HAMAMATSU
PHOTON IS OUR BUSINESS

Lateral flow readers THETA®

High sensitivity and high reproducibility with ease of use

Hamamatsu Photonics supplies lateral flow readers for R&D work and quality control of immunochromatographic reagents, and "core engine" specialized for line detection. lateral flow readers make rapid quantitative measurements of color and fluorescence intensity of immunochromatographic reagents using red/blue-based color particles or fluorescent particles as labels. Our lateral flow readers utilize the latest optical measurement technologies where we never stop exploring and pushing their limits. Try out our lateral flow readers for yourself and see the performance we can offer as a leading manufacturer of optical sensors!

Reagent development and reagent quality control

We offer powerful tools for development and quality control of immunochromatographic reagents. Our product lineup includes a variety of models to ideally match different detection targets and sensitivities, so you can select the optimal model for the target reagent you want to develop and use.

→ P.3

Supports development of lateral flow readers

We supply a 'core engine' for lateral flow readers as a single separate unit utilizable for developing lateral flow readers that deliver high-sensitivity line detection performance.

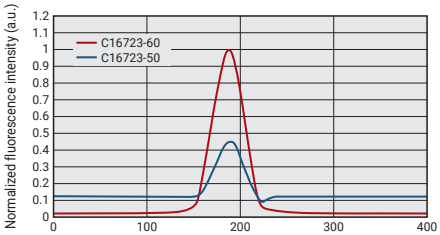
→ P.5

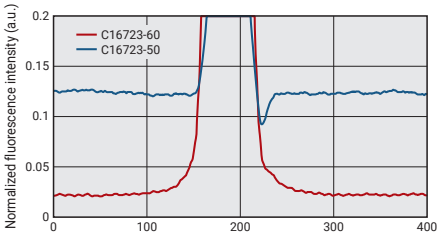
Features

Based on optical measurement technologies we have carefully built up over many years, we are continually improving our lateral flow readers to enhance their core performance such as sensitivity and reproducibility. We also weave a variety of underlying technologies into that work to develop and manufacture sophisticated devices having even more highly optimized designs.

● High sensitivity

The C16723 series lateral flow readers detect test lines that are virtually impossible for human eyes to identify. The C16723-60 in particular is designed to support the europium chemical element, providing higher sensitivity than other C16723 series models.

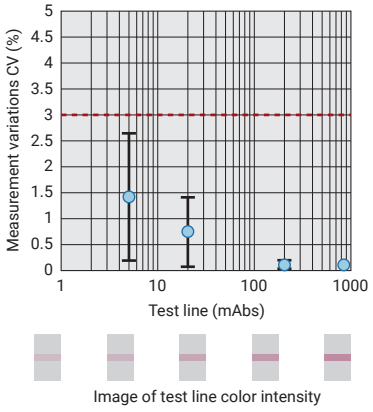




* Measurement sample: standard sample

● High reproducibility

The C16723 series suppresses measurement variations to lower than 3 %. This allows accurate evaluation of lot-to-lot differences in reagent performance and measurement variations over time.



CV: Coefficient of variation indicating analysis accuracy (ratio of the standard deviation to the mean during repeated measurements)

● Reagent compatibility

We have vast experience in detecting a wide range of labeled samples using both color-developing and fluorescent reagents. The C16723 series utilizes a flexible universal holder that accommodates various types of reagent trays.

