ScopeCorder DL850/DL850V

Plug-In Modules —Specifications and Uses —

For DL850/DL850V main unit functions and specifications, see the "Bulletin DL850-00EN" catalog.

Module Selection

Input	Model No.	Sample Rate	Resolution	Bandwidth	Number of Channels	Isolation	Maximum Input Voltage (DC+ACpeak)	DC Accuracy	Note
Analog Voltage	720210	100 MS/s	12-Bit	20 MHz	2	Isolated	1000 V[*2] 200 V[*3]	±0.5%	High speed · High voltage · Isolated Max. four (4) modules can be installed in a main unit.[*6]
	701250[*5]	10 MS/s	12-Bit	3 MHz	2	Isolated	600 V[*2] 250 V[*3]	±0.5%	high noise immunity
	701251	1 MS/s	16-Bit	300 kHz	2	Isolated	600 V[*2] 140 V[*3]	±0.25%	High sensitivity range (1mV/div), low noise (±100 µVtyp.), and high noise immunity
	701255[*5]	10 MS/s	12-Bit	3 MHz	2	Non-Isolated	600 V[*4] 250 V[*3]	±0.5%	non-isolation version of model 701250
	701260	100 kS/s	16-Bit	40 kHz	2	Isolated	1000 V[*2] 850 V[*3]	±0.25%	with RMS, and high noise immunity
	720220	200kS/s	16-Bit	5 kHz	16	Isolated(GND-terminal) non-isolated (CH-CH)	42V[*3]	±0.3%	16CH voltage measurement (Scan-type)
Temperature	701261	100 kS/s (Voltage), 500 S/s (Temperature)	16-Bit (Voltage), 0.1℃ (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, iron-doped gold/chromel)
	701262	100 kS/s (Voltage), 500 S/s (Temperature)	16-Bit (Voltage), 0.1℃ (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, iron-doped gold/chromel), with AAF
	701265	500 S/s (Voltage), 500 S/s (Temperature)	16-Bit (Voltage), 0.1℃ (Temperature)	100 Hz	2	Isolated	42 V	±0.08 (Voltage)	thermocouple (K, E, J, T, L, U, N, R, S, B, W, iron-doped gold/chromel), high sensitivity range (0.1mV/div), and low noise (±4 µVtyp.)
	720221[*8]	10 S/s	16-Bit	600 Hz	16	Isolated	42 V	±0.15% (Voltage)	16-CH voltage or temperature measurement (scan method) Thermocouple (K, E, J, T, L, U, N, R, S, B, W, Au-Fe-chromel)
Strain	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
	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
Analog Voltage, Acceleration	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	701280	25 kS/s	16-Bit	resolution 50 ns	2	Isolated	420 V[*2] 42 V[*3]	±0.1% (Frequency)	Measurement frequency of 0.01 Hz to 200 kHz, Measured parameters (frequency, rpm, period, duty, power supply frequency, distance, speed)
Logic	720230	10 MS/s	—	—	8-bit x 2 ports	non-isolated	depend on logic probe used.	—	(8-bit/port) x 2, compatible with four-type of logic probe (sold separately)
CAN	720240	100 kS/s	—	—	(60signalsx2) port	Isolated	10V	—	CAN Data of max. 32-bit allowable It is available for DL850V only. Max two (2) modules can be installed in a main unit.[*6 *7]
CAN, LIN	720241	100 kS/s	—	—	(60signalsx2) port	Isolated	10 V (CAN port) 18 V (LIN port)	—	CAN port x 1, LIN port x 1 Available for DL850V only, up to 2 modules[*6 *7]

*1: Probes are not included with any modules.   *2: In combination with 10:1 probe model 700929   *3: Direct input   *4: In combination with 10:1 probe model 701940
*5: Some of the models 701250/701255 shipped on or before July, 2007 may require factory rework.   *6: Any other modules can be installed in the remaining slots.
*7: Up to two CAN Bus Monitor Modules (720240) or CAN & LIN Bus Monitor Modules (720241) in total can be used on a single main unit.   *8: The 16-CH Scanner Box (701953) is required for measurement.

Main Specifications (plug-in modules)

*1: Under standard operating conditions (temperature of 23 °C ±5 °C, 20 to 80% RH,
warm-up of 30 min. or more), after calibration. Recommended calibration period: 1 year.
Note that the strain modules (701270/71) must be balanced.
*2-*11 See the figure on page 6 for notes on the maximum input voltage and maximum allowable common mode voltage.
*12: See the figure on page 6 for the voltage-axis sensitivity setting.

High-Speed 10 MS/s, 12-Bit Isolation Module (701250)

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	10 MS/s
Frequency range (-3dB)[1]	DC to 3 MHz
A/D conversion resolution	12-bit (150 LSB/div)
Voltage-axis sensitivity setting[12]	5 mV/div to 20 V/div (1-2-5 steps)

Maximum input voltage (1 kHz or less)
  In combination with 700929 (10:1)[2]   600 V (DC+ACpeak)
  In combination with 701901+701954 (1:1)[6] 250 V (DC+ACpeak)
  Direct input[10]   250 V (DC+ACpeak)
Maximum allowable common mode voltage (1 kHz or less)
  In combination with 700929 (10:1)[3]   400 Vrms (CAT I), 300 Vrms (CAT II)
  In combination with 701901+701954 (1:1)[9] 400 Vrms (CAT I), 300 Vrms (CAT II)
  Direct input[11]   42 V (DC+ACpeak) (CAT I and CAT II, 30 Vrms)
Vertical (voltage) axis accuracy[1]
  DC accuracy   ±(0.5% of 10 div)
Temperature coefficient
  Zero point   ±(0.05% of 10 div)/ ℃ (Typ.)
  Gain   ±(0.02% of 10 div)/ ℃ (Typ.)
Bandwidth limit   OFF/500 Hz/5 kHz/50 kHz/500 kHz
Weight   Approx. 250g

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
Maximum sample rate	1 MS/s
Frequency range (-3dB)[1]	DC to 300 kHz (5 mV/div to 20 V/div)
	DC to 200 kHz (1 mV/div, 2 mV/div)
A/D conversion resolution	16-bit (2400 LSB/div)
Voltage-axis sensitivity setting[12]	1 mV/div to 20 V/div (1-2-5 steps)

Maximum input voltage (1 kHz or less)
  In combination with 700929 (10:1)[2]   600 V (DC+ACpeak)
  In combination with 701901+701954 (1:1)[6] 140 V (DC+ACpeak)
  Direct input[10]   140 V (DC+ACpeak)
Maximum allowable common mode voltage (1 kHz or less)
  In combination with 700929 (10:1)[3]   400 Vrms (CAT I), 300 Vrms (CAT II)
  In combination with 701901+701954 (1:1)[9] 400 Vrms (CAT I), 300 Vrms (CAT II)
  Direct input[11]   42 V (DC+ACpeak)(CAT I and CAT II, 30 Vrms)
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)/℃(Typ.)
                  2 mV/div : ±(0.05% of 10 div)/℃ (Typ.)
                  1 mV/div : ±(0.10% of 10 div)/℃ (Typ.)
  Gain   1 mV/div to 20 V/div : ±(0.02% of 10 div)/℃ (Typ.)
Bandwidth limit   OFF/400 Hz/4 kHz/40 kHz
Weight   Approx. 250g

High-Voltage 100 kS/s, 16-Bit Isolation Module (with RMS) (701260)

Input channels	2
Input type	Isolated unbalanced
Input coupling	AC, DC, GND, AC-RMS, and DC-RMS
Input connector	BNC connector (isolated type)
Input impedance	1 MΩ±1%, approx. 35 pF
Maximum sample rate	100 kS/s

