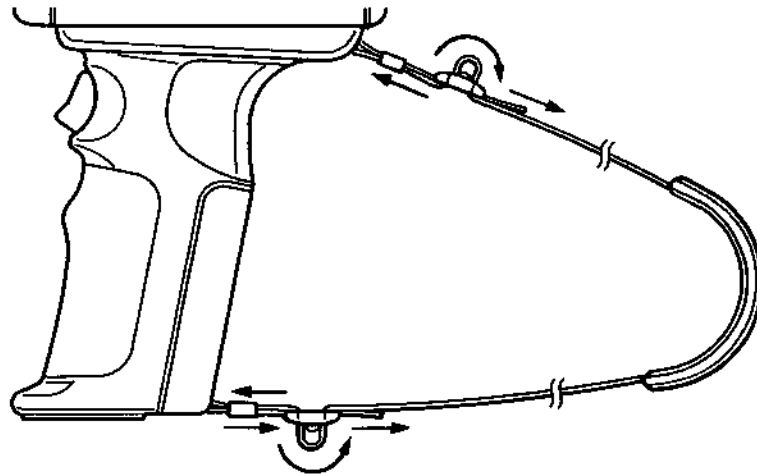
Removing Grip

The grip of the Cyclops 153/Cyclops 153A can be removed if desired when the Cyclops 153/Cyclops 153A is to be installed in position.

To remove the grip, remove the two grip-attaching screws as shown in the diagram below and tilt the grip toward the front of the Cyclops.

* When the grip has been removed, power can be supplied only by using the optional AC adapter AC-A10 connected to the AC-adapter input socket or a d.c. power supply connected to the digital-output socket.
* The Cyclops will automatically be set to monitor mode (see p. 16) when the grip has been removed.
* When the grip has been removed, the Cyclops can be installed in position using either the tripod-mounting socket (1/4-20) or the two ISO mounting sockets (ϕ5mm). See p. 32 for the location of mounting sockets.
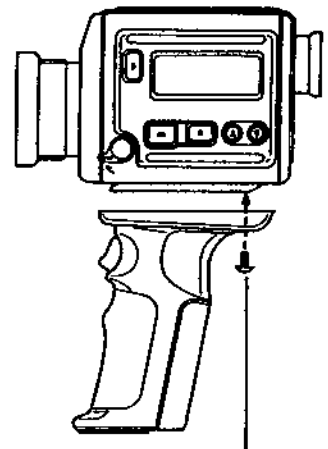
Grip attaching screws (2)

MEASUREMENTS

⚠ **WARNING**
🚫 Never aim the Cyclops directly at the sun and look through the viewfinder. Doing so can damage your eyes and the Cyclops.
⚠ **CAUTION**
🚫 Do not walk while looking through the viewfinder. Doing so may cause you to trip or bump something.

Notes on Taking Measurements

- Ensure that the emissivity of the object is correctly set. If emissivity is set to an incorrect value, measured temperatures will not be correct.
- Before taking a measurement, ensure that the eyepiece is adjusted correctly. If the eyepiece is not correctly adjusted, focus on the subject will be incorrect even if focus appears correct in the viewfinder and the measured temperature will also be incorrect.
- Focus on the subject before taking a measurement. If the eyepiece is subject is not in focus, the measured temperature will be incorrect.
- When taking measurements, ensure that the object being measured completely fills the measurement area indicated in the viewfinder. If the object does not completely fill the measurement area, the background may cause the measured temperature to be incorrect.
- Since the measuring angle of the Cyclops 153/Cyclops 153A is only 1/3˚, slight variations in the position of the Cyclops 153/Cyclops 153A may result in fairly large differences in measured temperature when talking measurements of extremely small subjects. To keep the position of the Cyclops 153/Cyclops 153A constant, the use of a tripod is recommended.

- Measurements of objects in direct sunlight may result in temperature values which are higher than the actual temperature of the object, due to infrared radiation reflected from the object.

Selecting Temperature Units

The Cyclops 153/Cyclops 153A can measure temperature in either Celsius (˚C) or degrees Fahrenheit (˚F).

To change the temperature display from °C to °F, press ▼ while holding **CALCULATE** pressed.
To change the temperature display from °F to °C, press ▲ while holding **CALCULATE** pressed.

Setting Emissivity

To measure the correct temperature of the surface being viewed, the emissivity must be set to the value appropriate for that surface. The emissivity value is displayed in the upper right of Cyclops 153/Cyclops 153A's external display panel, and can be set from 0.10 to 1.30 in 0.01 increments using the **EMISSIVITY** buttons (▲ and ▼).

Pressing ▲ once will increase the displayed emissivity value by 0.01; holding ▲ pressed will cause the displayed emissivity value to increase rapidly.

Pressing ▼ once will decrease the displayed emissivity value by 0.01; holding ▼ pressed will cause the displayed emissivity value to decrease rapidly.

Emissivity: 0.80

Emissivity: 1.00

* Measurement accuracy will be somewhat lower for subjects with low emissivity.
* The emissivity value which should be used when taking measurements with an infrared thermometer varies according to the measurement wavelength range of the model being used.

The appropriate emissivity value can be determined in the following way:

1) Measure the temperature of the subject with a contact-type thermometer (such as a thermocouple, thermistor, etc.)

2) Set the emissivity value of the Cyclops153/Cyclops 153A to 1.00 and measure the same area of the subject (the area measured in step 1) with the Cyclops 153/Cyclops 153A (see p.15). The measured value will be held in the display when the measuring trigger is released.

3) Use ▲ and ▼ to adjust the displayed emissivity until the temperature shown in the display is the same as the temperature measured in step 1. The displayed emissivity value will be the emissivity of the subject.

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Selecting Measuring Mode

Three different modes can be selected for taking measurements: CONT., PEAK, or VALLEY. The measuring mode selected is indicated below the temperature value in the external display panel.

When CONT. measuring mode is selected, nothing will be shown below the temperature value.

When PEAK measuring mode is selected, "PEAK" will be shown below the temperature value.

When VALLEY measuring mode is selected, "VALLEY" will be shown below the temperature value.

The mode can be selected by pressing **MODE** while the temperature is held in the displays or while the Cyclops 153/Cyclops 153A is in monitor mode. The measuring mode will change in the following order:
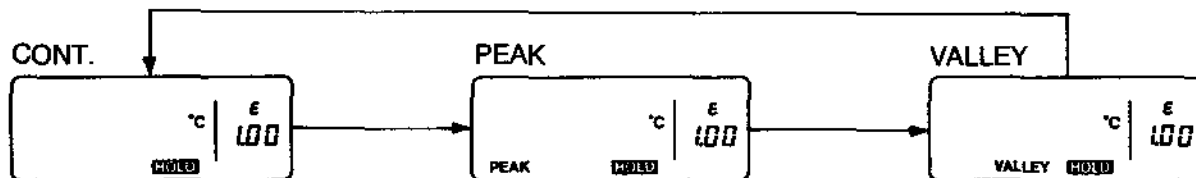
The temperature which is displayed in the viewfinder and the external display panel depends on the mode selected:

If CONT. is selected, the displayed temperature will be the temperature presently being measured.

If PEAK is selected, the displayed temperature will be the highest temperature which was measured during the period from when the trigger was pressed until the trigger was released.

If VALLEY is selected, the displayed temperature will be the lowest temperature which was measured during the period from when the trigger was pressed until the trigger was released.

The diagram at right shows an example of the values which would be displayed in the three modes.