Performance comparison of measurement methods

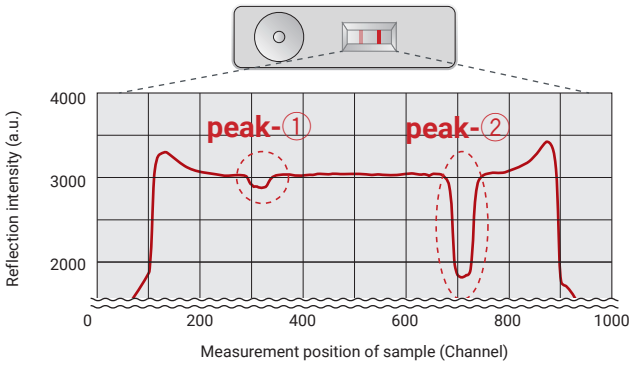
Item	Visual inspection	Ordinary reader	lateral flow reader
Sensitivity	**Low** Judgment results differ depending on the person.	**Medium** Provides higher sensitivity than visual inspections	**High** Can detect extremely faint color and fluorescence
Reproducibility	**No** No reproducibility, since judgment cannot be quantified.	**Low** Judgment results may vary depending on the reader's accuracy.	**High** High reproducibility with CV (coefficient of variation) kept within 3 %
Reagent compatibility	**Limited** Only reagents that can be checked visually.	**Limited** Measurable reagents are limited.	**Wide compatibility** Provides a lineup of readers compatible with different reagents and various shapes.

Functions

The software for the lateral flow reader series has two measurement modes that are selectable to match your task. Waveforms of measurement results are automatically acquired and their peaks then analyzed and displayed based on those waveforms.

* A PC is required to run the dedicated software. Customers must prepare a PC as it is not supplied with our lateral flow readers.

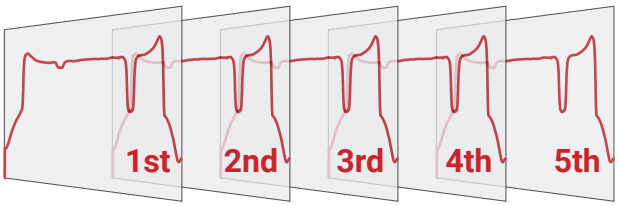
● Example of automatically acquired waveforms



Lot measurement mode

This mode continuously measures multiple reagents of the same lot (same type). Measurement results are saved in CSV format and can be viewed in their order of measurement

● Continuous measurement example



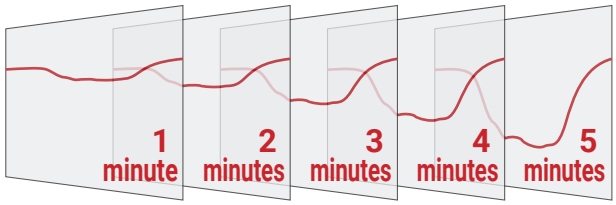
● Acquired analysis data example (CSV)

Sample	Peak-①		Peak-②	
No.	PeakX	mABS	PeakX	mABS
1	292	15.4	699	199.5
2	298	15.1	706	199.0
3	297	15.2	705	198.9
4	296	15.1	704	199.1
5	300	15.2	709	199.0

Time-course measurement mode

This mode measures the reaction process of one reagent and follows its changes over time. This is effective in checking the reaction speed of each reagent and in analyzing time-course changes in color development and fluorescence intensities.

● Time course measurement example



● Acquired analysis data example (time-course changes in peak absorbance)

Advantages over previous units

- Rapid measurement time: about one-half that of the previous units
- Supports a broader range of samples sizes
- Pass-fail check of color samples
- Display screen (for easy verification of measurement count, etc.)
- Improved versatility and operability via upgrades of measurement software