Frequency range (-3dB)[1]
  Waveform observation mode DC to 40 kHz
  RMS observation mode   DC, 40 Hz to 10 kHz
A/D conversion resolution   16-bit (2400 LSB/div)
Voltage-axis sensitivity setting[12] 20 mV/div to 200 V/div (1-2-5 steps)
Maximum input voltage (1 kHz or less)
  In combination with 700929 (10:1)[2]   1000 V (DC+ACpeak)
  In combination with 701901+701954 (1:1)[6] 850 V (DC+ACpeak)
  Direct input[10]   850 V (DC+ACpeak)
Maximum allowable common mode voltage (1 kHz or less)
  In combination with 700929 (10:1)[3]
                  H side: 1000 Vrms (CAT II)[4], L side: 400 Vrms (CAT II)[5]
  In combination with 701901+701954 (1:1)[9]
                  H side: 700 Vrms (CAT II)[7], L side: 400 Vrms (CAT II)[8]
  Direct input   H/L sides: 30 Vrms (42 VDC+ACpeak)[11]
Vertical (voltage) axis accuracy[1]
  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 1 kHz
    AC accuracy (crest factor 2 or less)
                 ±(2.0% of 10 div) At frequency of 40 Hz to 1 kHz
    AC accuracy (crest factor 3 or less)
                 ±(3.0% of 10 div) At frequency of 40 Hz to 1 kHz
Temperature coefficient (Waveform observation mode)
  Zero point   ±(0.02% of 10 div)/℃ (Typ.)
  Gain   ±(0.02% of 10 div)/℃ (Typ.)
Bandwidth limit   OFF/100 Hz/1 kHz/10 kHz
Response time (RMS observation mode)
  Rising (0 to 90% of 10 div) 100 ms (Typ.)
  Falling (100 to 10% of 10 div) 250 ms (Typ.)
Weight   Approx. 250g

Frequency Module (701280)

Measurement function	Frequency (Hz), RPMs, RPSs, period (sec),duty cycle (%), power supply frequency (Hz), pulse width (sec), 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: 4.7 kΩ, approx. 5 V (pull-up can be turned ON only when the input is set to Pull-Up 5V)
Data update rate	25 kHz (40 µs)
Minimum measurement resolution	50 ns
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 allowable common mode voltage
  In combination with 700929 (10:1)[3]   300 Vrms (CAT I and CAT II)
  Direct input[11]   L side: 30 Vrms (CAT I and CAT II)
Bandwidth limit   OFF/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 200 kHz	0.1 Hz/div to 50 kHz/div
RPMs	0.01 rpm to 100,000 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 (sec)	5 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 (sec)	2 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 accuracy[1]

• 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 10 kHz   0.1% of the input frequency
  10 kHz to 20 kHz   0.3% of the input frequency
  20 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
  100 μs to 500 μs   0.1% of the input period
  50 μs to 100 μs   0.3% of the input period
  50 μs or less   0.5% of the input period + 0.1 μs

• When in duty cycle measurement mode
 Accuracy dependent on the input frequency
  1 kHz or less   ±0.1%
  1 kHz to 10 kHz   ±0.2%
  10 kHz to 50 kHz   ±1.0%
  50 kHz to 100 kHz   ±2.0%
  100 kHz to 200 kHz ±4.0%

• 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
  100 μs to 500 μs   0.1% of the input pulse width
  50 μs to 100 μs   0.3% of the input pulse width
  50 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. 250g

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 (-3dB)[1]	DC to 3 MHz
A/D conversion resolution	12-bit (150 LSB/div)
Voltage-axis sensitivity setting[12]	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   250 V (DC+ACpeak)
Vertical (voltage) axis accuracy[1]
  DC accuracy   ±(0.5% of 10 div)
Temperature coefficient
  Zero point   ±(0.05% of 10 div)/℃ (Typ.)
  Gain   ±(0.02% of 10 div)/℃ (Typ.)
Bandwidth limit   OFF/500 Hz/5 kHz/50 kHz/500 kHz
Weight   Approx. 250g

Acceleration/Voltage Module (with AAF) (701275)

Input channels	2
Input type	Non-isolated, unbalanced
Input coupling	AC, DC, ACCL (acceleration), and GND
Input connector	BNC connector (metallic type)
Input impedance	1 MΩ±1%, approx. 35 pF
Maximum sample rate	100 kS/s
Frequency range (-3dB)[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 = x1 range) x0.1 to x1 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 allowable common mode voltage (1 kHz or less)[11]
                        30 Vrms (CAT I and CAT II)
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)/℃ (Typ.)
  Gain   ±(0.02% of 10 div)/℃ (Typ.)
Bandwidth limit   OFF/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 x 40%
                        fs ≦ 50 Hz : fc = 20 Hz
  Cutoff characteristics -65 dB at 2 x 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. 250g

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	±10,000 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 (-3dB)[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 x (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
10,000 μSTR	-10,000 μSTR to +10,000 μSTR
20,000 μSTR	-20,000 μSTR to +20,000 μSTR

Maximum input voltage (1 kHz or less)	
	10 V (DC+ACpeak)
Maximum allowable common mode voltage (1 kHz or less)	
	42 V (DC+ACpeak)(CAT I and CAT II, 30 Vrms)
DC accuracy[1]	±(0.5% of FS + 5 μSTR)
Temperature coefficient	
Zero point	±5 μSTR/℃ (Typ.)
Gain	±(0.02% of FS)/℃ (Typ.)
Bandwidth limit	OFF/10 Hz/100 Hz/1 kHz

- NDIS (701270)

Function	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. 250g

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 (-3dB)[1]	Voltage	DC to 40 kHz
	Temperature	DC to 100 Hz
Vertical resolution	Voltage	16-bit (2400 LSB/div)
	Temperature	0.1℃

Measurement range/accuracy[1]
  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
(Does not include the reference junction temperature compensation accuracy.)

Type	Measurement Range	Accuracy
K	-200℃ to 1300℃	±(0.1% of reading + 1.5℃)
E	-200℃ to 800℃	Except ±(0.2% of reading + 1.5℃)
J	-200℃ to 1100℃	for -200℃ to 0℃
T	-200℃ to 400℃	

Type	Measurement Range	Accuracy
L	-200℃ to 900℃	
U	-200℃ to 400℃	
N	0℃ to 1300℃	
R	0℃ to 1700℃	±(0.1% of reading + 3℃)
S	0℃ to 1700℃	Except, 0 to 200℃: ±8℃
		200℃ to 800℃: ±5℃
B	0℃ to 1800℃	±(0.1% of reading + 2℃)
		Except, 400℃ to 700℃: ±8℃
		Effective range is 400℃ to 1800℃
W	0℃ to 2300℃	±(0.1% of reading + 3℃)
Au7Fe3	0K to 300K	0K to 50K: ±4K
		50K to 300K: ±2.5K

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 allowable common mode voltage (1 kHz or less)	
	42 V (DC+ACpeak) (CAT I and CAT II, 30 Vrms)
Temperature coefficient (Voltage)	
Zero point	±(0.01% of 10 div)/℃ (Typ.)
Gain	±(0.02% of 10 div)/℃ (Typ.)
Bandwidth limit	
Voltage	OFF/AUTO(AAF)/40 Hz/400 Hz/4 kHz
Temperature	OFF/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 x 40%
	fs ≧ 50 Hz : fc = 20 Hz
Weight	Approx. 250g

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 (-3dB)[1]	DC to 100 Hz	
Vertical resolution	Voltage	16-bit (2400 LSB/div)
	Temperature	0.1℃

Measurement range/accuracy[1]
  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
(Does not include the reference junction temperature compensation accuracy.)

