iQSS

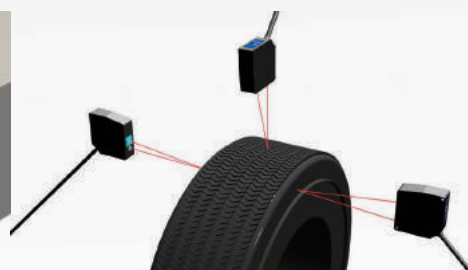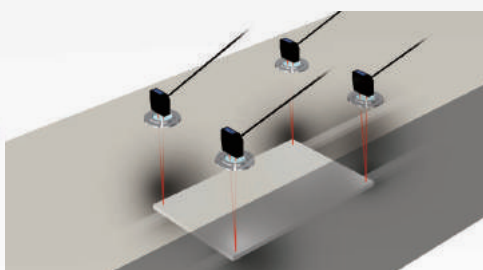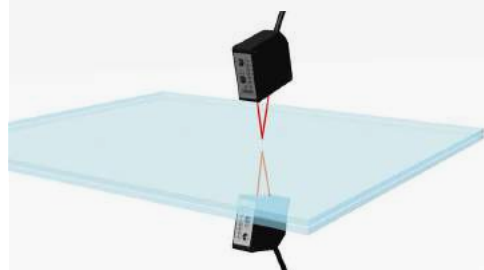# Applications Utilizing Displacement Sensors and PLCs

Displacement Sensor Control Module

UQ1 Series Applications

Electrical equipment industry

FPD/PV industry

Semiconductor industry

Electronic component industry

Automotive industry

Rubber industry

Machine industry

Metal industry

Steel industry

MITSUBISHI ELECTRIC CORPORATION ╱ OPTEX FA CO.,LTD.

Displacement Sensors ⇄ PLCs

Displacement Sensor Control Module

UQ1 Series Applications

▍What is a Laser Displacement Sensor?

A laser displacement sensor measures the distance to a target in order to obtain various measurements including height, width, thickness, minute steps, all in micron modules.

The sensor uses triangulation as its detection principle and a CMOS element as its light-receiving element.

There are two types of measurement methods, diffuse reflection and specular reflection. The specular reflection method is used for measuring transparent and specular objects.

Laser displacement sensor features

Non-contact measurement	Long-distance measurement
Minute object measurement	High-speed, high-accuracy measurement
Measurement of almost any object	

Laser displacement sensor abilities

Thickness measurement — Height measurement — Warpage/distortion measurement — Slackness measurement — Size measurement — Level control

Count/passage detection — Positioning — Step detection — Overlap detection — Transparent object detection — Profile/appearance inspection

2

Product Overview

## Displacement Sensor Control Module

UQ1 series
UQ1-01 (for CD5 series)
UQ1-02 (for CD33 series)

Traditionally, using a PLC to control a displacement sensor required complicated programming.
Using the innovative UQ1 series displacement sensor control module, however, makes it possible to connect a displacement sensor to a MELSEC-Q series module without ladder programming.

【GOT sample programs also available】
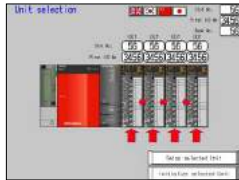
Module selection screen
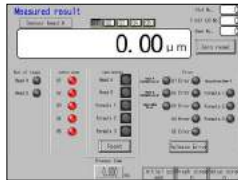
Measurement results screen

Storage data screen

Connectable CPU modules	Basic model QCPU
	High Performance model QCPU
	Universal model QCPU
	Built-in Ethernet port QCPU
	High-speed universal model QCPU
	Process CPU
	Universal process CPU
	Redundant CPU*
	C Controller module
	WinCPU module manufactured by Mitsubishi Electric
	WinCPU module manufactured by Contec
	Remote I/O station
Non-connectable CPU modules	Motion CPU
	Safety CPU

* Cannot be connected to the base module. Also, modules cannot be replaced online.

MELSEC-Q series

CD5 series

GOT series

CD33 series

Displacement Sensor Control Module
UQ1 series

24 VDC power supply

iQss
Mitsubishi Electric Partner Product

Displacement sensor

High-accuracy laser displacement sensor
CD5 series

Repeatability	Linearity	Measurement range		Laser class	Spot size	Model
0.02µm	±0.08%F.S.	Specular reflection type	25±1mm	Class 1	Approx. 25×35µm	CD5-L25
					Approx. 100×700µm	CD5-LW25
0.2µm	±0.08%F.S.	Diffuse reflection mode	30±5mm	Class 2	Approx. 30×100µm	CD5-30
0.1µm		Specular reflection mode	26.1±2.5mm			
0.2µm	±0.08%F.S.	Diffuse reflection mode	30±5mm	Class 2	Approx. 260×1000µm	CD5-W30
0.1µm		Specular reflection mode	26.1±2.5mm			
1µm	±0.05%F.S.	Diffuse reflection mode	85±20mm	Class 2	Approx. 70×290µm	CD5-85
0.5µm	±0.08%F.S.	Specular reflection mode	82.3±10mm			
1µm	±0.05%F.S.	Diffuse reflection mode	85±20mm	Class 2	Approx. 260×1200µm	CD5-W85
0.5µm	±0.08%F.S.	Specular reflection mode	82.3±10mm			
2µm	±0.05%F.S.	Diffuse reflection type	150±40mm	Class 2	Approx. φ180µm	CD5-150
					Approx. 330×1600µm	CD5-W150
5µm	±0.08%F.S.	Diffuse reflection type	350±100mm	Class 2	Approx. 700×2400µm	CD5-W350
10µm	±0.08%F.S.	Diffuse reflection type	500±200mm	Class 2	Approx. 1000×3700µm	CD5-W500
30µm	±0.1%F.S.	Diffuse reflection type	2000±500mm	Class 3R	Approx. 2100×7800µm	CD5-W2000

C-MOS laser displacement sensor
CD33 series

Repeatability	Linearity	Measurement range		Laser class	Spot size	Model
2µm	±0.1%F.S.	Diffuse reflection type	30±4mm	Class 2	Approx. 0.1×0.1mm	CD33-30N-422
5µm	±0.1%F.S.	Diffuse reflection type	50±10mm	Class 2	Approx. 0.5×1.0mm	CD33-50N-422
10µm	±0.1%F.S.	Diffuse reflection type	85±20mm	Class 2	Approx. 0.75×1.25mm	CD33-85N-422
30µm	±0.1%F.S.	Diffuse reflection type	120±60mm	Class 2	Approx. 1.0×1.5mm	CD33-120N-422
75µm	±0.3%F.S.	Diffuse reflection type	250±150mm	Class 2	Approx. 1.75×3.5mm	CD33-250N-422
1µm	±0.2%F.S.	Specular reflection type	26.3±2mm	Class 1	Approx. 0.1×0.1mm	CD33-L30N-422
2.5µm	±0.2%F.S.	Specular reflection type	47.3±5mm	Class 1	Approx. 0.1×0.1mm	CD33-L50N-422
5µm	±0.2%F.S.	Specular reflection type	82.9±10mm	Class 1	Approx. 0.1×0.1mm	CD33-L85N-422

