

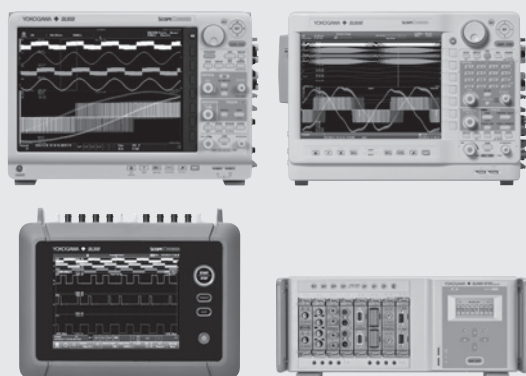
Plug-in modules specifications

ScopeCorder series

DL950/SL2000/DL850E/DL850EV/DL350/SL1000

Precision Making

Bulletin DL950-02EN



Module Selection^{*1}

Input	Model No.	Sample rate	Resolution	Bandwidth	Number of channels	Isolation	Maximum measurement voltage ^{**1} (DC + ACpeak)	DC accuracy	Note
Analog Voltage	720212 ^③	200 MS/s	14 bit	40 MHz	2	Isolated	1000 V ^② , 200 V ^⑤	±0.5%	High speed, high voltage, isolated
	720211 ^③	100 MS/s	12 bit	20 MHz	2	Isolated	1000 V ^② , 200 V ^⑤	±0.5%	High speed, high voltage, isolated
	720250	10 MS/s	12 bit	3 MHz	2	Isolated	800 V ^② , 200 V ^⑤	±0.5%	High noise immunity
	701251	1 MS/s	16 bit	300 kHz	2	Isolated	600 V ^② , 140 V ^⑤	±0.25%	High sensitivity range (1 mV/div), low noise (±100 μVtyp.), and high noise immunity
	720256	10 MS/s	16 bit	3 MHz	4	Isolated	600 V ^② , 200 V ^⑤	±0.25%	4 CH BNC input low noise, high noise immunity
	720254	1 MS/s	16 bit	300 kHz	4	Isolated	600 V ^② , 200 V ^⑤	±0.25%	4 CH BNC input low noise, high noise immunity
	701255	10 MS/s	12 bit	3 MHz	2	Non-Isolated	600 V ^④ , 200 V ^③	±0.5%	High speed, non-isolated
	720268	1 MS/s	16 bit	300 kHz	2	Isolated	1000 V ^⑩	±0.25%	With AAF, RMS, and high noise immunity
Analog Voltage & Temperature	720220	200 kS/s	16 bit	5 kHz	16	Isolated (GND-terminal) non-isolated (CH-CH)	20 V ^③	±0.3%	16 CH voltage measurement (Scan-type)
	701261	100 kS/s (Voltage), 500 S/s (Temperature)	16 bit (Voltage), 0.1°C (Temperature)	40 kHz (Voltage), 100 Hz (Temperature)	2	Isolated	42 V	±0.25% (Voltage)	Thermocouple (K, E, J, T, L, U, N, R, S, B, W, KP/AuFe)
	701262	100 kS/s (Voltage), 500 S/s (Temperature)	16 bit (Voltage), 0.1°C (Temperature)	40 kHz (Voltage), 100 Hz (Temperature)	2	Isolated	42 V	±0.25% (Voltage)	Thermocouple (K, E, J, T, L, U, N, R, S, B, W, KP/AuFe), with AAF
	701265	500 S/s (Voltage), 500 S/s (Temperature)	16 bit (Voltage), 0.1°C (Temperature)	100 Hz	2	Isolated	42 V	±0.08 (Voltage)	Thermocouple (K, E, J, T, L, U, N, R, S, B, W, KP/AuFe), high sensitivity range (0.1 mV/div)
	720266	125 S/s (Voltage), 125 S/s (Temperature)	16 bit (Voltage), 0.1°C (Temperature)	15 Hz	2	Isolated	42 V	±0.08 (Voltage)	Thermocouple (K, E, J, T, L, U, N, R, S, B, W, KP/AuFe), high sensitivity range (0.1 mV/div), Low noise
Strain	720221 ^⑧	10 S/s	16 bit	600 Hz	16	Isolated	20 V	±0.15% (Voltage)	16 CH voltage or temperature measurement (scan method) Thermocouple (K, E, J, T, L, U, N, R, S, B, W, KP/AuFe)
	701270	100 kS/s	16 bit	20 kHz	2	Isolated	10 V	±0.5% (Strain)	Supports strain NDIS, 2, 5, 10 V built-in bridge power supply
Analog Voltage, Acceleration	701271	100 kS/s	16 bit	20 kHz	2	Isolated	10 V	±0.5% (Strain)	Supports strain DSUB, 2, 5, 10 V built-in bridge power supply, and shunt CAL
	701275	100 kS/s	16 bit	40 kHz	2	Isolated	42 V	±0.25% (Voltage) ±0.5% (Acceleration)	Built-in anti-aliasing filter, Supports built-in amp type acceleration sensors (4 mA/22 V)
Frequency	720281	1 MS/s	16 bit	resolution 625 ps	2	Isolated	420 V ^② , 42 V ^③	±0.1% (Frequency)	Measurement frequency of 0.01 Hz to 500 kHz, Measured parameters (frequency, RPMs, RPSs, period, duty cycle, power supply frequency, pulse width, pulse integration, and velocity)
Logic	720230	10 MS/s	—	—	8 bit × 2 ports	non-isolated	depend on logic probe used.	—	(8 bit/port) × 2, compatible with four types of logic probe (sold separately)
CAN/ CAN FD/ LIN	720245	100 kS/s	—	—	(60 signals × 2) port	Isolated	10 V (CAN port) 18 V (LIN port)	—	CAN/CAN FD port × 2, CAN/CAN FD Data of maximum 32-bit allowable, LIN port × 2 CAN FD/LIN switchable on each port separately Available for DL950/VCE, SL2000/VCE and DL350 /VE option. ^{⑥ 7}
SENT	720243	100 kS/s	—	—	11 data × 2 ports	Isolated	42 V	—	Supported protocol: SAE J2716. Available for DL950/VCE, SL2000/VCE and DL350 /VE option. ^{⑥ 7}

*1: Probes are not included with any modules.

*2: In combination with 700929, 702902, or 701947 probe.

*3: Direct input

*4: In combination with 10:1 probe model 701940

*5: In combination with 701901 + 701954.

*6: Any other modules can be installed in the remaining slots.

*7: When using these modules with DL950/VCE or SL2000/VCE or DL850EV, up to four, CAN & LIN Bus Monitor Modules (720241), CAN/CAN FD Monitor Modules (720242), CAN FD/LIN Monitor Module (720245) or SENT Monitor Modules (720243) total can be used on a single main unit. For the CAN & LIN Bus Monitor Modules (720241), CAN/CAN FD monitor modules (720242), CAN FD/LIN Monitor Module (720245), up to two in total can be used on a single main unit.

*8: The 16 CH Scanner Box (701953) is required for measurement.

*9: Class 1 Laser Product, IEC60825-1:2014+A11:2021, IEC 60825-1:2014, GB 7247.1-2024

*10: In combination with 758933 and 701954. 1000 Vrms (1000 VDC or 1414 Vpeak maximum) when using with DL950 or SL2000 or DL350. 850V (DC + ACpeak) when using with DL850/DL850V/DL850E/DL850EV or SL1000.

*11: See the main specifications for voltage-axis sensitivity setting and measurement range.

Compatibility between plug-in modules and main units

Plug-in Module			Main Unit					
Model	Name	Remark	DL950	SL2000	DL350	DL850E	DL850EV	SL1000
720212	High-speed 200 MS/s 14 Bit Isolation Module		Yes	Yes	No	No	No	No
720210	High-speed 100 MS/s 12 Bit Isolation Module	Discontinued	No	No	No	Yes	Yes	Yes
720211	High-speed 100 MS/s 12 Bit Isolation Module		Yes	Yes	Yes	Yes	Yes	Yes
701250	High-speed 10 MS/s 12 Bit Isolation Module	Discontinued	Yes	Yes	No	Yes	Yes	Yes
720250	High-speed 10 MS/s 12 Bit Isolation Module		Yes	Yes	Yes	Yes	Yes	Yes
701251	High-speed 1 MS/s 16 Bit Isolation Module		Yes	Yes	No	Yes	Yes	Yes
720256	4 CH 10 MS/s 16 Bit Isolation Module		Yes	Yes	No	No	No	No
720254	4 CH 1 MS/s 16 Bit Isolation Module		Yes	Yes	Yes	Yes	Yes	No
701255	High-speed 10 MS/s 12 Bit Non-Isolation Module		Yes	Yes	No	Yes	Yes	Yes
701267	High-voltage 100 kS/s 16 Bit Isolation Module (with RMS)	Discontinued	No	No	No	Yes	Yes	Yes
720268	High-voltage 1 MS/s 16 Bit Isolation Module (with AAF, RMS)		Yes	Yes	Yes	Yes	Yes	Yes
720220	16 CH Voltage Input Module		No	Yes	Yes	Yes	Yes	No
701261	Universal Module		Yes	Yes	Yes	Yes	Yes	Yes
701262	Universal Module (with AAF)		Yes	Yes	Yes	Yes	Yes	Yes
701265	Temperature/High-Precision Voltage Module		Yes	Yes	Yes	Yes	Yes	Yes
720266	Temperature/High-Precision Voltage Isolation Module (Low Noise)		Yes	Yes	Yes	Yes	Yes	Yes
720221	16 CH Temperature/Voltage Input Module		Yes	Yes	Yes	Yes	Yes	No
701270	Strain Module (NDIS)		Yes	Yes	Yes	Yes	Yes	Yes
701271	Strain Module (DSUB, Shunt-CAL)		Yes	Yes	Yes	Yes	Yes	Yes
701275	Acceleration/Voltage Module (with AAF)		Yes	Yes	Yes	Yes	Yes	Yes
701281	Frequency Module	Discontinued	Yes	Yes	No	Yes	Yes	Yes
720281	Frequency Module		Yes	Yes	Yes	Yes	Yes	Yes
720230	Logic Input Module		Yes	Yes	Yes	Yes	Yes	No
720240	CAN Bus Monitor Module	Discontinued	Yes	Yes	Yes	No	Yes	No
720245	CAN FD/LIN Monitor Module		Yes	Yes	Yes	No	No	No
720242	CAN/CAN FD Monitor Module	Discontinued	Yes	Yes	Yes	No	Yes	No
720241	CAN & LIN Bus Monitor Module	Discontinued	Yes	Yes	Yes	No	Yes	No
720243	SENT Monitor Module		Yes	Yes	Yes	No	Yes	No

Note:

- Probes are not included with any modules.
- The use of a 720221 module requires an External Scanner Box (model 701953).
- Firmware update may be required depending the module used.
- The A/E option is required when using a 720240, 720241, 720242, 720243, or 720245 module with a DL350.
- The A/CE option is required when using a 720240, 720241, 720242, 720243, or 720245 module with a DL950 and SL2000.
- Refer to the note on page 17 when using a 720254 module with a DL850E or DL850EV.
- If 720254 is shipped before June 2025 and inserted into the SL2000, the SL2000 will not comply with CE marking (EMC).
- If 720211 is shipped before July 2023 and inserted into the SL2000, the SL2000 will not comply with CE marking (EMC).

Main Specifications (plug-in modules)

*1: Under standard operating conditions (temperature of 23°C ± 5°C, 20 to 80% RH, warm-up of 30 minutes or more), after calibration. Recommended calibration period: 1 year.
Note that the strain modules (701270/71) must be balanced.
*2 to *11: See the figure on page 9 for notes on the maximum input voltage and maximum rated voltage to earth.
*12: See the figure on page 9 for the voltage-axis sensitivity setting.

High-speed 200 MS/s 14 Bit Isolation Module (720212)		
Input channels	2	
Input type	Isolated unbalanced	
Input coupling	AC, DC, and GND	
Input connector	BNC connector (isolated type)	
Input impedance	1 MΩ ±1%, approx. 35 pF	
Maximum sample rate	200 MS/s	
Frequency rage (−3 dB) ^{*1}	DC to 40 MHz	
A/D conversion resolution	14 bit (600 LSB/div)	
Voltage-axis sensitivity setting ^{*12}	Direct input: 10 mV/div to 20 V/div (1-2-5 steps)	
Maximum input voltage (1 kHz or less)		
In combination with 700929 (10:1)/702902 (10:1)/701947 (100:1) ^{*2}	1000 V (DC + ACpeak)	
In combination with 701901 + 701954 (1:1) ^{*9}	200 V (DC + ACpeak)	
Direct input ^{*10}	42 V (DC + ACpeak)	
Maximum rated voltage to earth (1 kHz or less)		
In combination with 700929 (10:1)/702902 (10:1)/701947 (100:1) ^{*3}	1000 Vrms (CAT II)	
In combination with 701901 + 701954 (1:1) ^{*9}	1000 Vrms (CAT I)	
Direct input ^{*11}	42 V (DC + ACpeak)	
−3 dB point when AC coupled low frequency attenuation point	10 Hz or less	
Vertical (voltage) axis accuracy ^{*1}	DC accuracy: ±(0.5% of 10 div)	
Common mode rejection ratio	80 dB (50/60 Hz) or more (Typ.)	
Temperature coefficient	Zero point: ±(0.1% of 10 div)/°C (Typ.) Gain: ±(0.05% of 10 div)/°C (Typ.)	
Bandwidth limit	FULL/5 MHz/2.56 MHz/ 1.28 MHz/ 640 kHz/ 320 kHz/ 160 kHz/ 80 kHz/ 40 kHz/ 20 kHz/ 10 kHz	
Weight	Approx. 275 g	
High-Speed 100 MS/s, 12 Bit Isolation Module (720211)		
Input channels	2	
Input type	Isolated unbalanced	
Input coupling	AC, DC, and GND	
Input connector	BNC connector (isolated type)	
Input impedance	1 MΩ ±1%, approx. 35 pF	
Maximum sample rate	100 MS/s	
Frequency range (−3 dB) ^{*1}	DC to 20 MHz	
A/D conversion resolution	12 bit (150 LSB/div)	
Voltage-axis sensitivity setting ^{*12}	Direct input: 10 mV/div to 20 V/div (1-2-5 steps)	
Maximum input voltage (1 kHz or less)		
In combination with 700929 (10:1)/702902 (10:1)/701947 (100:1) ^{*2}	1000 V (DC + ACpeak)	
In combination with 701901 + 701954 (1:1) ^{*9}	200 V (DC + ACpeak)	
Direct input ^{*10}	42 V (DC + ACpeak)	
Maximum rated voltage to earth (1 kHz or less)		
In combination with 700929 (10:1)/702902 (10:1)/701947 (100:1) ^{*3}	1000 Vrms (CAT II)	
In combination with 701901 + 701954 (1:1) ^{*9}	1000 Vrms (CAT II)	
Direct input ^{*11}	42 V (DC + ACpeak) (CAT II, 30 Vrms)	
−3 dB point when AC coupled low frequency attenuation point	10 Hz or less (1 Hz or less when using the 700929, 702902, 0.1 Hz or less when using the 701947)	
Vertical (voltage) axis accuracy ^{*1}	DC accuracy: ±(0.5% of 10 div)	
Common mode rejection ratio	80 dB (50/60 Hz) or more (Typ.)	
Temperature coefficient	Zero point: ±(0.1% of 10 div)/°C (Typ.) Gain: ±(0.05% of 10 div)/°C (Typ.)	
Bandwidth limit	Full/2 MHz/1.28 MHz/640 kHz/320 kHz/160 kHz/80 kHz/ 40 kHz/20 kHz/10 kHz	
Probe attenuation setting	Voltage Probe 1:1, 10:1, 100:1, 1000:1 Current Probe 1 A: 1 V, 10 A: 1 V (for the 701932/701933) 100 A: 1 V (for the 701930/701931)	
Weight	Approx. 290 g	
High-Speed 10 MS/s, 12 Bit Isolation Module (720250)		
Input channels	2	
Input type	Isolated unbalanced	
Input coupling	AC, DC, and GND	
Input connector	BNC connector (isolated type)	
Input impedance	1 MΩ ±1%, approx. 35 pF	

