Plug-in modules specifications

ScopeCorder series
DL850E/DL850EV/DL350/SL1000
### Module Selection

<table>
<thead>
<tr>
<th>Model No.</th>
<th>Name</th>
<th>Compatibility of the plug-in modules with the main units</th>
</tr>
</thead>
<tbody>
<tr>
<td>DL500</td>
<td>720210</td>
<td>High-speed 100 MS/s 12 Bit Isolation Module</td>
</tr>
<tr>
<td>DL505</td>
<td>720211</td>
<td>High-speed 100 MS/s 12 Bit Isolation Module</td>
</tr>
<tr>
<td>DL505</td>
<td>720250</td>
<td>High-speed 100 MS/s 12 Bit Isolation Module</td>
</tr>
<tr>
<td>DL650</td>
<td>720251</td>
<td>High-speed 100 MS/s 12 Bit Isolation Module</td>
</tr>
<tr>
<td>DL505</td>
<td>720252</td>
<td>4 CH 1 MS/s 16 Bit Isolation Module</td>
</tr>
<tr>
<td>DL505</td>
<td>720254</td>
<td>High-speed 100 MS/s 12 Bit Isolation Module</td>
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<tr>
<td>DL505</td>
<td>720249</td>
<td>High-voltage 100 MS/s 16 Bit Isolation Module (with AAF, RMI)</td>
</tr>
<tr>
<td>DL505</td>
<td>720250</td>
<td>16 CH Voltage Input Module</td>
</tr>
<tr>
<td>DL505</td>
<td>720251</td>
<td>Universal Module</td>
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<tr>
<td>DL505</td>
<td>720252</td>
<td>Universal Module (with AAF)</td>
</tr>
<tr>
<td>DL505</td>
<td>720253</td>
<td>Temperature/High-Precision Voltage Module</td>
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<tr>
<td>DL505</td>
<td>720254</td>
<td>Temperature/High-Precision Voltage Module (Low Noise)</td>
</tr>
<tr>
<td>DL505</td>
<td>720255</td>
<td>16 CH Temperature/Voltage Input Module</td>
</tr>
<tr>
<td>DL505</td>
<td>720256</td>
<td>Strain Module (NDMS)</td>
</tr>
<tr>
<td>DL505</td>
<td>720257</td>
<td>Strain Module (GSR810, Shunt CAL)</td>
</tr>
<tr>
<td>DL505</td>
<td>720258</td>
<td>Acceleration/Voltage Module (with AAF)</td>
</tr>
<tr>
<td>DL505</td>
<td>720259</td>
<td>Frequency Module</td>
</tr>
<tr>
<td>DL505</td>
<td>720260</td>
<td>Logic Input Module</td>
</tr>
<tr>
<td>DL505</td>
<td>720261</td>
<td>CAN Bus Monitor Module</td>
</tr>
<tr>
<td>DL505</td>
<td>720262</td>
<td>CAN/CAN FD Monitor Module</td>
</tr>
<tr>
<td>DL505</td>
<td>720263</td>
<td>SENT Monitor Module</td>
</tr>
</tbody>
</table>

* Probes are not included with any modules. *2: In combination with 720230 | 720290 or 721947 probe. *3: Direct input. *4: In combination with 10.1 probe model 701490. *5: Any other module can be installed in the remaining slots. *6: When using these modules with DL350/650 up to four CAN Bus Monitor Modules (720248), CAN & LIN Bus Monitor Modules (720241), CAN/CANFD monitor modules (720242) or BENT Monitor Module (720244) in total can be used on a single main unit. For the CAN Bus Monitor Modules (720230) and CAN & LIN Bus Monitor Modules (720234), CAN/CAN FD monitor modules (720235), up to two in total can be used on a single main unit. *7: The 16 CH Scanner Box (701956) is required for measurement. *8: Class 1 Laser Product, IEC/EN60825-1:2007, GB7247.1-2012 *9: In combination with 759833 and 701954. *10: See the main specifications for voltage-axis sensitivity setting and measurement range. *11: 1000 Vrms (1000 VDC or 1414 Vpeak maximum) when using with DL350. 850V (DC + ACpeak) when using with DL850/DL850V/DL850E or SL1000.

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### Compatibility of the plug-in modules with the main units

#### Plug-in Module

<table>
<thead>
<tr>
<th>Model</th>
<th>Name</th>
<th>Remark</th>
<th>DL500</th>
<th>DL505</th>
<th>DL650E</th>
<th>DL650EV</th>
<th>BL1000</th>
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<td>720210</td>
<td>High-speed 100 MS/s 12 Bit Isolation Module</td>
<td>Discontinued</td>
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<td>Yes</td>
<td>Yes</td>
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<td>720211</td>
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<td>720250</td>
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<td>720252</td>
<td>4 CH 1 MS/s 16 Bit Isolation Module</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<td>720256</td>
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<td>720257</td>
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<td>Universal Module</td>
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<td>720260</td>
<td>Temperature/High-Precision Voltage Module</td>
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<td>720261</td>
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<td>720262</td>
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<td>720263</td>
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<td>720264</td>
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<td>720267</td>
<td>Logic Input Module</td>
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<td>720268</td>
<td>CAN Bus Monitor Module</td>
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<td>No</td>
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<td>720269</td>
<td>CAN/CAN FD Monitor Module</td>
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<tr>
<td>720270</td>
<td>SENT Monitor Module</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

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* The use of a 720231 module always requires the External Scanner Box (model 701956). * Fermata update may be required depending on the module used. * All option is required when using 720240, 720241, 720242 or 720243 module with DL350. * Refer to the note described in page 18 when using 720254 module with DL350E and DL650EV. * 720240 CAN Bus Monitor Modules will be discontinued in September 2018.
Main Specifications (plug-in modules)