3

Thickness measurement for substrate polishing

Electrical equipment industry | Thickness measurement
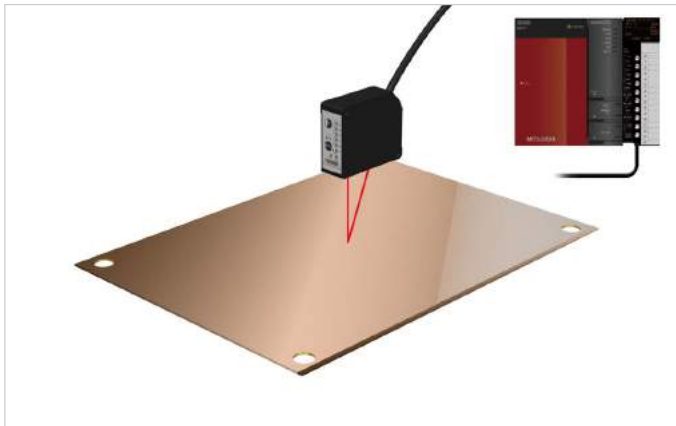
? Task

Provide feedback on the polishing amount to the polishing machine.

! Solution

Use the CD33-50□ laser displacement sensor to measure the thickness of substrates so that an accurate polishing amount can be fed back to the polishing machine.

Using the UQ1 control module allows for direct connection to a MELSEC-Q series module and also makes configuration of calculation settings easy when measuring with two sensors.

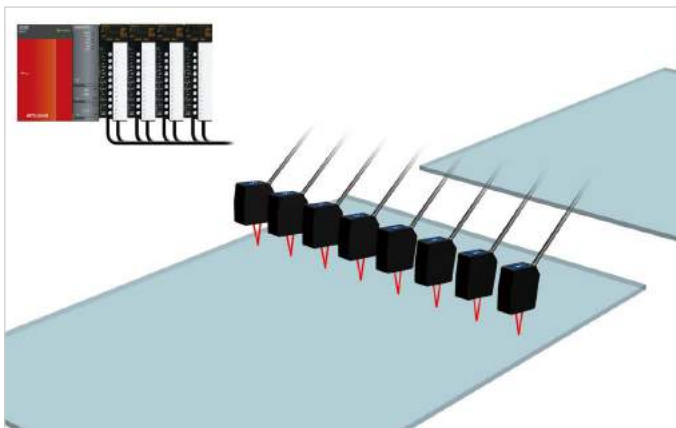**Products to use** MELSEC-Q series, UQ1-02 + CD33 series compact displacement sensor, MELSOFT Library

---

Faster glass substrate profile control

Electrical equipment industry | Profile/appearance inspection

? Task

Achieve high-precision profile control of glass substrates in a glass surface processing and inspection processes.

! Solution

Use laser displacement sensors to collect and save the height of glass surfaces at a high speed and at a certain interval (through the storage function) in order to control glass substrate profiles.

Connecting the sensors to a displacement sensor control module that can be directly connected to a MELSEC-Q series module allows for sampling at more stable intervals without being affected by the scan time (compared with a serial connection), which leads to precise profile control.

Products to use MELSEC-Q series, UQ1-01 + CD5 series high-accuracy displacement sensor, MELSOFT Library
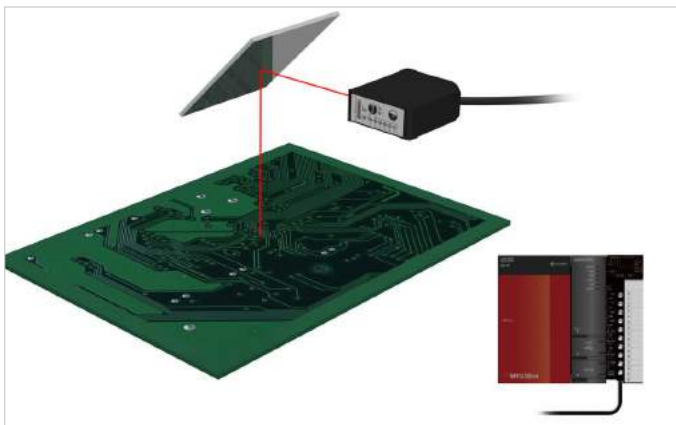

Substrate height measurement

Electrical equipment industry | Height measurement

? Task

Adjust the optical axis of a laser displacement sensor efficiently for simpler system startup.

! Solution

Use laser displacement sensors to measure the height of the substrate.

Even with a system that requires a long time to adjust the optical axis, like systems that bend laser beams 90 degrees, connecting a PC to the MELSEC-Q series module makes it possible to make adjustments while monitoring the received light waveform, meaning adjustments can be completed in even less time.

No amplifier is required for connection because the sensor is connected to a displacement sensor control module that can be directly connected to a MELSEC-Q series module.

Products to use MELSEC-Q series, UQ1-02 + CD33 series compact displacement sensor, MELSOFT Library
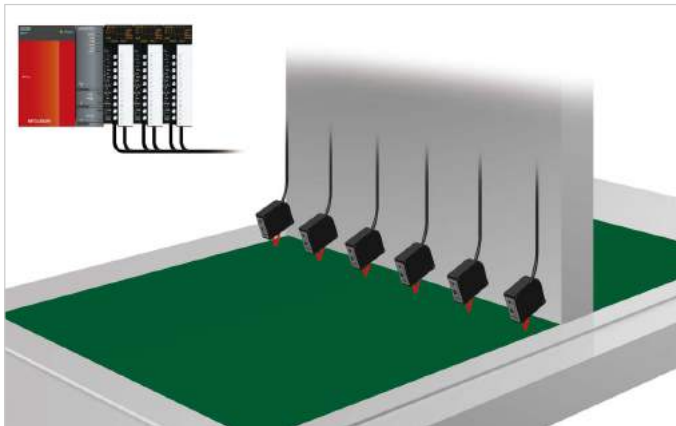
Exposure head Z-axis control

Electrical equipment industry   Positioning

❓ Task

Achieve high-precision exposure by using displacement sensors to adjust the Z axis of an exposure system.