Common mode rejection ratio	80 dB (50/60 Hz) or more (Typ.)	
Maximum sample rate	10 MS/s	
Frequency range (−3 dB) ^{*1}	DC to 3 MHz	
A/D conversion resolution	12 bit (150 LSB/div)	
Voltage-axis sensitivity setting ^{*12}	Direct input: 5 mV/div to 20 V/div (1-2-5 steps)	
Maximum input voltage (1 kHz or less)		
In combination with 700929 (10:1)/702902 (10:1)/701947 (100:1) ^{*2}	800 V (DC + ACpeak)	
In combination with 701901 + 701954 (1:1) ^{*9}	200 V (DC + ACpeak) (as a value that meets the safety standard) 250 V (DC + ACpeak) (Maximum allowable voltage, as a value that does not damage the instrument when applied.)	
Direct input ^{*10}	42 V (DC + ACpeak)	
Maximum rated voltage to earth (1 kHz or less)		
In combination with 700929 (10:1)/702902 (10:1)/701947 (100:1) ^{*3}	400 Vrms (CAT II)	
In combination with 701901 + 701954 (1:1) ^{*9}	400 Vrms (CAT II)	
Direct input ^{*11}	42 V (DC + ACpeak) (CAT II, 30 Vrms)	
−3 dB point when AC coupled low frequency attenuation point	10 Hz or less (1 Hz or less when using the 700929/702902, 0.1 Hz or less when using the 701947)	
Vertical (voltage) axis accuracy ^{*1}	DC accuracy: ±(0.5% of 10 div)	
Temperature coefficient	Zero point: ±(0.05% of 10 div)/°C (Typ.) Gain: ±(0.02% of 10 div)/°C (Typ.)	
Bandwidth limit	Full/500 Hz/5 kHz/50 kHz/500 kHz	
Weight	Approx. 280 g	
High-Speed 1 MS/s, 16 Bit Isolation Module (701251)		
Input channels	2	
Input type	Isolated unbalanced	
Input coupling	AC, DC, and GND	
Input connector	BNC connector (isolated type)	
Input impedance	1 MΩ ±1%, approx. 35 pF	
Common mode rejection ratio	80 dB (50/60 Hz) or more (Typ.)	
Maximum sample rate	1 MS/s	
Frequency range (−3 dB) ^{*1}	DC to 300 kHz (5 m V/div to 20 V/div) DC to 200 kHz (1 m V/div, 2 m V/div)	
A/D conversion resolution	16 bit (2400 LSB/div)	
Voltage-axis sensitivity setting ^{*12}	Direct input: 1 m V/div to 20 V/div (1-2-5 steps)	
Maximum input voltage (1 kHz or less)		
In combination with 700929 (10:1)/702902 (10:1)/701947 (100:1) ^{*2}	600 V (DC + ACpeak)	
In combination with 701901 + 701954 (1:1) ^{*9}	140 V (DC + ACpeak)	
Direct input ^{*10}	42 V (DC + ACpeak)	
Maximum rated voltage to earth (1 kHz or less)		
In combination with 700929 (10:1)/702902 (10:1)/701947 (100:1)	400 Vrms (O), 300 Vrms (CAT II)	
In combination with 701901 + 701954 (1:1) ^{*9}	400 Vrms (O), 300 Vrms (CAT II)	
Direct input ^{*11}	42 V (DC + ACpeak) (CAT II, 30 Vrms)	
−3 dB point when AC coupled low frequency attenuation point	1 Hz or less (0.1 Hz or less when using the 700929/702902, 0.01 Hz or less when using the 701947)	
Vertical (voltage) axis accuracy ^{*1}	DC accuracy 5 mV/div to 20 V/div: ±(0.25% of 10 div) 2 mV/div: ±(0.3% of 10 div) 1 mV/div: ±(0.5% of 10 div)	
Temperature coefficient	Zero point	5 mV/div to 20 V/div: ±(0.02% of 10 div)/°C (Typ.) 2 mV/div: ±(0.05% of 10 div)/°C (Typ.) 1 mV/div: ±(0.10% of 10 div)/°C (Typ.)
	Gain	1 mV/div to 20 V/div: ±(0.02% of 10 div)/°C (Typ.)
Bandwidth limit	Full/400 Hz/4 kHz/40 kHz	
Weight	Approx. 270 g	
4 CH 10 MS/s 16 Bit Isolation Module (720256)		
Input channels	4	
Input type	Isolated unbalanced	
Input coupling	AC, DC, and GND	
Input connector	BNC connector (isolated type)	
Input impedance	1 MΩ ±1%, approx. 32 pF	
Common mode rejection ratio	80 dB (50/60 Hz) or more (Typ.)	
Maximum sample rate	10 MS/s	
Frequency range (−3 dB) ^{*1}	DC to 3 MHz	
A/D conversion resolution	16 bit (2400 LSB/div)	
Voltage-axis sensitivity setting ^{*12}	Direct input: 5 mV/div to 20 V/div (1-2-5 steps)	

Maximum input voltage (1 kHz or less)		
In combination with 700929 (10:1)/702902 (10:1)/701947 (100:1) ²	600 V (DC + ACpeak)	
In combination with 701901 + 701954 (1:1) ⁹	200 V (DC + ACpeak)	
Direct input ¹⁰	42 V (DC + ACpeak)	
Maximum rated voltage to earth (1 kHz or less)		
In combination with 700929 (10:1)/702902 (10:1)/701947 (100:1) ³	300 Vrms (CAT II), 400 Vrms (O)	
or in combination with 701901 + 701954 (1:1) ⁹		
Direct input ¹¹	42 V (DC + ACpeak) (CAT II, 30 Vrms)	

–3 dB point when AC coupled low frequency attenuation point	
	10 Hz or less (1 Hz or less when using 700929, 702902, 0.1 Hz or less when using 701947)
Vertical (voltage) axis accuracy¹	DC accuracy: ±(0.25% of 10 div)
Temperature coefficient	Zero point: ±(0.02% of 10 div)/°C 50 mV/div to 20 V/div (Typ.) ±(0.1% of 10 div)/°C 5 mV/div to 20 mV/div (Typ.) Gain: ±(0.02% of 10 div)/°C (Typ.)
Bandwidth limit	Full/AUTO/400 kHz/128 kHz/64 kHz/32 kHz/16 kHz/ 8 kHz/4 kHz/2 kHz/1 kHz/500 Hz/250 Hz/125 Hz/62.5 Hz
Weight	Approx. 310 g

4 CH 1 MS/s 16 Bit Isolation Module (720254)	
Input channels	4
Input type	Isolated unbalanced
Input coupling	AC, DC, GND
Input connector	BNC connector (isolated type)
Input impedance	1 MΩ ±1%, approx. 35 pF
Common mode rejection ratio	80 dB (50/60 Hz) or more (Typ.)
Maximum sample rate	1 MS/s
Frequency range (–3 dB)¹	DC to 300 kHz
A/D conversion resolution	16 bit (2400 LSB/div)
Voltage-axis sensitivity setting¹²	Direct input: 10 mV/div to 50 V/div (1-2-5 steps)
Maximum input voltage (1 kHz or less)	
In combination with 700929 (10:1)/702902 (10:1)/701947 (100:1) ²	600 V (DC + ACpeak)
In combination with 701901 + 701954 (1:1) ⁹	200 V (DC + ACpeak), 400 V (DC + ACpeak) (Maximum allowable voltage, as a value that does not damage the instrument when applied.)
Direct input ¹⁰	42 V (DC + ACpeak)
Maximum rated voltage to earth (1 kHz or less)	
In combination with 700929 (10:1)/702902 (10:1)/701947 (100:1) ³	400 Vrms (O), 300 Vrms (CAT II)
In combination with 701901 + 701954 (1:1) ⁹	400 Vrms (O), 300 Vrms (CAT II)
Direct input ¹¹	42 V (DC + ACpeak) (CAT II, 30 Vrms)

–3 dB point when AC coupled low frequency attenuation point	
	1 Hz or less (0.1 Hz or less when using the 700929, 702902, 0.01 Hz or less when using the 701947)
Vertical (voltage) axis accuracy¹	DC accuracy: ±(0.25% of 10 div)
Temperature coeffi cient	Zero point: ±(0.02% of 10 div)/°C (Typ.) Gain: ±(0.02% of 10 div)/°C (Typ.)
Bandwidth limit	Full/6.25 Hz/12.5 Hz/25 Hz/50 Hz/100 Hz/200 Hz/400 Hz/ 800 Hz/1.6 kHz/3.2 kHz/6.4 kHz/12.8 kHz/40 kHz
Weight	Approx. 310 g

High-Speed 10 MS/s, 12 Bit Non-Isolation Module (701255)	
Input channels	2
Input type	Non-isolated, unbalanced
Input coupling	AC, DC, and GND
Input connector	BNC connector (metallic type)
Input impedance	1 MΩ ±1%, approx. 35 pF
Maximum sample rate	10 MS/s
Frequency range (–3 dB)¹	DC to 3 MHz
A/D conversion resolution	12 bit (150 LSB/div)
Voltage-axis sensitivity setting¹²	Direct input: 5 mV/div to 20 V/div (1-2-5 steps)
Maximum input voltage (1 kHz or less)	
In combination with 701940 (10:1)	600 V (DC + ACpeak)
Direct input	200 V (DC + ACpeak) (as a value that meets the safety standard) 250 V (DC + ACpeak) (Maximum allowable voltage, as a value that does not damage the instrument when applied.)
–3 dB point when AC coupled low frequency attenuation point	
	10 Hz or less (1 Hz or less when using the 701940)
Vertical (voltage) axis accuracy¹	DC accuracy: ±(0.5% of 10 div)
Temperature coefficient	Zero point: ±(0.05% of 10 div)/°C (Typ.) Gain: ±(0.02% of 10 div)/°C (Typ.)
Bandwidth limit	Full/500 Hz/5 kHz/50 kHz/500 kHz
Weight	Approx. 270 g

High-Voltage 1 MS/s, 16 Bit Isolation Module (with AAF, RMS) (720268)	
Input channels	2
Input type	Isolated unbalanced
Input coupling	AC, DC, GND, AC-RMS, and DC-RMS
Input connector	Plug-in terminal (safety terminal)
Input impedance	2 MΩ ±1%, Approx. 12 pF
Common mode rejection ratio	80 dB (50/60 Hz) or more (Typ.)
Maximum sample rate	1 MS/s
Frequency range (–3 dB)¹	Waveform observation mode: DC to 300 kHz RMS observation mode: DC, 40 Hz to 100 kHz
A/D conversion resolution	16 bit (2400 LSB/div)
Voltage-axis sensitivity setting¹²	20 mV/div to 200 V/div (1-2-5 steps)
Maximum input voltage (1 kHz or less)	
In combination with (758933 or 701904) + 701954 (1:1) ⁹	1000 Vrms (1000 VDC or 1414 Vpeak maximum) ^{*13}
Direct input ¹⁰	42 V (DC + ACpeak)
Maximum rated voltage to earth (1 kHz or less)	
In combination with (758933 or 701904) + 701954 (1:1) ⁹	1000 Vrms (CAT II), 600 Vrms (CAT III)
Direct input	42 V (DC + ACpeak) (CAT II, 30 Vrms) ¹¹
–3 dB point when AC coupled low frequency attenuation point	
	1 Hz or less

Vertical (voltage) axis accuracy¹	
Waveform observation mode	DC accuracy: ±(0.25% of 10 div)
RMS observation mode	DC accuracy: ±(1.0% of 10 div)
AC accuracy	
Sinewave input: ±(1.5% of 10 div) At frequency of 40 Hz to 10 kHz	
Crest factor 2 or less: ±(2.0% of 10 div) At frequency of 40 Hz to 10 kHz	
Crest factor 3 or less: ±(3.0% of 10 div) At frequency of 40 Hz to 10 kHz	
1 kHz to 10 kHz: Add 1.0% on the above AC accuracy.	
Temperature coefficient (Waveform observation mode)	
Zero point: ±(0.02% of 10 div)/°C (Typ.)	
Gain: ±(0.02% of 10 div)/°C (Typ.)	
Bandwidth limit	Full/400 Hz/4 kHz/40 kHz/AAF
Response time (RMS observation mode)	
Rising (0 to 90% of 10 div): 120 ms (Typ.)	
Falling (100 to 10% of 10 div): 280 ms (Typ.)	
Weight	Approx. 280 g

^{*13}: 850 V (DC + ACpeak) when using with DL850/DL850V/DL850E/DL850EV or SL1000

16 CH Voltage Input Module (720220)	
Input channels	16
Input type	Isolated unbalanced
Input coupling	DC, GND (Selectable for each sub-CH)
Maximum sample rate	200 kS/s (single CH) [10 kS/s when using 16 CH]
Frequency range (–3 dB)¹	DC to 5 kHz
A/D conversion resolution	16 bit (2400 LSB/div)
Voltage-axis sensitivity setting	200 mV/div to 2 V/div (1-2-5 steps)
Maximum input voltage (1kHz or less)	
Direct input: 42 V (DC + ACpeak)	
Maximum rated voltage to earth (1 kHz or less)	
Direct input: 42 V (DC + ACpeak) (CAT II, 30 Vrms)	
Vertical (voltage) axis accuracy	DC accuracy: ±(0.3% of 10 div)
Input connector	Spring-type terminal (removable per 8 CH)
Input impedance	1 MΩ ±1%
Common mode rejection ratio	80 dB (50/60 Hz) or more (Typ.)
Temperature coefficient	Zero point: ±(0.02% of 10 div)/°C (Typ.) Gain: ±(0.02% of 10 div)/°C (Typ.)
Bandwidth limit	Full/500 Hz (Selectable for each sub-CH)
Weight	Approx. 230 g

Universal (Voltage/Temp.) Module (701261) / with AAF (701262)	
Function	Temperature (thermocouple) or voltage measurement (switchable)
Input channels	2
Input type	Isolated unbalanced
Input coupling	TC (thermocouple), DC, AC, and GND
Input connector	Binding post
Input impedance	Approx. 1 MΩ
Maximum sample rate	Voltage: 100 kS/s
Data update rate	Temperature: 500 Hz
Frequency range (–3 dB)¹	Voltage: DC to 40 kHz Temperature: DC to 100 Hz
A/D conversion resolution	Voltage: 16 bit (2400 LSB/div) Temperature: 0.1°C

–3 dB point when AC coupled low frequency attenuation point	
Voltage measurement: 0.5 Hz or less	
Measurement range/accuracy¹	Voltage measurement:
	Voltage-axis sensitivity setting ¹²
	5 mV/div to 20 V/div (1-2-5 steps)
Vertical (voltage) axis accuracy	
±(0.25% of 10 div)	

Temperature measurement (Reference junction temperature compensation accuracy not included)		
Type	Measurement Range	Accuracy
K E J T L U N	–200°C to 1300°C –200°C to 800°C –200°C to 1100°C –200°C to 400°C –200°C to 900°C –200°C to 400°C 0°C to 1300°C	±(0.1% of reading + 1.5°C) Except ±(0.2% of reading + 1.5°C) for –200°C to 0°C
R S	0°C to 1700°C	±(0.1% of reading + 3°C) Except, 0 to 200°C: ±8°C 200°C to 800°C: ±5°C
B	0°C to 1800°C	±(0.1% of reading + 2°C) Except, 400°C to 700°C: ±8°C Effective range is 400°C to 1800°C
W	0°C to 2300°C	±(0.1% of reading + 3°C)
KP/AuFe	0 K to 300 K	0 K to 50 K: ±4 K 50 K to 300 K: ±2.5 K

Thermocouple standard JIS C1602 (K, E, J, T, N, R, S, B)

Maximum input voltage (1 kHz or less)	
42 V (DC + ACpeak) (as a value that meets the safety standard)	
150 V (DC + ACpeak) (maximum allowable voltage, as a value that does not damage the instrument when applied)	

Maximum rated voltage to earth (1 kHz or less)	
42 V (DC + ACpeak) (CAT II, 30 Vrms)	

Temperature coefficient (Voltage)	
Zero point: ±(0.01% of 10 div)/°C (Typ.) Gain: ±(0.02% of 10 div)/°C (Typ.)	