Type	Measurement Range	Accuracy
K	-200℃ to 1300℃	±(0.1% of reading + 1.5℃)
E	-200℃ to 800℃	Except ±(0.2% of reading + 1.5℃)
J	-200℃ to 1100℃	for -200℃ to 0℃
T	-200℃ to 400℃	
L	-200℃ to 900℃	
U	-200℃ to 400℃	
N	0℃ to 1300℃	
R	0℃ to 1700℃	±(0.1% of reading + 3℃)
S	0℃ to 1700℃	Except, 0 to 200℃: ±8℃
		200℃ to 800℃: ±5℃
B	0℃ to 1800℃	±(0.1% of reading + 2℃)
		Except, 400℃ to 700℃: ±8℃
		Effective range is 400℃ to 1800℃
W	0℃ to 2300℃	±(0.1% of reading + 3℃)
Au7Fe3	0K to 300K	0K to 50K: ±4K
		50K to 300K: ±2.5K

Maximum input voltage (1 kHz or less)	
	42 V (DC + ACpeak)
Maximum allowable common mode voltage (1 kHz or less)	
	42 V (DC+ACpeak) (CAT I and CAT II, 30 Vrms)
Temperature coefficient (Voltage)	
Zero point	±((0.01% of 10 div)/℃ +0.05μV)/℃ (Typ.)
Gain	±(0.02% of 10 div)/℃ (Typ.)
Bandwidth limit	OFF/2 Hz/8 Hz/30 Hz
Weight	Approx. 250g

High-Speed 100 MS/s, 12-Bit Isolation Module (720210)

Input channels	2
Input coupling	AC, DC and GND
Maximum sample rate	100MS/s
Input type	Isolated unbalanced
Frequency range(-3dB)[1]	DC to 20MHz
Voltage-axis range setting	
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)[2]	
	1000V (DC+ACpeak) (CAT Ⅱ)
In combination with 701901 + 701954[6]	
	200V (DC+ACpeak)
Direct input or cable incompatible with safety standards[10]	
	200V (DC+ACpeak)
Maximum allowable common mode voltage (1 kHz or less)	
In combination with 700929 (10:1)[3]	
	1000 Vrms (CAT Ⅱ)
In combination with 701901 + 701954[9]	
	1000 Vrms (CAT Ⅱ)
Direct input or cable incompatible with safety standards[11]	
	42 V (DC + ACpeak) (CAT I and CAT II, 30 Vrms)
Vertical (voltage) axis accuracy[1]	
DC accuracy	±(0.5% of 10 div)
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.)
Withstand voltage	1500 Vrms for 1 minute (across each terminal and earth) (60 Hz)
Insulation resistance	500 VDC, 10 MΩ or more (across each input terminal and earth)
A/D conversion resolution	12-bit (1500 LSB/div)
Temperature coefficient	
Zero point:	±(0.1% of 10 div)/℃(Typ.)
Gain:	±(0.05% of 10 div)/℃(Typ.)
Bandwidth limit	OFF/2MHz/1.28MHz/640kHz/320kHz/160kHz/80kHz/40kHz/20kHz/10kHz
Probe attenuation setting	
	Voltage Probe: 1:1, 10:1, 100:1, 1000:1
	Current Probe: 10A:1V(for the 700937/701933), 100A:1V(for the 701930/701931)

Note: Max. four (4) modules can be installed in a main unit.

Weight	Approx. 250g

16-CH Voltage Input Module (720220)

Input channels	16
Input coupling	DC, GND (Selectable for each sub-CH)
Maximum sample rate	200kS/s(single CH)
	[10kS/s when using 16-CH]
Input type	Isolated unbalanced
Frequency range(-3dB)[1]	DC to 5kHz
Voltage-axis sensitivity setting	200mV/div to 2V/div (1-2-5 steps)
Maximum input voltage(1kHz or less)	
	Direct input 42V (DC+ACpeak)
Maximum allowable common mode voltage(1kHz or less)	
	Direct input 42 V (DC+ACpeak) (CAT I and CAT II, 30 Vrms)
Vertical (voltage) axis accuracy	
DC accuracy	±(0.3% of 10div)
Input connector	Spring-type terminal (removable per 8CH)
Input impedance	1MΩ ±1%
Common mode rejection ratio	80 dB (50/60 Hz) or more (Typ.)
A/D conversion resolution	16-bit (2400 LSB/div)
Temperature coefficient	
Zero point:	±(0.02% of 10div)/℃ (Typ.)
Gain:	±(0.02% of 10div)/℃ (Typ.)
Bandwidth limit	OFF/500Hz(Selectable for each sub-CH)
Weight	Approx. 250g

Logic Input Module (720230)

Input ports	2
Input bits	8-bit/Port
Maximum sample rate	10MS/s
Input type	non-isolated
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. 250g

16-CH Temperature/Voltage Input Module (720221)

Input channels	16
Input coupling	TC: temp. (thermocouple) measurement
	DC: voltage measurement (DC coupling)
Data updating period	Switching among 100 ms, 300 ms, 1 s, and 3 s
Input type	Isolated unbalanced
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)

Temp. measurement	Type	Measurement range	Accuracy
	K[13]	–200 to 1300°C	±(0.1% of reading + 1.5°C)
	E[13]	–200 to 800°C	However, for –200 to 0°C,
	J[13]	–200 to 1100°C	±(0.2% of reading + 1.5°C)
	T[13]	–200 to 400°C	
	L[15]	–200 to 900°C	
	U[16]	–200 to 400°C	
	N[13]	0 to 1300°C	
	R[13]	0 to 1700°C	±(0.1% of reading + 3°C)
	S[13]	0 to 1700°C	However, 0 to 200°C: ±8°C
			200 to 800°C: ±5°C
	B[13]	0 to 1800°C	±(0.1% of reading + 2°C)
			However, 400 to 700°C: ±8°C
			Effective range is 400 to 1800°C
	W[14]	0 to 2300°C	±(0.1% of reading + 3°C)
	Au-Fe-chromel	0 to 300K	0 to 50K: ±4K
			50 to 300K: ±2.5K

*13:	R, S, B, K, E, J, T, N : IEC584-1 (1995) DIN IEC584 JIS C1602 - 1995	
*14:	W: W-5%Re/W-26%Re (Hoskins Mfg. Co.) ASTM E988	
*15:	L: Fe-CuNi, DIN43710	
*16:	U: Cu-CuNi, DIN43710	

Maximum input voltage (1 kHz or less)	
Both voltage & temp.	42 V (DC + ACpeak) (CAT I and CAT II)
Maximum allowable common mode voltage (1 kHz or less)	
Both voltage & temp.	42 V (DC + ACpeak) (CAT I and CAT II)
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	±0.01div(Typ.)
A/D conversion resolution	
At voltage measurement	16 bits (2400 LSB/range)
Temperature coefficient	
Zero point	±(0.025% of 10div)/℃ (Typ.)
Gain	±(0.01% of 10div)/℃ (Typ.)
Reference junction comp. accuracy (at input terminal temp. balancing)	
	K, E, J, T, L, U, N: ±1℃ R, S, B, W: ±1.5℃
	Au-Fe-chromel: ±1K
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. 250 g

CAN Bus Monitor Module (720240)

Input ports	2
Input type	Isolated
	(across port and main unit, across each port)
Input connector	D-Sub 9-pin (male)
Input channels	60-signal/port
Maximum sample rate	100kS/s (60-CH x 1kS/s per port)
Bit rate	10k, 20k, 33.3k, 50k, 62.5k, 66.7k, 83.3k, 100k,
	125k, 250k, 500k, 800k,1Mbps
Supported protocol	Physical layer: ISO-11898
	(High Speed Communication)
	CAN in Automation: CAN2.0B
	(Standard & extended massage format)
Terminator	Built-in, it is switchable On and Off per port.
Endian	Little or Big selectable
LED display	CAN Ch1: TERM on the panel
	CAN Ch2: TERM on the panel
Channel setting	Message ID (Standard or Extended)
	Extraction Position
	Bit Length (Max. 32-bit)
	Select the Endian (little or big)
	Convert physical value
Output function	Single shot
	Specified ID (Data) can be outputted manually.
Allowable voltage range	-3 to 10V
Maximum allowable common mode voltage	
(1kHz or less)	42 V (DC+ACpeak) (CAT I and CAT II, 30 Vrms)
Weight	Approx. 250 g

This module is available for DL850V only. Max. two (2) modules including the 720241 module can be installed.