❗ Solution

Align the Z axes of the exposure heads by using a CD33-L30 specular reflection type laser displacement sensors to measure the distance to printed boards.

The CD33 is compact and light, so it can be mounted on a movable exposure head with minimal additional load and with an alignment that does not prevent the smooth movement of the head.

In addition, by using a UQ1 displacement sensor control module, no amplifier module is required for the displacement sensor, and no I/O module is required for the PLC. This can significantly save space and costs, especially when using many displacement sensors.

❚ Products to use   MELSEC-Q series, UQ1-02 + CD33 series compact displacement sensor, MELSOFT Library
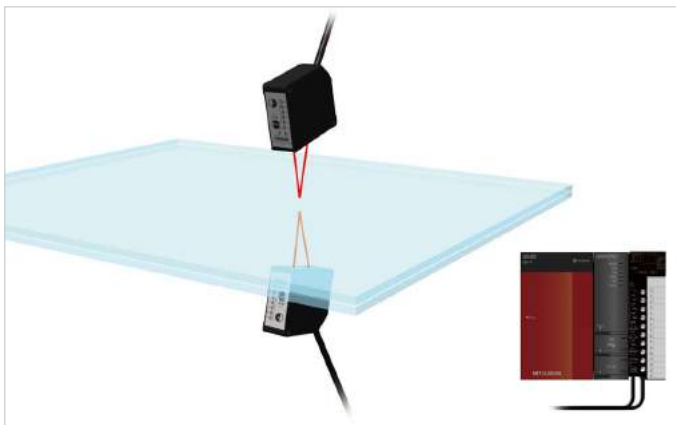

Glass substrate double-feeding detection

FPD/PV industry   Overlap detection

❓ Task

Detect any double-fed glass substrates in the transfer process.

❗ Solution

To prevent breakage, use laser displacement sensors to detect if two glass substrates have been fed simultaneously.

Measuring from above and below allows for stable measurement even with moving or vibrating workpieces.

In addition, the UQ1 displacement sensor control module includes the UQ1 Navigator software at no extra charge.

Simply select a desired thickness mode from the pull-down menu and enter a value and avoid complicated calculation settings.

❚ Products to use   MELSEC-Q series, UQ1-02 + CD33 series compact displacement sensor, MELSOFT Library
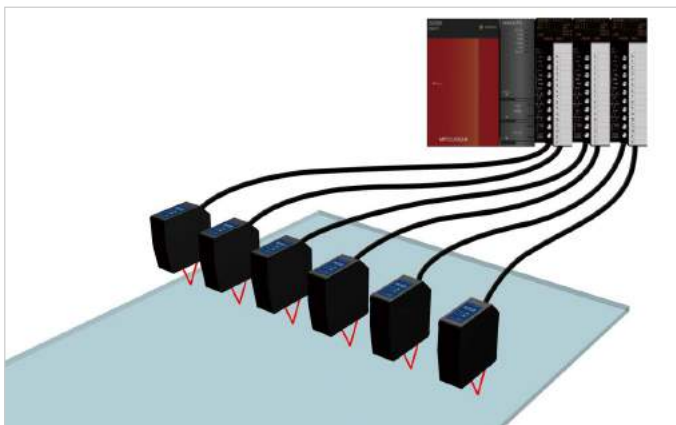

Liquid crystal glass thickness inspection

FPD/PV industry   Thickness measurement

❓ Task

Inspect the thickness of liquid crystal glass accurately and efficiently in the inspection process.

❗ Solution

Use laser displacement sensors to measure the thickness of liquid crystal glass.

Thickness will be measured through the reception of two light beams reflected from the glass, one from the front surface and the other from the rear.

Even when many laser displacement sensors are used to inspect wide workpieces, displacement sensor control modules collaborate with each other through high-speed infrared "FIrST" communication to capture data measured from other modules and to calculate the data together with its own measured data. This also makes it possible to detect if the average has deviated from the threshold.
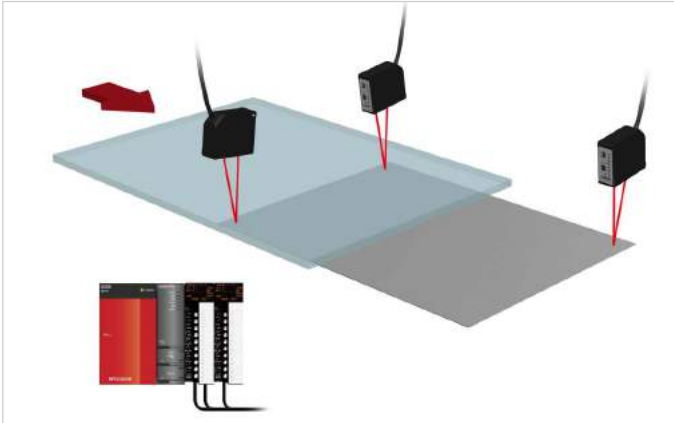
❚ Products to use   MELSEC-Q series, UQ1-01 + CD5 series high-accuracy displacement sensor, MELSOFT Library

Mask height control and glass substrate thickness measurement

FPD/PV industry · Thickness measurement

? Task

Control the height of masks and measure the thickness of glass substrates efficiently on an exposure system with a limited number of sensors.

! Solution

Use laser displacement sensors to control the height of masks and to measure the thickness of glass substrates from one side when the substrates are passing over the masks (some restrictions on glass transparency and thickness apply).

Anyone can easily and quickly set calculations that include multiple sensors because the sensors are connected to a displacement sensor control module that can be directly connected to a MELSEC-Q series module.
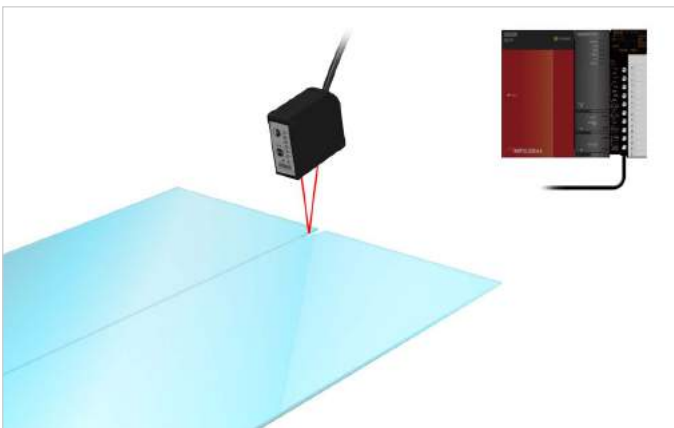
▌ Products to use   MELSEC-Q series, UQ1-02 + CD33 series compact displacement sensor, MELSOFT Library

---

Glass chipping inspection

FPD/PV industry · Profile/appearance inspection

? Task

Detect "chipping", where small chips appear on edges and other areas during glass processing.