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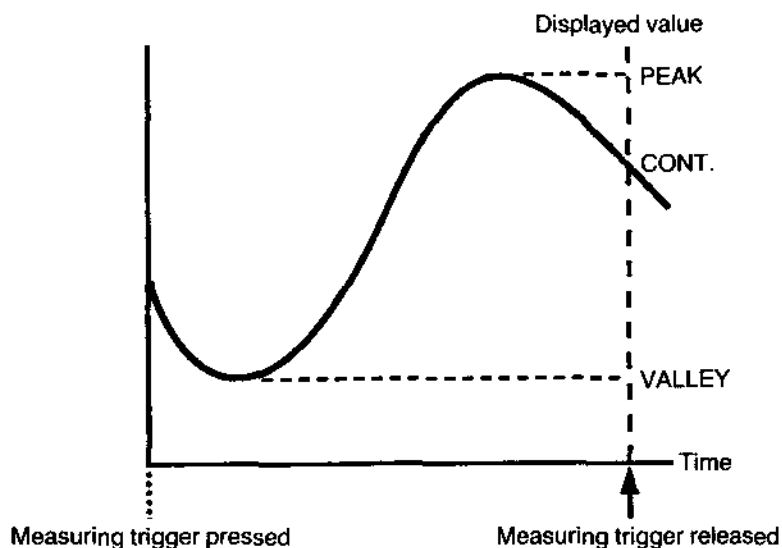
Taking Measurements

To take measurements of a subject, follow the steps below.

1. Press **POWER** to switch on the Cyclops 153/Cyclops 153A.

2. Set emissivity to the value appropriate for the subject being measured. See p.13.

3. Select measuring mode. See p.14.

4. Check that eyepiece is adjusted correctly. See p.10.

Measurement area

5. Aim the Cyclops 153/Cyclops 153A at the subject and turn the focusing ring to adjust focus until the subject appears sharp.

• Ensure that the subject completely fills the measurement area indicated in the viewfinder.

• Measurement areas at different subject distances are shown on p. 28.
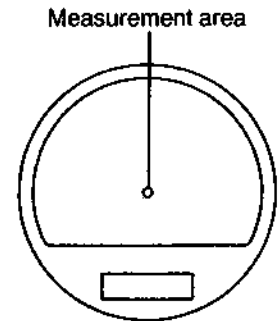
6. Press the measuring trigger and hold it pressed until the measured value appears in the viewfinder display.

• Measurements will continue to be taken as long as the measuring trigger is held pressed. When the measuring trigger is released, the latest measured value shown in the viewfinder will be held in the display and stored in memory. The display will automatically be cancelled approximately 30 seconds after the trigger is released.

• Measurements can also be taken by remote control through the digital-output socket. See p.23 for more information.

• Data shown in the display can be output to a separate computer through the data-output socket. See p.19 for more information.

• Measuring mode can be changed (see p.14) after the measuring trigger is released and the appropriate value will be displayed.

15
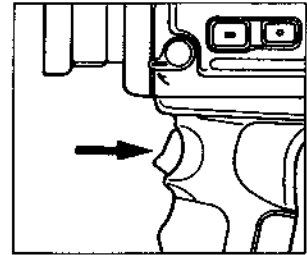
Monitor Mode

Monitor mode can be used to continually take measurements without the measuring trigger held pressed. This mode can be used when continuous unattended monitoring of temperatures is desired. To set monitor mode, follow the steps below.

1. While pressing the measuring trigger, set power switch from OFF to ON.
   - Measurement will be continuously performed until power switch is set to OFF.
2. Set emissivity to the value appropriate for the subject being measured. See p.13.
3. Select measuring mode. See p.14.
4. Check that eyepiece is adjusted correctly.
5. Aim the Cyclops at the subject and turn the focusing ring to adjust focus until the subject appears sharp.
   - Ensure that the subject completely fills the measurement area indicated in the viewfinder.
   - Measurement areas at different subject distances are shown on p. 28.
   - Data can be output to a separate computer through the digital-output socket. See p.19 for more information.
   - Monitor mode is automatically set if the grip of the Cyclops is removed. See p.11.
   - The Cyclops may not respond immediately if **MODE, CALCULATE, ▲**, or **▼** is pressed while "- U -" is blinking in the displays. Hold the keys pressed until the Cyclops responds.

Power switch (ON)

Measuring trigger
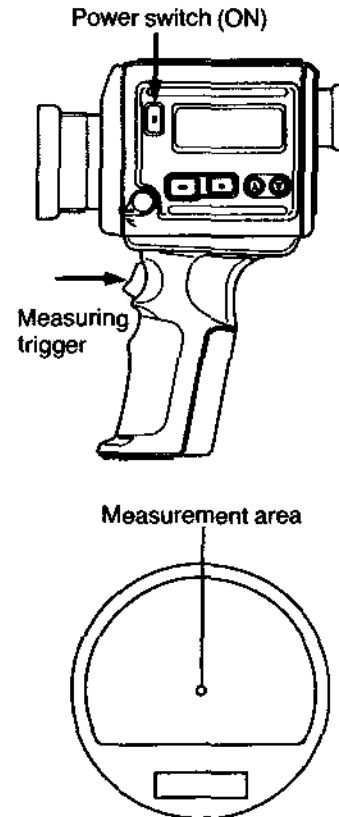
Measurement area

CALCULATING MODES

Cyclops 153 and Cyclops 153A are equipped with three calculating modes, which can be used to determine the MAXIMUM, MEAN, or MINIMUM of measurements stored in memory. Each time the measuring trigger is released, the latest measured value shown in the display is stored in memory and can be used for calculations.

- The memory of the Cyclops can store up to 65,535 values for calculating the MEAN value. MAXIMUM and MINIMUM values can be determined even if more than 65,535 measurements are taken.
- All values in memory will be erased if the power switch is set to OFF.

    The calculating mode selected is shown above the temperature value in the external display panel.
    When "MAX" is shown above the temperature value, the maximum value in memory will be displayed.
    When "MEAN" is shown above the temperature value, the mean value of all values in memory will be calculated and displayed.
    When "MIN" is shown above the temperature value, the minimum value in memory will be displayed.

To select any of the calculating modes, press **MODE** while holding **CALCULATE** pressed. The calculating mode will change in the following order:
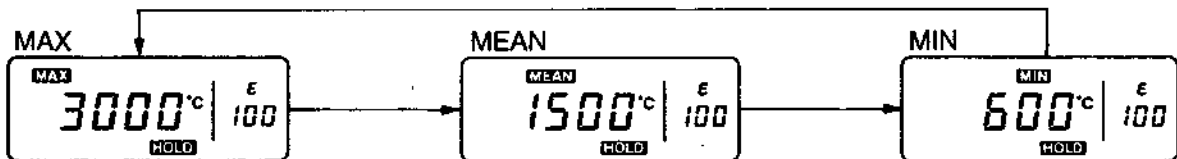
- If the measuring trigger is pressed while the Cyclops 153/Cyclops 153A is in one of the calculating modes, the calculating mode will be cancelled and the Cyclops will return to measurement mode and start taking measurements.
- The Cyclops will automatically enter standby mode and display will automatically be cancelled approximately six minutes after the last key is released. To recall the display, press and release the measuring trigger to cancel standby mode, then select the desired calculating mode again.
- If any of the calculating modes is selected after the Cyclops is switched on, but before any measurements have been taken, no value will appear in the display. This is because there is no data in memory which can be used for calculations.
- If the measuring trigger was released while "- U -" or "- O -" was displayed (resulting in "- U -" or "- O -" being stored in memory), the MEAN value cannot be calculated and "- - -" will be displayed when MEAN calculating mode is selected.