CAN & LIN Bus Monitor Module (720241)

Input ports	CAN port: 1, LIN port: 1
Input type	Isolated
	(across port and main unit, across each port)
Maximum sampling rate	100 kS/s (60-CH x 1 kS/s per port)
LIN port specifications	
Maximum input voltage	–1 V to +18 V (LIN input to GND)
LIN supply voltage input range	
	7 V to 18 V
Maximum allowable common mode voltage	
	30 Vrms (CAT I and CAT II)
Input connector	D-sub 9-pin (male)
Supported protocol	Physical layer: ISO-9141
Supported bit rate	2400, 9600, 19200bps
Supported data length	4 bytes maximum
Input channels	60-signal/port
Supported data field checksum	
	Standard and extended checksums
CAN port specifications	Compliant with CAN Bus Monitor Module (720240)
Weight	Approx. 250 g

This module is available for DL850V only. Max. two (2) modules including the 720240 module can be installed.

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 the offset voltage.
• Zoom in or out of the vertical axis (expand/reduce).

Maximum Input Voltage and Maximum Allowable Common Mode Voltage

See Specifications of Plug-in Modules

<In combination with 700929>

700929

<In combination with 701901 + 701954>

701901   701954
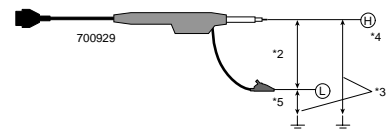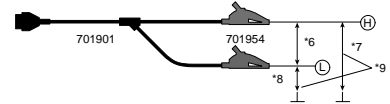
<Direct input>
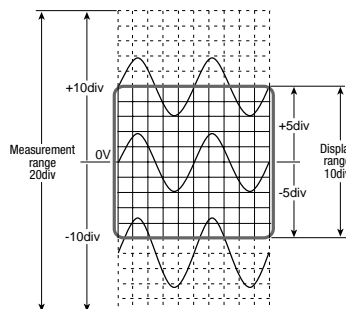(with a cable which doesn't comply with the safety standard)

BNC
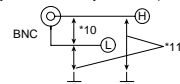
WARNING

Do not apply input voltage exceeding the maximum input voltage, withstand voltage, or allowable surge voltage. 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 isolation probe (701947)

Total length	1.5m
Input impedance/capacitance	100MΩ ± 1% *1 /7pF
Attenuation ratio	100: 1
Frequency range (-3dB)	DC to 200MHz
Voltage coefficient	0.001%/V(Typ.)
Maximum input voltage*2	Space between shield and earth.
	± 1000V(DC+ACpeak) CAT II
	± 1000V(DC+ACpeak) CAT I
	Space between tip and shield, tip and earth.
	± 1000V(DC+ACpeak) CAT II
	± 3540V(DC+ACpeak) CAT I

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.

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% rdg ± 1 mV
	30 Arms to 50 Apeak : ± 2% rdg (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% rdg ± 1 mV
	150 A to 300 A : ± 2% rdg (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% rdg ± 5 mV
	500 A to 700 A : ± 2% rdg (DC, and 45 to 66 Hz)

Differential Probe (700924)

Frequency range (-3 dB)	DC to 100 MHz
Attenuation ratio	Switched ratios of 100:1 and 1000:1
Input impedance/capacitance	4 MΩ/approx. 10 pF
Differential allowable voltage	± 1400 V (DC + ACpeak) or 1000 Vrms at 1000:1 attenuation
	± 350 V (DC + ACpeak) or 250 Vrms at 100:1 attenuation

High Voltage Differential Probe (701926)

Frequency range (-3dB)*13*14	DC to 50MHz
Attenuation	1000:1 or 100:1, switchable
Input resistance and capacitance (typ.)	
	50 MΩ + approx. 17 pF (parallel with respect to ground)
Allowable differential voltage (between + and - terminals)*15	
	5000 V rms or less and 7000 Vpeak or less at 1000:1 attenuation
	500 V rms or less and 700 Vpeak or less at 100:1 attenuation
Allowable common mode voltage*15	
	5000 Vrms or less and 7000 Vpeak or less
Maximum input voltage	1000Vrms CAT III
(to ground)*15	5000 Vrms and 7000 Vpeak CAT I
Operating conditions	5 to 40℃ 25 to 85%RH (no condensation)
Power requirements	· Internal battery: Four AA dry cells
	· External power supply: 6 VDC/200 mA or more or 9 VDC/150mA or more
	· From the probe power supply terminal of the DL Series, the 701934 using the probe power cable
External dimensions	202 mm × 83 mm × 38 mm (excluding connector and cable)
Weight	Approx. 500 g (excluding batteries)

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 max. (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, SL1400 earth and earth of all bits are common)
Maximum input voltage	± 35 V
Response time	3 µs or less
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+ACpeak)(CAT I and CAT II, 30 Vrms)
Response time	1 µ s or less
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) x 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
	AC input	within 20 ms
Maximum input voltage (1 kHz or less)(across H and L of each bit)		
		250 Vrms (CAT I and CAT II)
Maximum allowable common mode voltage (1 kHz or less)		
		250 Vrms (CAT I and CAT II)
Maximum allowable voltage between bits		250 Vrms (CAT I and CAT II)
Input impedance		Approx. 100 kΩ

Bridge Head (701955, 701956, 701957, 701958)

Bridge resistance	Model 701955, 701957 : 120Ω
	Model 701956, 701958 : 350Ω
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	Approx. 37(W) × 97(H) × 30(D) mm (701955, 701956)
	Approx. 50(W) × 101(H) × 29(D) mm (701957, 701958)
Weight	Approx. 85 g (Bridge head only) (701955, 701956)
	Approx. 100 g (Bridge head only) (701957, 701958)

Power Supply (701934)

Compatible Probes	700937 Current probe,
	701920 Differential probe, 701922 Differential probe
	700924 Differential probe, 701921 Differential probe
	701930 Current probe, 701931 Current probe
	701932 Current probe, 701933 Current probe
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 - 240VAC
	(actual power supply voltage may fluctuate within ± 10% of the rating)
Ripple Voltage	50mVp-p
Rated Power	190 VA Max (at the rated output current)
External Dimensions	80(W) × 119(H) × 200(D)mm
Weight	Approx. 1.2 kg

*13 When the supply voltage from the dry cells is 5 V or higher or when using an external power supply.
*14 At an ambient temperature 23±5°C.
*15 Derating is applied towards frequencies.