Reference junction comp. accuracy (at input terminal temp. balancing)	
K, E, J, T, L, U, N: ±1°C R, S, B, W: ±1.5°C KP/AuFe: ±1 K	

Bandwidth limit	
Voltage: Full/AUTO (AAF)/40 Hz/400 Hz/4 kHz Temperature: Full/2 Hz/8 Hz/30 Hz	

Anti-aliasing filter (AAF) (701262 only)	
Cutoff frequency (fc) Automatically linked with the sampling frequency (fs) fs ≥ 100 Hz : fc = fs × 40% fs ≥ 50 Hz : fc = 20 Hz	

Weight	
Approx. 280 g	

Temperature, High Precision Voltage Isolation Module (701265)	
Function	Temperature (thermocouple) or voltage measurement (switchable)
Input channels	2
Input type	Isolated unbalanced
Input coupling	TC (thermocouple), DC, and GND
Input connector	Binding post
Input impedance	Approx. 1 MΩ
Data update rate	Temperature: 500 Hz
Frequency range (–3 dB)¹	DC to 100 Hz
A/D conversion resolution	Voltage: 16 bit (2400 LSB/div) Temperature: 0.1°C
Measurement range/accuracy¹	Voltage measurement:
	Voltage-axis sensitivity setting ¹²
	100 μV/div to 10 V/div (1-2-5 steps)
Vertical (voltage) axis accuracy	
±(0.08% of 10 div + 2 μV)	

Temperature measurement (Reference junction temperature compensation accuracy not included)		
Type	Measurement Range	Accuracy
K E J T L U N	–200°C to 1300°C –200°C to 800°C –200°C to 1100°C –200°C to 400°C –200°C to 900°C –200°C to 400°C 0°C to 1300°C	±(0.1% of reading + 1.5°C) Except ±(0.2% of reading + 1.5°C) for –200°C to 0°C
R S	0°C to 1700°C	±(0.1% of reading + 3°C) Except, 0 to 200°C: ±8°C 200°C to 800°C: ±5°C
B	0°C to 1800°C	±(0.1% of reading + 2°C) Except, 400°C to 700°C: ±8°C Effective range is 400°C to 1800°C
W	0°C to 2300°C	±(0.1% of reading + 3°C)
KP/AuFe	0 K to 300 K	0 K to 50 K: ±4 K, 50 K to 300 K: ±2.5 K

Thermocouple standard JIS C1602 (K, E, J, T, N, R, S, B)

Maximum input voltage (1 kHz or less)	
42 V (DC + ACpeak)	

Maximum rated voltage to earth (1 kHz or less)	
42 V (DC + ACpeak) (CAT II, 30 Vrms)	

Temperature coefficient (Voltage)	
Zero point: ±(0.01% of 10 div)/°C + 0.05 μV/°C (Typ.) Gain: ±(0.02% of 10 div)/°C (Typ.)	

Reference junction comp. accuracy (at input terminal temp. balancing)	
K, E, J, T, L, U, N: ±1°C R, S, B, W: ±1.5°C KP/AuFe: ±1 K	

Bandwidth limit	
Full/2 Hz/8 Hz/30 Hz	

Weight	
Approx. 270 g	

Temperature/High-Precision Voltage Isolation Module (Low noise) (702066)	
Function	Temperature (thermocouple) or voltage measurement (switchable)
Input channels	2
Input type	Isolated unbalanced
Input coupling	TC (thermocouple), DC, and GND
Input connector	Binding post
Input impedance	Approx. 1 MΩ
Data update rate	125 Hz
Frequency range (–3 dB)¹	DC to 15 Hz
A/D conversion resolution	Voltage: 16 bit (2400 LSB/div)
	Temperature: 0.1°C

Measurement range/accuracy¹	Voltage measurement:
	Voltage-axis sensitivity setting ¹²
	100 μV/div to 20 V/div (1-2-5 steps)
Vertical (voltage) axis accuracy	
±(0.08% of 10 div + 2 μV)	

Temperature measurement (Reference junction temperature compensation accuracy not included)		
Type	Measurement Range	Accuracy
K E J T L U N	–200°C to 1300°C –200°C to 800°C –200°C to 1100°C –200°C to 400°C –200°C to 900°C –200°C to 400°C 0°C to 1300°C	±(0.1% of reading + 1.5°C) Except, 0 to 200°C: ±8°C for –200°C to 0°C
R S	0°C to 1700°C	±(0.1% of reading + 3°C) Except, 0 to 200°C: ±8°C 200°C to 800°C: ±5°C
B	0°C to 1800°C	±(0.1% of reading + 2°C) Except, 400°C to 700°C: ±8°C Effective range is 400°C to 1800°C
W	0°C to 2300°C	±(0.1% of reading + 3°C)
KP/AuFe	0 K to 300 K	0 K to 50 K: ±4 K, 50 K to 300 K: ±2.5 K

Thermocouple standard JIS C1602 (K, E, J, T, N, R, S, B)

Maximum input voltage (1 kHz or less)	
42 V (DC + ACpeak)	

Maximum rated voltage to earth (1 kHz or less)	
42 V (DC + ACpeak) (CAT II, 30 Vrms)	

Temperature coefficient (Voltage)	
Zero point: ±(0.01% of 10 div)/°C + 0.05 μV/°C (Typ.) Gain: ±(0.02% of 10 div)/°C (Typ.)	

Reference junction comp. accuracy (at input terminal temp. balancing)	
K, E, J, T, L, U, N: ±1°C R, S, B, W: ±1.5°C KP/AuFe: ±1 K	

Bandwidth limit	
Full/0.1 Hz/1 Hz/8 Hz	

Weight	
Approx. 270 g	

16 CH Temperature/Voltage Input Module (702221)	
Input channels	16
Input type	Isolated unbalanced
Input coupling	TC (thermocouple), DC, GND
Data updating period	Switching among 100 ms, 300 ms, 1 s, and 3 s
Measurement range/accuracy	Voltage measurement:
	Voltage axis sensitivity
	1 mV/div to 2 V/div (1-2-5 steps)
Voltage accuracy	
±(0.15% of 10 div)	

Temperature measurement (Reference junction temperature compensation accuracy not included)		
Type	Measurement Range	Accuracy
K E J T L U N	–200°C to 1300°C –200°C to 800°C –200°C to 1100°C –200°C to 400°C –200°C to 900°C –200°C to 400°C 0°C to 1300°C	±(0.1% of reading + 1.5°C) Except ±(0.2% of reading + 1.5°C) for –200°C to 0°C
R S	0°C to 1700°C	±(0.1% of reading + 3°C) Except, 0 to 200°C: ±8°C 200°C to 800°C: ±5°C
B	0°C to 1800°C	±(0.1% of reading + 2°C) Except, 400°C to 700°C: ±8°C Effective range is 400°C to 1800°C
W	0°C to 2300°C	±(0.1% of reading + 3°C)
KP/AuFe	0 K to 300 K	0 K to 50 K: ±4 K, 50 K to 300 K: ±2.5 K
Thermocouple standard JIS C1602 (K, E, J, T, N, R, S, B)		
Maximum input voltage (1 kHz or less) Both voltage & temp. 42 V (DC + ACpeak)		
Maximum rated voltage to earth (1 kHz or less) Both voltage & temp. 42 V (DC + ACpeak) (CAT II, 30 Vrms)		
Vertical resolution	At voltage input: 2400 LSB/div At temp. measurement: 0.1°C	
Common mode rejection ratio	At voltage measurement: 100 dB or more (50/60 Hz) (Typ.) At temp. measurement: 140 dB or more (at data updating rate of 3 s) (50/60 Hz) (Typ.)	
Residual noise level	±0.01 div (Typ.)	
A/D conversion resolution	At voltage measurement: 16 bit (2400 LSB/range)	
Temperature coefficient	Zero point: ±(0.025% of 10 div)/°C (Typ.) Gain: ±(0.01% of 10 div)/°C (Typ.)	
Reference junction comp. accuracy (at input terminal temp. balancing) K, E, J, T, L, U, N: ±1°C R, S, B, W: ±1.5°C KP/AuFe: ±1 K		
Bandwidth limit (Typ.) (–3 dB point) At data updating period of 100 ms 600 Hz At data updating period of 300 ms 200 Hz At data updating period of 1 s 50 Hz At data updating period of 3 s 10 Hz		
Input connector	Screwed type, External terminal mounting	
Input impedance	Approx. 1 MΩ	
Burnout detection function	ON/OFF available on channel basis	
Channel-to-channel interference	100 dB or more (50/60 Hz) (Typ.)	
Internal reference junction compensation	ON or OFF (Switchable)	
External scanner box	Model: 701953 Supplied cable length: 1 m, 3 m (selectable)	
Weight	Approx. 220 g	
Strain Module (NDIS) (701270) / Strain Module (DSUB, Shunt-Cal) (701271)		
Input channels	2	
Input type	DC bridge (auto balancing), balanced differential input, and isolated	
Auto balance type	Electronic auto balance	
Auto balance range	±10000 μSTR (1 gauge method)	
Bridge voltage	Select from 2 V, 5 V, and 10 V.	
Gauge resistance	120 Ω to 1000 Ω (bridge voltage: 2 V) 350 Ω to 1000 Ω (bridge voltage: 2 V, 5 V, and 10 V)	
Gauge factor	1.90 to 2.20 (set in 0.01 steps)	
Maximum sample rate	100 kS/s	
Frequency range (–3 dB) ¹	DC to 20 kHz	
A/D conversion resolution	16 bit (4800 LSB/div: Upper = +FS, Lower = –FS)	
mV/V range support	mV/V range = 0.5 × (μSTR range/1000)	
Measurement range/measurable range		
Measurement range (FS)		Measurable range (–FS to +FS)
500 μSTR		–500 μSTR to +500 μSTR
1000 μSTR		–1000 μSTR to +1000 μSTR
2000 μSTR		–2000 μSTR to +2000 μSTR
5000 μSTR		–5000 μSTR to +5000 μSTR
10000 μSTR		–10000 μSTR to +10000 μSTR
20000 μSTR		–20000 μSTR to +20000 μSTR
Maximum input voltage (1 kHz or less) 10 V (DC + ACpeak)		
Maximum rated voltage to earth (1 kHz or less) 42 V (DC + ACpeak) (CAT II, 30 Vrms)		
DC accuracy ¹	±(0.5% of FS + 5 μSTR)	
Temperature coefficient	Zero point: ±5 μSTR/°C (Typ.) Gain: ±(0.02% of FS)/°C (Typ.)	

Bandwidth limit • NDIS (701270) Function	Full/10 Hz/100 Hz/1 kHz mV/V support. Supports the strain gauge transducer unit system.	
Input connector	NDIS connector [Recommended by JSNDI (The Japanese Society for Non-destructive Inspection)]	
Standard accessories	NDIS connector : 2 pieces	
Recommended bridge head (sold separately)	701955 (NDIS 120 Ω, comes with a 5-m cable) 701956 (NDIS 350 Ω, comes with a 5-m cable)	
• DSUB, Shunt-Cal (701271) Function	mV/V support.	
Supports	the strain gauge transducer unit system. Shunt calibration support. Built-in shunt calibration relay (1 gauge method).	
Input connector	9-pin D-Sub connector (female)	
Standard accessories	Connector shell set for soldering: 2 sets	
Recommended bridge head (supports DSUB shunt-Cal) (sold separately)	701957 (D-Sub 120 Ω, comes with a 5-m cable) 701958 (D-Sub 350 Ω, comes with a 5-m cable)	
Weight	Approx. 260 g	
Acceleration/Voltage Module (with AAF) (701275)		
Input channels	2	
Input type	Isolated unbalanced	
Input coupling	AC, DC, ACCL (acceleration), and GND	
Input connector	BNC connector (metallic type)	
Input impedance	1 MΩ ±1%, approx. 35 pF	
Common mode rejection ratio	80 dB (50/60 Hz) or more (Typ.)	
Maximum sample rate	100 kS/s	
Frequency range (–3 dB) ¹	Acceleration: 0.4 Hz to 40 kHz Voltage: DC to 40 kHz	
A/D conversion resolution	16 bit (2400 LSB/div)	
Voltage-axis sensitivity setting ¹²	Acceleration (±5 V = × 1 range) X0.1 to × 1 to X100 (1-2-5 steps) Voltage: 5 mV/div to 10 V/div (1-2-5 steps)	
Maximum input voltage (1 kHz or less) ¹⁰	42 V (DC + ACpeak)	
Maximum rated voltage to earth (1 kHz or less) ¹¹	42 V (DC + ACpeak) (CAT II, 30 Vrms)	
–3 dB point when AC coupled low frequency attenuation point	0.4 Hz or less (0.04 Hz or less when using the 701940) (Typ.)	
Vertical (voltage) axis accuracy ¹	Voltage (DC accuracy): ±(0.25% of 10 div) Acceleration: ±(0.5% of range) at 1 kHz	
Temperature coefficient (voltage) (excluding AUTO filter)	Zero point: ±(0.02% of 10 div)/°C (Typ.) Gain: ±(0.02% of 10 div)/°C (Typ.)	
Bandwidth limit	Full/Auto (AAF)/40 Hz/400 Hz/4 kHz	
Anti-aliasing filter (AAF)	Cutoff frequency (fc): automatically linked with the sampling frequency (fs) fs ≥ 100 Hz : fc = fs × 40% fs ≤ 50 Hz : fc = 20 Hz Cutoff characteristics: –65 dB at 2 × fc (Typ.)	
Sensor supply current (voltage)	OFF/4 mA ±10% (approx. 22 VDC)	
Applicable acceleration sensor	Built-in amplifier type Kistler Instruments Corp. : Piezotron, PCB Piezotronics Inc. : ICP, Endevco Corp : Isotron, etc.	
Weight	Approx. 280 g	
Frequency Module (720281)		
Measurement function	Frequency (Hz), RPMs, RPSs, period (s), duty cycle (%), power supply frequency (Hz), pulse width (s), pulse integration, and velocity	
Input channels	2	
Input type	Isolated unbalanced	
Input coupling	AC and DC	
Input connector	BNC connector (isolated type)	
Input impedance	1 MΩ ±1%, approx. 35 pF Pull-up function: 10 kΩ, approx. 5 V (pull-up can be turned ON only when the input is set to Pull-Up 5 V)	
Data update rate	1 MHz (1 μs)	
Minimum measurement resolution	625 ps	
Measured data resolution	16 bit (2400 LSB/div)	
Input voltage range (±FS)	(1:1) ±1 V to ±50 V (1-2-5 steps)	
Maximum input voltage	In combination with 700929 (10:1) ²	420 V (DC + ACpeak)
	Direct input ¹⁰	42 V (DC + ACpeak)