DIGITAL-OUTPUT SOCKET

The digital-output socket of the Cyclops can be used for the following purposes:

1. To output data in RS-232C format to an external device, such as the Data Processor DP-C2 (sold separately) or a computer. For output to a computer, see p.19.
2. To receive a measurement-request signal from an external device. See p. 23.
3. To receive power from an external device. See p. 24.
4. To output power (5V, 10mA), clock signal, and measurement condition signal to an external device.

Pin Arrangement

The pin arrangement of the digital-output socket is shown at right. A Hirose HR-10A-10P-12P plug should be used for connection and should be wired as shown.

Digital-output socket
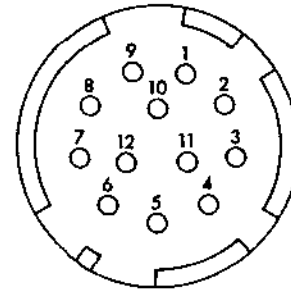
Pin Number	Signal	Voltage	Function
1	Clock output	0 or 5V	To provide synchronization between data output (at 4800Hz) from the Cyclops and input by an external device.
2			Not connected.
3			Not connected.
4	Measurement request input	0 or 5V	To allow measurement to be controlled by the external device; measurement taken while signal is held high (+ 5V), measure-ment held when signal is low (0V).
5	Power input	8 to 12V	To input power from an external device; power should be d.c. 8 to 12V, 100mA minimum.
6	Busy output	0 or 5V	Indicates whether or not Cyclops is in the middle of performing measurement; high (+ 5V) when measuring button is pressed or pin 4 is high.
7	Ground (GND)	0V	Signal ground
8	Power output	5V	Outputs power (5V ± 10%, 10mA maximum) to D/A Converter IR-2 or other external device.
9			Used for calibration by service facility. Do not connect.
10	Serial data output (TXD)	±5V	Outputs measurement data in RS-232C format when pin 11 is high (+ 5V).
11	Clear to send (CTS)	±5V	Indicates to the Cyclops whether or not the external device is ready to receive data. Data will not be output from pin 10 if CTS is low (− 5V). • If pin 11 is not connected to an external device, hold pin 11 high (+ 5V).
12			Not connected.

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Data Output

Data is output from the Cyclops as digital data according to the RS-232C format.
- Analog output can be obtained directly from the Cyclops 153A (see p.25); analog output from the Cyclops 153 can be obtained by using the D/A Converter IR-2 (sold separately).

CONNECTIONS

1. Check that the power switches of both the Cyclops and the computer are set to OFF.
   - Never connect or disconnect the Cyclops or computer while either power switch is set to ON. This may damage the internal circuits of either unit.

2. Connect the digital-output socket of the Cyclops to the RS-232C terminal of the computer according to the diagram below.

Cyclops			Computer		
				Pin number	
Pin number	Signal		Signal	25-pin D-subminiature plug	9-pin D-subminiature plug (PC-AT)
7	GND		GND	7	5
10	TXD		RXD	3	2
11	CTS		DTR	20	4
			DSR	6	6
			CD	8	1
			RTS	4	7
			CTS	5	8
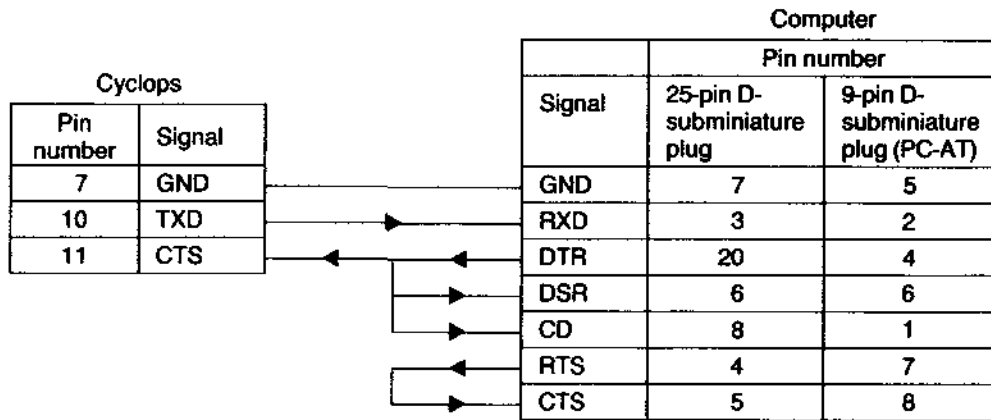
COMMUNICATION PARAMETERS

Baud rate:	4800bps
Start bit:	1
Character bits:	7 (ASCII code)
Parity:	Even
Stop bits:	2

OUTPUT DATA

Data is output in the following situations:
1. While power is switched on and measuring trigger is held pressed.
2. While power is switched on and measurement request signal (pin 4) is held high (+ 5V).
3. While power is switched on and Cyclops is in monitor mode.

Data will not be output when:
1. Cyclops is set to any calculating mode.
2. Clear to send signal (pin 11) is low (– 5V).
3. Measurement data is held in the display after trigger is released while taking measurements (unless Cyclops is in monitor mode).

DATA FORMAT

Each measurement value output consists of ten data words: three words indicating operating condition, five words indicating displayed data, CR (carriage return; ASCII code: 0D$_H$). and LF (line feed: ASCII code: 0A$_H$).

Data word 1: Infrared thermometer type

Output character	Explanation
H	High-temperature type

Data word 2: Display mode or over-/under-range message

Output character	Explanation
C	CONT. measuring mode
P	PEAK measuring mode
V	VALLEY measuring mode
O	Over-range message (measured temperature is 3251˚C/5901˚F or more)
U	Under-range message (measured temperature is 499˚C/929˚F or less)

• "- O -" or "- U -" are output regardless of the measuring mode.

Data word 3: Continuous measurements or display hold

Output character	Explanation
C	Continuous measurement: measuring trigger held in, measurement request signal (pin 4) held high (+ 5V), or in monitor mode
H	Display hold: measuring trigger released or measurement request signal (pin 4) switched from high to low (0V)

Data words 4 through 8: Measurement data
• If the data consists of less than five characters, spaces (ASCII code: 20$_H$) will be output before the data as required.
• If measured temperature is over display range (3251˚C/5901˚F or more) and "- O -" appears in the display, "   - O -" will be output. If measured temperature is under display range (449˚C/929˚F or less) and "- U -" appears in the display, "   - U -" will be output.

Output Examples:

In the following examples:
" " (space) is output as 20н
CR (carriage return) is output as 0Dн
LF (line feed) is output as 0Aн

Output 1 . . . 5 . . . . 1 0	Explanation
H O C □ □ - O - C R L F	Over display range (3251˚C/5901˚F or more), measuring trigger held pressed
H O C □ 3 2 0 5 C R L F	Over measuring range, measuring trigger held pressed, 3205˚C
H O C □ 5 8 4 7 C R L F	Over measuring range, measuring trigger held pressed, 5847˚F
H C C □ 1 5 2 9 C R L F	CONT. measuring mode, measuring trigger held pressed, 1529˚C/˚F
H C H □ 1 5 3 8 C R L F	CONT. measuring mode, display hold, 1538˚C/˚F
H P C □ 2 3 5 7 C R L F	PEAK measuring mede, measuring trigger held pressed, 2357˚C/˚F
H V C □ 1 2 3 0 C R L F	VALLEY measuring mode, measuring trigger held pressed, 1230˚C/˚F
H U C □ □ 5 2 4 C R L F	Under measuring range, measuring trigger held pressed, 524˚C
H U C □ □ 9 7 3 C R L F	Under measuring range, measuring trigger held pressed, 973˚F
H U C □ □ - U - C R L F	Under display range (449˚C/929˚F or less), measuring trigger held pressed