Isolation Probe
700929

Isolation Probe
701947

Current Probe
701933

Current Probe
701930

Current Probe
701931

Differential Probe
700924

10:1 Passive Probe
701940

1:1 Safety BNC
Adapter Lead
701901*1

Alligator Clip
(Dolphin type)
701954

Safety Mini-Clip
(Hook type)
701959

Alligator Clip Adapter Set
(Rated Voltage 300 V)
758922

Alligator Clip Adapter
Set (Rated Voltage
1000 V) 758929

Fork Terminal
Adapter
758921

1:1 BNC-Alligator Cable
366926

1:1 Banana-Alligator
Cable
366961

High-speed Logic Probe
700986

Isolation Logic Probe
700987

Logic Probes
702911 (1 m)/702912 (3 m)

Measurement Lead Set
for Isolation Logic
758917

External I/O Cable
720911

Safety BNC-BNC
Cable (1 m) 701902

Safety BNC-BNC
Cable (2 m) 701903

Safety BNC-Banana
Adapter 758924

Probe Power Supply
701934

16-CH Scanner box
701953*2

Connecting Cable
(1 m) 705926

Connecting Cable
(3 m) 705927

Bridge Head
701955 (NDIS, 120 Ω)

Bridge Head
701956 (NDIS, 350 Ω)

Bridge Head
701957 (DSUB, 120 Ω)

Soft Carrying Case
701963

Bridge Head
701958 (DSUB, 350 Ω)

*1 The 1:1 BNC safety adapter lead (701901) must be used with one of the following accessories (which are sold separately): alligator clip (dolphin type: 701954), safety miniclip (hook type: 701959), alligator adapter (758922 or 758929), or fork terminal adapter (758921).

*2 The length of the 16-CH scanner box (701953) cable varies depending on the 16-CH scanner box suffix code.

Accessories for DL850V/DC model

701971
DC Power Supply Cable
(alligator clip type), 1.8 m

701970
DC Power Supply Cable
(cigarette lighter plug type), 1.8 m

B8023WZ
DC Power Supply Connector
(without cable, D-sub 3 pin solder type)
One connector comes standard with the option.

Using the Strain Modules (701270, 701271)

Strain Module (NDIS)
(Model: 701270)

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

Two types of modules are available depending on differences in the input connectors and support for shunt calibration. These 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.

$+\Delta R$ Expansion: Resistance value increases

$-\Delta R$ Contraction: Resistance value decreases

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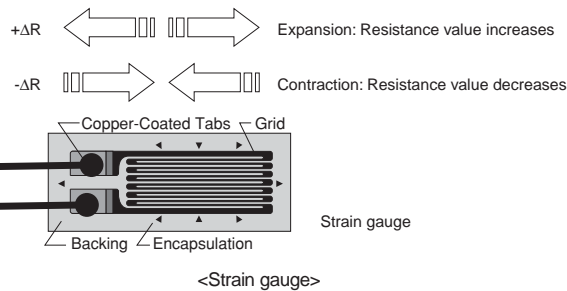
The strain gauge's rate of change in resistance is very small. For instance, when using a 120-Ω strain gauge, the change in resistance corresponding to a strain of 1000 μ STR is 0.24 Ω. Relative to 1 μSTR, the change is a mere 0.00024 Ω. Converting such minute resistance changes to voltage requires a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

< Strain gauge and measurement circuit >
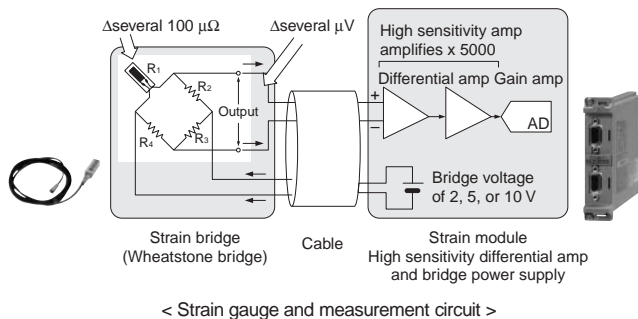
Furthermore, because the bridge output is as small as a few micro volts, the input must be amplified inside the strain module using a differential and high gain amp. The DL850 provides amplification of 5000 times.

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 5/10 V .

■ Measuring with a Strain Module

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

$$\sigma = \varepsilon E$$

σ : stress
ε : strain
E : elasticity (Young's modulus)

<Relationship between strain and stress>
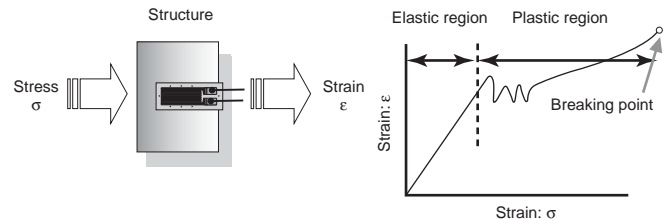
Stress (σ) is calculated using the elasticity (Young's modulus) which depends on the material of the structure, and the durability of the structure is evaluated from the relationship thereof.

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

■ Connecting to a Strain Module
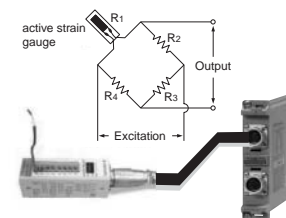
For strain measurements with a strain gauge, use the accessory bridge head.
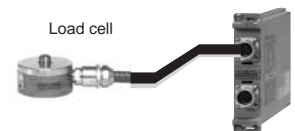
Strain gauge type sensors are connected directly.

■ 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 (before) introducing a load, and while not perfectly accurate, the correction can include up to the gauge wiring cables.
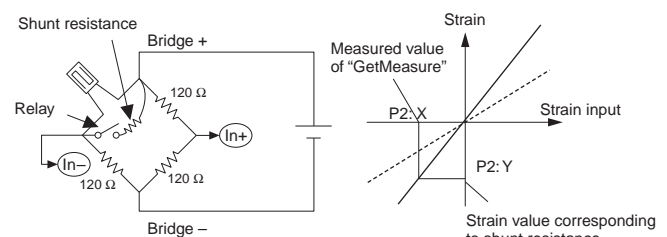
< Gain correction using shunt CAL (gain correction on the negative (-) side) >

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)

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

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 doubles 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.
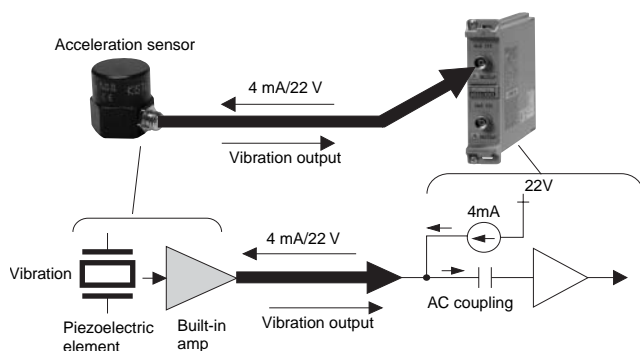
< Connecting a built-in amp type acceleration sensor >

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[TM1]   PCB: ICP[TM1]   Endevco: isotron2[TM1]

1. These are registered trademarks.

■ Charge Output Type Acceleration Sensors

When you need to perform measurements by connecting a charge output type acceleration sensor, you can input to the 70125 Acceleration/Voltage module through a commercially available charge converter or charge amp.
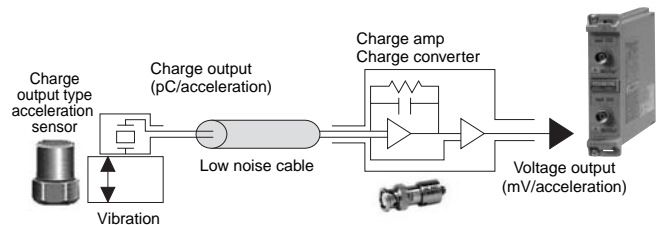
< Connecting a charge output type acceleration sensor >

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, turn ON the bias output (constant drive current).

