The scalable high-precision laser measurement sensor

ZS-HL series

The ZS laser sensor family provides outstanding measurement performance on all kind of materials. Its huge range of sensor heads and scalable concept makes it a versatile platform for all high precision sensing applications.

- Highest resolution and dynamic sensing range for all surfaces
- Modular and scalable platform concept for up to 9 sensors
- Easy to use, install and maintain for all user levels
- Fast response time of 110 µs
- Multi-tasking capability – manages up to 4 measurement tools in one controller

Ordering information

Sensors

ZS-HL-series sensor heads

Optical system	Sensing distance	Beam shape	Beam diameter	Resolution*1	Model
Regular reflective models	20±1 mm	Line beam	1.0 mmx20 µm	0.25 µm	ZS-HLD2ST
	25±2 mm		2.2 mmx45 µm	0.6 µm	ZS-HLDS2VT
Diffuse reflective models	50±5 mm		1.0 mmx30 µm	0.25 µm	ZS-HLDS5T
	100±20 mm		3.5 mmx60 µm	1 µm	ZS-HLDS10
	600±350 mm		16 mmx0.3 mm	8 µm	ZS-HLDS60
	1500±500 mm		40 mmx1.5 mm	500 µm	ZS-HLDS150

*1. Refer to the table of ratings and specifications for details.

ZS-HL-series sensor heads (for nozzle gaps) also compatible with ZS-L controller

Optical system	Sensing distance	Beam shape	Beam diameter	Resolution*1	Model
Regular Reflective	10±0.5 mm	Line beam	900x25 µm	0.25 µm	ZS-LD10GT
	15±0.75 mm				ZS-LD15GT

*1. Refer to the table of ratings and specifications for details.

ZS-L-series sensor heads

Optical System	Sensing distance	Beam shape	Beam diameter	Resolution*1	Model
Regular reflective models	20±1 mm	Line beam	900x25 µm	0.25 µm	ZS-LD20T
		Spot beam	25 µm dia.		ZS-LD20ST
	40±2.5 mm	Line beam	2000x35 µm		ZS-LD40T
Diffuse reflective models	50±5 mm	Line beam	900x60 µm	0.8 µm	ZS-LD50
		Spot beam	50 µm dia.		ZS-LD50S
	80±15 mm	Line beam	900x60 µm	2 µm	ZS-LD80
	130±15 mm	Line beam	600x70 µm	3 µm	ZS-LD130
	200 ±50 mm	Line beam	900x100 µm	5 µm	ZS-LD200
	350 ±135 mm	Spot beam	240 µm dia.	20 µm	ZS-LD350S

*1. This is the peak-to-peak displacement conversion value in the displacement output at the measuring center distance in high-precision mode when the number of samples to average is set to 128 and the measuring mode is set to the high-resolution mode. The standard workpiece is white aluminum ceramics in diffuse reflection mode and glass in the regular reflection mode.

Sensor controllers

Shape	Supply voltage	Control outputs	Model
	24 VDC	NPN outputs	ZS-HLDC11
		PNP outputs	ZS-HLDC41
			ZS-HLDC41A (incl. USB cable + Smart Monitor)

Multi controllers

Shape	Supply voltage	Control outputs	Model
	24 VDC	NPN outputs	ZS-MDC11
		PNP outputs	ZS-MDC41

Data storage units

Shape	Supply voltage	Control outputs	Model
	24 VDC	NPN outputs	ZS-DSU11
		PNP outputs	ZS-DSU41

Accessories (Sold separately)

Controller link

Shape	Model
	ZS-XCN

Panel mount adapter

Shape	Model	
	ZS-XPM1	For 1st controller
	ZS-XPM2	For expansion (from 2nd controller on

Cables for connecting to a Personal Computer

Shape	Model	Type	Qty
	ZS-XRS2	RS-232C	1
	ZS-XUSB2	USB	

Extension cables for sensor heads

Cable length	Model	Qty
1 m	ZS-XC1A	1
4 m	ZS-XC4A	1
5 m	ZS-XC5B*1,*2	1
8 m	ZS-XC8A	1
10 m	ZS-XC10B*1	1

*1. Up to two ZS-XC□B Cables can be connected (22 m max.).
*2. A Robot Cable (ZS-XC5BR) is also available.

Logging software

Name	Model
Smart Monitor Zero Professional	ZS-SW11E

Memory card

Model	Model
F160-N64S(S)	64 MB
QM300-N128S	128 MB
F160-N256S	256 MB

Safety precautions for using laser equipment

Laser Label Indications

Attach the following warning label to the side of the ZS-L-series Sensor Head.