TIMING DIAGRAMS

Data Output
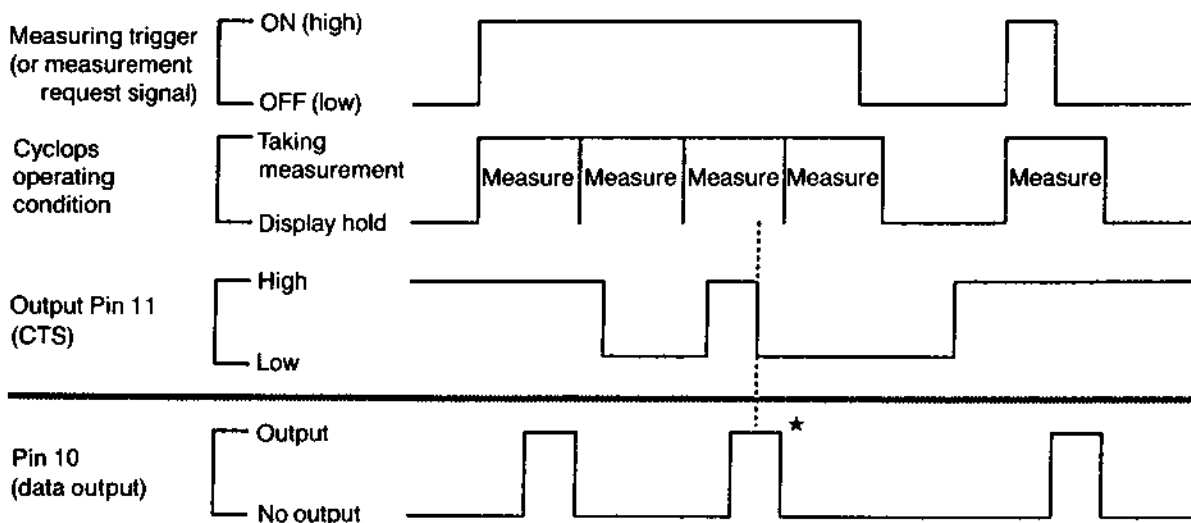
★ If pin 11 (CTS) changes to low while the Cyclops is outputting data, data output will continue until finished.

• If the signal from pin 11 (CTS) is high and Cyclops is continuously taking measurements, data will be output every 60ms.

Relation Between Display and Data Output
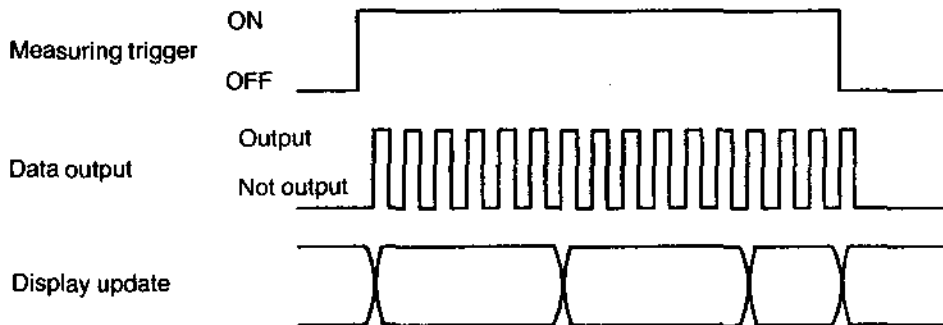
- In the time for one update of the display during continuous measurement, data is output six times. When display is held, display update occurs immediately, even if data has not been output six times.

SAMPLE PROGRAM

The following program can be run on an IBM PC or compatible computer to receive data from the Cyclops and display it on the computer screen.

```
100    'Input data
110    OPEN ''COM1:4800,E,7,2,CS,DS,CD'' AS #1
120    LINE INPUT #1,D$
130    CLOSE #1
140    A2$ = MID$(A$,2,1) : A3$ = MID$(A$,3,1) : A4$ = MID$(A$,4,5)
150    'Check data word 2
160    IF  A2$ = ''C'' THEN  B$ = ''CONT. MODE'' : GOTO  220
170    IF  A2$ = ''P'' THEN  B$ = ''PEAK MODE'' : GOTO  220
180    IF  A2$ = ''V'' THEN  B$ = ''VALLEY MODE'' : GOTO  220
190    IF  A2$ = ''O'' THEN  B$ = ''  OVER   '' : GOTO  220
200    IF  A2$ = ''U'' THEN  B$ = ''  UNDER   '' : GOTO  220 ELSE  110
210    'Check data word 3
220    IF  A3$ = ''C'' THEN  C$ = ''    '' : GOTO  250
230    IF  A3$ = ''H'' THEN  C$ = ''HOLD'' : GOTO  250 ELSE  110
240    'Display data
250    PRINT  B$,A4$,C$
260    IF  A3$ = ''H'' THEN  PRINT  ''''
270    PRINT  ''TO END PROGRAM, PRESS E''
280    IF  INKEY$ = ''E''  OR  INKEY$ = ''e''  THEN  END  ELSE  110
```

- The above program may not accept all data output by the Cyclops due to the time required for each loop of the program. Because of this, data which is output when display is held may or may not be accepted by the program, depending on what point the program is at when data is output.

Remote Control

An external device can be used instead of the measuring trigger to take measurements. The external device should be connected to pin 4 of the digital-output socket, and should be able to provide high signals of + 5V and low signals of 0V. When the signal is high, measurement will be performed; when the signal is low, the value will be held in the display.
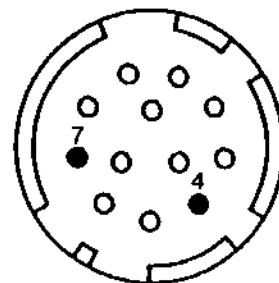
- When Cyclops is set to monitor mode, remote control cannot be performed.
- Even if pin 4 is held high while power switch is set from OFF to ON, monitor mode will not be set.
- When measurement is performed by remote control, the viewfinder display will not show any value but the external display panel will show the measured value. If display of the measured value is required in the viewfinder, press the measuring trigger.
- If the signal to pin 4 changes from high to low while the measuring trigger is pressed, the display will blink off momentarily and then be held temporarily.

CIRCUIT EXAMPLE

One way in which a switch can be connected to the digital-output socket for remote control is shown below.
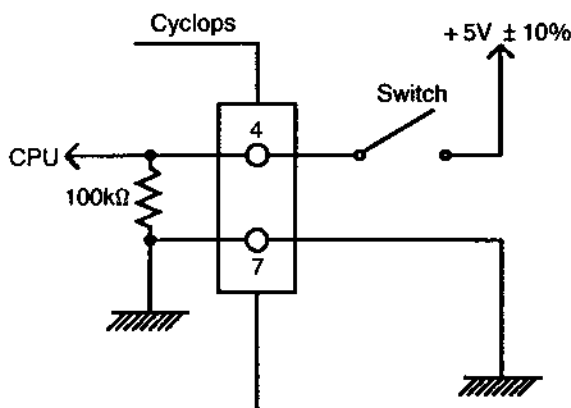
Supplying Power from an External Source

Power for the Cyclops can be supplied through the digital-output socket from the Data Processor DP-C2 (sold separately) or another d.c. power supply.

USING DATA PROCESSOR DP-C2

When the Data Processor DP-C2 is connected to the Cyclops, the power supply of the Data Processor will also supply power to the Cyclops.