! Solution

Use a CD33-L85 specular reflection type laser displacement sensor, which can measure transparent objects, to detect chippings on FPD glass.

Use the UQ1 as a controller to easily connect the sensor to a MELSEC-Q series module. In addition, quick sensor setup is possible by using the dedicated UQ1 Navigator setup software.
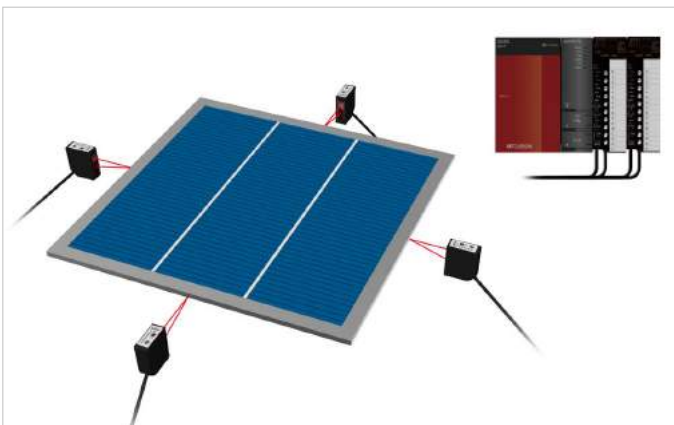
▌ Products to use   MELSEC-Q series, UQ1-02 + CD33 series compact displacement sensor, MELSOFT Library

---

Solar panel assembly accuracy inspection

FPD/PV industry · Size measurement

? Task

Inspect the accuracy of a solar panel assembly accurately and efficiently in the assembly process.

! Solution

Use laser displacement sensors to measure the accuracy of solar panel assemblies.

Workpieces can be measured with a high repeatability over long ranges even on a multi-product production line where workpiece sizes vary.

The laser displacement sensors can also be set quickly by connecting a PC to the PLC CPU.

▌ Products to use   MELSEC-Q series, UQ1-02 + CD33 series compact displacement sensor, MELSOFT Library
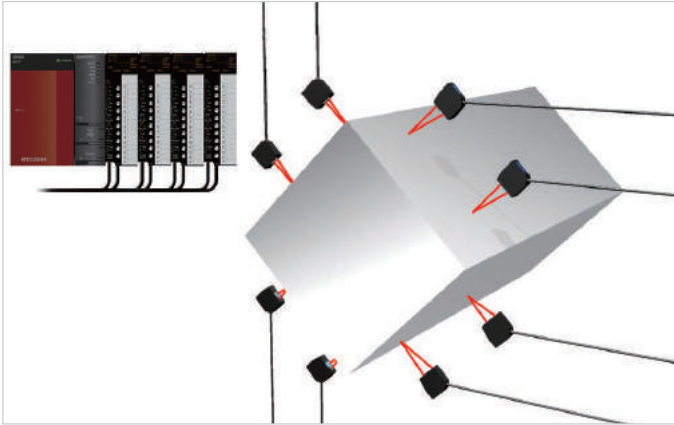
Measurement of external size of wafer ingots

Semiconductor industry — Size measurement

❓ Task

Measure the outer dimension of ingots accurately using a non-contact method.

❗ Solution

Use eight displacement sensors to inspect the outer dimension of wafer ingots.
The CD5's stable measurement function, Tri-CORE, enables stable measurement even for irregularly reflective wafers.
Use the UQ1 control module to easily set calculations even when multiple displacement sensors are used.

❙ **Products to use** MELSEC-Q series, UQ1-01 + CD5 series high-accuracy displacement sensor, MELSOFT Library
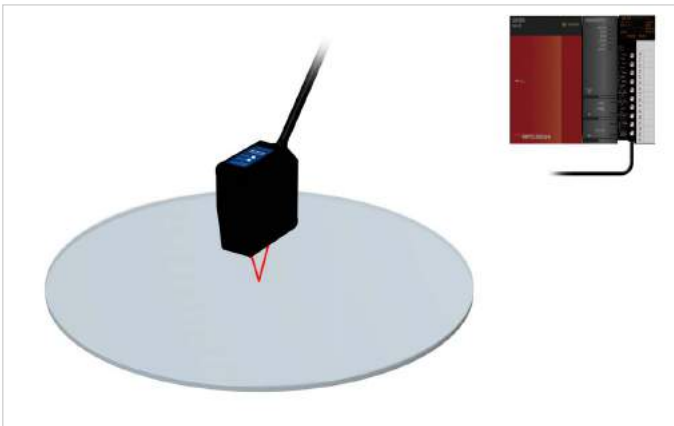
Wafer film thickness measurement

Semiconductor industry — Thickness measurement

❓ Task

Measure film thickness accurately and efficiently in the wafer inspection process.

❗ Solution

Use a laser displacement sensor to measure the thickness of films on wafers.
The sensor can be easily connected without communication programming because it is connected to a displacement sensor control module that can be directly connected to a MELSEC-Q series module.
It is also possible to quickly configure the sensor even with no knowledge of PLCs.

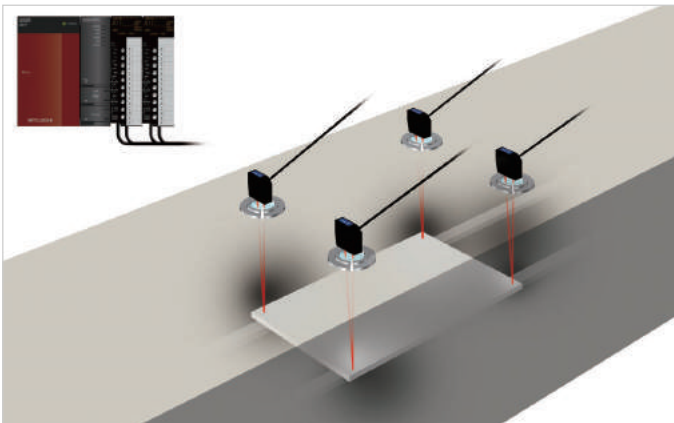❙ **Products to use** MELSEC-Q series, UQ1-01 + CD5 series high-accuracy displacement sensor, MELSOFT Library

Metal frame warpage measurement

Semiconductor industry — Warpage/distortion measurement

❓ Task

Detect warpage of metal frames in the vacuum chamber.