Maximum rated voltage to earth In combination with 700929 (10:1)/702902 (10:1)/701947 (100:1) ³ 400 Vrms (CAT II)		
Direct input ¹⁾	42 V (DC + ACpeak) (CAT II, 30 Vrms)	
Bandwidth limit	Full/100 Hz/1 kHz/10 kHz/100 kHz	
Comparator section	Preset function	Logic (5 V/3 V/12 V/24 V), electromagnetic pickup, zero crossing, pull-up (5 V), AC100 V, AC 200 V, and user-defined
	Threshold range	±FS range, resolution 1% units
	Hysteresis	±1%, ±2.5%, ±5% of FS
Chatter elimination function	OFF or 1 ms to 1000 ms (1 ms resolution)	
LED display (per CH)	ACT (green): Operating status (lights during pulse input)	
	OVER (red): Overdrive status (lights when input exceeds range)	

Measured parameters and measuring range

Measured parameter	Measuring Range	Vertical axis sensitivity setting
Frequency (Hz)	0.01 Hz to 500 kHz	0.1 Hz/div to 100 kHz/div
RPMs	0.01 rpm to 100000 rpm	0.1 rpm/div to 10 krpm/div
RPSs	0.001 rps to 2000 rps	0.01 rps/div to 200 rps/div
Period (s)	2 μs to 50 s	10 μs/div to 5 s/div
Duty cycle (%)	0% to 100%	1%/div to 20%/div
Power supply frequency (Hz)	(50 Hz, 60 Hz, 400 Hz) ±20 Hz	0.1 Hz/div to 2 Hz/div
Pulse width (s)	1 μs to 50 s	10 μs/div to 5 s/div
Pulse integration	Up to 2×10^9 pulses	10×10^{-21} value/div to 0.5×10^{21} value/div
Velocity	Measuring range same as frequency (units can be converted to km/h, etc.)	

Measurement accuracy¹⁾

- When in frequency, RPM, RPS, or velocity measurement mode
Measurement accuracy
±(0.05% of 10 div + accuracy dependent on the input frequency)

Accuracy dependent on the input frequency

2 kHz or less	0.05% of the input frequency + 1 mHz
2 kHz to 50 kHz	0.05% of the input frequency
50 kHz to 100 kHz	0.1% of the input frequency
100 kHz to 200 kHz	0.2% of input frequency
200 kHz or higher	0.5% of the input frequency
- When in period measurement mode
Measurement accuracy
±(0.05% of 10 div + accuracy dependent on the input frequency)

Accuracy dependent on the input period

500 μs or greater	0.05% of the input period
20 μs to 500 μs	0.1% of the input period + 0.1 μs
10 μs to 20 μs	0.2% of the input period + 0.1 μs
10 μs or less	0.5% of the input period + 0.1 μs
- When in duty cycle measurement mode
Accuracy dependent on the input frequency

50 kHz or less	±0.1%
50 kHz to 100 kHz	±0.2%
100 kHz to 200 kHz	±0.5%
200 kHz to 500 kHz	±1.0%
- When in pulse width measurement mode
Measurement accuracy
±(0.05% of 10 div + accuracy dependent on the input pulse width)

Accuracy dependent on the input pulse width

500 μs or greater	0.05% of the input pulse width
20 μs to 500 μs	0.1% of the input pulse width + 0.1 μs
10 μs to 20 μs	0.2% of the input pulse width + 0.1 μs
10 μs or less	0.5% of the input pulse width + 0.1 μs
- When in power supply frequency mode
Measurement accuracy
When the center frequency is 50/60 Hz: ±0.03 Hz (0.01 Hz resolution)
When the center frequency is 400 Hz: ±0.3 Hz (0.01 Hz resolution)

Auxiliary measurement functions

Deceleration prediction	Computes the deceleration condition in realtime when the pulse input is cut off. Can be specified when measuring the frequency, RPMs, RPSs, period, and velocity.
Stop prediction	Sets the frequency to 0 after a certain time elapses after the pulse input is cut off. Stop interval setting: Set in the range of 1.5 to 10 times (10 settings) the period of the pulse measured last. Can be specified when measuring the frequency, RPMs, RPSs, period, and velocity.
Smoothing	Computes the moving average of the measured data using the specified time. Specified time: 0.1 to 1000 ms (0.1 ms resolution). Can be specified on all measurement parameters.
Pulse average	Performs frequency measurement per specified number of pulses. When fluctuation exists periodically in the pulse interval, the fluctuation can be eliminated. Specified number of pulses: 1 to 4096. Can be specified when measuring the frequency, RPMs, RPSs, power supply frequency, period, pulse integration, and velocity.
Offset function	Observe fluctuation with respect to the offset frequency. Offset range: Can be set up to 100 times the maximum range value.

Weight Approx. 270 g

Logic Input Module (720230)	
Input ports	2
Input type	non-isolated
Input bits	8 bit/Port
Maximum sample rate	10 MS/s
Compatible probes	Model: 700986 (8 bit, non isolated input) Model: 700987 (8 bit, isolated input) Model: 702911 (8 bit, non-isolated input, support contact input) Model: 702912 (8 bit, non-isolated input, support contact input)
Weight	Approx. 250 g

CAN FD/LIN Monitor Module (720245)	
Number of input ports	2
Input type	Isolated unbalanced
Input connector	D-sub 9 pin (male)
Maximum sample rate	100 kS/s
Port features	CAN FD/LIN switchable on each port separately
Maximum rated voltage to ground Between input and case Between inputs	42 V (DC + ACpeak) (CAT II 30 Vrms)
CAN operation specifications	
Maximum input voltage	−3 V to +10 V (between CAN_H and GND or CAN_L and GND)
Terminator	Internal, can be enabled or disabled for each port
Supported protocols	CAN, CAN FD (ISO 11898-1: 2015 or non-ISO) Physical layer: ISO-11898 (High Speed Communication)
Supported bit rates	10 kbps, 20 kbps, 33.3 kbps, 50 kbps, 62.5 kbps, 66.7 kbps, 83.3 kbps, 125 kbps, 250 kbps, 500 kbps, 800 kbps, 1 Mbps Flexible data rate 1 Mbps, 2 Mbps, 5 Mbps
Multiplexing	Supports extended multiplexing (limited to the second byte for Multiplexor signals)
SAE J1939	Source address and destination address masking possible. Can receive signals in the transport protocol
LED Display	Illuminates to indicate that the terminator is enabled
Number of sub channels	60 sub channels/ports
One shot output	Frames can be output in single shots. CAN/CAN FD package can be exported (packet format can be specified). Up to 64 bytes can be exported for CAN FD.

LIN operation specifications	
Maximum input voltage	−0.3 V to +18 V (between LIN and GND or VBAT and GND)
Supported protocols	Physical layer: Complies with ISO9141
Supported bit rates	2400 bps, 9600 bps, 19200 bps
Number of sub channels	60 sub channels
Supported check sums	Standard check sum, extended check sum

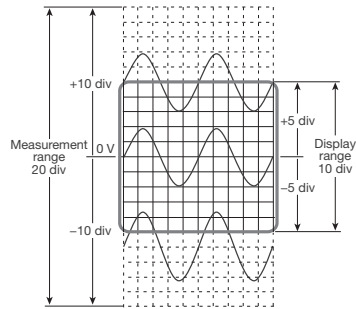
Weight Approx. 260 g

SENT Monitor Module (720243)	
Input ports	2
Input type	Isolated
Maximum sampling rate	100 kS/s (10 μs)
Input connector	BNC connector (isolated type)
Input impedance	1 MΩ ±1%, approx. 35 pF
Supported protocol	SAE J2716
Clock Tick	1 μs to 100 μs (set in 0.01 steps)
Nibble	1 to 6
Channel setting	FAST CHANNEL 8 CH maximum SLOW CHANNEL 5 CH maximum (Up to 8 CH in total by FAST CHANNEL and SLOW CHANNEL) STATUS & COMMUNICATION 1 CH (4 bit) Error 1 CH Error count 1 CH
FAST CHANNEL analysis	FAST CHANNEL MULTIPLEXING support
L input voltage	1.5 V (Typ.)
H input voltage	3.5 V (Typ.)
Input status indication	Status indication through LED In operation: Illuminates in green when input is detected. Overdriven: Illuminates in red when the input voltage exceeds 20 V.
Maximum input voltage	42 V (DC + ACpeak) (CAT II, 30 Vrms)
Maximum rated voltage to earth	42 V (DC + ACpeak) (CAT II, 30 Vrms)
Weight	Approx. 260 g

Measurement Range and Display Range

The measurement range of the ScopeCorder is ± 10 divisions (20 divisions of absolute width (span)) around 0 V. The display range of the screen is ± 5 divisions (10 divisions of span). The following functions can be used to move the displayed waveform and display the waveform outside the display range by expanding/reducing the displayed waveform.

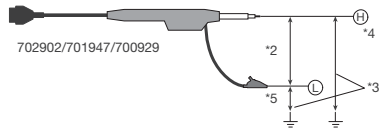
- Move the vertical position.
- Set an offset voltage.
- Zoom in or out of the vertical axis (expand/reduce).



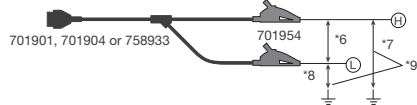
Maximum Input Voltage and Maximum rated voltage to earth

See the plug-in module specifications.

In combination with 702902/701947/700929

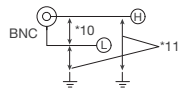


In combination with (701901+701954), (701904+701954) or (758933+701954)



Direct input

(with a cable not complying with the safety standard)



WARNING

Do not apply input voltage exceeding the maximum input voltage or maximum rated voltage to earth. To prevent the possibility of electric shock, be sure to furnish protective earth grounding of the main unit. To prevent the possibility of electric shock, be sure to fasten the module screws.

Main Specifications (probes and accessories)

100:1 Probe (for Isolated BNC Input) (701947)	
Frequency range (–3 dB)	DC to 200 MHz
Attenuation ratio	100:1
Input impedance/capacitance	100 MΩ ±1% ¹ /7 pF
Maximum input voltage ²	Space between shield and earth. ±1000 V (DC + ACpeak) CAT II ±1000 V (DC + ACpeak) CAT I Space between tip and shield, tip and earth. ±1000 V (DC + ACpeak) CAT II ±3540 V (DC + ACpeak) CAT I
Total length	1.5 m

¹1: When the input impedance of the measuring instrument is 1 MΩ ±1%.
²2: When the input voltage is AC, the maximum allowable input decreases depending on the frequency.

10:1 Passive Probe (Wide operating temperature range) (702902)	
Frequency range (–3 dB)	DC to 60 MHz
Attenuation ratio [*]	10:1 (Fixed) ±2% (5 to 40°C) ±3% (–40 to 5°C, 40 to 85°C)
Input resistance/capacitance [*]	10 MΩ ± 2%/17.0 pF (Typ.)
Maximum input voltage	Between the pincher tip and safety ground lead ±1000 V (DC + ACpeak) CAT II Between safety ground lead and ground ±1000 V (DC + ACpeak) CAT II
Total length	2.5 m
Operating temperature range	–40 to +85°C

^{*}In conjunction with a measuring instrument with an input impedance of 1 MΩ ±1%.

10:1 Probe (for Isolated BNC Input) (700929)	
Frequency range (–3 dB)	DC to 100 MHz
Attenuation ratio	10:1
Input impedance/capacitance	10 MΩ/approx. 18 pF
Maximum input voltage (probe alone)	1000 V (DC + AC peak) Space between clip and lead, lead and earth. When the input voltage is AC, the maximum allowable input decreases depending on the frequency.
Total length	1.5 m

Current Probe (701917/701918)	
Frequency range (–3 dB)	DC to 50 MHz (701917) / DC to 120 MHz (701918)
Maximum continuous input range	5 Arms (The maximum allowable input decreams depending on the frequency.)
Maximum peak current	7.5 Apeak, non-continuous
Output voltage range	1 V/A
Amplitude accuracy	±3.0% of reading ±1 mV typical, ±3.0% of reading ±1 mV (DC and 45 to 66 Hz)

Current Probe (702915/702916)			
Frequency range (–3 dB)	DC to 50 MHz (702915) / DC to 120 MHz (702916)		
Current measurement range	0.5 A	5 A	30 A
Maximum peak current	±0.75 A	±7.5 A	±50 A (2 s or less)
Output voltage rate	0.1 V/A	1 V/A	10 V/A
Amplitude accuracy	±3.0% of reading ±10 mV		±3.0% of reading ±1 mV

Current Probe (701932)	
Frequency range (–3 dB)	DC to 100 MHz
Maximum continuous input range	30 Arms (The maximum allowable input decreases depending on the frequency.)
Maximum peak current	50 Apeak, non-continuous
Output voltage rate	0.1 V/A
Amplitude accuracy	To 30 Arms: ±1% of reading ±1 mV 30 Arms to 50 Apeak: ±2% of reading (DC and 45 to 66 Hz)

Current Probe (701933)	
Frequency range (–3 dB)	DC to 50 MHz
Maximum continuous input range	30 Arms (AC and DC components) (The maximum allowable input decreases depending on the frequency.)
Maximum peak current	50 Apeak, non-continuous
Output voltage rate	0.1 V/A
Amplitude accuracy	To 30 Arms: ±1% of reading ±1 mV 30 Arms to 50 Apeak: ±2% of reading (DC and 45 to 66 Hz)

Current Probe (701930)	
Frequency range (–3 dB)	DC to 10 MHz
Maximum continuous input range	150 A (The maximum allowable input decreases depending on the frequency.)