Specifications

Sensor heads

ZS-HL-series sensor heads

Item	ZS-HLDS2T		ZS-HLDS2VT	ZS-HLDS5T		ZS-HLDS10		ZS-HLDS60	ZS-HLDS150
Applicable controllers	ZS-HLDC series								
Optical system	Regular reflection	Diffuse reflection	Regular reflection	Regular reflection	Diffuse reflection	Regular reflection	Diffuse reflection	Diffuse reflection	Diffuse reflection
Measuring center distance	20 mm	5.2 mm	25 mm	44 mm	50 mm	94 mm	100 mm	600 mm	1,500 mm
Measuring range	±1 mm	±1 mm	±2 mm	±4 mm	±5 mm	±16 mm	±20 mm	±350 mm	±500 mm
Light source	Visible semiconductor laser (wavelength: 650 nm, 1 mW max., JIS Clas							Visible semiconductor laser (wavelength 658 nm, 1 mW max., Class 2)	
Beam shape	Line beam								
Beam diameter*1	1.0 mmx20 µm		2.2 mm x45 µm	1.0 mmx30 µm		3.5 mmx60 µm		0.3 mm x16 mm	1.5 mm x40 mm
Linearity*2	±0.05% F.S.		±0.2 %F.S.	±0.1% F.S.				±0.07 %F.S. (250 mm to 750 mm) ±0.1% F.S. (750 mm to 950 mm)	±0.2 %F.S.
Resolution*3	0.25 µm (No. of samples to average: 256)		0.5 µm (No. of samples to average: 128)	0.25 µm (No. of samples to average: 512)		1 µm (No. of samples to average: 64)		8 µm (average 64) (at 250 mm) 40 µm (average 64) (at 600 mm)	500 µm (average 64)
Temperature characteristic*4	0.01% F.S./°C		0.1% F.S./°C	0.01% F.S./°C					
Sampling cycle	110 µs (high-speed mode), 500 µs (standard mode), 2.2 ms (high-precision mode), 4.4 ms (high-sensitivity mode)								
Indicators: NEAR indicator	Lits near the measurement center, and nearer than the measurement center distance inside the measuring range. Flashes when the measurement target is outside of the measuring range or when the received light amount is insufficient.								
Indicators: FAR indicator	Lits near the measurement center, and further than the measurement center distance inside the measuring range. Flashes when the measurement target is outside of the measuring range or when the received light amount is insufficient.								
Operating ambient illumination	Illumination on received light surface 3,000 lx or less (incandescent light)							Illumination on received light surface 1,000 lx or less (incandescent light)	Illumination on received light surface 500 lx or less (incandescent light)
Ambient temperature	Operating: 0 to +50°C, storage: -15 to +60°C (with no icing or condensation)								
Ambient humidity	Operating and storage: 35% to 85% (with no condensation)								
Degree of protection	IP64		IP67	Cable length 0.5 m: IP66, cable length 2 m: IP67				IP66 (IEC60529)	
Vibration resistance (destructive)	10 to 150 Hz, 0.7 mm double amplitude, 80 min each in X, Y, and Z directions								
Shock resistance (destructive)	150 m/s² 3 times each in six directions (up/down, left/right, forward/backward)								
Materials	Case: aluminum die-cast, front cover: glass								
Cable length	0.5 m, 2 m		2 m	0.5 m, 2 m					
Weight	Approx. 350 g			Approx. 600 g				Approx. 800 g	

F.S.: Full scale of measurement

*1. Defined as $1/e^2$ (13.5%) of the center optical intensity in the measurement center distance. The beam diameter is sometimes influenced by the ambient conditions of the workpiece such as leaked light from the main beam.

*2. This is the error on the measured value with respect to an ideal straight line. Linear curve may change according to the workpiece. The following lists the workpieces

Model	Diffusive reflection	Mirror reflection
ZS-HLDS2T	SUS block	Glass
ZS-HLDS5T/HLDS10	White alumina ceramic	Glass
ZS-HLDS60/HLDS150	White alumina ceramic	-
ZS-HLDS2VT	-	Glass

*3. This is the "peak-to-peak" displacement conversion value of the displacement output in the measurement center distance when high-resolution mode and the average number in the table are set (For ZS-HLDS60, the maximum resolution at 250 mm is also included). The following lists the workpieces.

Model	Diffusive reflection	Mirror reflection
ZS-HLDS2T	SUS block	Glass
ZS-HLDS5T	White alumina ceramic	Glass
ZS-HLDS10	White alumina ceramic	
ZS-HLDS60/HLDS150	White alumina ceramic	-
ZS-HLDS2VT	-	Glass

*4. Value obtained when the sensor part and object part are fixed with an aluminum jig.