❗ Solution

Use CD5-W500 laser displacement sensors to measure warpage of metal frames for semiconductors in the vacuum chamber through the view port.
Because the CD5-W500 has a measurement range of 500 $\pm$ 200 mm, warpage can be measured from a long distance.
Also, using the UQ1 control module allows for direct connection to a MELSEC-Q series module and also enables quick configuration of calculation settings for multiple sensors.

❙ **Products to use** MELSEC-Q series, UQ1-01 + CD5 series high-accuracy displacement sensor, MELSOFT Library
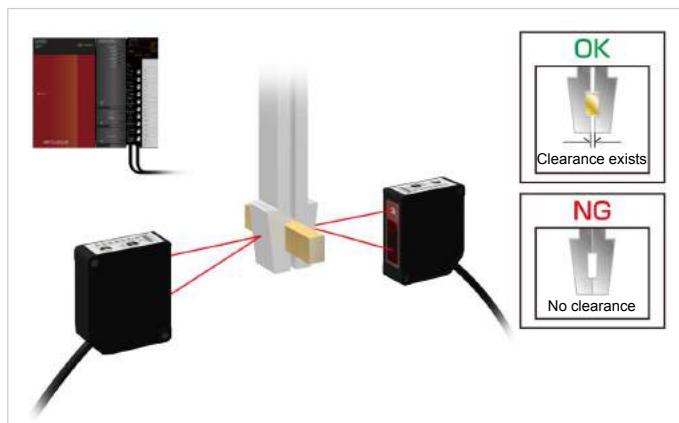
Chucking detection for minute workpieces

Electronic component industry | Thickness measurement

❓ Task

Detect chucking errors on minute workpieces.

❗ Solution

Use laser displacement sensors to measure the width of the robot arm tip (chuck) to determine if a workpiece is caught in the chuck.
No amplifier is required for connection because the sensor is connected to a displacement sensor control module that can be directly connected to a MELSEC-Q series module.
It is also possible to quickly configure the sensors even with no knowledge of ladder programming or PLCs.

OK — Clearance exists

NG — No clearance

❙ Products to use MELSEC-Q series, UQ1-02 + CD33 series compact displacement sensor, MELSOFT Library

---

Brake pad parallelism measurement

Automotive industry | Height measurement
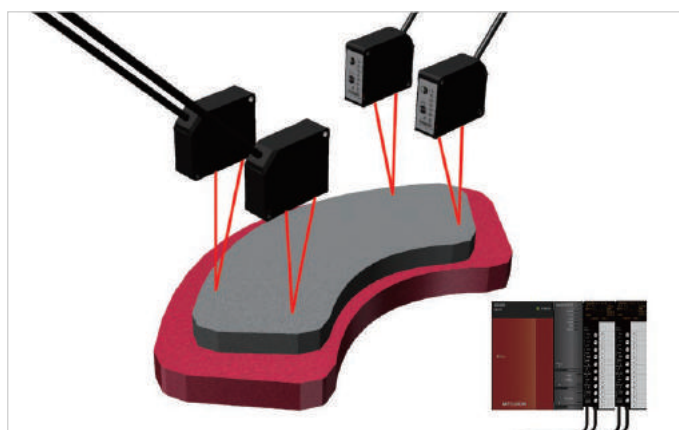
❓ Task

Measure the parallelism of brake pads using a non-contact method due to a dusty environment.

❗ Solution

Use four displacement sensors to measure the parallelism of brake pads in the post-grind process.
Because the CD33 uses a highly sensitive C-MOS element as a light receiving element, the parallelism can be measured with little influence from the color of the pads.
In addition, by using a UQ1 displacement sensor control module, no amplifier module is required for the displacement sensor, and no I/O module is required for the PLC. This, together with the low cost CD33 series, can reduce overall system costs.

❙ Products to use MELSEC-Q series, UQ1-02 + CD33 series compact displacement sensor, MELSOFT Library
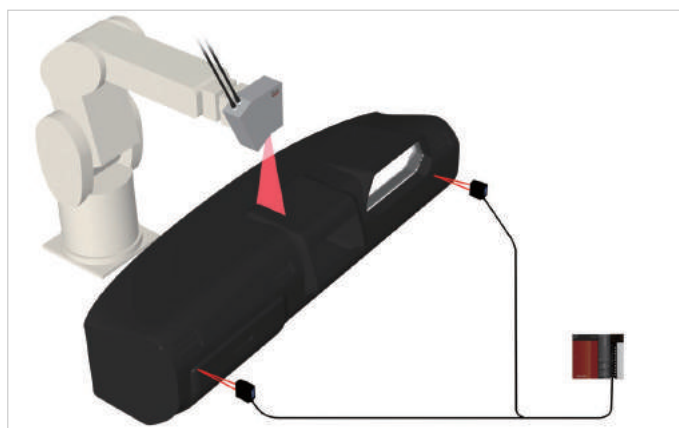

Dashboard inspection

Automotive industry | Positioning

❓ Task

Establish a high-precision profile inspection system that can also check positioning.

❗ Solution

Use the "3D-Eye35000" 3D image inspection system to inspect dashboard profiles.
Installing the 3D-Eye35000 onto a robot to scan dashboards allows for complete profile inspection.
Because measurement is possible not only in the X and Y directions (width and depth) but also the Z direction (height), defective projections and depressions can also be inspected, a task that is impossible with regular 2D cameras.
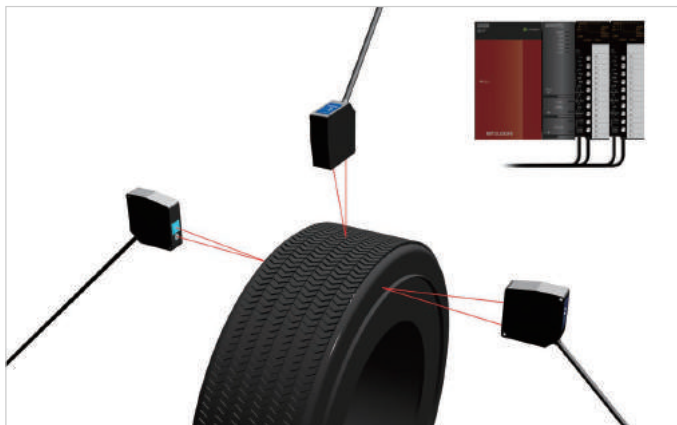Use multiple laser displacement sensors for positioning dashboards.