Using the Frequency Module (701280)

Frequency Module (Model: 701280)

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 200 kHz. Measured values are updated at high speed (40 μs/25 kHz) for real time confirmation.
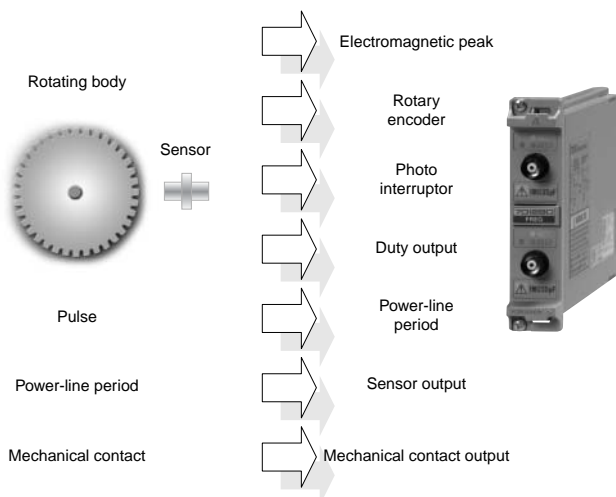
< DUTs of the Frequency module >

Test Item	Measurement	Real-Time Calculation	Measurement Range[1]
Frequency (Hz)		Frequency (Hz) = 1÷Tw (s)	0.01 Hz~200 KHz
Period (s)		Period (s) = Tw (s)	5 μs~50 s
Rpm		Rpm = freq. (Hz) ÷pulses per revolution (Nr)×60	0.01 rpm~100,000 rpm
Rps		Rps = freq (Hz) ÷pulses per revolution (Nr)	0.001 rps~2000 rps
Duty (%)		Duty (%) = Thigh (s)÷Tw (s) or = Tlow (s)÷Tw (s)	0%~100%
Pulse width		Pulse width (sec) = Thigh (s) or Tlow (s)	2 μs~50 s
Power Supply Freq. (Hz)		Power supply freq. (Hz) = 1÷Tw (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)		Velocity (km/h) = distance per pulse ℓ (km)÷Tw (s)×3600 Velocity (m/s) = distance per pulse ℓ (m)÷Tw (s) * Units are user-definable (angular velocity and other units)	F= (1/Tw) = 0.01 Hz~200 kHz

1 Allowable input frequency range : 0.01 Hz~200 kHz

< Frequency module test items >

Unlike general FV converters, the model 701280 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.
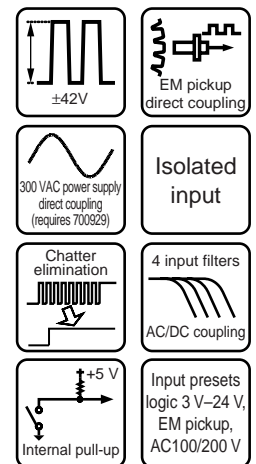
■ Real-Time Digital Filtering

● Smoothing Filter (Moving Average)

Smooth stair-step shaped waveforms: Updating occurs every 40 μs, giving a high speed averaging effect. Filters are set at 0.1ms-1 sec (up to the 25000th order). Filters reduce jitter in observed waveforms, and increases resolution.
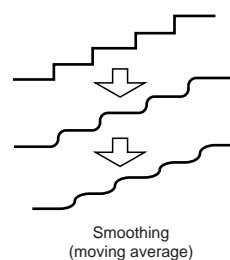
● Pulse Average

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).


Smoothing (moving average)

Pulse average
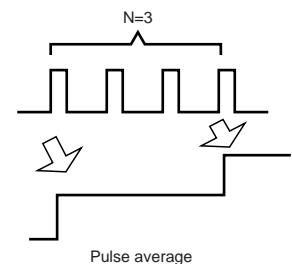
■ Supports Braking Applications

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.
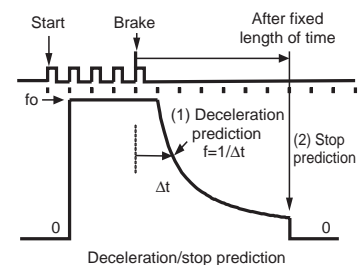
● Stop Prediction (2)

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.

Deceleration/stop prediction

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-channel 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).
You can build a 128-CH measuring system by installing up to eight modules in a single DL850/DL850V.
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.
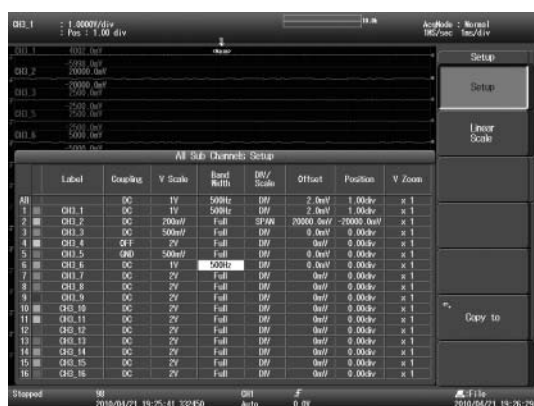
< Channel setting screen >

■ Connecting wires to terminal block
The following electrical wire is recommended.
0.20 mm^2 to 1.00 mm^2 (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
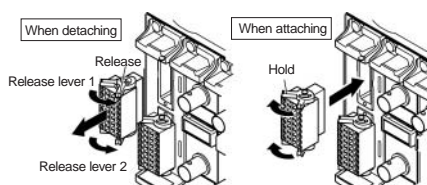
right; wires can be easily installed.

■ Number of subchannels to be used, sampling rate, and record length
Subchannels under measurement (those set to ON) are sampled in turn. 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
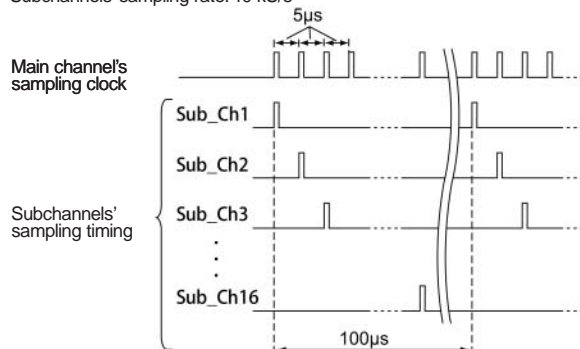
When the number of subchannels to be measured is 2 (subchannels 1 and 16 set to ON)
Subchannels' sampling rate: 100 kS/s
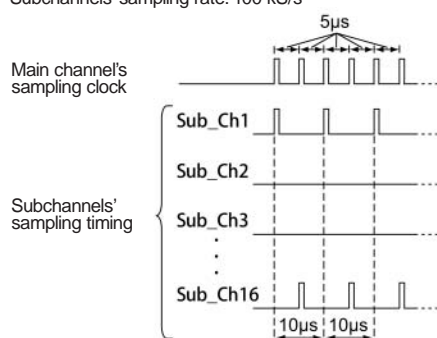
For example, if the main channel's sampling rate is 200 kS/s, the sampling clock is 5 µs period. The subchannels are sampled at this sampling clock in turn. Therefore, the subchannels' sampling timing is as shown in the figure above. Because scanning all required channels takes time in proportion to 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 DL850/DL850V 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:

Record length of each subchannel ≤ set record length / number of subchannels to be used

Using the 16-CH Temperature/Voltage Input Module (720221)
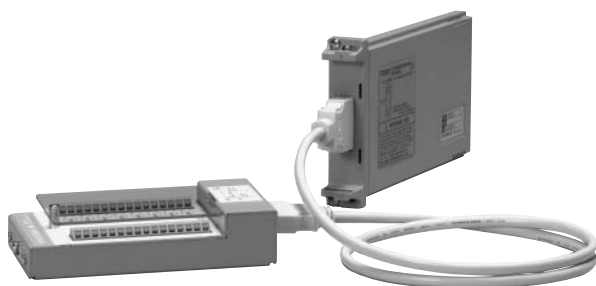
External Scanner Box (Model: 701953)   16-CH Temperature/Voltage Input Module (Model: 720221)

This is a multichannel input module capable of measuring up to 16 channels (subchannels' 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 always 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 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 5 of this manual.