USING A D.C. POWER SUPPLY

A d.c. power supply can be connected to pins 5 and 7 of the digital-output socket to supply power to the Cyclops. The power supply should be d.c. 8 to 12V, 100mA minimum. To use a d.c. power supply, follow the steps below.
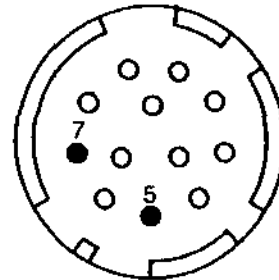
1. Check that the power switches of both the Cyclops and the d.c. power supply are set to OFF.
2. Remove the cover of the digital-output socket.
3. Connect the d.c. power supply to pins 5 and 7 of the digital-output socket as shown below. Pin 5 should be connected to the positive (+ 8 to 12V) terminal of the power supply; pin 7 should be connected to the ground terminal of the power supply.
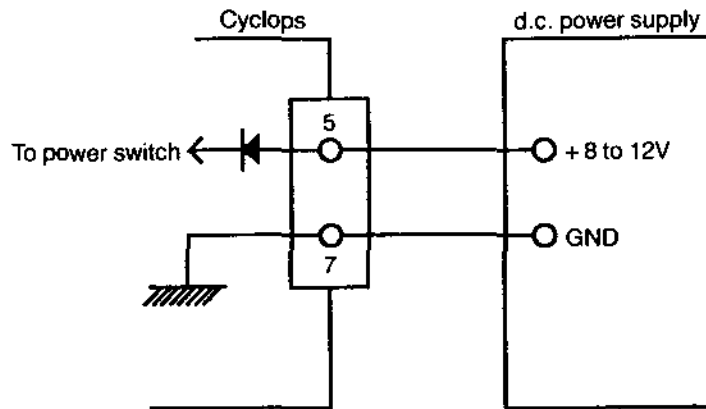
4. Switch on the power supply.
5. Switch on the Cyclops.
NOTE: Switch off both the power supply and the Cyclops before connecting or disconnecting either unit. If the power switch of either unit is left at ON, the internal circuits could be damaged.

ANALOG OUTPUT (Cyclops 153A only)

Cyclops 153A is equipped with an analog-output socket for providing a signal to analog data recorder.

● Analog output from the Cyclops 153 can be obtained using the optional D/A Converter IR-2.

Output Format

Output socket	φ3.5mm subminiature plug (center positive, outside negative)
Output	1mV/°C or °F
Resolution	1mV
Output range	0V; 550 to 3100mV for °C; 1000 to 5600mV for °F
Accuracy	Within ±3mV (depending on digital output; at ambient temperature between 18°C/64°F and 28°C/82°F)
Drift with ambient temperature	±0.02%/°C
Response time	Less than 0.1s (90% response) after digital output
Output impedance	1kΩ

● 0V will be output when Cyclops 153A is swiched on but no measurement has been taken or when battery-power indication is blinking and no other indication is shown in the display.
● 550mV/1000mV will be output respectively when measured temperature is below display range (549°C/999°F or less; "- U -" shown in displays).
● 3100mV/5600mV will be output respectively when measured temperature is over display range (3101°C/5601°F or more; "- O -" shown in displays).
● When display is being held, the voltage corresponding to the displayed value will be output.
● When no indication is shown in the display (when Cyclops 153A is switched off or when no batteries are installed or batteries are installed incorrectly) or when Cyclops 153A is in standby mode, the output voltage will be around 0V but may vary slightly.
● If measurements are to be taken over a long period of time, it is recommended that the optional AC Adapter AC-A10 be used to supply power to the Cyclops 153A.

Connections

A φ3.5mm subminiature plug for connection to the analog-output socket is included with the Cyclops 153A and is shown at right. To use the plug, solder a two-conductor shielded cable to the plug. The wire for the signal should be soldered to the tab for the plug center; the ground wire should be soldered to the tab for the outside of the plug.

Outside ⊖
Center ⊕
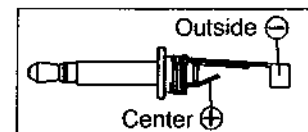
Once a cable has been attached to the plug, the Cyclops 153A can be connected to an analog recorder as shown below.
● Switch off the power of both the Cyclops 153A and the analog recorder before connecting the two units to avoid the possibility of damaging the circuits of either unit.

Cyclops 153A
Outside (ground)
Center (signal)
⊕ Signal
Ground ⊖
GND
Analog-output socket
Subminiature plug
Analog recorder
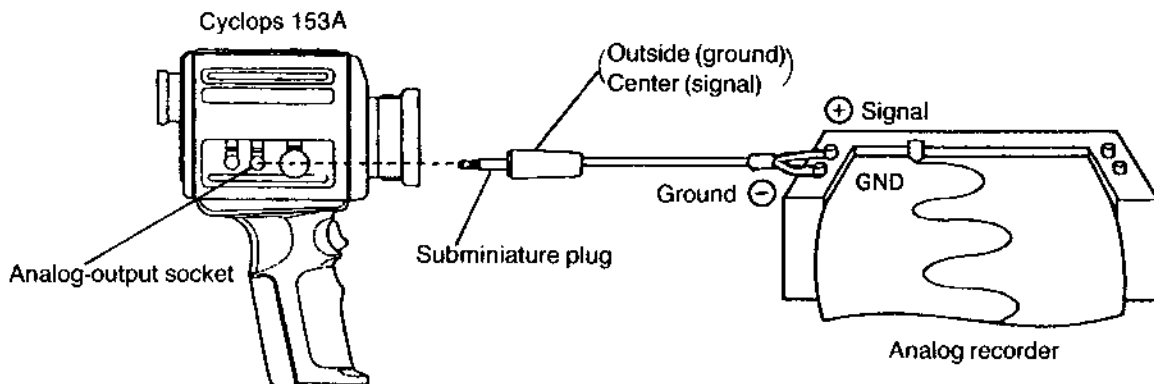
MEASUREMENT PRINCIPLE

Cyclops 153 and Cyclops 153A determine the temperature of an object by measuring the amount of radiant energy emitted by the object. Every object emits an amount of radiant energy proportional to the temperature of the object.

For exact temperature measurements, it is necessary to set the emissivity of the object on the Cyclops. Emissivity is the ratio of the radiant energy emitted by the object and the radiant energy emitted by a blackbody at the same temperature as the object. The emissivity depends on the object being measured, and also on the wavelength range which is detected by the Cyclops. The emissivity can be set using the **EMISSIVITY** buttons on the Cyclops.

Block Diagram
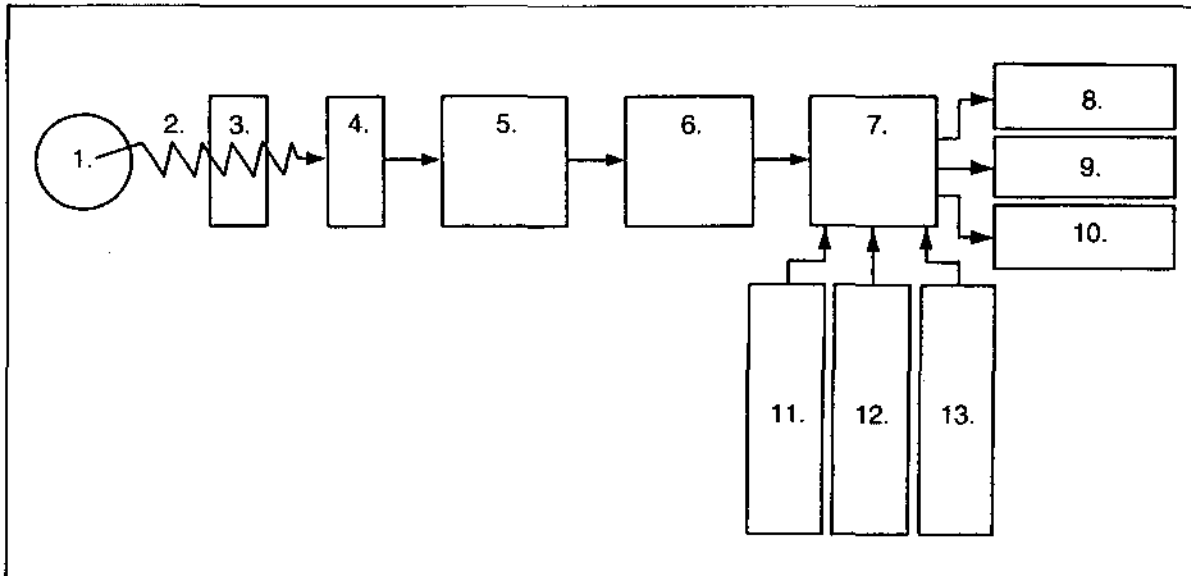
1. Measurement subject	8. Displays
2. Emitted energy	9. Digital-output socket
3. Optical system	10. Analog-output socket (Cyclops 153A only)
4. Detector	11. **EMISSIVITY** buttons
5. Amplifier	12.**MODE** button
6. A/D converter	13. **CALCULATE** button
7. Microprocessor	