ZS-L-series sensor heads

Item	Model	ZS-LD20T		ZS-LD20ST		ZS-LD40T		ZS-LD10GT	ZS-LD15GT
Applicable controllers		ZS-HLDC/LDC series							
Optical system		Regular reflection	Diffuse reflection	Regular reflection	Diffuse reflection	Regular reflection	Diffuse reflection	Regular reflection	
Measuring center distance		20 mm	6.3 mm	20 mm	6.3 mm	40 mm	30 mm	10 mm	15 mm
Measuring range		±1 mm	±1 mm	±1 mm	±1 mm	±2.5 mm	±2 mm	±0.5 mm	±0.75 mm
Light source		Visible semiconductor laser (wavelength: 650 nm, 1 mW max., JIS Class 2)							
Beam shape		Line beam		Spot beam		Line beam			
Beam diameter*1		900x25 µm		25 µm dia.		2,000x35 µm		Approx. 25x900 µm	
Linearity*2		±0.1%F.S							
Resolution*3		0.25 µm		0.25 µm		0.4 µm		0.25 µm	0.25 µm
Temperature characteristic*4		0.04% FS/°C		0.04% FS/°C		0.02% FS/°C		0.04% FS/°C	
Sampling cycle*5		110 µs (high-speed mode), 500 µs (standard mode), 2.2 ms (high-precision mode), 4.4 ms (high-sensitivity mode)							
Indicators	NEAR indicator	Lights near the measuring center distance, and nearer than the measuring center distance inside the measuring range. Flashes when the measurement target is outside of the measuring range or when the received light amount is insufficient.							
	FAR indicator	Lights near the measuring center distance, and further than the measuring center distance inside the measuring range. Flashes when the measurement target is outside of the measuring range or when the received light amount is insufficient.							
Operating ambient illumination		Illumination on received light surface: 3,000 lx or less (incandescent light)							
Ambient temperature		Operating: 0 to 50°C, storage: -15 to 60°C (with no icing or condensation)							
Ambient humidity		Operating and storage: 35% to 85% (with no condensation)							
Degree of protection		Cable length 0.5 m: IP66, cable length 2 m: IP67						IP40	
Materials		Case: Aluminum die-cast, front cover: Glass							
Cable length		0.5 m, 2 m							
Weight		Approx. 350 g						Approx. 400 g	
Accessories		Laser labels (1 each for JIS/EN, 3 for FDA), ferrite cores (2), insure Locks (2), instruction sheet						Laser safety labels (1 each for JIS/EN),ferrite cores (2), insure locks (2)	

*1. Defined as $1/e^2$ (13.5%) of the center optical intensity at the actual measurement center distance (effective value). The beam diameter is sometimes influenced by the ambient conditions of the workpiece, such as leaked light from the main beam.

*2. This is the error in the measured value with respect to an ideal straight line. The standard workpiece is white aluminum ceramics in diffuse reflection mode and glass in the regular reflection mode of the ZS-LD20T/40T/50. Linearity may change according to the workpiece.

*3. This is the peak-to-peak displacement conversion value in the displacement output at the measuring center distance in high-precision mode when the number of samples to average is set to 128 and the measuring mode is set to the high-resolution mode. The standard workpiece is white aluminum ceramics in diffuse reflection mode and glass in the regular reflection mode.

*4. This is the value obtained at the measuring center distance when the Sensor and workpiece are fixed by an aluminum jig.

*5. This value is obtained when the measuring mode is set to the high-speed mode.

Item	Model	ZS-LD50		ZS-LD50S		ZS-LD80		ZS-LD130		ZS-LD200		ZS-LD350S
Applicable controllers		ZS-HLDC/LDC series										
Optical system (reflection)		Diffuse	Regular	Diffuse	Regular	Diffuse	Regular	Diffuse	Regular	Diffuse	Regular	Diffuse
Measuring center distance		50 mm	47 mm	50 mm	47 mm	80 mm	78 mm	130 mm	130 mm	200 mm	200 mm	350 mm
Measuring range		±5 mm	±4 mm	±5 mm	±4 mm	±15 mm	±14 mm	±15 mm	±12 mm	±50 mm	±48 mm	±135 mm
Light source		Visible semiconductor laser (wavelength: 650 nm, 1 mW max., JIS Class 2)										
Beam shape		Line beam		Spot beam		Line beam		Line beam		Line beam		Spot beam
Beam diameter*1		900x60 µm		50 µm dia.		900x60 µm		600x70 µm		900x100 µm		240 µm dia.
Linearity*2		±0.1%F.S.							±0.25% F.S.	±0.1%F.S.	±0.25% F.S.	±0.04% F.S.
Resolution*3		0.8 µm		0.8 µm		2 µm		3 µm		5 µm		20 µm
Temperature characteristic*4		0.02% FS/°C		0.02% FS/°C		0.01% FS/°C		0.02% FS/°C		0.02% FS/°C		0.04% FS/°C
Sampling cycle*5		110 µs (high-speed mode), 500 µs (standard mode), 2.2 ms (high-precision mode), 4.4 ms (high-sensitivity mode)										
Indicators	NEAR indicator	Lights near the measuring center distance, and nearer than the measuring center distance inside the measuring range. Flashes when the measurement target is outside of the measuring range or when the received light amount is insufficient.										
	FAR indicator	Lights near the measuring center distance, and further than the measuring center distance inside the measuring range. Flashes when the measurement target is outside of the measuring range or when the received light amount is insufficient.										
Operating ambient illumination		Illumination on received light surface: 3,000 lx or less (incandescent light)						Illumination on received light surface: 2,000 lx or less (incandescent light)		Illumination on received light surface: 3,000 lx or less (incandescent light)		
Ambient temperature		Operating: 0 to 50°C, storage: -15 to 60°C (with no icing or condensation)										
Ambient humidity		Operating and storage: 35% to 85% (with no condensation)										