Lateral flow readerss for reagent development and quality control

C16723 series

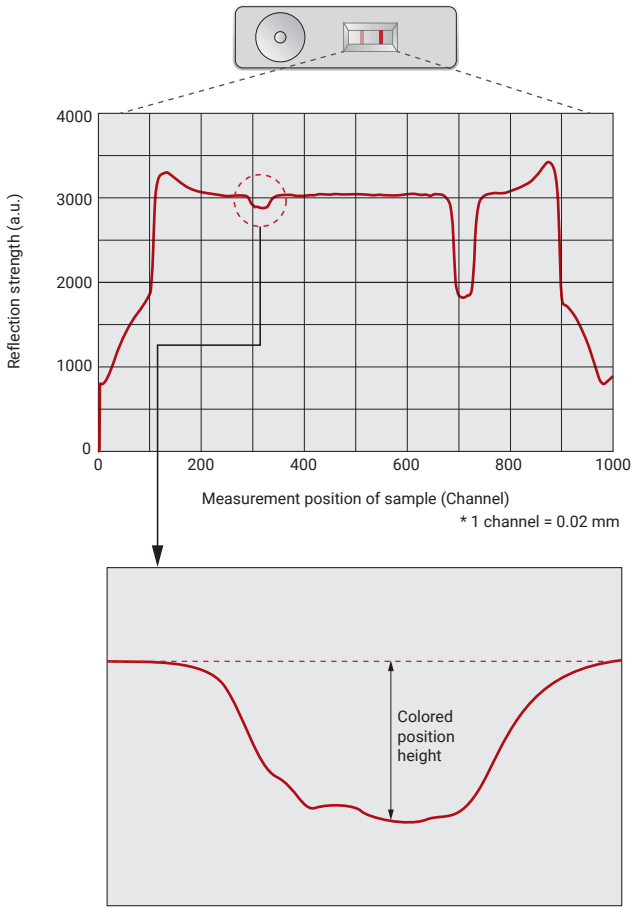
The C16723 series is a family of lateral flow readers optimized for reagent development and quality control. The lineup includes 5 models: C16723-10 and -11 that utilize the absorption method; and C16723-50, -51 and -60 that utilize the fluorescence method. All models have excellent sensitivity, reproducibility and reliability.

Item	Description / value				
Suffix	-10	-11	-50	-51	-60
Target label	Red-based color lines	Blue-based color lines	Europium	FITC	Europium
Measurement target *1	Color labels		Fluorescent labels		
Measurement method	Absorption method		Fluorescence method		High-sensitivity Fluorescence method
Light source	Green LED	Red LED	UV LED	Blue LED	UV LED

*1: Two colors cannot be measured simultaneously.

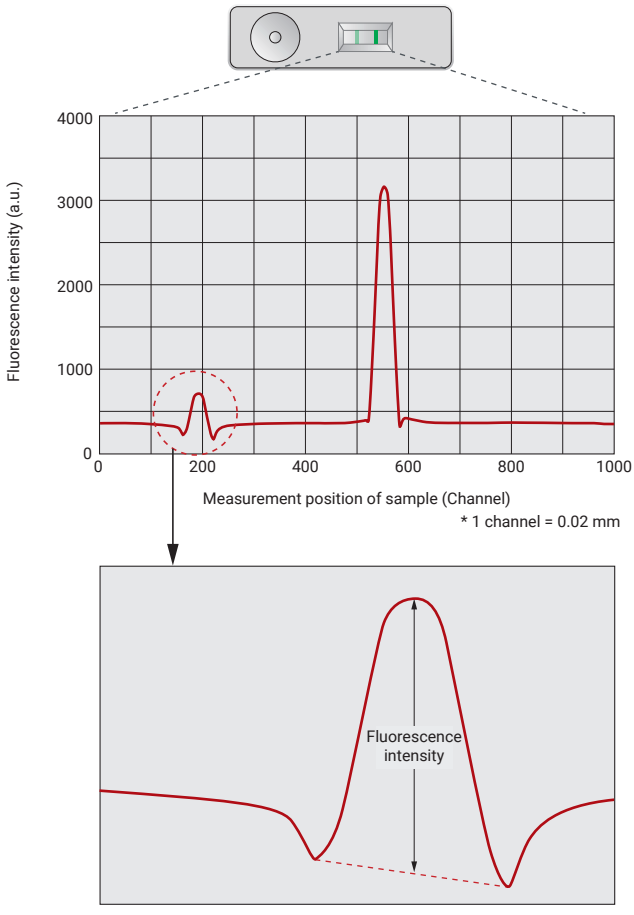
Waveform analysis

Absorption profile waveform image (C16723-10/-11)