Maximum peak current	300 Apeak, non-continuous
Output voltage rate	0.01 V/A
Amplitude accuracy	To 150 A: ±1% of reading ±1 mV 150 A to 300 A: ±2% of reading (DC and 45 to 66 Hz)

Current Probe (701931)	
Frequency range (–3 dB)	DC to 2 MHz
Maximum continuous input range	500 A (The maximum allowable input decreases depending on the frequency.)
Maximum peak current	700 Apeak, non-continuous
Output voltage rate	0.01 V/A
Amplitude accuracy	To 500 A: ±1% of reading ±5 mV 500 A to 700 A: ±2% of reading (DC and 45 to 66 Hz)

Clamp-on Probe (720930)	
Measuring range	AC 0 to 50 Arms
Measurable conductor size	Maximum 18 mm diameter
Output voltage	AC 0 to 500 mVrms (10 mV/A)
Accuracy (sine wave input)	Bandwidth ±0.5% of reading ±0.1 mV (50/60 Hz) ±0.8% of reading ±0.2 mV (40 Hz to 1 kHz) ±1.0% of reading ±0.4 mV (1 kHz to 3.5 kHz) Phase Within ±2.0 deg (0.5 to 50 A, 40 Hz to 3.5 kHz)
Maximum allowable input	AC 130 Arms continuous (50/60 Hz)
Output impedance	Approx. 18 Ω
Output terminal	BNC connector (isolated)
External dimensions	52 (W) × 106 (H) × 25 (D) mm (excluding protrusions)
Cable length	Approx. 3 m
Weight	Approx. 210 g

Clamp-on Probe (720931)	
Measuring range	AC 0 to 200 Arms (300 Apeak)
Measurable conductor size	Maximum 30 mm diameter
Output voltage	AC 0 to 500 mVrms (2.5 mV/A)
Accuracy (sine wave input)	Bandwidth ±0.5% of reading ±0.1 mV (50/60 Hz) ±0.8% of reading ±0.2 mV (40 Hz to 1 kHz) ±1.0% of reading ±0.4 mV (1 kHz to 3.5 kHz) Phase Within ±1.0 deg (2 to 200 A, 40 Hz to 3.5 kHz)
Maximum allowable input	AC 250 Arms continuous (50/60 Hz)
Output impedance	Approx. 6 Ω
Output terminal	BNC connector (isolated)
External dimensions	73 (W) × 130 (H) × 30 (D) mm (excluding protrusions)
Cable length	Approx. 3 m
Weight	Approx. 280 g

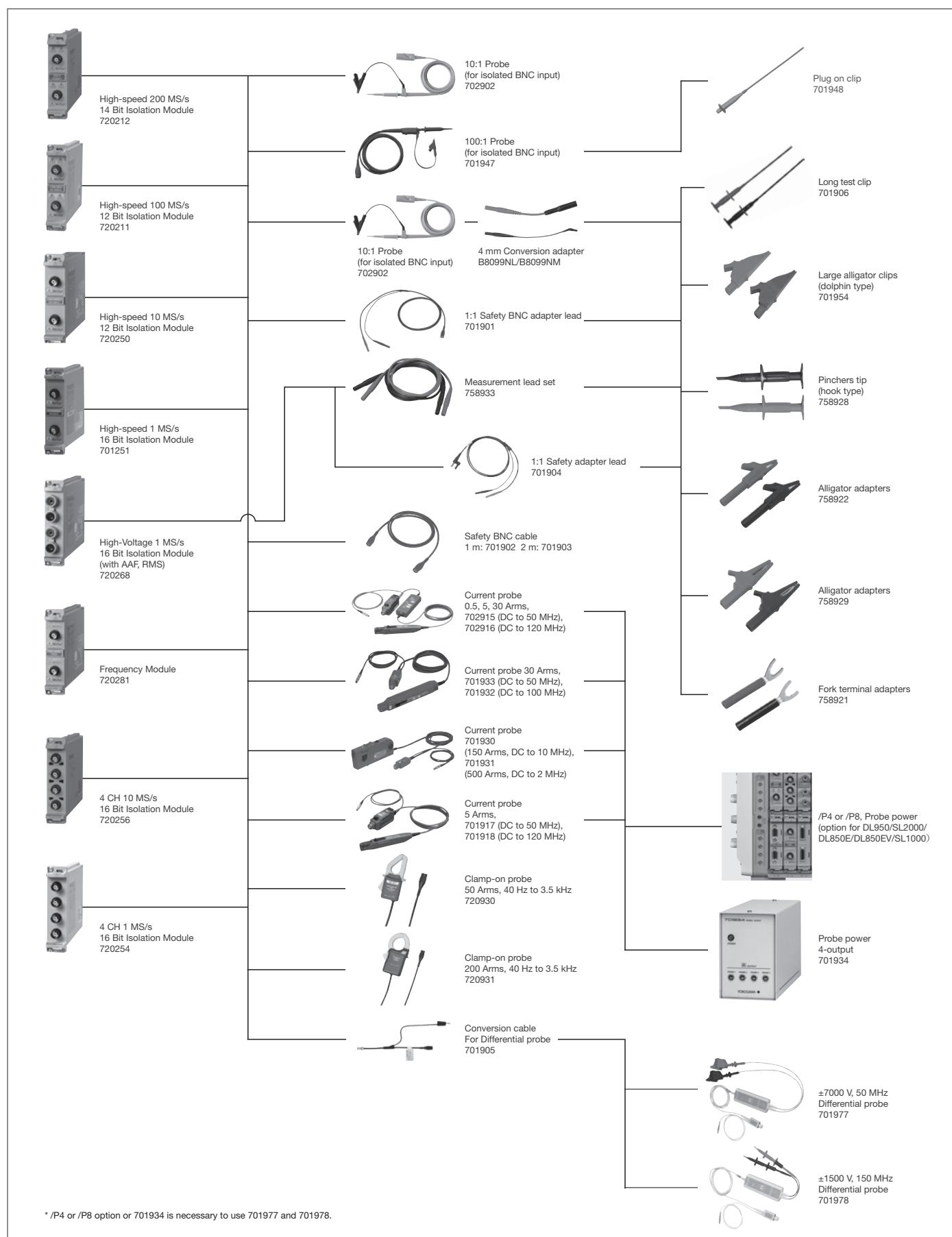
High Voltage Differential Probe (701977)	
Frequency range (–3dB)	DC to 50 MHz
Attenuation ratio	Switched ratios of 100:1 and 1000:1
Input impedance/capacitance	52 MΩ/10 pF
Differential allowable voltage	5000 Vrms or less, and 7000 Vpeak or less
Maximum input voltage	5000 Vrms or less, and 7000 Vpeak or less
Operating conditions	5 to 40°C, 25 to 85% (no condensation)
Weight	Approx. 500 g

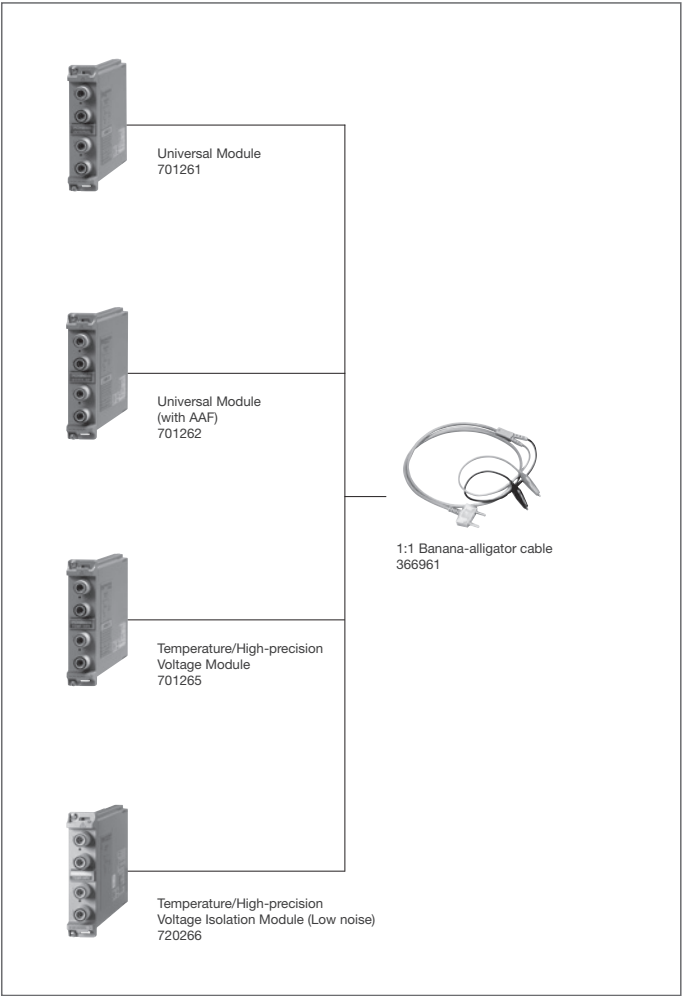
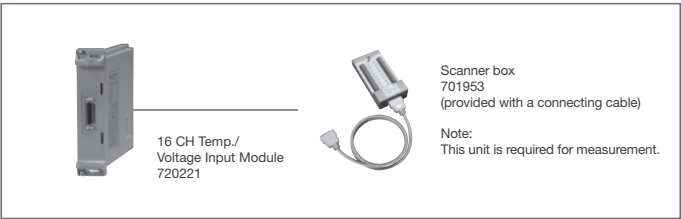
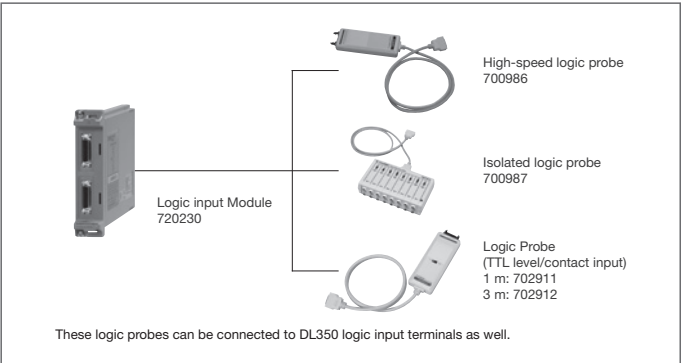
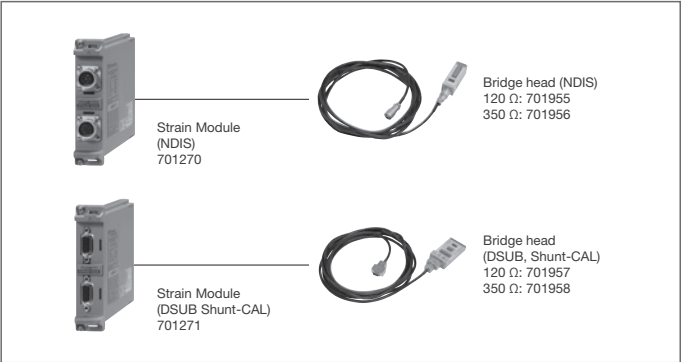
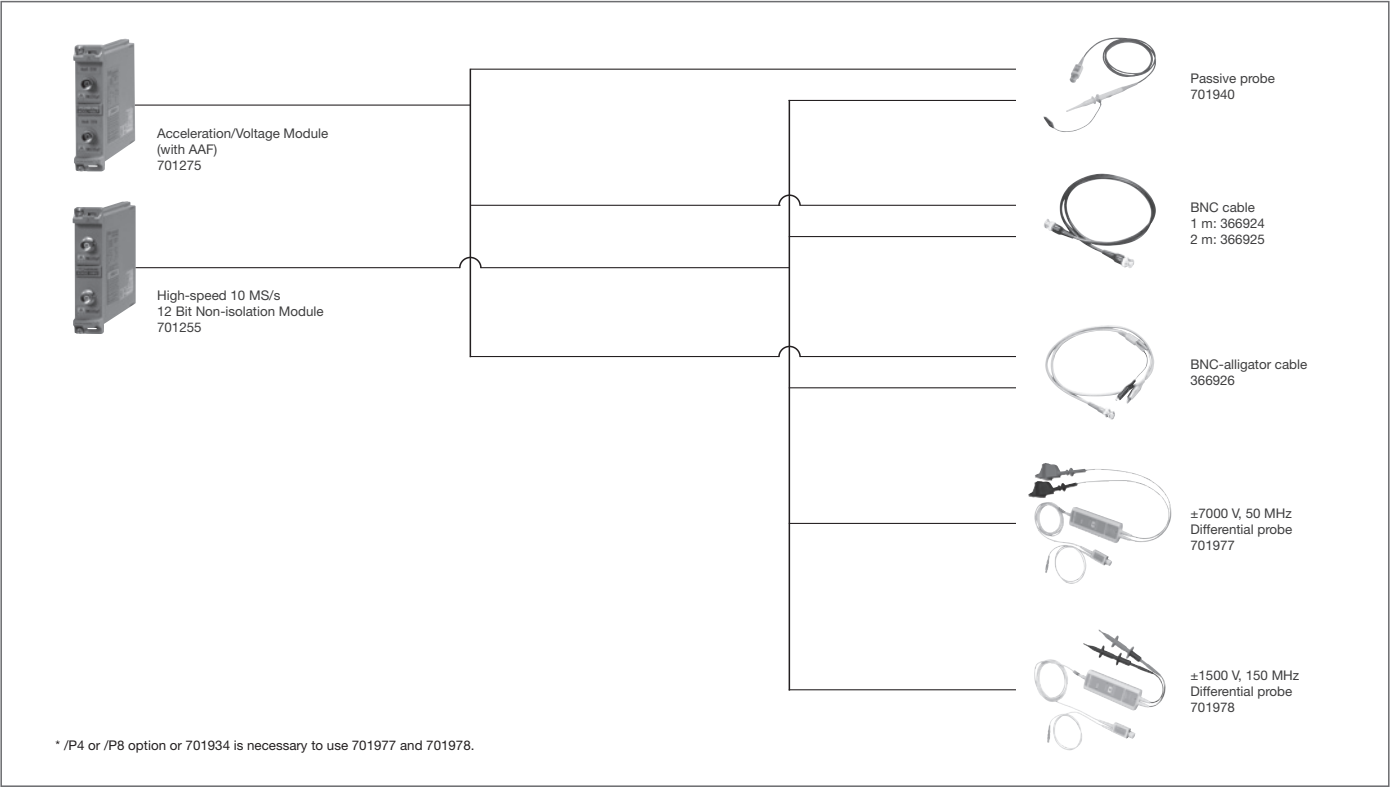
Differential Probe (701978)	
Frequency range (–3dB)	DC to 150 MHz
Attenuation ratio	Switched ratios of 50:1 and 500:1
Input impedance/capacitance	4.1 MΩ/5 pF
Differential allowable voltage	±1500 V (DC + ACpeak)
Maximum input voltage	±1500 V (DC + ACpeak)

Passive Probe (701940)	
Frequency range (–3 dB)	DC to 10 MHz at 10:1 attenuation DC to 6 MHz at 1:1 attenuation
Attenuation ratio	Switched ratios of 10:1 and 1:1
Input impedance/capacitance	10 MΩ/approx. 22 pF (10:1), 200 pF maximum (1:1)
Maximum input voltage (probe alone)	600 V (DC + AC peak)