Item	Model	ZS-LD50	ZS-LD50S	ZS-LD80	ZS-LD130	ZS-LD200	ZS-LD350S
Degree of protection		Cable length 0.5 m: IP66, cable length 2 m: IP67					
Materials		Case: Aluminum die-cast, front cover: Glass					
Cable length		0.5 m, 2 m					
Weight		Approx. 350 g					
Accessories		Laser labels (1 each for JIS/EN, 3 for FDA), ferrite cores (2), insure Locks (2), instruction sheet					

*1. Defined as $1/e^2$ (13.5%) of the center optical intensity at the actual measurement center distance (effective value). The beam diameter is sometimes influenced by the ambient conditions of the workpiece, such as leaked light from the main beam.

*2. This is the error in the measured value with respect to an ideal straight line. The standard workpiece is white aluminum ceramics in diffuse reflection mode and glass in the regular reflection mode of the ZS-LD20T/40T/50. Linearity may change according to the workpiece.

*3. This is the peak-to-peak displacement conversion value in the displacement output at the measuring center distance in high-precision mode when the number of samples to average is set to 128 and the measuring mode is set to the high-resolution mode. The standard workpiece is white aluminum ceramics in diffuse reflection mode and glass in the regular reflection mode.

*4. This is the value obtained at the measuring center distance when the sensor and workpiece are fixed by an aluminum jig.

*5. This value is obtained when the measuring mode is set to the high-speed mode.

Sensor controllers

ZS-HLDC11/HLDC41

Sensor controllers	Model		ZS-HLDC11	ZS-HLDC41
NPN/PNP			NPN	PNP
No. of samples to average			1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1,024, 2,048, or 4,096	
Number of mounted sensors			1 per sensor controller	
External interface	Connection method		Serial I/O: connector, other: pre-wired (standard cable length: 2 m)	
	Serial I/O	USB 2.0	1 port, full speed (12 Mbps max.), MINI-B	
		RS-232C	1 port, 115,200 bps. max.	
	Output	Judgement output	HIGH/PASS/LOW 3 outputs NPN open collector, 30 VDC, 50 mA max., residual voltage 1.2 V max	HIGH/PASS/LOW: 3 outputs PNP open collector, 50 mA max., residual voltage 1.2 V max
		Linear output	Selectable from 2 types of output, voltage or current (selected by slide switch on bottom). Voltage output: .10 to 10 V, output impedance: 40 Ω Current output: 4 to 20 mA	
	Inputs	Laser OFF, ZERO reset timing, RESET	ON: Short-circuited with 0 V terminal or 1.5 V or less OFF: Open (leakage current: 0.1 mA max.)	ON: Short-circuited to supply voltage or within 1.5 V of supply voltage. OFF: Open (leakage current: 0.1 mA max.)
Functions			Display: Measured value, threshold value, voltage/current, received light amount, and resolution/terminal block output Sensing: Mode, gain, measurement object, head installation Measurement point: Average, peak, bottom, thickness, step, and calculations Filter: Smooth, average, and differentiation Outputs: Scaling, various hold values, and zero reset I/O settings: Linear (focus/correction), judgments (hysteresis and timer), non-measurement, and bank (switching and clear) System: Save, initialization, measurement information display, communications settings, key lock, language, and data load Task: Single task or multitask (up to 4)	
Status indicators			HIGH (orange), PASS (green), LOW (orange), LDON (green), ZERO (green), and ENABLE (green)	
Segment display		Main digital	8-segment red LED, 6 digits	
		Sub-digital	8-segment green LEDs, 6 digits	
LCD			16 digitsx2 rows, colour of characters: green, resolution per character: 5x8 pixel matrix	
Setting inputs		Setting keys	Direction keys (UP, DOWN, LEFT, and RIGHT), SET key, ESC key, MENU key, and function keys (1 to 4)	
		Slide switch	Threshold switch (2 states: High/Low), mode switch (3 states: FUN, TEACH, and RUN)	
Power supply voltage			21.6 V to 26.4 VDC (including ripple)	
Current consumption			0.5 A max. (when sensor head is connected)	
Ambient temperature			Operating: 0 to 50°C, storage: -15 to +60°C (with no icing or condensation)	
Ambient humidity			Operating and storage: 35% to 85% (with no condensation)	
Degree of protection			IP20	
Materials			Case: Polycarbonate (PC)	
Weight			Approx. 280 g (excluding packing materials and accessories)	
Accessories			Ferrite core (1), instruction sheet	