❙ Products to use MELSEC-Q series, 3D-Eye35000 3D image inspection system, UQ1-01 + CD5 series high-accuracy displacement sensor, MELSOFT Library

Tire appearance inspection

Task

Inspect the outer shape of completed tires.

Solution

Measure the tread surface and sidewalls for appearance defect inspection.
Use displacement sensors to measure tires rotating on a jig from three directions.
Using the UQ1 control module also enables easy calculation of measured values.

Products to use   MELSEC-Q series, UQ1-01 + CD5 series high-accuracy displacement sensor, MELSOFT Library

---

Machine industry | Height measurement

Rotation angle measurement for airplane parts

Task

Calculate the angle of rotating parts.

Solution

Use the CD5-W85 laser displacement sensor to control the rotation shaft in a non-destructive inspection system.
The angle is calculated by measuring the upper surface of high-precision parts rotating on the system. The sensor measures the processing accuracy of parts to determine whether it is within acceptable ranges.
In addition, using the UQ1 displacement sensor control module means the sensor can be connected to a MELSEC-Q series module without going through the sensor's amplifier module, thus reducing the space required within the system.

Products to use   MELSEC-Q series, UQ1-01 + CD5 series high-accuracy displacement sensor, MELSOFT Library

---

Machine industry | Warpage/distortion measurement

Grinding wheel deflection measurement
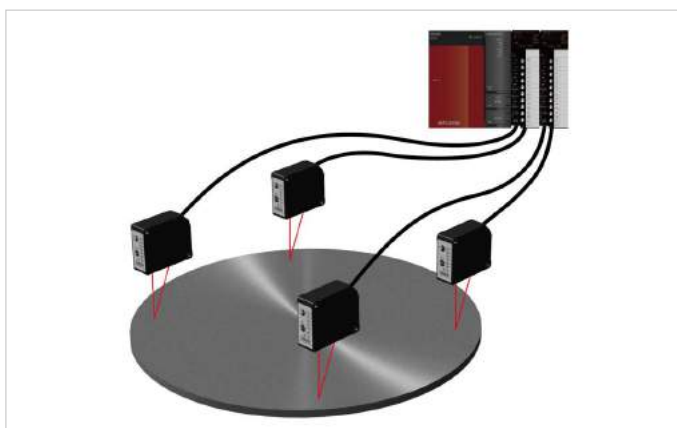
Task

Measure the deflection of rotating grinding wheels.

Solution

The CD33-50N□ allows for measurements with a repeatability of 5 μm from 50 mm away.
Using the UQ1 control module also allows for easy connection to a MELSEC-Q series module and also enables quick configuration even when using multiple sensors.

Products to use   MELSEC-Q series, UQ1-02 + CD33 series compact displacement sensor, MELSOFT Library

9

Measurement of metallic column cut length

Metal industry   Size measurement
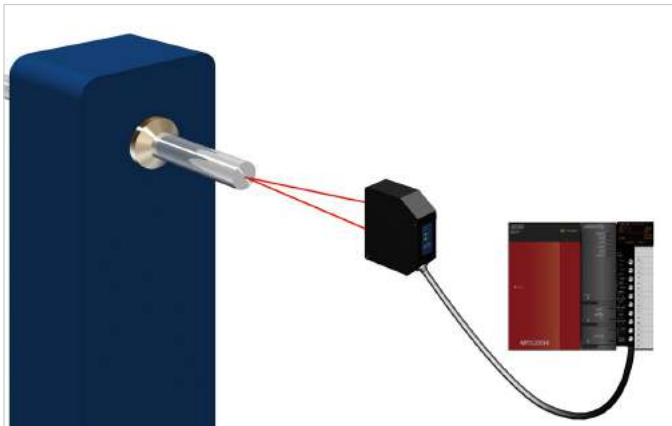
? Task

Measure the length of cut workpieces easily in a process that cuts long workpieces such as metallic columns.

! Solution

Control cut lengths by using a long-range laser displacement sensor to measure the feed rate of workpieces.

No amplifier is required for connection because the sensor is connected to a displacement sensor control module that can be directly connected to a MELSEC-Q series module.

Connecting a PC to the MELSEC-Q series module makes it possible to make adjustments while monitoring the received light waveform, meaning adjustments can be completed in even less time.
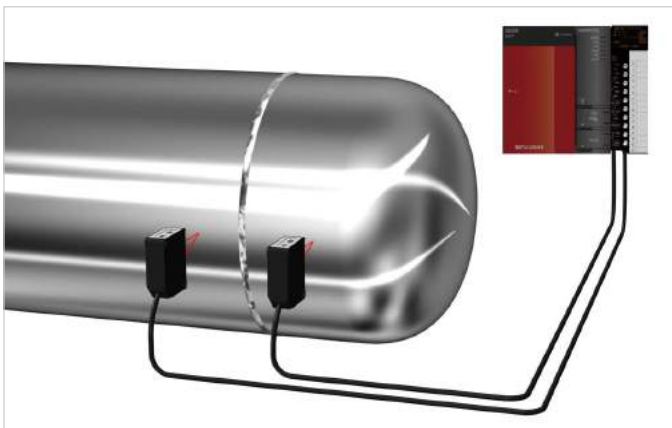
| Products to use   MELSEC-Q series, UQ1-01 + CD5 series high-accuracy displacement sensor, MELSOFT Library

---

Measurement of welded boiler misalignment

Metal industry   Step detection

? Task

Detect misalignments in height after welding to utilize the data for quality control.
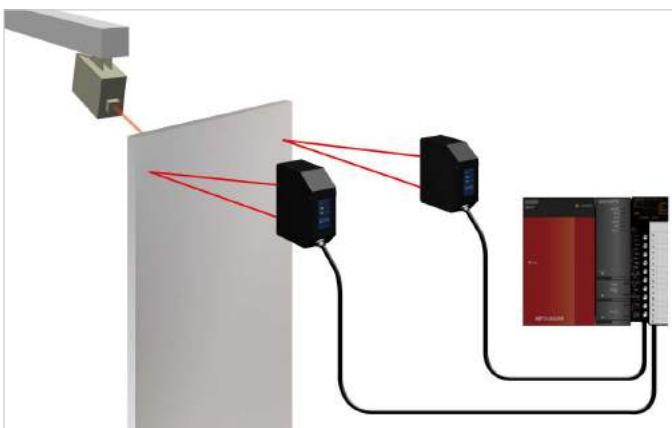
! Solution

Use CD33-120 laser displacement sensors to inspect for misalignment between welded right and left pipes in the height direction and to feed the data back to the PLC.