**High-Speed 10 M/s/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
- **Maximum sample rate**: 10 Ms/s
- **Frequency range**: -3 dB
  - DC to 300 kHz: ±(0.3% of 10 div)
  - DC to 200 kHz: ±(0.10% of 10 div)
- **A/D conversion resolution**: 12 bit (150 LSB/div)
- **Voltage-axis sensitivity setting**: Direct input: 5 mV/div to 20 V/div (1-2-5 steps)
- **Maximum input voltage (1 kHz or less)**
  - In combination with 709209 (10:1) × 709147 (100:1): 1000 V (DC + ACpeak)
  - In combination with 701901 + 701964 (1:1): 200 V (DC + ACpeak)
- **Maximum rated voltage to earth (1 kHz or less)**
  - In combination with 709209 (10:1) × 709147 (100:1): 1000 Vrms (CAT II)
  - In combination with 701901 + 701964 (1:1): 1000 Vrms (CAT II)
- **Gain**: ±(0.02% of 10 div)/ ˚C (Typ.)
- **Common mode rejection ratio**: ±(0.5% of 10 div)/ ˚C (Typ.)
- **Vertical (voltage) axis accuracy**: DC accuracy: ±0.05% of 10 div

**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
  - DC to 20 kHz
- **A/D conversion resolution**: 12 bit (150 LSB/div)
- **Voltage-axis sensitivity setting**: Direct input: 10 mV/div to 20 V/div (1-2-5 steps)
- **Maximum input voltage (1 kHz or less)**
  - In combination with 709209 (10:1) × 709147 (100:1): 1000 V (DC + ACpeak)
  - In combination with 701901 + 701964 (1:1): 200 V (DC + ACpeak)
- **Maximum rated voltage to earth (1 kHz or less)**
  - In combination with 709209 (10:1) × 709147 (100:1): 1000 Vrms (CAT II)
  - In combination with 701901 + 701964 (1:1): 1000 Vrms (CAT II)
- **Gain**: ±(0.05% of 10 div)/ ˚C (Typ.)
- **Common mode rejection ratio**: ±(0.5% of 10 div)/ ˚C (Typ.)
- **Vertical (voltage) axis accuracy**: DC accuracy: ±0.5% of 10 div

**High-Speed 100 Ms/s, 12 Bit Non-Isolation Module (720195)**

- **Input channels**: 2
- **Input type**: Non-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**: ±(0.03% of 10 div)/ ˚C (Typ.)
- **Maximum sample rate**: 1 Ms/s
- **Frequency range**: -3 dB
  - DC to 20 kHz
  - DC to 200 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**: Direct input: 1 mV/div to 20 V/div (1-2-5 steps)
- **Maximum input voltage (1 kHz or less)**
  - In combination with 700903 (10:1) × 700902 (10:1) × 701947 (100:1): 420 V (DC + ACpeak)
  - In combination with 701901 + 701964 (1:1): 140 V (DC + ACpeak)
- **Maximum rated voltage to earth (1 kHz or less)**
  - In combination with 700903 (10:1) × 700902 (10:1) × 701947 (100:1): 400 Vrms (O), 300 Vrms (CAT II)
  - In combination with 701901 + 701964 (1:1): 400 Vrms (O), 300 Vrms (CAT II)
- **Gain**: ±(0.05% of 10 div)/ ˚C (Typ.)
- **Common mode rejection ratio**: ±(0.5% of 10 div)/ ˚C (Typ.)
- **Vertical (voltage) axis accuracy**: DC accuracy: ±0.05% of 10 div

---

1: Under standard operating conditions (temperature of 25°C ±5°C, 20 to 80% RH, warm-up of 30 minutes or more), after calibration. Recommended calibration period: 1 year. Note: the strain modules (701270/1) must be balanced.

2: to 10: See the figure on page 1 for notes on the maximum input voltage and maximum rated voltage to earth.

11: Note that the strain modules (701270/1) must be balanced.
### Bandwidth limit
- Full/50 Hz/5 kHz/50 kHz/500 kHz

### Weight
- Approx. 270 g

### High-Voltage 1 MΩ, 16 Bit Isolation Module (with AAF, RMS) (702098)
- **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.)
- **Frequency range (~3 dB)**: 2 MΩ ±1%, Approx. 12 pF
- **A/D conversion resolution**: 16 bit (2400 LSB/div)
- **Data update rate**: 16 bit (2400 LSB/div)

### Temperature measurement
- **(Does not include the reference junction temperature compensation accuracy)**
- **Type** | **Measurement Range** | **Accuracy**
- **K** | −200°C to 1300°C | ±0.1% of reading + 1.5°C
- **E** | −200°C to 800°C | ±0.1% of reading + 1.5°C
- **J** | −200°C to 1100°C | ±0.1% of reading + 1.5°C
- **T** | −200°C to 400°C | ±0.1% of reading + 1.5°C
- **L** | −200°C to 900°C | ±0.1% of reading + 1.5°C
- **U** | −200°C to 400°C | ±0.1% of reading + 1.5°C
- **N** | 0°C to 1300°C | ±0.1% of reading + 1.5°C

### Maximum input voltage (1 kHz or less)
- **24 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)**

### Weight
- Approx. 230 g
Temperature coefficient (Voltage)  
Zero point: ±0.01% of 10 V/°C (Typ.)  
Gain: ±0.02% of 10 V/°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  
KPF/AuFe: ±1 K

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

Weight  
Approx. 270 g

Temperature/High-Precision Voltage Isolation Module (Low noise) (720245)

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  
120 Hz

Frequency range (−3 dB)  
DC to 15 Hz

A/D conversion resolution  
Voltage: 16 bit (2400 LSB/range)  
Temperature: 0.1°C