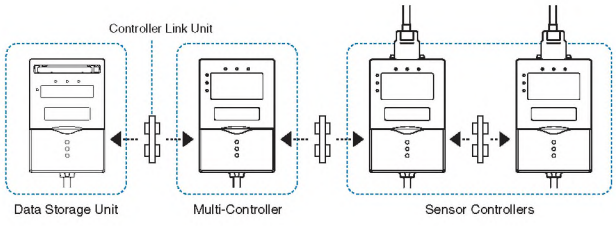
ZS-MDC11/MDC41 multi-controllers

Basic specifications are the same as those for the sensor controllers.
The following points, however, are different.

(1) Sensor heads cannot be connected.
(2) A maximum 9 of controllers can be connected. Control link units are required to connect controllers.
(3) Processing functions between controllers: Math functions

Controller link unit

Connection using the ZS-XCN



Data storage units

Sensor controllers	Model		ZS-DSU11	ZS-DSU41
Number of mounted censor heads			Cannot be connected	
Number of connectable controllers			10 controllers max. (ZS-MDC: 1 controller, ZS-HLDC: 9 controllers max.)*1	
Connectable controllers			ZS-HLDC__, ZS-MDC__	
External interface	Connection method		Serial I/O: connector, other: pre-wired (standard cable length: 2 m)	
	Serial I/O	USB 2.0	1 port, full speed (12 Mbps), MINI-B	
		RS-232C	1 port, 115,200 bps max.	
	Outputs		3 outputs: HIGH, PASS, and LOW NPN open-collector, 30 VDC, 50 mA max., residual voltage: 1.2 V max.	3 outputs: HIGH, PASS, and LOW PNP open-collector, 50 mA max., residual voltage: 1.2 V max.
	Inputs		ON: Short-circuited with 0V terminal or 1.5 V or less OFF: Open (leakage current: 0.1 mA max.)	ON: Short-circuited to supply voltage or within 1.5 V of supply voltage OFF: Open (leakage current: 0.1 mA max.)
Data resolution			32 bits	
Functions	Logging trigger functions		Start and stop triggers can be set separately; external triggers, data triggers (self-triggers), and time triggers	
	Other functions		External banks, alarm outputs, saved data format customization, and clock	
Status indicators			OUT (orange), PWR (green), ACCESS (orange), and ERR (red)	
Segment display			8-segment green LEDs, 6 digits	
LCD			16 digitsx2 rows, colour of characters: green, resolution per character: 5x8 pixel matrix	
Setting inputs		Setting keys	Direction keys (UP, DOWN, LEFT, and RIGHT), SET key, ESC key, MENU key, and function keys (1 to 4)	
		Slide switch	Threshold switch (2 states: High/Low), mode switch (3 states: FUN, TEACH, and RUN)	
Power supply voltage			21.6 V to 26.4 VDC (including ripple)	
Current consumption			0.5 A max.	
Ambient temperature			Operating: 0 to 50°C, storage: -15 to 60°C (with no icing or condensation)	
Ambient humidity			Operating and storage: 35% to 85% (with no condensation)	
Materials			Case: Polycarbonate (PC)	
Weight			Approx. 280 g (excluding packing materials and accessories)	
Accessories			Ferrite core (1) instruction sheet, tools for data storage unit: CSV file converter for data storage unit, smart analyzer macro edition (Excel macros for analysis of collected data)	

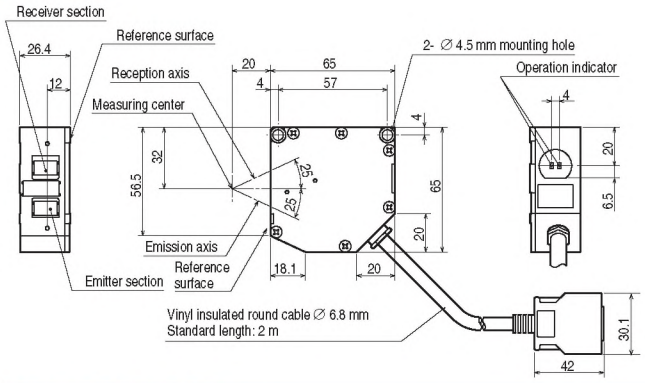
*1. Control link units are required to connect controllers.