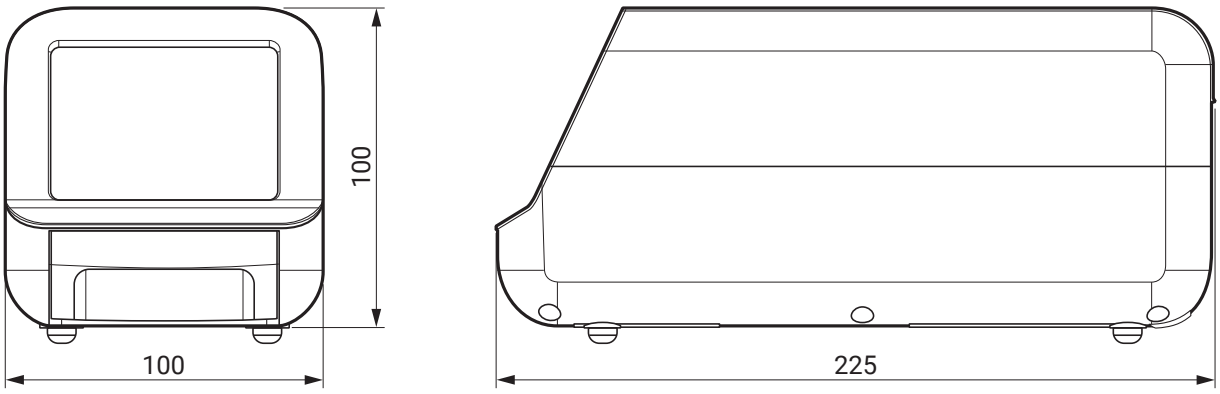
Color development intensity is automatically calculated by dedicated software.

Fluorescence profile waveform image (C16723-50/-51/-60)



Fluorescence intensity is automatically calculated by dedicated software.

Dimensional outlines (unit: mm)



Specifications

Main unit

Item		C16723-10	C16723-11	C16723-50	C16723-51	C16723-60	Unit
Target label		Red-based color lines	Blue-based color lines	Europium	FITC	Europium	-
Features		Absorption method		Fluorescence method		High-sensitivity Fluorescence method	-
Power requirements	Max.	5					V
Interface		USB2.0					-
Light source		Green LED	Red LED	UV LED	Blue LED	UV LED	-
Detector		Silicon photodiode					-
Dimensions (W × H × D) *1		100 × 100 × 225					mm

*1: Not including protruding parts.

Software (for PC operation)

Item	Absorption method type	Fluorescence method type	Unit
Supported OS	Windows® 10 (32 bit / 64 bit), Windows® 11		-
Measurement program	Lot measurement, time-course measurement (30 s / 60 s intervals)		-
Analysis program	Calibration curve function, concentration conversion		-

Ratings

Item		Absorption method type	Fluorescence method type	Unit
Number of measurement lines	Max.	6		lines
Measurement line spacing (center-to-center spacing)	Min.	3		mm
Measurement line width		0.8 to 1.2		mm
Measurable range		3 × 20		mm
Minimum sensitivity		5	-	mABS *2
Maximum sensitivity		800	-	mABS *2
Fluorescence intensity resolution		-	12	bit
Measurement reproducibility *3	Max.	3 % CV (at +25 °C)		-
Operating ambient temperature		+15 to +30		°C
Operating ambient humidity *4		Bellow 80		% RH
Storage temperature		-20 to +50		°C
Storage humidity *4		Bellow 80		% RH

*2: mAbs = milli-absorbance (Absorbance is the logarithm of the ratio of incident to transmitted radiant power through a sample.)
*3: When measured using our standard sample. *4: No condensation

Compatible reagent sizes (maximum)

Item	C16723 series	Unit
Reagent housing (W × H × D)	39.5 × 8.0 × 120.4	mm
Reagent housing (W × D)	10 × 120	mm

Lateral flow reader engine

C16171 series

The C16171 series lateral flow reader engine consists of an optical head for detecting reagent color development and fluorescence lines and a control board integrated with a motor for driving the optical head. This lateral flow reader engine detects lines with high sensitivity by utilizing software programs for profile data acquisition and waveform analysis. When developing a lateral flow reader, this lateral flow reader engine will serve as the core component specially optimized for reading of lines.