−3 dB point when AC coupled low frequency attenuation point  
Voltage measurement: 0.5 Hz or less

Measurement range/accuracy  
Voltage measurement  
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)

<table>
<thead>
<tr>
<th>Type</th>
<th>Measurement Range</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>K</td>
<td>−200°C to 1300°C</td>
<td>±0.1% of reading + 1.5°C</td>
</tr>
<tr>
<td>E</td>
<td>−200°C to 800°C</td>
<td>±0.1% of reading + 1.5°C</td>
</tr>
<tr>
<td>J</td>
<td>−200°C to 1100°C</td>
<td>±0.1% of reading + 1.5°C</td>
</tr>
<tr>
<td>T</td>
<td>−200°C to 400°C</td>
<td>±0.1% of reading + 1.5°C</td>
</tr>
<tr>
<td>L</td>
<td>−200°C to 900°C</td>
<td>±0.1% of reading + 1.5°C</td>
</tr>
<tr>
<td>U</td>
<td>−200°C to 400°C</td>
<td>±0.1% of reading + 1.5°C</td>
</tr>
<tr>
<td>N</td>
<td>0°C to 1300°C</td>
<td>±0.1% of reading + 1.5°C</td>
</tr>
<tr>
<td>R</td>
<td>0°C to 1700°C</td>
<td>±0.1% of reading + 1.5°C</td>
</tr>
<tr>
<td>S</td>
<td>0°C to 1700°C</td>
<td>±0.1% of reading + 1.5°C</td>
</tr>
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<td>B</td>
<td>0°C to 1800°C</td>
<td>±0.1% of reading + 1.5°C</td>
</tr>
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<td>W</td>
<td>0°C to 2500°C</td>
<td>±0.1% of reading + 1.5°C</td>
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<tr>
<td>KPF/AuFe</td>
<td>0 K to 300 K</td>
<td>±0.2% of reading + 2°C</td>
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</table>

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

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

Maximum rated voltage to earth (1 kHz or less)  
42 V DC + AC peak (CAT 3, 30 Vrms)

Temperature coefficient (Voltage)  
Zero point: ±0.01% of 10 V/°C ± 0.05 µV/°C (Typ.)  
Gain: ±0.02% of 10 V/°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  
KPF/AuFe: ±1 K

Bandwidth limit (Typ.)  
(−3 dB point)  
DC at data updating period of 100 ms: 600 Hz  
DC at data updating period of 300 ms: 200 Hz  
DC at data updating period of 1 s: 50 Hz  
DC 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 Hz to 20 kHz)

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, 5 V, and 10 V)

Gauge factor  
1.00 ± 2.00 in last 3 digits

Maximum sample rate  
100 kS/s

Frequency range (−3 dB)  
DC to 20 kHz

A/D conversion resolution  
16 bit (4000 LSB/div)  
Upper: ±FS, Lower: −FS

mV/V range support  
10 mV/V range = 0.5 × (µSTR range/1000)

Measurement range/ measurable range  

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>Measurable range</th>
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<tbody>
<tr>
<td>500 µSTR</td>
<td>500 µSTR to 5000 µSTR</td>
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<td>1000 µSTR</td>
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<td>5000 µSTR</td>
<td>5000 µSTR to 50000 µSTR</td>
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<td>10000 µSTR</td>
<td>10000 µSTR to 100000 µSTR</td>
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<tr>
<td>20000 µSTR</td>
<td>20000 µSTR to 200000 µSTR</td>
</tr>
</tbody>
</table>

Maximum input voltage (1 kHz or less)  
10 V DC + AC peak

Maximum rated voltage to earth (1 kHz or less)  
42 V DC + AC peak (CAT 3, 30 Vrms)

DC accuracy  
±0.5% of FS + 5 µSTR

Temperature coefficient  
Zero point: ±5 µSTR/°C (Typ.)  
Gain: ±0.02% of FS/°C (Typ.)

Bandwidth limit  
Full/1 Hz/10 Hz/80 Hz

Weight  
Approx. 150 g

• NDIS (701270)  
Function  
mV/V support.  
Supports the strain gauge transducer unit system.

Input connector  
NDIS connector, Placedomoted 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))  
701997 (D-Sub 120 Ω, comes with a 5-m cable)  
701998 (D-Sub 350 Ω, comes with a 5-m cable)