Dimensions

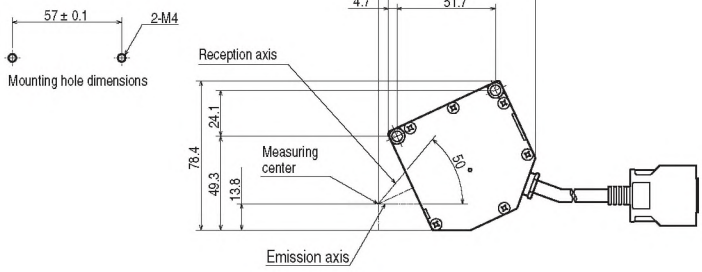
Unit: mm

Sensor heads

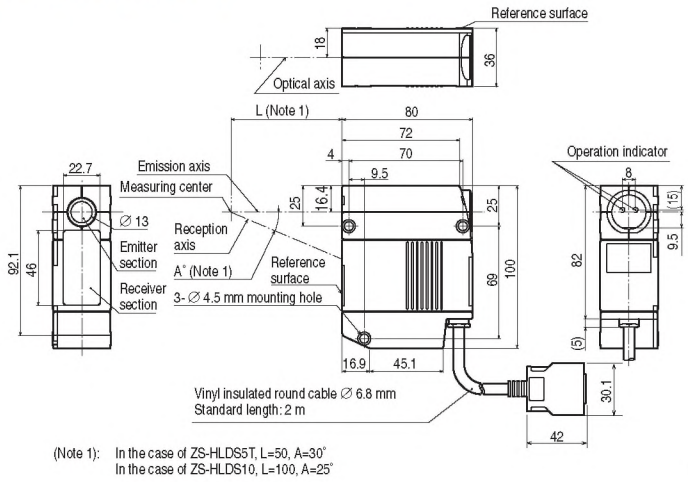
ZS-HLDS2T



When used in diffuse reflection

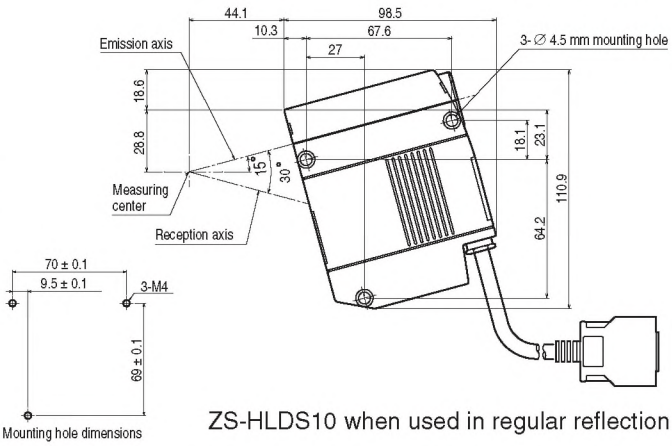


ZS-HLDS5T/HLDS10

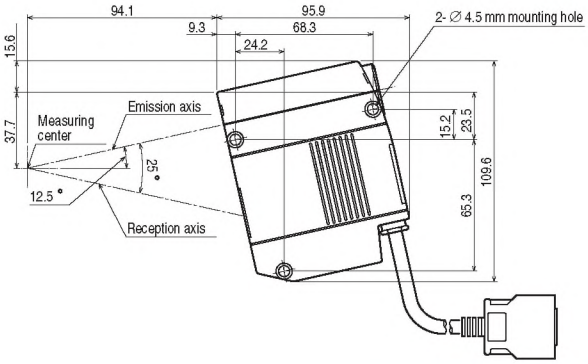


(Note 1): In the case of ZS-HLDS5T, L=50, A=30°
In the case of ZS-HLDS10, L=100, A=25°

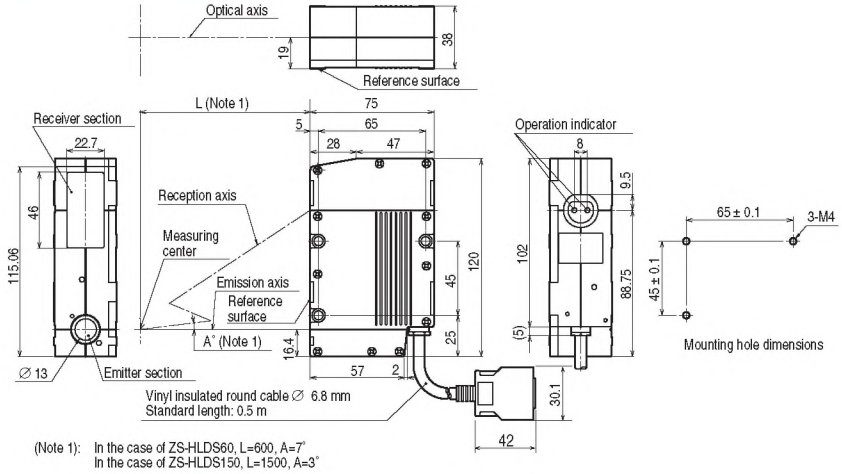
ZS-HLDS5T when used in regular reflection