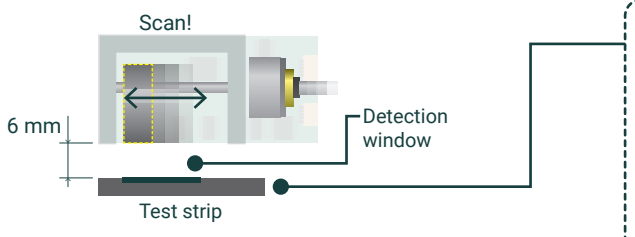
Item	Description / value				
Suffix	-10	-11	-50	-51	-60
Target label	Red-based color lines	Blue-based color lines	Europium	FITC	Europium
Measurement target *1	Color labels		Fluorescent labels		
Measurement method	Absorption method		Fluorescence method		High-sensitivity Fluorescence method
Light source	Green LED	Red LED	UV LED	Blue LED	UV LED

*1: Two colors cannot be measured simultaneously.

C16171 series operation sequence

When the lateral flow reader engine receives a measurement start command, the optical head starts scanning the reagent color development (fluorescence) area. One measurement completes in about 12 seconds.

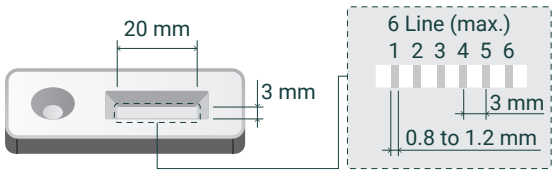
● Lateral flow reader engine operation viewed from side



Item		Description / value	Unit
Focal length		6	mm
Self-check run time	Typ.	12	s
Measurement run time	Typ.	12*	

* For C16171-60, 17 s are required.

● Compatible test strip

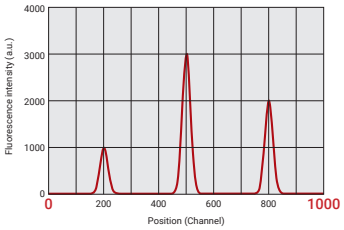


Item	Description / value	Unit
Detection area (lateral flow direction × width)	20 × 3	mm
Maximum number of detection lines	6	Lines
Detection line width	0.8 to 1.2	mm
Detection line interval	3	

Data acquisition

Reagent color development and fluorescence profile are measured while scan. A measurement is taken a total of 1000 profile data are measured and acquired in one measurement cycle.

● Example of acquired profile (fluorescence line)