Weight  
Approx. 260 g

-200˚C to 1100˚C  
-200˚C to 800˚C  
-200˚C to 1700˚C  
-200˚C to 1300˚C  
0 K to 300 K  
0 K to 400 K  
0 K to 50 K  
0 K to 50 K
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency range (f)</td>
<td>±0.05% of 10 div, accuracy dependent on the input frequency</td>
</tr>
<tr>
<td>Cutoff characteristics</td>
<td>-65 dB at 2 × fc (Typ.)</td>
</tr>
<tr>
<td>Vertical (voltage) axis accuracy</td>
<td>±(0.025% of 10 div)</td>
</tr>
<tr>
<td>Temperature coefficient (voltage (excluding AUTO filter))</td>
<td>±0.02% of 10 div/°C (Typ.)</td>
</tr>
<tr>
<td>Bandwidth limit</td>
<td>FullAuto (A/B)/40 Hz to 500 Hz (Typ.)</td>
</tr>
<tr>
<td>Cutoff characteristics</td>
<td>-65 dB at 2 x fc (Typ.)</td>
</tr>
<tr>
<td>Sensor supply current (voltage)</td>
<td>OFF/ min x 10% (approx. 22 VDC)</td>
</tr>
<tr>
<td>Applicable acceleration sensor</td>
<td>Built-in amplifier type</td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 270 g</td>
</tr>
<tr>
<td>Frequency Module (720281)</td>
<td></td>
</tr>
<tr>
<td>Measurement function</td>
<td>Frequency (Hz), RPMs, RPSs, period (s), duty cycle (%), power supply frequency (Hz), pulse width (s), pulse integration, and velocity.</td>
</tr>
<tr>
<td>Input channels</td>
<td>2</td>
</tr>
<tr>
<td>Input type</td>
<td>Isolated/unbalanced</td>
</tr>
<tr>
<td>Input coupling</td>
<td>AC and DC</td>
</tr>
<tr>
<td>Input connector</td>
<td>BNC connector (isolated type)</td>
</tr>
<tr>
<td>Input impedance</td>
<td>1 MΩ ±1%, approx. 35 pF</td>
</tr>
<tr>
<td>Pulse width (s)</td>
<td>10 Hz, approx. 5 V, pulse width can be turned on only when the input is set to Pulse-Up 5 V.</td>
</tr>
<tr>
<td>Minimum measurement resolution</td>
<td>625 µs</td>
</tr>
<tr>
<td>Measured data resolution</td>
<td>16 bit (240 LSB/di)</td>
</tr>
<tr>
<td>Input voltage range (x1)</td>
<td>±0.05% of 10 div</td>
</tr>
<tr>
<td>Maximum input voltage</td>
<td>In combination with 700992 (10:1) x 420 V (DC + AC peak)</td>
</tr>
<tr>
<td>Direct input</td>
<td>42 V (DC + AC peak)</td>
</tr>
<tr>
<td>Maximum rated voltage to earth</td>
<td>In combination with 700992 (10:1)/702902 (10:1)/701947 (100:1) 400 Vrms (CAT III)</td>
</tr>
<tr>
<td>Bandwidth limit</td>
<td>Full100 Hz to 1 kHz/10 kHz/100 kHz</td>
</tr>
<tr>
<td>Comparator section</td>
<td>Preset function: Logic 5 V/3 V/12 V/24 V, electromagnetic, pickup, zero crossing, pull-up (5 V), AC/AC/AC/V, AC 200 V, and user-defined.</td>
</tr>
<tr>
<td>Chatter elimination function</td>
<td>OFF to 1 ms to 1000 ms (1 ms resolution)</td>
</tr>
<tr>
<td>LED display (per channel)</td>
<td>ACT (green): Operating status (lights during pulse input)</td>
</tr>
</tbody>
</table>
Output function
Single shot
Specified ID (Data) can be outputted manually. (Up to 64 bytes of CAN FD data frame is supported.)

Allowable voltage range
-3 V to +10 V (CAN_H, CAN_L input to GND)

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

Weight
Approx. 240 g

**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 × 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)
- Input connector: D-sub 9-pin (male)
- Endian: Little or Big selectable
- LED display: Indicates on/off status of built-in terminator

**Supported protocol**
- Physical layer: ISO-9141
- Maximum bit rate: 2400, 9600, 19200 bps
- Supported data length: 32 bits
- Input channels: 60-signal/port
- Supported field checksum: Standard and extended checksums

**CAN port specifications**
- Maximum input voltage: -3 V to +10 V (CAN_H, CAN_L input to GND)
- Maximum allowable common mode voltage: 30 Vrms (CAT I)
- Input connector: D-sub 9-pin (male)
- Terminator: Built-in, it is switchable On and Off
- Endian: Little or Big selectable
- LED display: Indicates on/off status of built-in terminator
- Supported protocol: Physical layer: ISO-11898 (High Speed Communication)
- Bit rate: 10 k, 20 k, 33.3 k, 50 k, 62.5 k, 66.7 k, 83.3 k, 100 k, 125 k, 200 k, 250 k, 400 k, 500 k, 800 k, 1 Mbps
- Supported data length: 32 bits
- Input channels: 60-signal/port
- Output function: Single shot
- Specified ID (Data) can be outputted manually.

**Weight**
Approx. 240 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

**FAST CHANNEL analysis**
- Input voltage: ±5 V (Typ.)
- Input status indication: Status indication through LED
- Input voltage range: ±5 V
- Status indication: Status is indicated in green when input is detected.

**Maximum input voltage**
±5 V (DC + ACpeak) (CAT II, 30 Vrms)

**Maximum rated voltage to earth**
±5 V (DC + ACpeak) (CAT II, 30 Vrms)

**Weight**
Approx. 240 g

---

**Measurement Range and Display Range**

**ScopeCorder**
- Measurement range: ±10 divisions (20 divisions of absolute width (span) around 0 V)
- Display range: ±5 divisions (10 divisions of span)

**Warning**
Do not apply input voltage exceeding the maximum input voltage. 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.

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**Maximum Input Voltage and Maximum rated voltage to earth**

See Specifications of Plug-in Modules.
**Main Specifications (probes and accessories)**

### 10:1 Passive Probe (Wide operating temperature range) (702902)

- **Frequency range**: DC to 50 MHz
- **Attenuation ratio**: 10:1
- **Input impedance/capacitance**
  - 100 MΩ ±1% / 17 pF (Typ.)
- **Maximum input voltage**
  - 100:1
  - 50 Apeak, non-continuous
  - 5000 Vrms and 7000 Vpeak CAT
- **To 500 A**: ±1% of reading ±5 mV
- **Approx. weight**: 210 g

### 100:1 Probe (for Isolated BNC Input) (700929)

- **Frequency range**: DC to 100 MHz
- **Attenuation ratio**: 100:1
- **Input impedance/capacitance**
  - 50 Ω ±2%/17.0 pF (Typ.)
- **Maximum input voltage**
  - 1000 V (DC + APeak) CAT II
  - Between tip and shield, tip and earth: ±3540 V (DC + APeak) CAT II
- **Total length**: 1.5 m