Logic Probe (702911: 1 m and 702912: 3 m)	
Number of inputs	8
Input type	Non-isolated (earth of all bits is common, main unit earth and earth of all bits are common)
Maximum input voltage	±35 V
Response time	3 μs (Typ.)
Input impedance	10 kΩ or greater
Threshold level	Approx. 1.4 V
Input level	TTL level or contact input (switching type)
High-Speed Logic Probe (700986)	
Number of inputs	8
Input type	Non-isolated (earth of all bits is common, main unit earth and earth of all bits are common)
Maximum input voltage (1 kHz or less) (across probe tip and earth)	42 V (DC + AC _{peak})
Response time	1 μs (Typ.)
Input impedance	Approx. 100 kΩ
Threshold level	Approx. 1.4 V
Isolation Logic Probe (700987)	
Number of inputs	8
Input type	Isolated (all bits are isolated)
Input connector	Safety terminal type (for banana plug) × 8
Input switching	Can switch between AC/DC input for each bit
Applicable input range	DC input H/L detection of 10 VDC to 250 VDC
	AC input H/L detection of AC type of 80 VAC to 250 VAC 50/60 Hz
Threshold level	DC input 6 VDC ±50%
	AC input 50 VAC ±50%
Response time	DC input within 1 ms (Typ.)
	AC input within 20 ms (Typ.)
Maximum input voltage (1 kHz or less) (across H and L of each bit)	250 Vrms (CAT II)
Maximum rated voltage to earth (1 kHz or less)	250 Vrms (CAT II)
Maximum allowable voltage between bits	250 Vrms (CAT II)
Input impedance	Approx. 100 kΩ
Bridge Head (701955, 701956, 701957, 701958)	
Bridge resistance	Model 701955, 701957 : 120 Ω Model 701956, 701958 : 350 Ω
Applicable gauge methods	Single-gauge, Single-gauge three-wire, Adjacent-side two-gauge, Opposed-side two-gauge, Opposed-side two-gauge three-wire, Four-gauge
Operating conditions	Temperature: 5 to 40°C Humidity: 20 to 85% RH
External dimensions	701955, 701956: Approx. 37 (W) × 97 (H) × 30 (D) mm 701957, 701958: Approx. 50 (W) × 101 (H) × 29 (D) mm
Weight	701955, 701956: Approx. 85 g (Bridge head only) 701957, 701958: Approx. 100 g (Bridge head only)
Power Supply (701934)	
Compatible Probes	Current probe: 701930, 701931, 701932, 701933, 701917, 701918 Differential probe: 701920, 701921, 701922, 701978, 701977
No. of Power Receptacles	4
Output Voltage	±(12 ± 0.5) V
Rated Output Current	±2.5 A (total value for each output)
Rated Supply Voltage	100 to 240 VAC (actual power supply voltage may fluctuate within ±10% of the rating)
Ripple Voltage	50 mVp-p
Rated Power	190 VA maximum (at the rated output current)
External Dimensions	80 (W) × 119 (H) × 200 (D) mm
Weight	Approx. 1.2 kg
Conversion Cable (701905)	
Maximum input voltage	42 V
Operating temperature	5 to 40°C
Cable length	Approx. 310 mm
Ground cable length	Approx. 300 mm
Weight	Approx. 50 g

Module and accessory combinations





Using the Strain Modules (701270, 701271)



Strain Module (NDIS)
(Model: 701270)

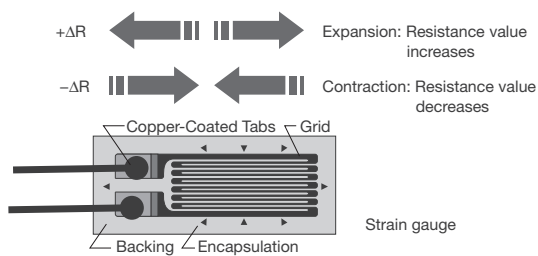


Strain Module (DSUB, Shunt-CAL)
(Model: 701271)

There are two types of modules depending on the difference in the input connector type and whether or not shunt calibration is supported. These modules support not only strain gauges, but also strain gauge type sensors.

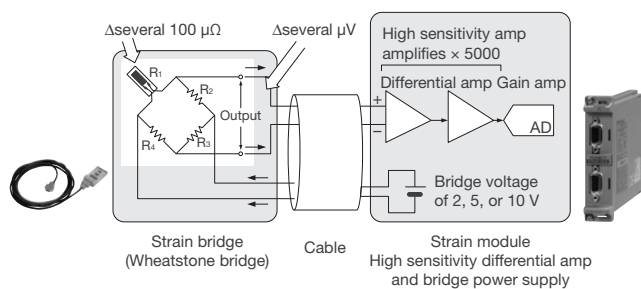
Strain gauge

A strain gauge is a sensor that detects mechanical stress (strain). It works on the principle that the resistance value of a metal foil changes as it expands and contracts. The strain gauge uses a specialized sensor that is affixed in the direction of expansion and contraction with an instant adhesive.



Strain gauge

The strain gauge's rate of change in resistance is very small. For instance, when using a 120 Ω strain gauge, the change in resistance corresponding to a strain of 1000 μSTR is 0.24 Ω. Relative to a strain of 1 μSTR, the resistance change is only 0.00024 Ω. Converting such minute resistance changes to voltage requires a Wheatstone bridge.



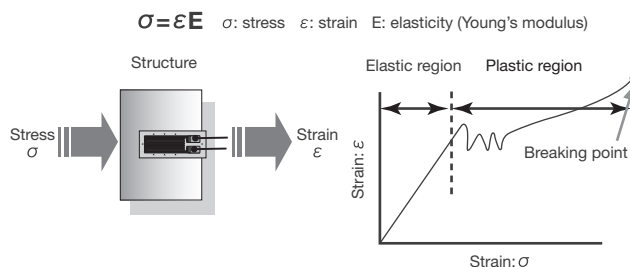
Strain gauge and measurement circuit

Furthermore, because the bridge output is as small as a few micro volts, the input must be amplified inside the strain module using a differential and high gain amp.

You can select a bridge voltage (DC) of 2, 5, or 10 V. The higher the input voltage the higher the output voltage. Therefore, low noise measurements are possible, but only a bridge resistance of 350 ohm is supported at 5 or 10 V.

Measuring with a strain module

You can determine structural durability (elasticity) by measuring the strain.

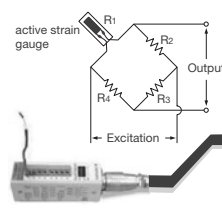


Relationship between strain and stress

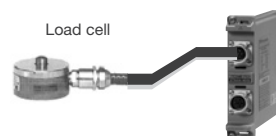
Stress is calculated using the relationship of elasticity (Young's modulus), which depends on structure's material, and the durability of the structure.

A strain gauge type sensor uses built-in strain gauge to measure stresses that occur with changes in various physical quantities (load, pressure, displacement, vibration, torque, etc.) based on the above principle. It then converts those to the original physical quantities and outputs them.

Connecting to a strain module



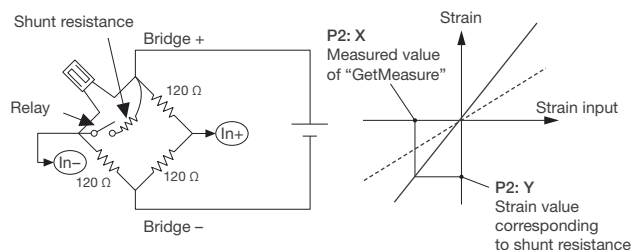
For strain measurements with a strain gauge, use the accessory bridge head.



Strain gauge type sensors are connected directly.

Shunt calibration

Shunt calibration (shunt CAL) means correcting the gain in strain measurements by inserting a known resistance (shunt resistance) in parallel with the strain gauge. Correction can be made without introducing a load, and while not perfectly accurate the correction can include the gauge wiring cables.



Gain correction using shunt CAL
[gain correction on the negative (-) side]

The model 701271 Strain Module (DSUB, shunt CAL) supports shunt calibration. A bridge head that supports shunt CAL (model 701957 or 701958) is required to execute shunt CAL.

Using the Acceleration Module (701275)



Acceleration/Voltage Module
(with Anti-Aliasing Filter) (Model: 701275)

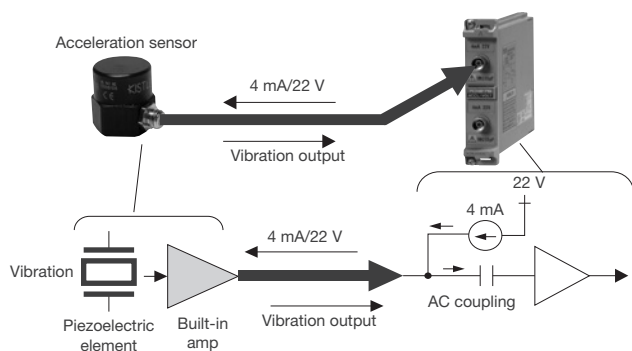
This module will accept direct input from a built-in amp type acceleration sensor to measure acceleration. You can also connect a charge output type acceleration sensor via a commercially available charge converter. Additionally, the module functions as a voltage module to support common voltage measurements, and an effective anti-aliasing filter is built in for FFT analysis.

Built-in amp type acceleration sensors

Built-in amp type acceleration sensors use a voltage (piezoelectric) method, and have a built in piezoelectric element that emits a charge from the area of distortion when it encounters mechanical stress. When vibration occurs, a charge is generated on both ends of the element. Vibration is measured by measuring the voltage proportional to the generated charge.

DC power (4 mA/22 V) is supplied from the module to the sensor, and the vibration detected by the sensor is fed back to the module as AC output. The DC component is cut from the vibration output to isolate the AC component which is then amplified.

The model 701275 Acceleration/Voltage Module supports built-in amp type acceleration sensors. No charge amp is required, allowing sensors to be connected directly. It has low impedance, thus offering anti-noise characteristics.



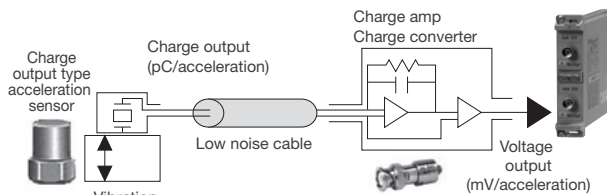
Connecting a built-in amp type acceleration sensor

The 701275 Acceleration/Voltage Module can connect to any built-in amp type acceleration sensor that supports a constant drive current of 4 mA and drive voltage of 22 V. Please check the sensor's spec sheet to ensure you are using one that meets the constant drive current and voltage (range) requirement of 4 mA and 22 V. They are available from the following manufacturers.

Kistler: Piezotron PCB: ICP Endevco: isotron2

Charge output type acceleration sensors

When you need to perform measurements by connecting a charge output type acceleration sensor, you can input signals to the 701275 Acceleration/Voltage module through a commercially available charge converter or charge amp.



Connecting a charge output type acceleration sensor

The electric charge proportional to acceleration (pC/acceleration) is conveyed to the charge amp via a low noise cable. The charge amp converts charge to voltage (mV/acceleration). Because impedance is high and charge is small, the signal is susceptible to noise and caution should be exercised. The drive current/voltage needed for connecting a built-in amp type acceleration sensor is not required with charge output type acceleration sensors.

When using the model 701275 Acceleration/Voltage Module to measure acceleration, enter output units (sensitivity, mV/unit) that are appropriate for the acceleration sensor being used. The output units are included on the sensor's spec sheet.

When connecting a built-in amp type acceleration sensor or charge output type acceleration sensor via charge converter, turn ON the bias output (constant drive current).

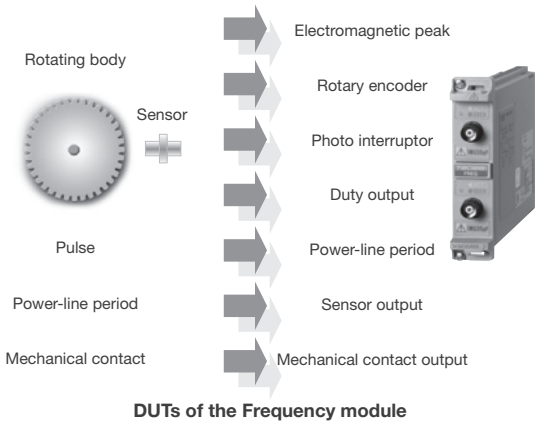
Using the Frequency Module (720281)



Frequency Module (Model: 720281)

This module incorporates all the functions and performance required for measuring rotating bodies (pulses). It performs measurement of 9 different items, and reads in measured values directly.

With isolated input, its measurement range is 0.01 Hz to 500 kHz. Measured values are updated at high speed (1 μs/1 MHz) for real time confirmation.



Frequency module test items

Test item	Real-time calculation	Measurement range ¹	Measurement
Frequency (Hz)	$\text{Frequency (Hz)} = \frac{1}{T_w \text{ (s)}}$	0.01 Hz to 500 KHz	
Period (s)	$\text{Period (s)} = T_w \text{ (s)}$	2 μs to 50 s	
Rpm	$\text{Rpm} = \frac{\text{freq. (Hz)}}{\text{pulses per revolution (Nr)}} \times 60$	0.01 rpm to 100000 rpm	
Rps	$\text{Rps} = \frac{\text{freq (Hz)}}{\text{pulses per revolution (Nr)}}$	0.001 rps to 2000 rps	
Duty (%)	$\text{Duty (\%)} = \frac{T_{\text{high}} \text{ (s)}}{T_w \text{ (s)}} \text{ or } \frac{T_{\text{low}} \text{ (s)}}{T_w \text{ (s)}}$	0% to 100%	
Pulse width	$\text{Pulse width (s)} = T_{\text{high}} \text{ (s)} \text{ or } T_{\text{low}} \text{ (s)}$	1 μs to 50 s	
Power Supply Freq. (Hz)	$\text{Power supply freq. (Hz)} = \frac{1}{T_w \text{ (s)}}$ at the 50/60 Hz setting, 0.01 Hz resolution	(50 Hz, 60 Hz, 400 Hz) ±20 Hz	
Pulse Integration (Distance/Quantity of flow)	Distance = N (count) × distance per pulse ℓ *Distance ℓ and units are user-definable.	up to 2 × 10 ⁹ count	
Velocity (km/h, mph)	$\text{Velocity (km/h)} = \frac{\text{distance per pulse } \ell \text{ (km)}}{T_w \text{ (s)}} \times 3600$ $\text{Velocity (m/s)} = \frac{\text{distance per pulse } \ell \text{ (m)}}{T_w \text{ (s)}}$ *Units are user-definable (angular velocity and other units)	$F = \left(\frac{1}{T_w} \right)$ = 0.01 Hz to 200 kHz	

¹ Allowable input frequency range: 0.01 Hz to 200 kHz

Unlike general FV converters, the model 720281 Frequency Module does not require scale conversion when acquiring measurement items such as the ones in figure 1 because it can read in values directly. It not only displays data as waveforms, but enables cursor and waveform parameter measurement of those waveforms.