Radiant energy emitted by the object is transmitted by the optical system and is focused on the detector, which converts the radiant energy to an analog electrical signal. This analog signal is amplified and then sent to the A/D converter, where the analog signal is converted to a digital signal. The digital signal is received by the microprocessor, which calculates the appropriate temperature value based on the emissivity setting. The value calculated by the microprocessor is then shown in the display according to the measurement mode (PEAK, CONT., or VALLEY) and sent to the digital-output socket. When the measuring trigger is released, the latest measured value will be held in the display and will be stored in memory. The values in memory are then used for statistical calculations when MAX, MEAN, or MIN calculating mode is selected.

Optical System

F$_1$:   Protective filter
L$_1$:   Objective lens
M: Mirror
S: Aperture plate
F$_2$:   Spectral-sensitivity filter
D: Silicon photocell
F$_3$:   Neutral-density (ND) filter
P: Porroprism
G: Viewfinder focusing screen
L$_2$:   Viewfinder optical system
F$_4$:   Eyepiece infrared-cut filter
LCD: Viewfinder display
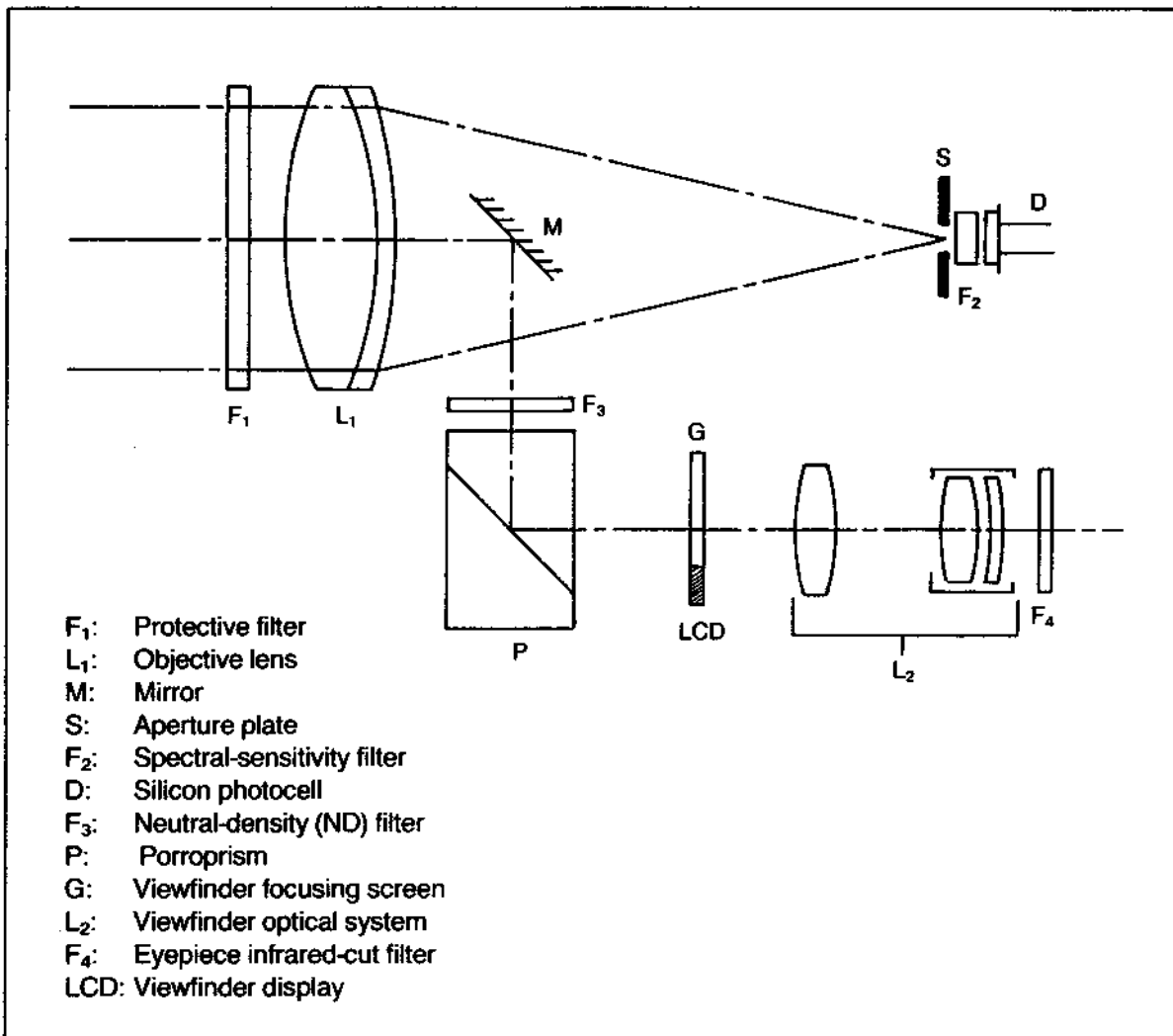
The optical system of the Cyclops 153 and Cyclops 153A is shown in the diagram above. A single-lens-reflex system is used to ensure that the actual measurement area is the same as the measurement area seen in the viewfinder. The detector is placed at the focal point of the measurement portion of the optical system; the viewfinder focusing screen (with the measurement-area indication) is placed at a position equivalent to that of the detector in the viewfinder portion of the optical system.

MEASUREMENT AREA

The Cyclops 153/Cyclops 153A has a measurement angle of 1/3°. The size of the measurement area varies according to the target distance as shown below.