### 1000:1 Passive Probe (for Isolated BNC Input) (700928)

- **Frequency range**: DC to 5 MHz
- **Attenuation ratio**: 1000:1
- **Input impedance/capacitance**
  - 6 MΩ ±2%/17 pF (Typ.)
- **Maximum input voltage**
  - 10000 V (DC + APeak) CAT II
- **Total length**: 1.5 m

### Differential Probe (700924)

- **Frequency range**: DC to 50 MHz
- **Attenuation ratio**: Switched ratios of 100:1 and 1000:1
- **Input impedance/capacitance**: 4 MΩ ±1% / 10 pF
- **Differential allowable input voltage**: ±250 V (DC + APeak) or 1000 Vrms at 1000:1 attenuation
- **Max common mode voltage**: ±250 V (DC + APeak) or 1000 Vrms
- **Max input voltage (to ground)**: ±1400 V (DC + APeak) or 1000 Vrms

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**Differential Probe (701928)**

- **Frequency range**: DC to 5 MHz
- **Attenuation**: 1000 or 1:1, switchable
- **Input resistance/capacitance (Typ.)**: 50 MΩ ± 17 pF (parallel with respect to ground)
- **Allowable differential voltage (between + and – terminals)**: 5000 Vrms or less and 7000 Vpeak or less at 1000:1 attenuation
- **Allowable common mode voltage**: 5000 Vrms or less and 7000 Vpeak or less
- **Differential allowable input voltage**: ±250 V (DC + APeak) or 1000 Vrms at 1000:1 attenuation
- **Max common mode voltage**: ±250 V (DC + APeak) or 1000 Vrms
- **Max input voltage (to ground)**: ±1400 V (DC + APeak) or 1000 Vrms

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**Operating conditions**

- **Power requirements**
  - Internal battery: Four AA dry cells
  - External power supply: 6 VDC/200 mA or more or 9 VDC/150 mA 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. 250 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
- 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 (700996)

- 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: 1 µs (Typ.)
- Input impedance: 10 MΩ or greater
- Threshold level: Approx. 1.4 V
- Isolation Logic Probe (700997)

- 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 50 VAC to 250 VAC 50/60 Hz
- Threshold level: DC input: ±50%; AC input: ±50% (Typ.)
- Response time: DC input: within 1 ms (Typ.); AC input: within 20 ms (Typ.)
- Maximum input voltage (1 kHz or less) (across probe tip and earth): 42 V (DC + AC peak)
- Maximum rated voltage to earth (1 kHz or less): 250 Vrms (CAT I)
- Maximum allowable voltage between bits: 250 Vrms (CAT I)
- Input impedance: 10 kΩ
- Bridge Head (701955, 701956, 701957, 701958)

<table>
<thead>
<tr>
<th>Bridge resistance</th>
<th>701955, 701956: Approx. 37 (W) x 97 (H) x 30 (D) mm 701957, 701958: Approx. 50 (W) x 101 (H) x 29 (D) mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applicable gauge methods</td>
<td>Single-gauge, Single-gauge three-wire, Adjacent-side two-gauge, Opposed-side two-gauge, Opposed-side two-gauge three-wire, Four-gauge</td>
</tr>
<tr>
<td>Operating conditions</td>
<td>Temperature: 5 to 40°C; Humidity: 20 to 85% RH</td>
</tr>
<tr>
<td>Weight</td>
<td>701955, 701956: Approx. 85 g (Bridge head only) 701957, 701958: Approx. 100 g (Bridge head only)</td>
</tr>
</tbody>
</table>

Power Supply (701934)

- 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) x 119 (H) x 200 (D) mm
- Weight: Approx. 1.2 kg
Module and accessory combinations

Warning: Connect the probe earth cable to ground (grounding potential) when using these differential probes with isolation modules.
Universal Module 701261

1:1 Banana-alligator cable 368961

Universal Module (with AAF) 701262

Shunt resistor for 4–20 mA measurement
250 Ω ± 0.1% : 438920
100 Ω ± 0.1% : 438921
10 Ω ± 0.1% : 438922

Temperature/High-precision Voltage Module 701285

These logic probes can be connected to DL350 logic input terminal as well.

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

16 CH Temp./Voltage Input Module 720221

Scan box
701953
(provided with a connecting cable)
Note: This unit is always required for measurement.

Strain Module (NDIS) 701270

Bridge head (NDIS)
120 Ω: 701955
350 Ω: 701956

Strain Module (DSUB, Shunt-CAL) 701271

Bridge head (DSUB, Shunt-CAL)
120 Ω: 701957
350 Ω: 701958

Logic Input Module 720230

High-speed logic probe 700986
Isolated logic probe 700987

Strain Module (NDIS) (Low noise) 701270

Bridge head (NDIS) (Low noise)
120 Ω: 701955
350 Ω: 701956

Strain Module (DSUB, Shunt-CAL) (Low noise) 701271

Bridge head (DSUB, Shunt-CAL) (Low noise)
120 Ω: 701957
350 Ω: 701958

Logic Input Module (Low noise) 720230

Isolated logic probe (Low noise) 700987

Isolated logic probe (Low noise) 700987

These logic probes can be connected to DL350 logic input terminal as well.

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

16 CH Temp./Voltage Input Module (Low noise) 720221

Isolated logic probe (Low noise) 700987

These logic probes can be connected to DL350 logic input terminal as well.

Scanner box 701953
(provided with a connecting cable)
Note: This unit is always required for measurement.