Input signals

A variety of signal types can be input, such as encoder pulse input of up to ±42 V, powered electromagnetic pickup direct input (1:1), and AC power of up to 300 V (when using a 10:1 probe). The isolation function, amplifier, and filters are all equivalent to those in a normal voltage module, therefore it supports a broad range of voltage (6 ranges) and input formats. Precise chattering elimination from 1 ms to 1 s is supported. The unit comes configured with menu presets for logic input (3 V to 24 V), electromagnetic pickup, AC power, and other inputs.

±42 V

EM pickup direct coupling

300 VAC power supply direct coupling (requires 700829)

Isolated input

Chatter elimination

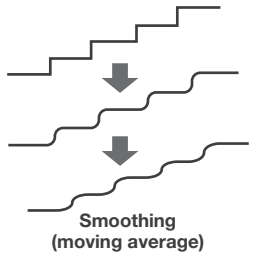
4 input filters

Internal pull-up

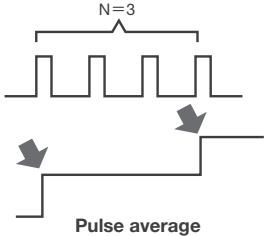
Input presets logic 3 V–24 V, EM pickup, AC100/200 V

Real-time digital filtering

Smoothing filter (Moving average)
Smooth stair-step shaped waveforms. Updating occurs every 1 μs, giving a high speed averaging effect. Filters are set at 0.1 ms to 1 s (up to the 25000th order). Filters reduce jitter in observed waveforms, and increases resolution.



Pulse average
Useful for determining the average value per rotation, or determining the number of rotations when a gear is missing teeth. Output is averaged every specified number of pulses (between 1 and 4096 pulses).

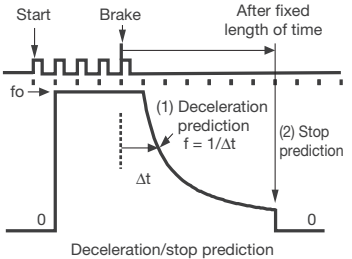


Supports braking applications

By predicting the deceleration curve and stop point, the module automatically compensates for the lack of information on encoder pulses which occur during deceleration.

Deceleration Prediction (1)
Automatically calculates and outputs a deceleration curve based on the interval of the last input pulse.

Stop Prediction (2)
If no pulses are inputted for a period of time, a stop is inferred, and output is set to 0. Up to 10 steps can be specified.



You can detect actions from pulse output stop (break, etc.) to the actual stop, therefore it is effective for applications involving pulse measurement associated with deceleration and stopping.

Using the 16 CH Voltage Input Module (720220)



16 CH Voltage Input Module (Model: 720220)

This is a multichannel voltage module capable of measuring 16 channels (subchannels) of DC voltage on a single unit. Scan method measurements are possible by using a removable spring-type terminal block (removable in 8 channel sections) at the input. The input section uses Weidmueller B2L 3.5/16LH clamp connectors.

The maximum sampling rates are 200 kS/s (for 1 CH) and 10 kS/s (for 16 CH simultaneously). The minimum voltage input range is 200 mV/div, and the maximum input voltage is 42 V (direct input, 1 kHz or less).

Input terminal blocks are isolated from ground. There is no isolation between channels within the input terminal block.

Setting subchannels

On each of the 16 channels (subchannels) in the module, you can individually set the range and other input conditions, position, zoom, and other display conditions.

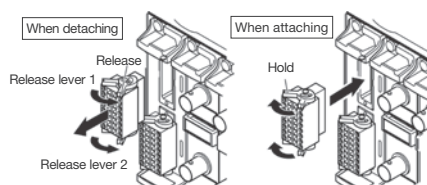


Channel setting screen (SL2000)

Connecting wires to terminal blocks

The following electrical wire is recommended.
0.20 mm² to 1.00 mm² (two solid wires or thin stranded wire). AWG size: 24-18

Strip approx. 7 mm of the insulation from the end of the wire and insert the end into a wire inlet of a terminal block. A terminal block can be detached from the module as shown right; wires can be easily installed.



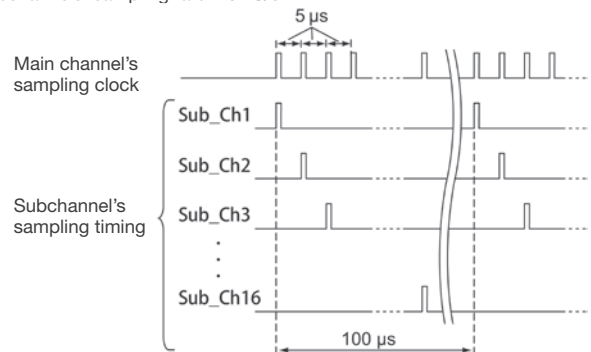
Number of subchannels to be used, sampling rate, and record length

Subchannels under measurement (those set to ON) are sampled in order. As noted above, the subchannel sampling rate changes depending on the main channel's sampling rate and the number of subchannels to be used. The figure below shows the difference in sampling rate when all subchannels (16 CH) are set to ON and when only two subchannels (subchannels 1 and 16) are set to ON.

Main channel's sampling rate: 200 kS/s

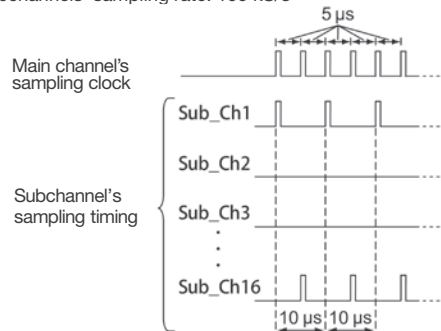
When the number of subchannels to be measured is 16 (all subchannels set to ON)

Subchannels' sampling rate: 10 kS/s



When the number of subchannels to be measured is 2 (subchannels 1 and 16 set to ON)

Subchannels' sampling rate: 100 kS/s



For example, if the main channel's sampling rate is 200 kS/s, the sampling clock is 5 μs period. The subchannels are sampled at this sampling clock in turn. Therefore, the subchannel's sampling timing is as shown in the figure above. Because scanning all required channel's takes time in proportion to the number of subchannels to be used (set to ON), the greater the number of subchannels to be used, the lower the sampling rate for one subchannel.

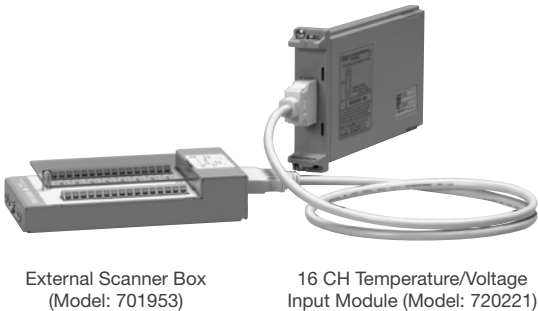
In the example shown above, the sampling rate is 10 kS/s (5 μs × 16 CH+20 μs) when using 16 CH, while it is 100 kS/s (5 μs × 2) when using 2 CH.

The sampling rate that is displayed on the main unit screen is the main channel's sampling rate.

The record length of each subchannel changes depending on the set record length and the number of subchannels to be used and there is a relationship between them as follows:

$$\text{Record length of each subchannel} \leq \frac{\text{set record length/}}{\text{number of subchannels to be used}}$$

Using the 16 CH Temperature/Voltage Input Module (720221)



This is a multichannel input module capable of measuring up to 16 channels (subchannel's DC voltage or temperature measured by TC) on a single unit. It consists of the module body (model: 720221) and external scanner box (model: 701953), and both units are required to make measurement. Wires for voltage measurement or a thermocouple for temperature measurement are connected to terminal blocks (screwed type) of the external scanner box. The input section is isolated between the ground and terminal blocks and between subchannels. For the voltage measurement range and temperature measurement range (available thermocouple types and accuracy), see the module specifications described on page 7. Both the maximum input voltage and maximum rated voltage to earth are 42 V (AC + DCpeak, 1 kHz or less).

Scanning method, Data updating period, and Bandwidth limit

Alternatives	Setting ①	Setting ②	Setting ③	Setting ④
Data updating period (selectable)	100 ms	300 ms	1 s	3 s
Bandwidth limit (–3 dB) (unselectable, automatic setting)	600 Hz	200 Hz	50 Hz	10 Hz

The data updating period can be selected from among the following settings ① to ④. According to the selected data updating period, the predetermined bandwidth limit is imposed as per the following combinations.

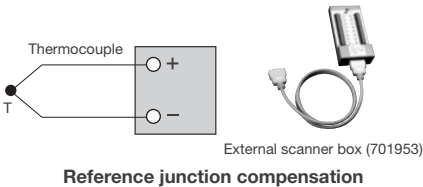
The scan data updating period for one scan (maximum 16 CH) can be selected from among four types of alternatives (① to ④) shown in the table above. The selected updating period is independent of the number of subchannels to be used and is consistent. Thus, if setting ① is selected, a maximum of 16 points (CH) can be measured every 100 ms. The updating rate is also independent of the measurement object and is common to both voltage and temperature. The predetermined bandwidth limit is automatically enabled according to the selected scan data updating period. The combinations of the updating period and bandwidth limit are as shown in the table above (① to ④).

If a signal to be measured contains significant noise, lower the data updating period. This allows the bandwidth limit to be enabled at a lower cut-off frequency, improving the noise reduction effect.

Reference junction compensation (RJC)

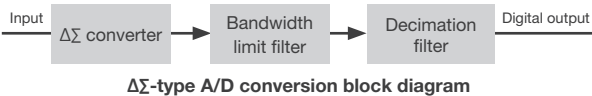
The RJC circuit is built into the external scanner box. The RJC allows switching between internal and external equipment. For details of the RJC compensation accuracy, see the module specifications described on page 7 of this bulletin.

Moreover, the external scanner box also incorporates a burnout circuit for detecting a wire break and this burnout detection is always available even during measurement. The burnout detection can be set to ON/OFF for each subchannel.

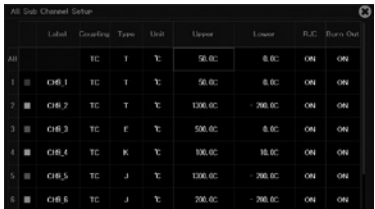


Noise reduction performance

This module adopts the $\Delta\Sigma$ -type A/D conversion method. Using the digital filtering function based on oversampling, it reduces the noise effect and ensures accurate measurement. The oversampling performs sampling (A/D conversion) at a higher frequency by comparison with input signal frequency. Since the module performs a larger number of samplings at a faster period to take the average of them, the resolution of measured values is improved, enabling a measured value closer to the true value to be obtained. At the same time, it provides a noise component reduction (averaging) effect if a signal contains noise. Moreover, because the sampling resolution is high, input signal waveforms can be reproduced more faithfully.



In general temperature scanner modules, the filtering performance tends to be sacrificed (weakened) to improve the data updating period, and therefore high-frequency noise cannot be reduced sufficiently in some cases.



Channel setting screen (DL950)

The module also offers excellent common mode reduction performance as well as the ability to scan 16 points (CH) of data at an updating period as high as 100 ms.

Comparison with the 16 CH Voltage Input Module (720220)

The features of the two types of 16 CH input modules (models: 720220 and 720221) are compared in the table below. The hatched areas show the features of the respective modules. You can select an appropriate module according to the measurement application.

	16 CH Voltage Module (720220)	16 CH Voltage/Temp. Module (720221)
Channels	16	16
Input	DC V	DC V, temperature
Voltage measurement range	200 mV/div to 2 V/div (1-2-5 steps)	1 mV/div to 2 V/div (1-2-5 steps)
Voltage accuracy	±(0.3% of 10 div)	±(0.15% of 10 div)
Updating period	5 μ s maximum (when only one subchannel is used)	100 ms, 300 ms, 1 s, or 3 s (user selectable) (Independent of the number of subchannels to be used)
Maximum rated voltage to earth	42 V (DC + ACpeak) (CAT II, 30 Vrms)	42 V (DC + ACpeak) (CAT II, 30 Vrms)
Isolation between channels	No	Yes
A/D conversion resolution	16 bit (2400 LSB/div)	16 bit (2400 LSB/div)

Using the Logic Input Module (720230)



Logic Input Module (Model: 720230)

Input logic signals can be displayed as waveforms at a sampling resolution of up to 10 MS/s. Each port can measure 8 bit, and 2 ports of input are available on each module. Thus, a single module can observe 16 bit logic signals. You can turn the display

Probe model	Number of inputs	Isolated/ non-isolated	Maximum input voltage	Threshold level	Response time
702911/702912	8	Non-isolated	±35 V	Approx. 1.4 V	3 μs or less
700986	8	Non-isolated	30 Vrms	Approx. 1.4 V	1 μs or less
700987	8	Isolated	250 Vrms	6 VDC or 50 VAC	1 ms or less (DC), 20 ms or less (AC)

Input logic signals can also be displayed for numeric monitoring in either binary or hexadecimal format. Moreover, you can put the cursor on the measured logic waveform to read bit data.



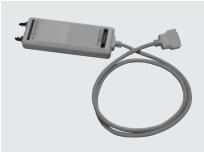
Logic display setting screen (DL950)

of individual bits ON/OFF, and assign each bit its own unique label. In all, you can input and display up to 128 bit of logic signals by installing up to eight modules in a single DL950/DL850E/DL850EV for example.

You can select from four different types of logic probe to best fit the input signal. (For details on logic probes, see page 11.) The input format, maximum input voltage, threshold level, and other settings depend on the logic probe being used; please refer to the specifications of your logic probe. The following logic probes can be used.



Logic probe
(TTL level/contact input)
1 m: 702911/3 m: 702912

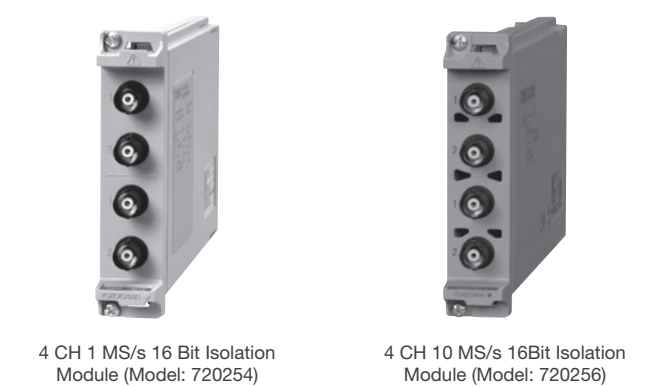


High-speed logic probe
700986



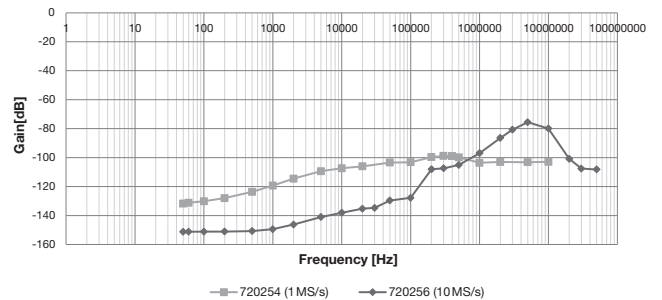
Isolation logic probe
700987

Using the 4 CH 1MS/s / 10MS/s 16 Bit Isolation Module (720254 and 720256)



This module has four isolated BNC input channels. Installing eight of this module in a DL950 makes a 32-CH stand-alone measurement system. This module can be used to perform isolated high-voltage and multi-channel (up to 32) measurements and recording. The A/D conversion resolution is 16 bit (2400 LSB/div), and the maximum input voltage is 600 V (DC + ACpeak, when using a 700929 or 701947 probe). The maximum rated voltage to earth is 300 Vrms (CAT II). The 720256 can measure at sample rates up to 10 MS/s, and the 720254 can measure at sample rates up to 1 MS/s.