Both the maximum input voltage and the maximum allowable common mode voltage are 42 V (AC + DCpeak, 1 kHz or less).

■ Scanning Method, Data Updating Period, and Bandwidth Limit

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

The scan data updating period for one scan (max. 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 5 of this manual.

Reference junction compensation

External scanner box (701953)
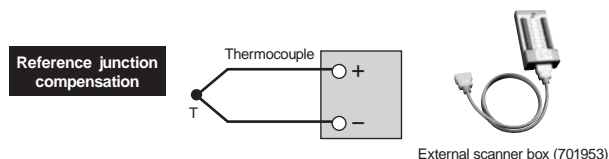
Moreover, the external scanner box also incorporates a burnout circuit for detecting a wire break and this burnout detection is always available even during measurement. The burnout detection can be set to ON/OFF for each subchannel.

■ 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.

< $\Delta\Sigma$-type A/D conversion block diagram >
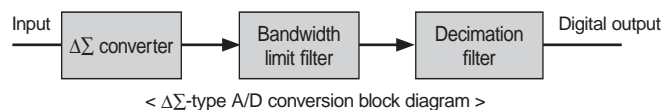
In general temperature scanner modules, the filtering performance tends to be sacrificed (weakened) to improve the data updating period, and therefore high-frequency noise cannot be reduced sufficiently in some cases. The module also offers excellent common mode reduction performance as well as the ability to scan 16 points (CH) of data at an updating period as high as 100 ms.

< Channel setting screen >

■ 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 2V/div (1-2-5 steps)	1mV/div to 2V/div (1-2-5 steps)
Voltage accuracy	± (0.3% of 10div)	± (0.15% of 10div)
Updating period	5 μs max. (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)
Max. common mode voltage	42V (DC+ACpeak) (CAT I , CAT II)	42V (DC+ACpeak) (CAT I , CAT II) 42V (DC+ACpeak) (CAT I , CAT II)
Isolation between channels	No	Yes
A/D conversion resolution	16-bit (2,400 LSB/div)	16-bit (2,400 LSB/div)

■ Differences from the MX100 High-speed Acquisition Unit (Yokogawa Electric)

This unit can measure multipoint voltage/temperature in the same way; however, there are the following differences in features compared with the DL850/DL850V.

MX100 PC-based Multichannel Voltage/Temp. Acquisition Unit (Yokogawa Electric):
This unit can acquire multichannel voltage/temperature data for many hours. It offers a high withstand voltage and allowable common mode voltage. This is effective, for example, for applications such as measuring each cell voltage of a multi-layer battery.

DL850/DL850V ScopeCorder, 16-CH Temp/Voltage Input Module (720221)

This module features excellent common mode reduction performance, is compact and lightweight, and a single box-type measuring instrument can acquire signals ranging from high-speed electric signals to multi-type mechanical signals. It is ideal for applications such as measuring not only temperature but also various types of signals (particularly high-speed electric signals) and evaluating the relation among them on an experimental bench or in the field.

Using the Logic Input Module (720230)

Logic Input Module (Model: 720230)

| | Logic Probe (TTL level/contact input) 1 m: 702911/3 m: 702912 | High-Speed Logic Probe 700986 | Isolation Logic Probe 700987 |

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

Input logic signals can be displayed as waveforms at a sampling resolution of up to 10 MS/s. Each port can measure 8 bits, 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 of individual bits ON/OFF, and assign each bit its own unique label.
In all, you can input and display up to 128 bits of logic signals by installing up to eight modules in a single DL850/DL850V.

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.
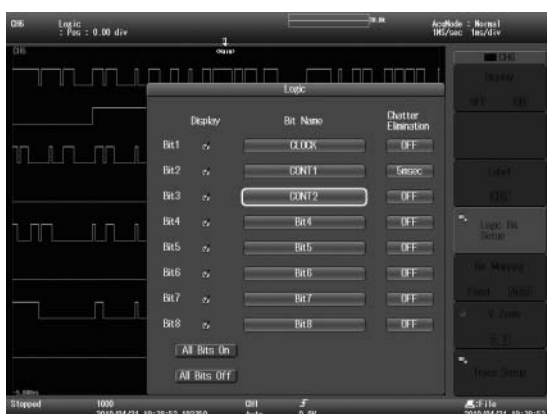
< Logic display setting screen >

You can select from four different types of logic probe to best fit the input signal. (For details on logic probes, see page 6 of this catalog. Also see the "Bulletin DL850-00E" catalog for logic probes, adaptors, and other accessories.)
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.

CAN Bus Monitor Module (Model: 720240)   CAN & LIN Bus Monitor Module (Model: 720241)

These modules interpret the vehicle-installed network CAN protocol or LIN protocol, monitors communication data on the bus, and displays the time series trend waveforms. It is connected as a CAN or LIN bus node and can read data frames of each protocol communicating on the bus.

By combining it with other input modules, it can simultaneously measure communication data on the CAN and LIN buses, voltage and temperature, 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, enabling evaluation of the overall vehicle-installed system.

The CAN Bus Monitor Module (720240) is equipped with two CAN input ports, enabling a single module to be connected to two CAN network systems. The CAN & LIN Bus Monitor Module (720241) is equipped with one CAN and one LIN input port, enabling a single module to be connected to a CAN and a LIN protocol network.

■ Data Frames That Can be Monitored

These modules can monitor data frames defined by the CAN protocol. They support both standard and extended formats.

Moreover, the CAN & LIN Bus Monitor Module (720241) can monitor data frames of up to 4 bytes defined by the LIN protocol.

For the supported protocol of each bus, see the description of each module's specifications in this manual.

■ CAN Data Monitoring Method (Example)
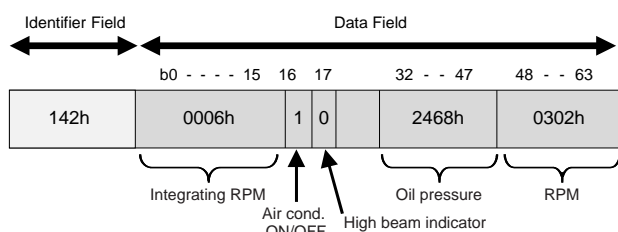
< Example of CAN frames and physical data >

The following describes the CAN data monitoring method as an example. 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 Bus Monitor Module (720240) and that of up to 60 signals for a single CAN & LIN Bus

Monitor Module (720241). Both standard (11-bit) and extended (29-bit) message IDs can be specified, and arbitrary locations and bit lengths can also be specified for extraction.

The relationship between sampled data and displayed waveforms is as shown in the figure below (example of CAN).
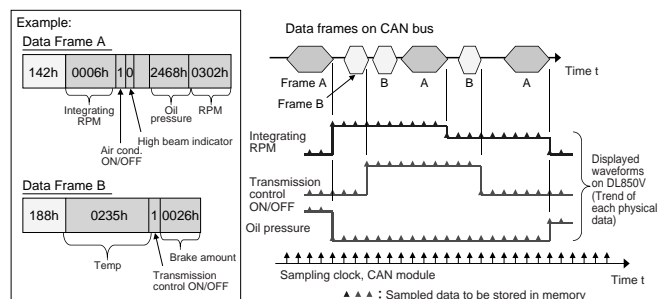
< Relationship between sampling data and displayed waveform(s), example >

The following shows an example of the actual monitor screen.
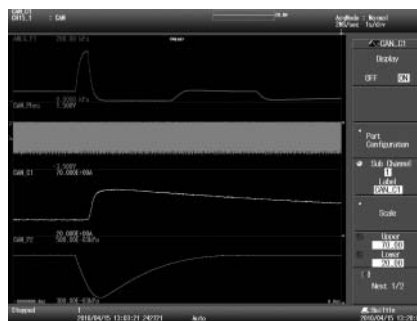
< Example monitor screen >

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

When monitoring LIN bus data using the CAN & LIN Bus Monitor Module (720241), the same principle applies.