Universal Module 701261

1:1 Banana-alligator cable 368961

Universal Module (with AAF) 701262

Shunt resistor for 4–20 mA measurement
250 Ω ± 0.1% : 438920
100 Ω ± 0.1% : 438921
10 Ω ± 0.1% : 438922

Temperature/High-precision Voltage Module 701285

These logic probes can be connected to DL350 logic input terminal as well.

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

16 CH Temp./Voltage Input Module 720221

Isolated logic probe (Low noise) 700987

These logic probes can be connected to DL350 logic input terminal as well.

Scanner box 701953
(provided with a connecting cable)
Note: This unit is always required for measurement.
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.

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.

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

**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.

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)

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.

**Charge output type acceleration sensors**

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

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).

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
Using the Frequency Module (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.

**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 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.

---

**Frequency module test items**

<table>
<thead>
<tr>
<th>Test Item</th>
<th>Real-time calculation</th>
<th>Measurement range</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency (Hz)</td>
<td>Frequency (Hz) = ( \frac{1}{f} ) (Hz)</td>
<td>0.01 Hz to 500 kHz</td>
<td></td>
</tr>
<tr>
<td>Period (s)</td>
<td>Period (s) = ( \frac{T}{f} ) (s)</td>
<td>2 µs to 50 s</td>
<td></td>
</tr>
<tr>
<td>Rpm</td>
<td>Rpm = ( \frac{N}{f} ) pulses per rev (Hz) \times 60</td>
<td>0.01 rpm to 100000 rpm</td>
<td></td>
</tr>
<tr>
<td>Rps</td>
<td>Rps = ( \frac{N}{f} ) pulses per rev (Hz)</td>
<td>0.001 rps to 2000 rps</td>
<td></td>
</tr>
<tr>
<td>Duty (%)</td>
<td>Duty (%) = ( \frac{T}{f} ) Thigh (s) or Tlow (s)</td>
<td>0% to 100%</td>
<td></td>
</tr>
<tr>
<td>Pulse width</td>
<td>Pulse width (s) = Thigh (s) or Tlow (s)</td>
<td>1 µs to 50 s</td>
<td></td>
</tr>
<tr>
<td>Power supply freq. (Hz)</td>
<td>Power supply freq. (Hz) = Power supply freq. (Hz) at the 50/60 Hz setting, 0.3 Hz resolution</td>
<td>50 Hz, 60 Hz, 400 Hz x20 Hz</td>
<td></td>
</tr>
<tr>
<td>Pulse integration (Distance/Quantity of flow)</td>
<td>Distance = ( N ) count \times distance per pulse ( \Delta f )</td>
<td>up to 2 \times 10^17 count</td>
<td></td>
</tr>
<tr>
<td>Velocity (m/s, mph)</td>
<td>Velocity (m/s) = ( \Delta f ) distance per pulse ( \Delta f ) \times 3600</td>
<td>0.01 Hz to 200 kHz</td>
<td></td>
</tr>
</tbody>
</table>

*Units are user-definable (angular velocity and other units)

---

**Frequency Module (Model: 720281)**

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.
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 DL850E/DL850EV.

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.

### 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 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:

\[
\text{Record length of each subchannel} \leq \frac{\text{set record length}}{\text{number of subchannels to be used}}
\]
This is a multichannel input module capable of measuring up to 16 channels (subchannels’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 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 maximum rated voltage to earth are 42 V (AC + DCpeak, 1 kHz or less).

Scanning method, Data updating period, and Bandwidth limit

<table>
<thead>
<tr>
<th>Alternatives</th>
<th>Setting (1)</th>
<th>Setting (2)</th>
<th>Setting (3)</th>
<th>Setting (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data updating period</td>
<td>100 ms</td>
<td>300 ms</td>
<td>1 s</td>
<td>3 s</td>
</tr>
<tr>
<td>Bandwidth limit (−3 dB)</td>
<td>600 Hz</td>
<td>200 Hz</td>
<td>50 Hz</td>
<td>10 Hz</td>
</tr>
</tbody>
</table>

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 5 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 ΔΣ-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 reduced noise 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. 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.
Using the Logic Input Module (720230)

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

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.

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 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 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 9 of this bulletin.)

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 1 MS/s 16 Bit Isolation Module (720254)

This module has 4 CH isolated BNC inputs. By installing 8 pieces of this module in a DL850E/EV for example, it makes total 32 channels stand-alone measurement system. This module meets your applications widely as isolated high-voltage and multi-channel (up to 32) measurements and recording. The A/D conversion resolution is 16 bit (2400 LSB/div) and maximum input voltage is 600 V (DC + ACpeak, when using 700929 or 701947 probe). Maximum rated voltage to earth is 300 Vrms (CAT II).

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

In general, a high number of isolated CHs and high resolution are required to record inverter signals typically 300 Vrms or greater for long periods of time. In transportation applications, a high number of isolated CHs are also essential to measure the advanced control signals and sensor output signals controlled 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 can be done efficiently by measuring multiple signals simultaneously in one measuring instrument. This module supports these applications.

Note
When using this module with the DL850E/DL850EV, the sample rate will be always half or less of the 2 CH voltage input module such as 720250 under the same recording length.

When an external clock signal is applied, the sample rate will also be always half or less 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) sampled by an external pulse signal such as a rotary encoder.

The sample timing is simultaneous for 4 CH. Refer to the following table for detail.

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

Relationship between the main channel sample rate and the 4 CH 1 MS/s, 16 bit isolation module sample rate. (DL850E/DL850EV only)
Using the CAN/CAN FD Monitor Module (720242), the CAN & LIN Bus Monitor Module (720241) and the SENT Monitor Module (720243)

These modules will interpret the vehicle installed communication protocols, monitor the communication data, and display the time series trend waveform. It is connected as a CAN/CAN FD or LIN bus node and can read data frames of each protocol communicating on the bus, or read transmitting signal values on SENT (Single Edge Nibble Transmission) from a sensor to a controller.