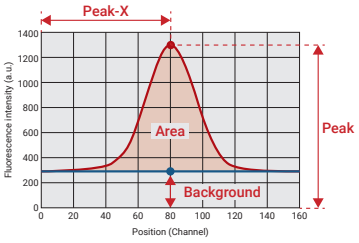


Data analysis

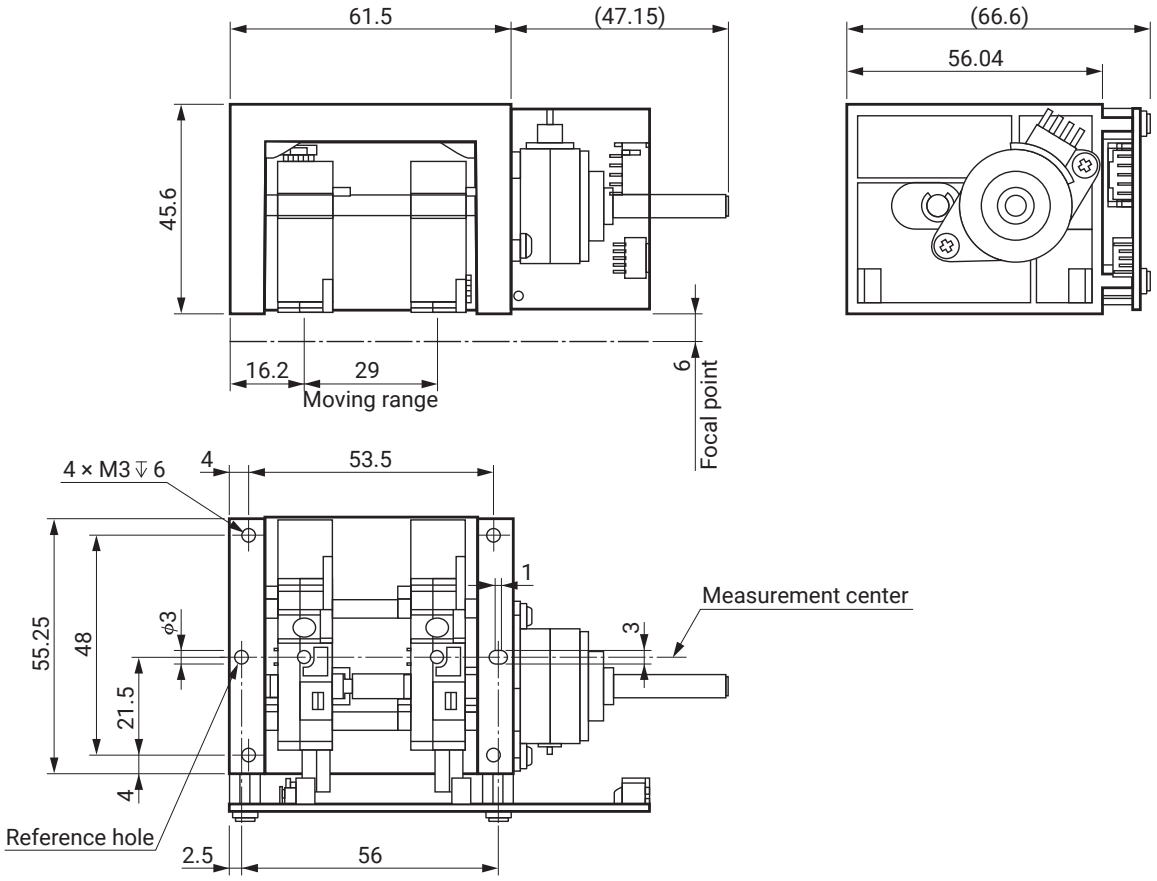
Color development and fluorescence lines are automatically analyzed from the acquired profile.

Peak position (Peak-X)
Peak intensity(Peak)
Background (Background)
Area(Area)

● Example of waveform (fluorescence line)



Dimensional outlines (unit: mm)