ZS-HLDS10 when used in regular reflection



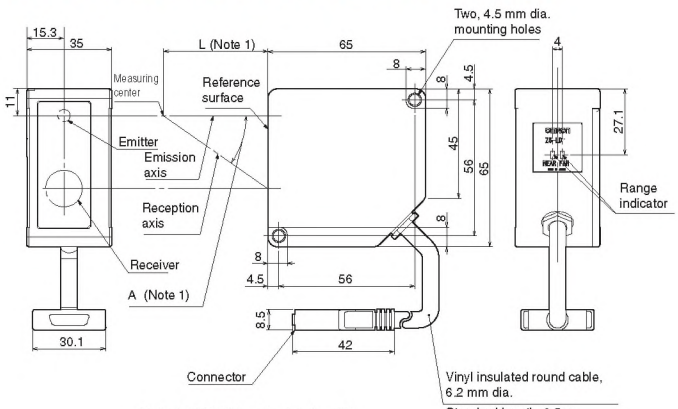
ZS-HLDS60/HLDS150

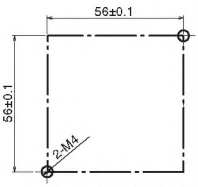


(Note 1): In the case of ZS-HLDS60, L=600, A=7°
In the case of ZS-HLDS150, L=1500, A=3°

Sensor heads

ZS-LD50/LD50S/LD80/ZS-LD130/LD200/ZS-LD350S



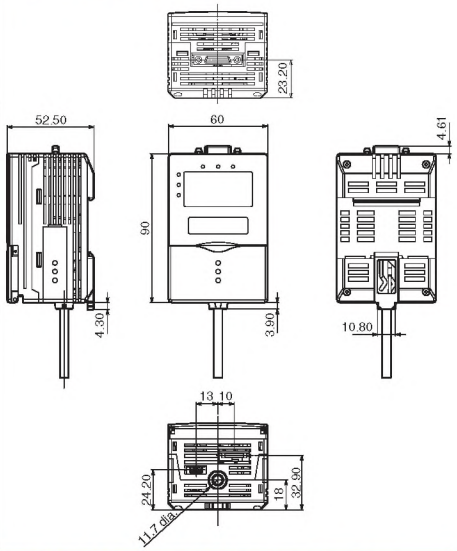


Mounting hole dimensions

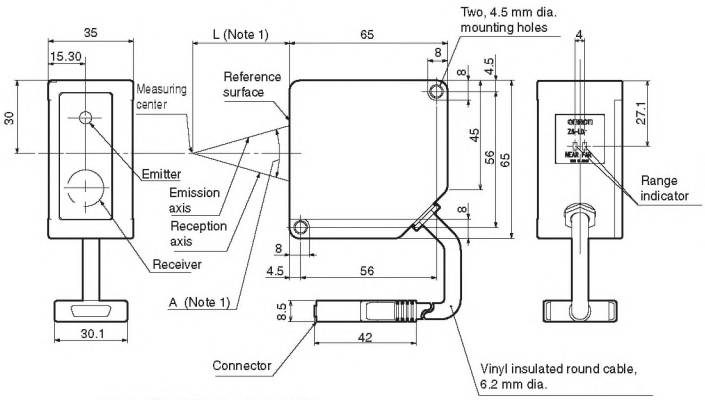
Note 1 ZS-LD50: L = 50, A = 25º
ZS-LD50S: L = 50, A = 25º
ZS-LD80: L = 80, A = 15º
ZS-LD130: L = 130, A = 12º
ZS-LD200: L = 200, A = 8º
ZS-LD350S: L = 350, A = 5º