By combining them with other input modules, it can simultaneously measure communication data in a vehicle, 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, thus enabling the evaluation of the overall vehicle installed system.

The CAN/CAN FD Monitor Module (720242) is equipped with two CAN/CAN FD input ports, enabling a single module to be connected to two CAN/CAN FD 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. This module does not support CAN FD. The SENT Monitor Module (720243) is equipped with two input ports, enabling maximum 11 data trend are monitored simultaneously.

For the supported protocol of each modules, see the description of each specifications in this manual.

**CAN data monitoring method (example)**

<table>
<thead>
<tr>
<th>Identifier Field</th>
<th>Data Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>142h</td>
<td>0006h</td>
</tr>
<tr>
<td></td>
<td>0246h</td>
</tr>
<tr>
<td></td>
<td>0302h</td>
</tr>
</tbody>
</table>

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/CAN FD Monitor Module (720242) 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 (up to 32 bits) can also be specified for extraction.

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

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 & LIN Bus Monitor Module (720241) or SENT using 720243 module, 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 main unit.

**Outputting frame data (only CAN/CAN FD data)**

At the CAN/CAN FD port on 720242 and CAN port on 720241, a single specified (defined) data frame or remote frame can be output (manually, at a desired timing).
Plug-in module model numbers

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>702511</td>
<td>High-speed 100 Ms/s 12 Bit Isolation Module</td>
</tr>
<tr>
<td>720254</td>
<td>High-speed 10 Ms/s 12 Bit Isolation Module</td>
</tr>
<tr>
<td>701251</td>
<td>High-speed 1 Ms/s 16 Bit Isolation Module</td>
</tr>
<tr>
<td>720254</td>
<td>4 CH 1 Ms/s 16 Bit Isolation Module</td>
</tr>
<tr>
<td>701251</td>
<td>High-speed 10 Ms/s 12 Bit non-isolation Module</td>
</tr>
<tr>
<td>720268</td>
<td>High-Voltage 1 Ms/s, 16 Bit Isolation Module (with AAF, RMS)</td>
</tr>
<tr>
<td>720220</td>
<td>Voltage Input Module (16 CH)</td>
</tr>
<tr>
<td>701261</td>
<td>Universal Module</td>
</tr>
<tr>
<td>701262</td>
<td>Universal Module (with Anti-Alias Filter)</td>
</tr>
<tr>
<td>702255</td>
<td>Temperature/High-Precision Voltage Module</td>
</tr>
<tr>
<td>720256</td>
<td>Temperature/High-Precision Voltage Isolation Module (Low Noise)</td>
</tr>
<tr>
<td>701953-L1</td>
<td>16 CH Scanner Box (provided with 1 m cable)</td>
</tr>
<tr>
<td>701953-L3</td>
<td>16 CH Scanner Box (provided with 3 m cable)</td>
</tr>
<tr>
<td>701270</td>
<td>Strain Module (NUR)</td>
</tr>
<tr>
<td>701271</td>
<td>Strain Module (6DBU, Shunt-CAL)</td>
</tr>
<tr>
<td>702275</td>
<td>Acceleration/Voltage Module (with Anti-aliasing Filter)</td>
</tr>
<tr>
<td>702361</td>
<td>Frequency Module</td>
</tr>
<tr>
<td>702380</td>
<td>Logic Input Module</td>
</tr>
<tr>
<td>702242</td>
<td>CAN/CAN FD Monitor Module</td>
</tr>
<tr>
<td>720241</td>
<td>CAN &amp; LIN Bus Monitor Module</td>
</tr>
<tr>
<td>720243</td>
<td>SENT Monitor Module</td>
</tr>
</tbody>
</table>