Another feature of this module is the excellent noise immunity. The common mode rejection ratio (CMRR) is more than 80 dB (50/60 Hz) (typical). The following graph shows a typical CMRR performance.



In general, a high number of isolated channels and high resolution are required to record inverter signals that are 300 Vrms or greater for long periods of time. In transportation applications, a high number of isolated channels are also essential to measure the advanced control signals and sensor output signals generated by the ECU (Electronic Control Unit). An increase in the number of measurement systems in power plants also requires more channels in one instrument. Troubleshooting is efficient by measuring multiple signals simultaneously in one measuring instrument.

Note

When using this module with the DL850E/DL850EV, the sample rate will be half or less than half of that of a 2 CH voltage input module (e.g., 720250) when the recording length setting is the same.

When an external clock signal is applied, the sample rate will also be half or less than half of the sample rate of the external clock. Please pay particular attention when using only the 4 CH 1 MS/s, 16 bit isolation module (s) to sample using an external pulse signal such as that of a rotary encoder.

Sampling is simultaneous on four channels. Refer to the following table for details.

Relationship between the main channel sample rate and the 4 CH 1 MS/s, 16 bit isolation module sample rate (DL850E/DL850EV only)

Main channel sample rate (S/s)	Sample rate of the 4 CH 1 MS/s, 16 bit isolation module (720254) (S/s)
100 M	1 M
50 M	1 M
20 M	1 M
10 M	1 M
5 M	1 M
2 M	1 M
1 M	500 k
500 k	100 k
200 k	100 k
100 k	50 k
50 k	10 k
20 k	10 k
10 k	5 k
5 k	1 k
2 k	1 k
1 k	500
500	100
200	100
100	50
50	10
20	10
10	5
5	1

Using the CAN FD/LIN Monitor Module (720245) and SENT Monitor Module (720243)

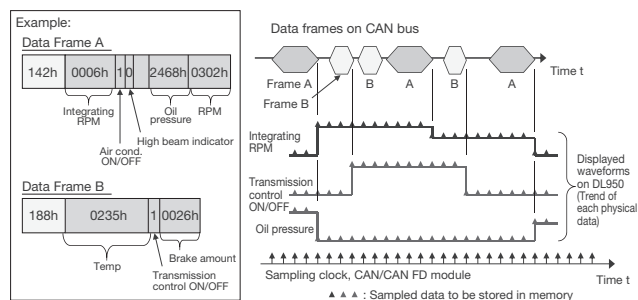


CAN FD/LIN Monitor Module
(Model: 720245)



SENT Monitor Module
(Model: 720243)

The relationship between sampled data and displayed waveforms is as shown in the figure below (an example of CAN).



Relationship between sampling data and
displayed waveforms, an example

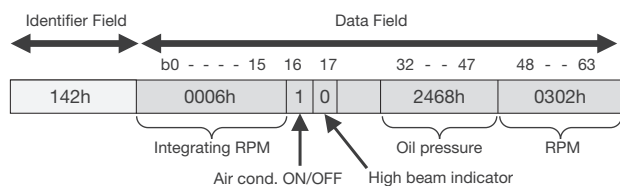
These modules will interpret vehicle installed communication protocols, monitor the communication data, and display the time series trend waveforms. They are connected as CAN/CAN FD or LIN bus nodes and can read the data frames of each protocol communicating on the bus or read the signal values transmitted between a sensor to a controller on SENT (Single Edge Nibble Transmission).

By combining them with other input modules, they can simultaneously measure the communication data in a vehicle, the voltage and temperature, the sensor signals and other changes in analog data over time, as well as ECU (Electronic Control Unit) control logic signals. These data can be displayed as waveforms or saved as files. All related data in the system can be interpreted, thus enabling the evaluation of the overall vehicle installed system.

The CAN FD/LIN Monitor Module (720245) is equipped with two CAN/CAN FD and LIN input ports, enabling a single module to be connected to two CAN/CAN FD or LIN network systems. CAN/CAN FD and LIN can be switched in a single module. This module supports the SAE J1939 communication protocol. The SENT Monitor Module (720243) is equipped with two input ports, enabling simultaneous monitoring of up to 11 data trends.

For the protocols that each module supports, see the respective specifications in this manual.

CAN data monitoring method (example)



Example of CAN frames and physical data

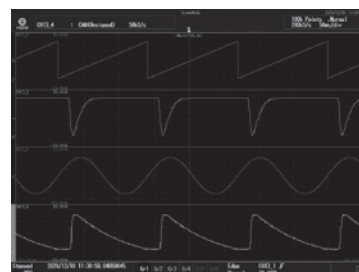
The following is an example of how CAN data can be monitored. With CAN data frames, multiple data (physical data) are carried and received under a single ID. These modules acquire (extract) identifiers for data fields defined as channel settings (for example, "oil pressure" or "RPM"), re-sample the data, and then convert it to time series data.

Data sections can be specified on up to 60 signals per port. That is, a total of up to 120 signals for a single CAN FD/LIN Monitor Module (720245). Both standard (11 bit) and extended (29 bit) message IDs can be specified, and arbitrary locations and bit lengths (up to 32 bits) can also be specified for extraction.

The following shows an example of the monitor screen.

Sampled data (trend waveform data) can be saved to files.

When monitoring LIN bus data using the CAN FD/LIN Monitor Module (720245) or SENT using the 720243 module, the same principle applies.



Example monitor screen (DL950)

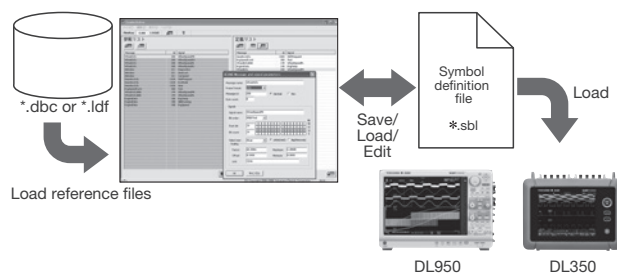
Using vehicle installed network definition files (CAN DBC, LIN LDF)

Data to be monitored (acquired) can not only be specified in digital codes (hexadecimal or numeric), but can also be loaded from a network definition file (CAN DBC or LIN LDF).

CAN DBC: Vector Informatik's CANdb database file (.dbc format)

LIN LDF: LIN Description file, complying with the LIN Configuration Language Specification

Using Yokogawa's free Windows PC software, "Symbol Editor", you can convert these definition files to our proprietary symbol definition file (.sbl format) and import that file to the main unit.



Using a vehicle-installed network definition file

Outputting frame data (only CAN/CAN FD data)

A single specified (defined) data frame or remote frame can be output (manually, at a desired timing) from the CAN/CAN FD port of the 720245.

Probes, cables, and converters*⁸

Model	Product	Description ¹
701947	100:1 Probe (for isolated BNC input)	1000 V (DC + ACpeak) CAT II, 1.5 m
702902	10:1 Probe (for isolated BNC input)	Operating temp. range: -40 to 85°C, 2.5 m
700929	10:1 Probe (for isolated BNC input)	1000 V (DC + ACpeak) CAT II, 1.5 m
701901	1:1 Safety BNC adapter lead	1000 Vrms CAT II
701904	1:1 Safety Adapter Lead (in combination with following)	1000 Vrms CAT II, 600 Vrms CAT III
758928	Pinchers tip (Hook type)	1000 Vrms CAT III, 1 set each of red and black
701954	Large alligator-clip (Dolphin type)	1000 Vrms CAT III, 1 set each of red and black
758929	Alligator clip adaptor set (Rated voltage 1000 V)	1000 Vrms CAT II, 1 set each of red and black
758922	Alligator clip adaptor set (Rated voltage 300 V)	300 Vrms CAT II, 1 set each of red and black
758921	Fork terminal adapter set	1000 Vrms CAT II, 1 set each of red and black
701940	Passive probe ²	Non-isolated 600 Vpk (701255) (10:1)
366926	1:1 BNC-alligator cable	Non-isolated 42 V or less, 1 m
366961	1:1 Banana-alligator cable	Non-isolated 42 V or less, 1.2 m
702915	Current probe ^{3, 4}	0.5, 5, 30 Arms, DC to 50 MHz
702916	Current probe ^{3, 4}	0.5, 5, 30 Arms, DC to 120 MHz
701917	Current probe ^{3, 4}	5 Arms, DC to 50 MHz
701918	Current probe ^{3, 4}	5 Arms, DC to 120 MHz
701932	Current probe ^{3, 4}	30 Arms, DC to 100 MHz
701933	Current probe ^{3, 4}	30 Arms, DC to 50 MHz
701930	Current probe ^{3, 4}	150 Arms, DC to 10 MHz
701931	Current probe ^{3, 4}	500 Arms, DC to 2 MHz
720930	Clamp-on probe	AC 50 Arms, 40 Hz to 3.5 kHz
720931	Clamp-on probe	AC 200 Arms, 40 Hz to 3.5 kHz
701934	Probe power supply	Large current output, external probe power supply (4 outputs)
701977	Differential probe ^{3, 4}	5000 Vrms and 7000 Vpeak or less (For 701255)
701978	Differential probe ^{3, 4}	±1500 V (DC + ACpeak) (For 701255)
701905	Conversion cable	For differential probe
701955	Bridge head (NDIS, 120 Ω)	With 5 m cable
701956	Bridge head (NDIS, 350 Ω)	With 5 m cable
701957	Bridge head (DSUB, 120 Ω)	shunt-CAL with 5 m cable
701958	Bridge head (DSUB, 350 Ω)	shunt-CAL with 5 m cable
758924	Safety BNC-banana adapter	500 Vrms CAT II
B9988AE	Printer roll paper	One lot: 10 rolls, 10 m each, for DL850E/EV

Model	Product	Description ¹
702911	Logic probe ⁵	8 bit, 1 m, non-Isolated, TTL level/Contact Input
702912	Logic probe ⁵	8 bit, 3 m, non-Isolated, TTL level/Contact Input
700986	High-speed logic probe ⁵	8 bit, non-Isolated, response speed: 1 μs (typ.)
700987	Isolation logic probe ⁶	8 bit, each channel isolated
758917	Measurement lead set ⁷	0.75 m, Stackable type (2 per set) Alligator-Clip is required separately.
758933	Measurement lead set ⁷	1000 V/19 A/1 m length Alligator-Clip is required separately.
701902	Safety BNC-BNC cable (1 m)	1000 Vrms CAT II (BNC-BNC)
701903	Safety BNC-BNC cable (2 m)	1000 Vrms CAT II (BNC-BNC)
720911	External I/O Cable	For DL850E/EV
720922	DC Power Cable (Cigarette Lighter Plug)	For DL350
701948	Plug-on clip	For 700929 and 701947
701906	Long test clip	For 701977, 701978 and 701901
A1800JD	Terminal	For 720220 input terminal, one (1) piece
A1833JD	Terminal	For 720220 input terminal, one (1) piece
720941	Optical Transceiver Module	For DL950 multi-unit connection
720942	Optical Fiber Cord	For DL950 multi-unit connection, 3 m
701972	Soft carrying case	For DL950
705926	Connecting cables	Connecting cable for 701953, 1 m
705927	Connecting cables	Connecting cable for 701953, 3 m
720940	GPS unit	For DL950 and DL350
751542-E4	Rack Mounting kit	For EIA
751542-J4	Rack Mounting kit	For JIS

*1: Actual allowable voltage is the lower of the voltages specified for the main unit and cable.

*2: 30 Vrms is safe when using the 701940 with an isolated type BNC input.

*3: Either the probe power option of the main unit or the probe power supply (701934) is required.

*4: The number of current probes that can be powered from the main unit's probe power option is limited.

*5: Includes one of each of the B9879PX and B9879KX connection leads.

*6: Additionally, 758917 and either the 758922 or 758929 are required for measurement.

*7: Alligator clip is required.

*8: Refer to the bulletin and user's manual of each product to confirm the compatibility with the main unit.

Plug-in module model numbers

Model	Description
720212	High-speed 200 MS/s 14 Bit Isolation Module
720211	High-speed 100 MS/s 12 Bit Isolation Module
720250	High-speed 10 MS/s 12 Bit Isolation Module
701251	High-speed 1 MS/s 16 Bit Isolation Module
720256	4 CH 10 MS/s 16 Bit Isolation Module
720254	4 CH 1 MS/s 16 Bit Isolation Module
701255	High-speed 10 MS/s 12 Bit non-Isolation Module
720268	High-Voltage 1 MS/s, 16 Bit Isolation Module (with AAF, RMS)
720220	Voltage Input Module (16 CH)
701261	Universal Module
701262	Universal Module (with Anti-Aliasing Filter)
701265	Temperature/High-Precision Voltage Module
720266	Temperature/High-Precision Voltage Isolation Module (Low Noise)
720221	16 CH Temperature/Voltage Input Module
701953-L1	16 CH Scanner Box (provided with 1 m cable)
701953-L3	16 CH Scanner Box (provided with 3 m cable)
701270	Strain Module (NDIS)
701271	Strain Module (DSUB, Shunt-CAL)
701275	Acceleration/Voltage Module (with Anti-Aliasing Filter)
720281	Frequency Module
720230	Logic Input Module
720245	CAN FD/LIN Monitor Module
720243	SENT Monitor Module

*Probes are not included with any modules.

*The External Scanner Box (model 701953) is required to use the 720221 module.

*Firmware update may be required when using these modules.

*The specifications of these modules are expressed differently in the case of the SL1000. See the SL1000 user's manual.

* The 720220 does not support the DL950.

This is a Class A instrument based on Emission standards EN61326-1 and EN55011, and is designed for an industrial environment.

Operation of this equipment in a residential area may cause radio interference, in which case users will be responsible for any interference which they cause.

See previous page for detail about probes, cables, and converters.

The DL950, SL2000, DL350, 720212, and 720211 use an Internal laser light source.



Complies with 21 CFR 1040.10 and 1040.11 except for conformance with IEC 60825-1 Ed. 3., as described in Laser Notice No. 36, dated May 8, 2019.
4-9-8 Myojin-cho, Hachioji-shi, Tokyo 192-8566, Japan

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- In order to protect the global environment, Yokogawa's electrical products are designed in accordance with Yokogawa's Environmentally Friendly Product Design Guidelines and Product Design Assessment Criteria.

NOTICE

- Before operating the product, read the user's manual thoroughly for proper and safe operation.

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 [Ed: 02/b] Printed in Japan, 505(KP)