Using the UQ1 control module allows for direct connection to a MELSEC-Q series module and also makes configuring calculation settings for two sensors simple.

| Products to use   MELSEC-Q series, UQ1-02 + CD33 series compact displacement sensor, MELSOFT Library

---

Inclination detection for hot workpieces

Steel industry   Positioning

? Task

Detect the orientation of hot metal sheets accurately.

! Solution

Use long-range laser displacement sensors to measure the inclination amount of metal sheets and apply laser marking.

If steel sheets are hot, they can be measured from a long distance to reduce the effects of radiation heat.

The sensor can be easily connected without communication programming because it is connected to a displacement sensor control module that can be directly connected to a MELSEC-Q series module.

The displacement sensor control module can also perform high-speed calculation and judgment for two displacement sensors without applying load to the PLC CPU.

| Products to use   MELSEC-Q series, UQ1-01 + CD5 series high-accuracy displacement sensor, MELSOFT Library
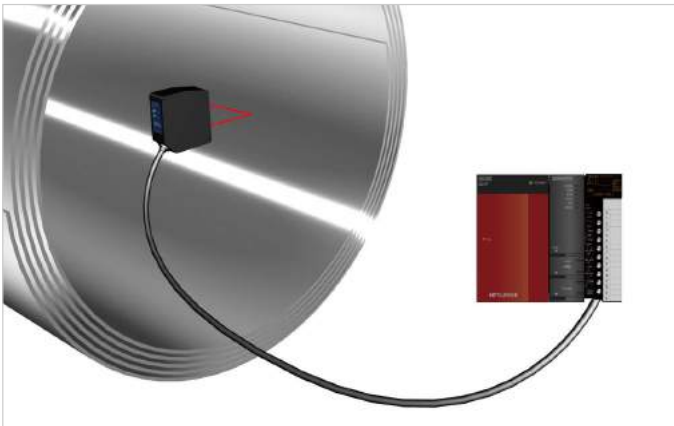
Coiler starting end/step detection

Steel industry · Step detection

❓ Task

Detect the starting ends of coilers accurately and efficiently in the labeling process.

⚠ Solution

To determine the position for labeling, use a laser displacement sensor to detect the starting end of the thin sheet inside thin sheet coils based on the step.

No amplifier is required for connection because the sensor is connected to a displacement sensor control module that can be directly connected to a MELSEC-Q series module.

In addition, using the UQ1 displacement sensor control module means the sensor can be connected to a MELSEC-Q series module without going through the sensor's amplifier module, thus reducing the space required within the system.

❙ **Products to use**   MELSEC-Q series, UQ1-01 + CD5 series high-accuracy displacement sensor, MELSOFT Library
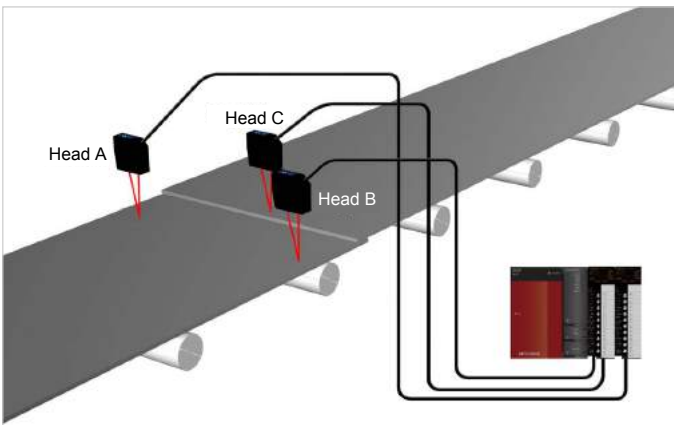

Detection for thin sheet joints

Steel industry · Step detection

Head A · Head C · Head B

❓ Task

Detect joints without being affected by deflection in the thin sheets.

⚠ Solution

Use the CD5-W150 laser displacement sensors to detect joints in thin sheets.

Data measured by sensor heads A and B are calculated to detect for sheet deflection, and if no deflection is found, data measured by sensor heads A and C are calculated to detect joints (steps).

Using the UQ1 displacement sensor control module allows for direct connection to a MELSEC-Q series module and also makes configuring calculation settings for multiple sensors simple.

❙ **Products to use**   MELSEC-Q series, UQ1-01 + CD5 series high-accuracy displacement sensor, MELSOFT Library

---

Thickness measurement of aluminum materials

Steel industry · Thickness measurement
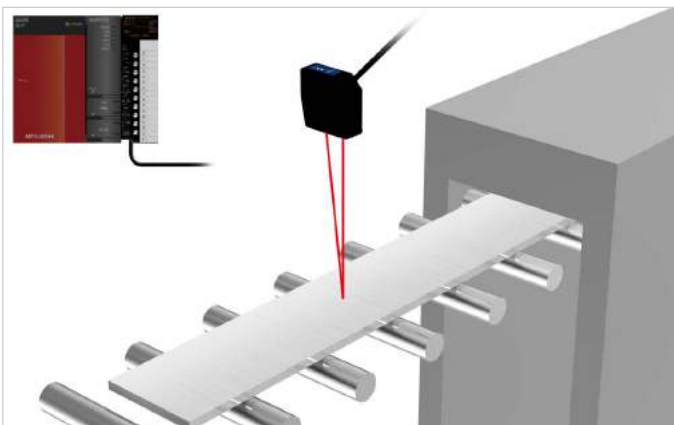
❓ Task

Record measurement data from thickness measurements of aluminum materials.

⚠ Solution

Use the CD5-W500 laser displacement sensor to measure the thickness of aluminum materials for traceability checking.

Using the UQ1 displacement sensor control module, which includes a storage function, makes it possible to save more than 260,000 data records.

Records can also be output to a CSV file, which allows for easy checking of traceability.