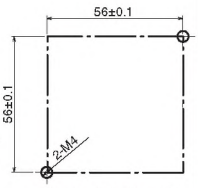
Sensor controllers

ZS-HLDC11/HLDC41



ZS-HLDS2VT/LD20T/LD20ST/LD40T

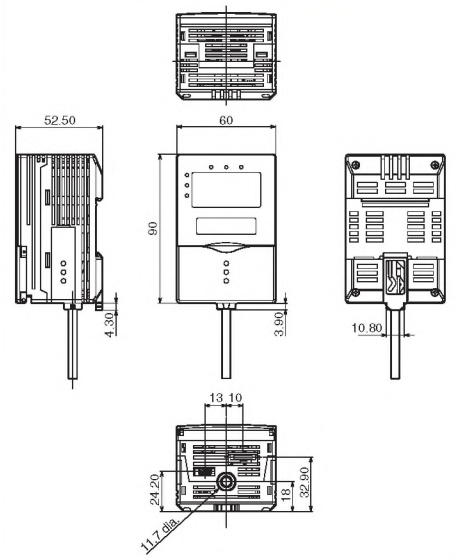




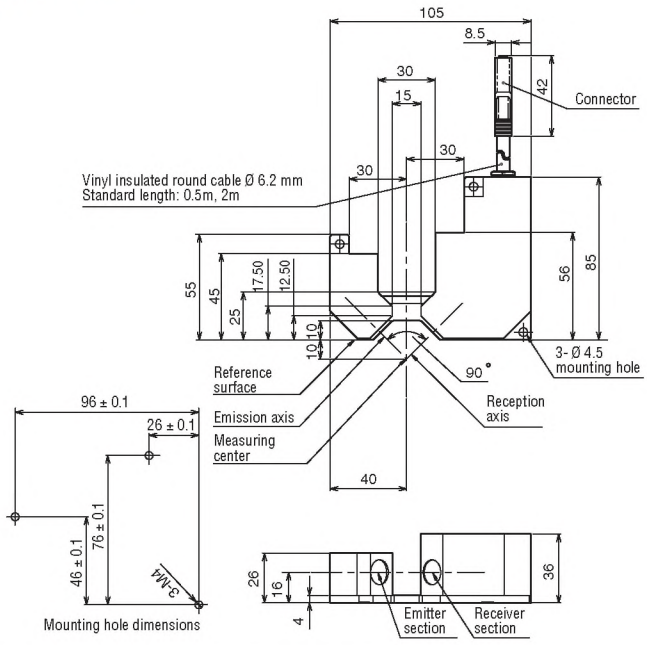
Mounting hole dimensions

Note 1 ZS-LD20T: L = 20, A = 45º
ZS-LD20ST: L = 20, A = 45º
ZS-LD40T: L = 40, A = 32º

ZS-MDC11/MDC41 Multi-Controllers

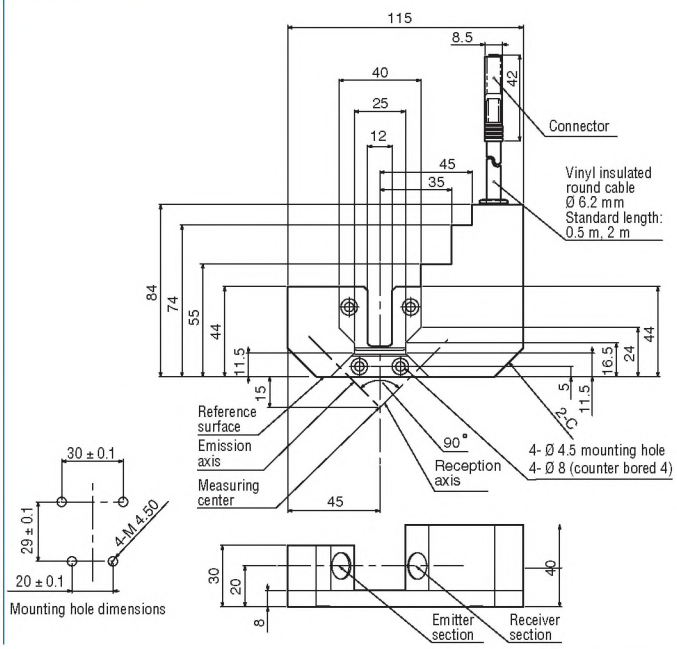


ZS-LD10GT



Mounting hole dimensions

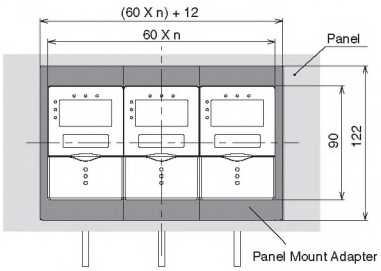
ZS-LD15GT

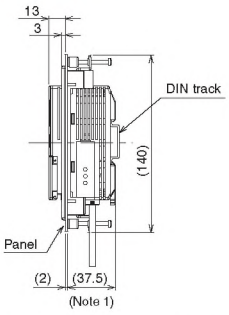


Mounting hole dimensions

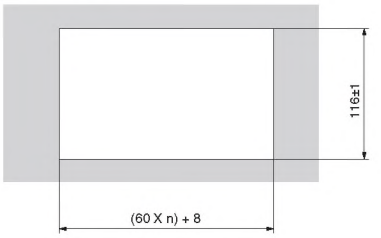
Panel mount adapters

ZS-XPM1/XPM2 (Dimension for panel mounting)





Panel cutout dimensions



Note 1: Dimensions are shown for a panel thickness of 2.0 mm.
n: Number of gang-mounted Controllers (1 to 11)

Data storage unit

ZS-DSU11/DSU41