Probes, cables and converters

<table>
<thead>
<tr>
<th>Model</th>
<th>Product</th>
<th>Description†</th>
</tr>
</thead>
<tbody>
<tr>
<td>701847</td>
<td>100/1 Probe</td>
<td>(for isolated BNC input) 1000 V (DC + APeak) CAT II, 1.5 m</td>
</tr>
<tr>
<td>702902</td>
<td>10/1 Probe</td>
<td>operating temp. range: -40 to 85°C, 2.5 m</td>
</tr>
<tr>
<td>700292</td>
<td>11/1 Probe</td>
<td>(for isolated BNC input) 1000 V (DC + APeak) CAT II, 1.5 m</td>
</tr>
<tr>
<td>701900</td>
<td>1/1 Safety BNC adapter lead</td>
<td>1000 Vms CAT II</td>
</tr>
<tr>
<td>701904</td>
<td>1/1 Safety BNC adapter lead</td>
<td>1 m (in combination with following)</td>
</tr>
<tr>
<td>B9852MM</td>
<td>Pinchers tip (hook type)</td>
<td>1000 Vms CAT III black</td>
</tr>
<tr>
<td>B9852MN</td>
<td>Pinchers tip (hook type)</td>
<td>1000 Vms CAT III red</td>
</tr>
<tr>
<td>701954</td>
<td>Large alligator-clip (Dolphin type)</td>
<td>1000 Vrms CAT III, 1 set each of red and black</td>
</tr>
<tr>
<td>758929</td>
<td>Alligator clip adapter set (Rated voltage 1000 V)</td>
<td>100 Vms CAT II, 1 set each of red and black</td>
</tr>
<tr>
<td>758922</td>
<td>Alligator clip adapter set (Rated voltage 300 V)</td>
<td>300 Vms CAT II, 1 set each of red and black</td>
</tr>
<tr>
<td>758931</td>
<td>Fork terminal adapter set</td>
<td>1000 Vms CAT II, 1 set each of red and black</td>
</tr>
<tr>
<td>710180</td>
<td>Passive probe†</td>
<td>Non-isolated 800 Vp (101250 (10:1)</td>
</tr>
<tr>
<td>366926</td>
<td>1/1 BNC-alligator probe</td>
<td>Non-isolated 32 V or less, 1 m</td>
</tr>
<tr>
<td>368901</td>
<td>1/1 banana-alligator non-isolated 32 V or less, 1.2 m</td>
<td></td>
</tr>
<tr>
<td>701917</td>
<td>Current probe†</td>
<td>5 Arms, DC to 50 MHz</td>
</tr>
<tr>
<td>701918</td>
<td>Current probe†</td>
<td>5 Arms, DC to 100 MHz</td>
</tr>
<tr>
<td>701932</td>
<td>Current probe†</td>
<td>30 Arms, DC to 500 MHz</td>
</tr>
<tr>
<td>701933</td>
<td>Current probe†</td>
<td>30 Arms, DC to 500 MHz</td>
</tr>
<tr>
<td>701930</td>
<td>Current probe†</td>
<td>150 Arms, DC to 10 MHz</td>
</tr>
<tr>
<td>701954</td>
<td>Current probe†</td>
<td>500 Arms, DC to 2 MHz</td>
</tr>
<tr>
<td>720290</td>
<td>Clamp-on probe†</td>
<td>AC 200 Arms, AC 2.5 Hz</td>
</tr>
<tr>
<td>720291</td>
<td>Clamp-on probe†</td>
<td>AC 200 Arms, 40 Hz to 3.5 kHz</td>
</tr>
<tr>
<td>701934</td>
<td>Probe power supply</td>
<td>Large current output, external probe power supply (4 outputs)</td>
</tr>
<tr>
<td>438820</td>
<td>Shunt resistor</td>
<td>250 Ω ± 0.1%</td>
</tr>
<tr>
<td>438921</td>
<td>Shunt resistor</td>
<td>100 Ω ± 0.1%</td>
</tr>
<tr>
<td>438922</td>
<td>Shunt resistor</td>
<td>10 Ω ± 0.1%</td>
</tr>
<tr>
<td>700924</td>
<td>Differential probe</td>
<td>1000 Vms CAT II</td>
</tr>
<tr>
<td>700925</td>
<td>Differential probe</td>
<td>500 V, 300 Vms (For 701255)</td>
</tr>
<tr>
<td>701926</td>
<td>Differential probe</td>
<td>7000 Vpk, 5000 Vms</td>
</tr>
<tr>
<td>701954</td>
<td>Bridge head (BNC, 120 (1))</td>
<td>With 5 m cable</td>
</tr>
<tr>
<td>701956</td>
<td>Bridge head (BNC, 300 (1))</td>
<td>With 5 m cable</td>
</tr>
<tr>
<td>701957</td>
<td>Bridge head (6DBU, 120 (1))</td>
<td>shunt-CAL, with 5 m cable</td>
</tr>
<tr>
<td>701958</td>
<td>Bridge head (6DBU, 300 (1))</td>
<td>shunt-CAL, with 5 m cable</td>
</tr>
<tr>
<td>758924</td>
<td>Safety BNC-banan-adapter set</td>
<td>5000 Vms CAT II</td>
</tr>
<tr>
<td>B9898AE</td>
<td>Printer roll paper</td>
<td>One kit: 10 rolls, 10m each, for DL5065/6E</td>
</tr>
<tr>
<td>700911</td>
<td>Logic probe†</td>
<td>8 bit, 1 m, non-isolated, 1 Td, level/contact Input</td>
</tr>
<tr>
<td>700912</td>
<td>Logic probe†</td>
<td>8 bit, 3 m, non-isolated, 1 Td, level/contact Input</td>
</tr>
<tr>
<td>700986</td>
<td>High-speed logic probe†</td>
<td>8 bit, 3 m, non-isolated, response speed: 1 μs (typ)</td>
</tr>
<tr>
<td>700936</td>
<td>Isolation logic probe†</td>
<td>16 bit, each channel isolated</td>
</tr>
<tr>
<td>758917</td>
<td>Measurement lead set</td>
<td>U: 75 m, Stackable type (2 per set) Alligator-Cip is required separately.</td>
</tr>
<tr>
<td>758933</td>
<td>Measurement lead set</td>
<td>Alligator-Cip is required separately.</td>
</tr>
<tr>
<td>701902</td>
<td>Safety BNC-BNC cable (1 m)</td>
<td>1000 Vms CAT II (BNC-BNC)</td>
</tr>
<tr>
<td>701903</td>
<td>Safety BNC-BNC cable (2 m)</td>
<td>1000 Vms CAT II (BNC-BNC)</td>
</tr>
<tr>
<td>701948</td>
<td>Plug-on clip</td>
<td>For 701929 and 710947</td>
</tr>
<tr>
<td>701906</td>
<td>Long test clip</td>
<td>Connecting cable for 701953 (1 m)</td>
</tr>
<tr>
<td>A1800UD</td>
<td>Terminal</td>
<td>For 702200 input terminal, one (1) piece</td>
</tr>
<tr>
<td>705926</td>
<td>Connecting cables</td>
<td>Connecting cable for 701953 (1 m)</td>
</tr>
<tr>
<td>705921</td>
<td>Connecting cables</td>
<td>Connecting cable for 701953 (1 m)</td>
</tr>
</tbody>
</table>

† Probes are not included with any modules.
‡ The 702221 module always requires the External Scanner Box (model 701953).
§ Firmware update may be required when using these modules.
¶ Specifications may be changed depending on the main unit.

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 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.