Target distance (m)	∞	100	50	20	10	7	5	3	2	1.5	1.2	1.0	0.75	0.2
Measurement area (mm)	∞	φ576	φ287	φ114	φ57	φ39	φ28	φ16	φ11	φ8	φ6	φ4.8	[*1] φ3	[*2] φ0.4

• Target distance is measured from the focal-plane indication (φ).
[*1] Using optional Close-Up Lens #153
[*2] Using optional Close-Up Lens #110

The standard minimum measurement area of the Cyclops 153/Cyclops 153A is φ4.8mm (at a distance of 1m). By using optional close-up lenses (sold separately), subjects as small as φ0.4mm can be accurately measured.
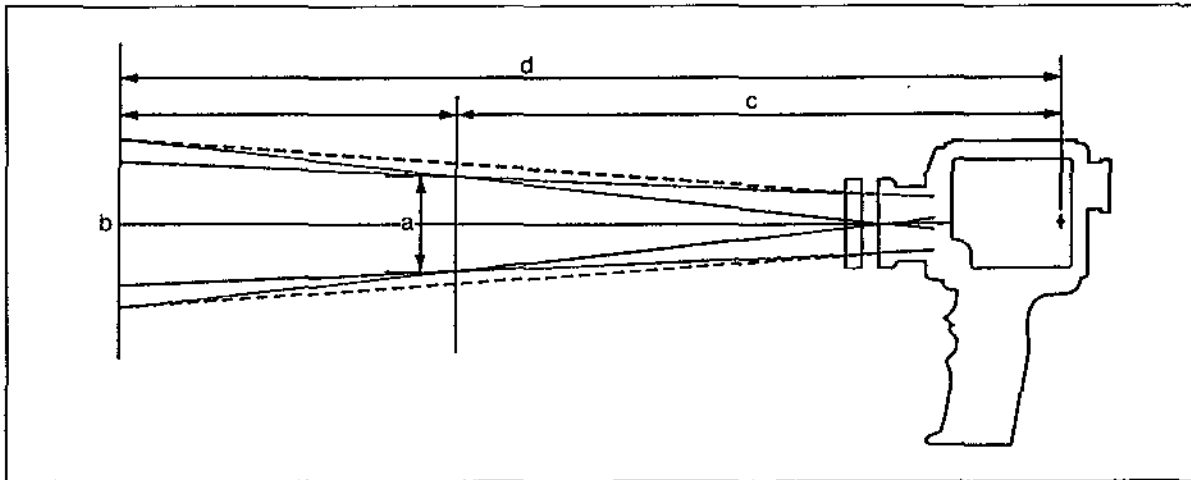
mm Close-up lens	(a) Minimum measurement area	(b) Maximum measurement area	(c) Minimum target distance	(d) Maximum target distance
None	φ4.8	—	1000	∞
No.153	φ2.5	φ5.7	589	1104
No.135	φ1.7	φ2.9	447	628
No.122	φ1.1	φ1.5	324	379
No.110	φ0.4	φ0.5	207	214

• When attaching the selected close-up lens, remove the protective lens filter.
• Only one close-up lens at a time must be used.

CARE

- If the Cyclops becomes dirty, it can be cleaned with a soft, dry cloth, preferably silicone-treated. Never use organic solvents, such as benzene or thinner, for cleaning. These may damage the thermometer.
- Be extremely careful to keep the protective filter clean. If the filter becomes dirty, use a blower to blow off dust; if necessary, the filter can then be wiped lightly with a lens tissue.

STORAGE

- The Cyclops should be stored in a cool, dry place at temperatures between $-20°C$ ($-4°F$) and $+55°C$ ($+131°F$). In damp environments it should be stored in a sealed airtight container with a drying agent such as silica gel.
- If the Cyclops will be not used for more than two weeks, remove the battery to avoid the possibility of damage due to corrosion.
- Do not leave the Cyclops inside a closed motor vehicle, in direct sunlight, or near sources of heat such as stoves, strong lights, etc.

TROUBLESHOOTING

If a problem occurs with the Cyclops, please check the following points before requesting service. If the problem continues even after checking these points, contact the nearest Land authorized service center.

|		
No indications appear in the display even though measuring trigger is pressed.	Is power switch set to ON?	Set power switch to ON.
	Are batteries installed correctly?	Install batteries correctly. See p. 8.
	Are batteries old?	Replace old batteries with fresh ones. See p. 8.
Displayed value doesn't change even if a different object is measured.	Is PEAK or VALLEY measuring mode selected?	When PEAK measuring mode is selected, displayed value will not change unless the object being measured is hotter than all other objects measured previously during the period when measuring trigger was held pressed. When VALLEY measuring mode is selected, displayed value will not change unless the object being measured is colder than all other objects measured previously during the period when measuring trigger was held pressed. See p.14.
	Was Cyclops in standby mode before measuring trigger was pressed?	If the measuring button is pressed when Cyclops is in standby mode, the Cyclops recalls the measurement value which was shown in the display before standby mode was entered. Release the measuring trigger and press it again to start taking measurements.
Displayed measurement value seems strange.	Is protective filter dirty, scratched, or broken?	If filter is dirty, clean filter. If filter is scratched or broken, contact the nearest Land service facility.
	Is emissivity setting correct?	Set correct emissivity for object being measured. See p.13.
	Is temperature unit set correctly?	Set temperature units to the desired units. See p.12.
Display is not held when measuring trigger is released.	Is Cyclops in monitor mode?	Set power switch to OFF and then to ON again to cancel monitor mode.
Calculating mode (MAX, MEAN, or MIN) cannot be entered even if CALCULATE is held pressed when MODE is pressed.	Is Cyclops in monitor mode?	Set power switch to OFF and then to ON again to cancel monitor mode.
No value is displayed when a calculating mode (MAX, MEAN, or MIN) is selected.	Was at least one measurement stored in memory? (Was measuring trigger pressed to take a measurement, and then released to hold display and store data?)	If no measurement was taken after power switch was set to ON, there is no data in memory with which to perform calculations. Take measurements.
Even though measurement was taken, no data was output.	Is pin 11 of digital-output socket low (– 5V)?	Set pin 11 high (+ 5V).
	Is display being held?	Press measuring trigger or set pin 4 of digital-output socket high (+ 5V) to take measurement.
Object to be measured cannot be seen clearly in the viewfinder.	Is focus adjusted correctly?	Turn focusing ring until object appears sharp.
	Is object too close to be focused on?	Objects closer than 1m/39.3 in.(from focal-plane indication) cannot be focused on.
Measurement area in viewfinder cannot be seen clearly.	Is eyepiece adjusted correctly?	Turn eyepiece ring until measurement area appears sharp.
Viewfinder is too dark to see anything.	Is lens cap still attached?	Remove lens cap.
	Is neutral-density filter in viewfinder optical path?	Move neutral-density filter lever to remove neutral-density filter from viewfinder optical path. See p.10.