■ 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 each network definition file (CAN DBC or LIN LDF).
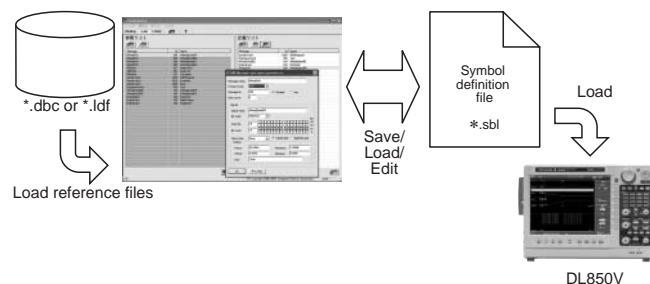
CAN DBC:
Vector Informatik's CANdb database file (.dbc format)
LIN LDF:
LIN Description file, complying with the LIN Configuration Language Specification

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 DL850V.

< Using a vehicle-installed network definition file >

■ Outputting Frame Data (only CAN Data)

At the CAN port, a single specified (defined) data frame or remote frame can be output (manually, at a desired timing).

Plug-in Module Model Numbers

Model	Description
720210	High-speed 100 MS/s 12-Bit Isolation Module (2 ch)
720220	Voltage Input Module(16 ch)
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)
720230	Logic Input Module (16 ch)
720240	CAN Bus Monitor Module (32 ch, available DL850V only)
720241	CAN & LIN Bus Monitor Module
701250	High-speed 10 MS/s 12-Bit Isolation Module (2 ch)
701251	High-speed 1 MS/s 16-Bit Isolation Module (2 ch)
701255	High-speed 10 MS/s 12-Bit non-Isolation Module (2 ch)
701260	High-voltage 100 kS/s 16-Bit Isolation Module (with RMS, 2 ch)
701261	Universal Module (2 ch)
701262	Universal Module (with Anti-Aliasing Filter, 2 ch)
701265	Temperature/high-precision voltage Module (2 ch)
701270	Strain Module (NDIS, 2 ch)
701271	Strain Module (DSUB, Shunt-CAL, 2 ch)
701275	Acceleration/Voltage Module (with Anti-Aliasing Filter, 2 ch)
701280	Frequency Module (2 ch)

* Probes are not included with any modules.

Note 1: These modules can be used with the DL750/DL750P/SL1000 and SL1400 as well with some exceptions.
Note 2: Up to two 720240 or 720241 modules in total can be installed in a single DL850V main unit.
Note 3: Max. four(4) 720210 modules can be installed in a main unit.
Note 4: The use of a 720221 module always requires the External Scanner Box (model 701953).
Note 5: The firmware ver2.00 or later is required when using 720221 and/or 720241 module.

SCOPECORDER are trademarks, pending trademarks or registered trademarks of Yokogawa Electric Corporation.
* Any company's names and product names mentioned in this document are trade names, trademarks or registered trademarks of their respective companies.

Probes, Cables, and Converters

Product	Model No.	Description[*1]
100:1 Isolation Probe	701947	1000 V (DC+ACpeak) CAT II
10:1 Probe (for Isolated BNC Input)	700929	1000 V (DC+ACpeak) CAT II
1:1 Safety BNC Adapter Lead (in combination with followings)	701901	1000 Vrms-CAT II
Safety Mini-Clip (Hook type)	701959	1000 Vrms-CAT II, 1 set each of red and black
Large Alligator-Clip (Dolphin type)	701954	1000 Vrms-CAT II, 1 set each of red and black
Alligator Clip Adaptor Set (Rated Voltage 1000 V)	758929	1000 Vrms-CAT II, 1 set each of red and black
Alligator Clip Adaptor Set (Rated Voltage 300 V)	758922	300 Vrms-CAT II, 1 set each of red and black
Fork Terminal Adapter Set	758321	1000 Vrms-CAT II, 1 set each of red and black
Passive Probe[*2]	701940	Non-isolated 600 Vpk (701255)(10:1)
1:1 BNC-Alligator Cable	366926	Non-isolated 42 V or less, 1m
1:1 Banana-Alligator Cable	366961	Non-isolated 42 V or less, 1.2m
Current Probe[*3]	701933	30 Arms, DC to 50 MHz, supports probe power
Current Probe[*3]	701930	150 Arms, DC to 10 MHz, supports probe power
Current Probe[*3]	701931	500 Arms, DC to 2 MHz, supports probe power
Probe Power Supply[*4]	701934	Large current output, external probe power supply (4 outputs)
Shunt Resistor	438920	250 Ω±0.1%
Shunt Resistor	438921	100 Ω±0.1%
Shunt Resistor	438922	10 Ω±0.1%
Differential Probe	700924	1400 Vpk, 1000 Vrms-CAT II
Differential Probe	700925	500 Vpk, 350 Vrms (For 701255)
Differential Probe	701926	7000Vpk, 5000Vrms
Bridge Head (NDIS, 120 Ω/350 Ω)	701955/56	With 5 m cable
Bridge Head (DSUB, Shunt-CAL, 120 Ω/350 Ω)	701957/58	With 5 m cable
Safety BNC-banana Adapter	758924	500 Vrms-CAT II
Printer Roll Paper	B9988AE	For DL750, DL850, DL850V, 10 m x 10
Logic Probe[*5]	702911	8-Bit, 1 m, non-Isolated, TTL level/Contact Input
Logic Probe[*5]	702912	8-Bit, 3 m, non-Isolated, TTL level/Contact Input
High-speed Logic Probe[*5]	700986	8-Bit, non-Isolated, response speed: 1 μs
Isolated Logic Probe[*6]	700987	8-Bit, each channel isolated
Measurement Lead Set	758917	Measurement leads (2 per set) Alligator-Clip is required separately.
Safety BNC-BNC Cable (1 m)	701902	1000 Vrms-CAT II (BNC-BNC)
Safety BNC-BNC Cable (2 m)	701903	1000 Vrms-CAT II (BNC-BNC)
External I/O Cable	720911	For external I/O connection
Plug-On Clip	701948	For 700929 and 701947
Long Test Clip	701906	For 700924 and 701926
Terminal	A1800JD	For 720220 input terminal, one (1) piece
Soft Carrying Case	701963	For DL850/DL850V/DL750
Connecting cables	705926	Connecting cable for 701953 (1 m)
	705927	Connecting cable for 701953 (3 m)
DC Power Supply Cable (Alligator clip type)	701971	For DL850V DC12 V power
DC Power Supply Cable (Cigarette lighter plug type)	701970	For DL850V DC12 V power
DC Power Supply Connector	B8023WZ	It comes standard with the /DC option

*1 Actual allowable voltage is the lower of the voltages specified for the main unit and cable.
*2 42 V is safe when using the 701940 with an isolated type BNC input.
*3 The number of current probes that can be powered from the main unit's power supply is limited.
*4 Any number of externally powered probes can be used.
*5 Includes one each of the B9879PX and B9879KX connection leads.
*6 Additionally, 758917 and either the 758922 or 758929 are required for measurement.

Yokogawa's Approach to Preserving the Global Environment

• Yokogawa's electrical products are developed and produced in facilities that have received ISO14001 approval.
• In order to protect the global environment,Yokogawa's electrical products are designed in accordance with Yokogawa's Environmentally Friendy Product Design Guidelines and Product Design Assessment Criteria.

YOKOGAWA ◆
Yokogawa Meters & Instruments Corporation