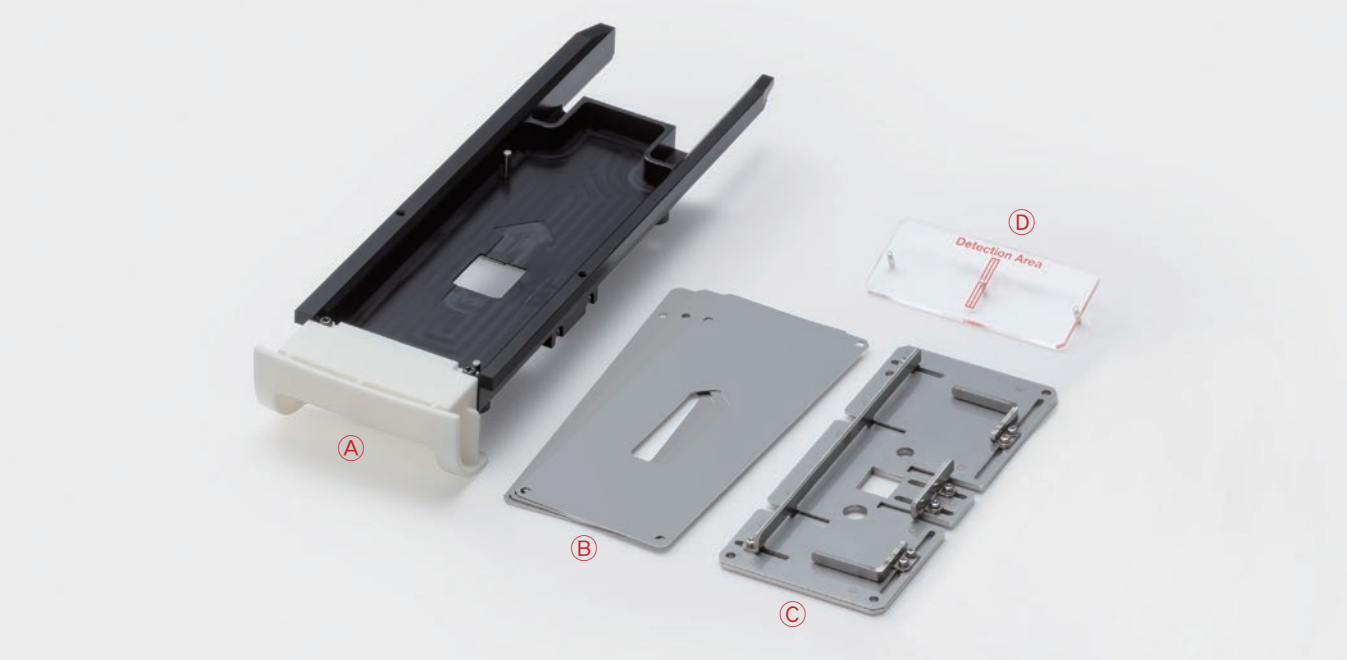
specifications

Ratings

Item			Description / value	Unit
Supply voltage		Min.	+3.0	V
		Typ.	+3.3 / +5.0	V
		Max.	+5.5	V
Supply current	At power-down	Typ.	0	A
	In standby	Typ.	0.1 *1	A
	In operation	Max.	1	A
Control input voltage	R x D	Max.	+5.5	V
	PWRDWN	Max.	+5.5	V
Control output voltage	T x D	Max.	+5.5	V
Operating ambient temperature			+15 to +30	°C
Operating ambient relative humidity *2			Below 80	% RH
Storage temperature			-20 to +50	°C
Storage ambient relative humidity *2			Below 80	% RH

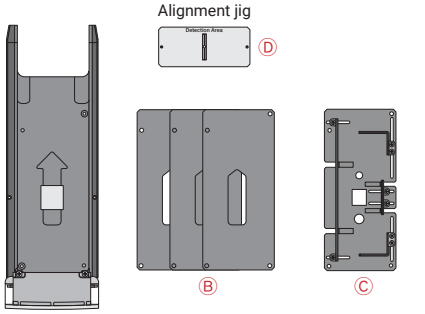
*1: C16171-60: 0.2 A
*2: No condensation

Accessories



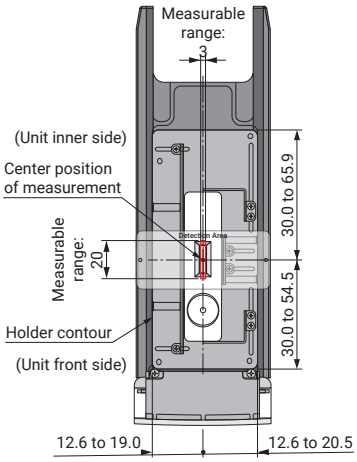
Accessories

- Universal holder

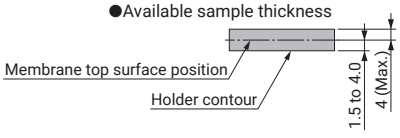


- Dedicated AC adapter
  Cable length: 1200 mm
- USB cable
- CD-ROM (containss software and user manual)
- Color sample / Fluorescence color sample for checking main unit