DIMENSION DIAGRAM

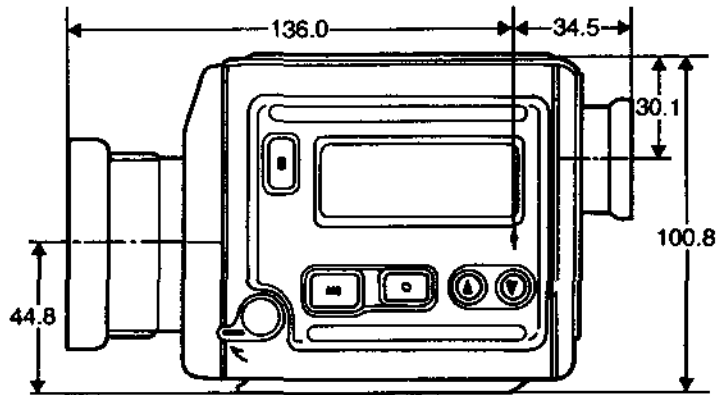(Units: mm; Lens setting: infinity: Eyepiece setting: – 1D)
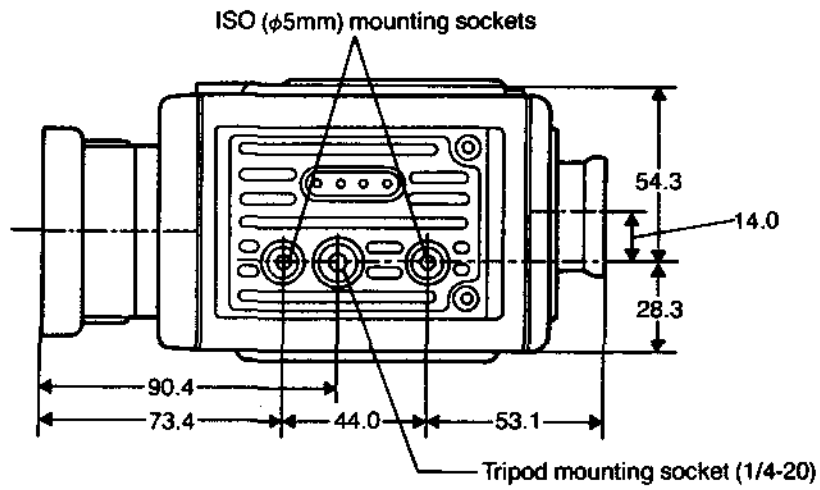
Front View
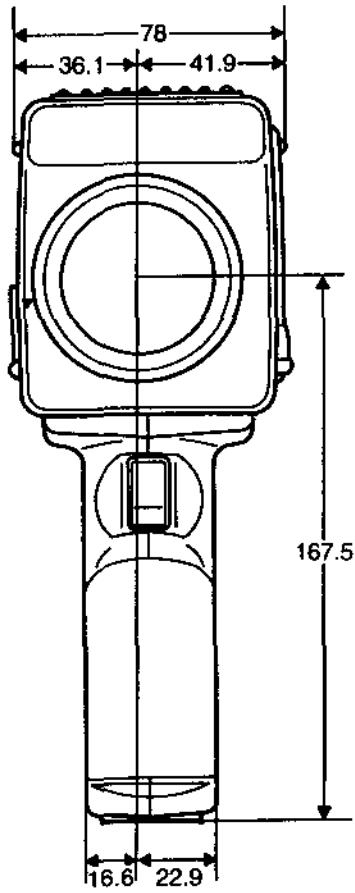
Side View
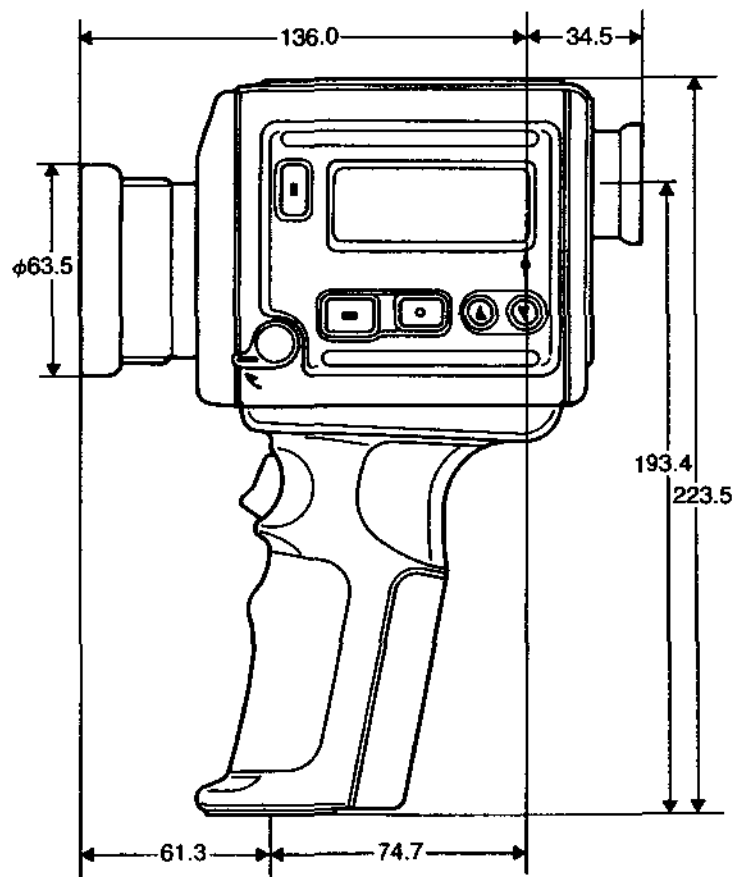
WITH GRIP REMOVED

Side View

Bottom View

ISO (ϕ5mm) mounting sockets

Tripod mounting socket (1/4-20)

SPECIFICATIONS

Cyclops 153/Cyclops 153A

Type:	Infrared radiation thermometer for non-contact temperature measurements
Temperature Measurement Range:	550 to 3200°C (or 1000 to 5800°F)
Indication:	Viewfinder display: 4-digit LCD with green backlight: 1°C/°F increments
	External display panel: 4-digit measured value: 3-digit emissvity value; measuring mode indications (PEAK, VALLEY); calculating mode indications (MAX, MIN, MEAN); 5-level battery-power indication
	Display range (both displays): 500 to 3250°C (or 930 to 5900°F); displayed value blinks when measurement temperature within display range but outside measurement range, "- U -" or "- O -" displayed when measurement under or over display range (respectively)
Measuring Modes:	Continuous, Peak hold (PEAK), Minimum hold (VALLEY)
Calculating Modes:	Maximum (MAX.), Mean (MEAN), Minimum (MIN.)
Optical System:	Focusing lens optical system
Focusing Range:	1m (39.3 in.) to infinity; 0.2m (7-7/8 in.) to infinity with optional close-up lenses
Viewfinder:	SLR (single-lens-reflex) viewfinder; 8° field of view with 1/3° measurement area; Eyepiece adjustable − 3.5 to + 2.5 diopters
Measurement angle:	1/3°
Target Diameter:	4.8mm at 1m; minimum of 0.4mm when using optional close-up lenses
Detector:	Silicon photocell
Spectral Response:	0.8 to 1.1μm
Emissivity Adjustment:	0.10 to 1.30 in 0.01 increments
Response Time:	Display: Less than 0.45s (98% response); display change: 0.38s
	Digital output: Less than 0.13s (98% response); data change: 0.06s
	Analog output (Cyclops 153A only): Less than 0.1s (90% response)
Accuracy:	±0.5% of reading ±1 digit (in ambient temperature 18°C/64°F to 28°C/82°F, effective emissivity approximately 1.00)
Repeatability:	Within 0.15% of reading (in ambient temperature 18°C/64°F to 28°C/82°F), effective emissivity approximately 1.00)
Drift with Ambient Temperature:	±0.02% of reading/°C (2°F) (in ambient temperature within operating temperature range, effective emissivity of approximately 1.00)
Operating Temperature:	0 to 50°C (32 to 122°F) with relative humidity of less than 85% at 35°C (95°F) with no condensation
Storage Temperature:	−20 to 55°C (−4 to 131°F) with no condensation
Power Source:	Six AA-size alkaline-manganese or carbon-zinc (1.5V) or nickel-cadmium (1.2V) batteries; optional AC Adapter AC-A10 can also be used
Power Consumption:	During measurement: Approximately 20mA for Cyclops 153, approximately 25mA for Cyclops 153A
Digital Output:	RS-232C format
Analog Output (Cyclops 153A only):	Output: 1mV/° (C or F); Resolution: 1mV; Accuracy: Within ±3mV (at ambient temperature between 18°C/64°F and 28°C/82°F); Output impedance: 1kΩ

The Quality Management System of Land Instruments International Ltd. is approved to BS EN ISO 9001 for the design, manufacture, and on-site servicing of combustion, environmental monitoring and non contact temperature measuring instrumentation, associated software is designed and developed in accordance with TickIT. Stock holding of the Minolta/Land Cyclops range of portable thermometers is covered by approval to BS EN ISO 9002.

Traceability of calibration is to National Standards. Calibration certificates are available from the UKAS accredited calibration laboratory 0034.

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