❙ **Products to use**   MELSEC-Q series, UQ1-01 + CD5 series high-accuracy displacement sensor, MELSOFT Library

MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE: TOKYO BUILDING, 2-7-3, MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, JAPAN
NAGOYA WORKS: 1-14, YADA-MINAMI 5, HIGASHI-KU, NAGOYA, JAPAN

Country/Region	Sales office	Tel/Fax
USA	MITSUBISHI ELECTRIC AUTOMATION, INC. 500 Corporate Woods Parkway, Vernon Hills, IL 60061, U.S.A.	Tel : +1-847-478-2100 Fax : +1-847-478-2253
Mexico	MITSUBISHI ELECTRIC AUTOMATION, INC. Mexico Branch Mariano Escobedo #69, Col. Zona Industrial, Tlalnepantla Edo, C.P.54030, Mexico	Tel : +52-55-3067-7500
Brazil	MITSUBISHI ELECTRIC DO BRASIL COMÉRCIO E SERVIÇOS LTDA. Rua Jussara, 1750-Bloco B Anexo, Jardim Santa Cecilia, CEP 06465-070, Barueri-SP, Brasil	Tel : +55-11-4689-3000 Fax : +55-11-4689-3016
Germany	MITSUBISHI ELECTRIC EUROPE B.V. German Branch Gothaer Strasse 8, D-40880 Ratingen, Germany	Tel : +49-2102-486-0 Fax : +49-2102-486-1120
UK	MITSUBISHI ELECTRIC EUROPE B.V. UK Branch Travellers Lane, Hatfield, Hertfordshire, AL10 8XB, U.K.	Tel : +44-1707-28-8780 Fax : +44-1707-27-8695
Ireland	MITSUBISHI ELECTRIC EUROPE B.V. Irish Branch Westgate Business Park, Ballymount, IRL-Dublin 24, Ireland	Tel : +353-1-4198800 Fax : +353-1-4198890
Italy	MITSUBISHI ELECTRIC EUROPE B.V. Italian Branch Centro Direzionale Colleoni-Palazzo Sirio Viale Colleoni 7, 20864 Agrate Brianza(Milano) Italy	Tel : +39-039-60531 Fax : +39-039-6053-312
Spain	MITSUBISHI ELECTRIC EUROPE, B.V. Spanish Branch Carretera de Rubí, 76-80-Apdo. 420, 08173 Sant Cugat del Vallés (Barcelona), Spain	Tel : +34-935-65-3131 Fax : +34-935-89-1579
France	MITSUBISHI ELECTRIC EUROPE B.V. French Branch 25, Boulevard des Bouvets, F-92741 Nanterre Cedex, France	Tel : +33-1-55-68-55-68 Fax : +33-1-55-68-57-57
Czech Republic	MITSUBISHI ELECTRIC EUROPE B.V. Czech Branch Avenir Business Park, Radlicka 751/113e, 158 00 Praha5, Czech Republic	Tel : +420-251-551-470 Fax : +420-251-551-471
Poland	MITSUBISHI ELECTRIC EUROPE B.V. Polish Branch ul. Krakowska 50, 32-083 Balice, Poland	Tel : +48-12-630-47-00 Fax : +48-12-630-47-01
Sweden	MITSUBISHI ELECTRIC EUROPE B.V. (Scandinavia) Fjelievägen 8, SE-22736 Lund, Sweden	Tel : +46-8-625-10-00 Fax : +46-46-39-70-18
Russia	MITSUBISHI ELECTRIC EUROPE B.V. Russian Branch St. Petersburg office Piskarevsky pr. 2, bld 2, lit "Sch", BC "Benua", office 720; RU-195027 St. Petersburg, Russia	Tel : +7-812-633-3497 Fax : +7-812-633-3499
Turkey	MITSUBISHI ELECTRIC TURKEY A.Ş Ümraniye Branch Serifali Mahallesi Nutuk Sokak No:5, TR-34775 Umraniye, Istanbul, Turkey	Tel : +90-216-526-3990 Fax : +90 -216-526-3995
Dubai	MITSUBISHI ELECTRIC EUROPE B.V. Dubai Branch Dubai Silicon Oasis, P.O.BOX 341241, Dubai, U.A.E.	Tel : +971-4-3724716 Fax : +971-4-3724721
South Africa	ADROIT TECHNOLOGIES 20 Waterford Office Park, 189 Witkoppen Road, Fourways, Johannesburg, South Africa	Tel : +27-11-658-8100 Fax : +27-11-658-8101
China	MITSUBISHI ELECTRIC AUTOMATION (CHINA) LTD. No.1386 Hongqiao Road, Mitsubishi Electric Automation Center, Shanghai, China	Tel : +86-21-2322-3030 Fax : +86-21-2322-3000
Taiwan	SETSUYO ENTERPRISE CO., LTD. 6F, No.105, Wugong 3rd Road, Wugu District, New Taipei City 24889, Taiwan, R.O.C.	Tel : +886-2-2299-2499 Fax : +886-2-2299-2509
Korea	MITSUBISHI ELECTRIC AUTOMATION KOREA CO., LTD. 7F-9F, Gangseo Hangang Xi-tower A, 401, Yangcheon-ro, Gangseo-Gu, Seoul 157-801, Korea	Tel : +82-2-3660-9530 Fax : +82-2-3664-8372
Singapore	MITSUBISHI ELECTRIC ASIA PTE. LTD. 307, Alexandra Road, Mitsubishi Electric Building, Singapore 159943	Tel : +65-6473-2308 Fax : +65-6476-7439
Thailand	MITSUBISHI ELECTRIC FACTORY AUTOMATION (THAILAND) CO., LTD. 12th Floor, SV.City Building, Office Tower 1, No. 896/19 and 20 Rama 3 Road, Kwaeng Bangpongpang, Khet Yannawa, Bangkok 10120, Thailand	Tel : +66-2682-6522 Fax : +66-2682-6020
Vietnam	MITSUBISHI ELECTRIC VIETNAM COMPANY LIMITED Hanoi Branch 6-Floor, Detech Tower, 8 Ton That Thuyet Street, My Dinh 2 Ward, Nam Tu Liem District, Hanoi, Vietnam	Tel : +84-4-3937-8075 Fax : +84-4-3937-8076
Indonesia	PT. MITSUBISHI ELECTRIC INDONESIA Gedung Jaya 11th Floor, JL. MH. Thamrin No.12, Jakarta Pusat 10340, Indonesia	Tel : +62-21-3192-6461 Fax : +62-21-3192-3942
India	MITSUBISHI ELECTRIC INDIA PVT. LTD. Pune Branch Emerald House, EL-3, J Block, M.I.D.C Bhosari, Pune-411026, Maharashtra, India	Tel : +91-20-2710-2000 Fax : +91-20-2710-2100
Australia	MITSUBISHI ELECTRIC AUSTRALIA PTY. LTD. 348 Victoria Road, P.O. Box 11, Rydalmere, N.S.W 2116, Australia	Tel : +61-2-9684-7777 Fax : +61-2-9684-7245

OPTEX FA CO.,LTD.

600-8815 Kyoto, Shimogyo, Chudoji Awata 91, Japan
TEL. +81- (0)75-325-1314 FAX. +81- (0)75-325-2921

74673-01-003-1505

| Ramco National | 800-280-6933 | nsales@ramcoi.com | www.Optex-Ramco.com |