●Available sample size



●Available sample thickness



Unit: mm

ⒺAbsorption method
C16723-10/-11: A10792 *
ⒻFluorescence method
C16723-50: A15924
C16723-51: A16441
C16723-60: A16350

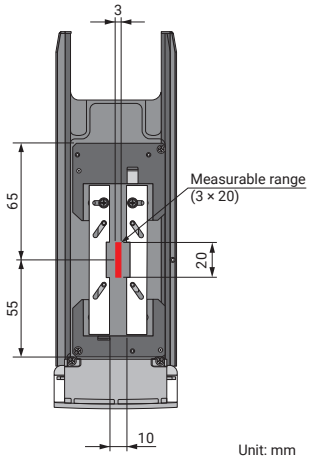
* Due to regulatory restrictions, A10792 is not available for sale in the European region.

Options (sold separately)

Dip type holder A10793-01

This holder is designed for our lateral flow readers to allow easy setup of a reagent kit with no housing or a dip type.

●Available sample size



Unit: mm

Custom holders

We design and fabricate custom holders that will perfectly match your reagent housing.
If our standard Universal holder does not support the size of the reagent housing you are using, our custom-designed holders may prove an ideal solution.
So please contact us and provide the reagent housing dimensions.

Maintenance and inspection

To maintain the reliability and measurement accuracy of the C16723 series lateral flow readers, we recommend making daily checks and doing regular maintenance.

Daily check

You can easily make a daily check by using dedicated a color sample.
Make the check both before and after using the lateral flow reader helps maintain its high reliability.
For the color sample, please refer to page 7.

Recommended check period

- Daily check: Once a day
- Replacement of color sample:
  Once a year (Fee will be charged)

- Color sample replacement period

The line of the color sample deteriorates due to daily use, so the color sample should be replaced every 12 months.
Missing this replacement period may cause discrepancies between the reference value and the actual line density.
Do not continue using the color sample if you kept using it after the scheduled replacement period.
Purchase a new color sample from us as soon as possible.

Periodic inspections (overhaul)

Please return the unit to us for inspection and maintenance of the entire unit. We will disassemble and inspect individual parts while checking measurement performance and mechanical operation.

Recommended period

- Inspection: Once every 3 years (Fee will be charged)

Frequently Asked Questions (FAQ)

Q. The reagent I'm using does not fit the supplied tray. What should I do?

A. If our Universal holder (see page 7) does not fit your reagent, then our custom-designed holder may be the perfect solution. Please contact us, providing us with the size of the reagent you are using. We can also lend you a demo unit or we can evaluate your sample at our site if you send it to us.

Q. Is it possible to detect color lines other than red and blue?

A. Measurement is possible but the detection sensitivity may be lower than the specifications listed for red and blue colors.

Q. Do you offer any support for inspection and maintenance of the unit?

A. We provide support for maintenance if you send the unit to us. Please contact our sales office. Before sending the unit to us, please clean and disinfect it in view of the needs for bio-safety.

Q. Can the C16723 series make diagnoses in a clinical environment?

A. No, the C16723 series is not a medical device.
The C16723 series cannot be used for making diagnoses in a clinical environment. Use it as a tool only for development and management of reagents.

Q. Are there PCs that come with an lateral flow reader?

A. There is no PC that comes with an lateral flow reader. Please prepare one on your own. (We recommend using a Windows® PC with a USB 1.1/2.0 port.)

Q. Is it possible to measure two color lines with one unit?

A. No, multiple color lines cannot be measured with just one unit. A single unit can only measure one color line.

HAMAMATSU PHOTONICS K.K. **www.hamamatsu.com**

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