

## cTEST series 5 1/2 Digit 2ch Digital Multimeter Board for PCI DMM-552-PCI

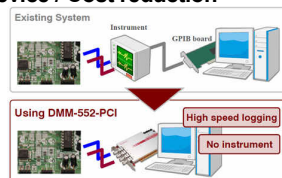


\* Specifications, color and design of the products are subject to change without notice.

### Features

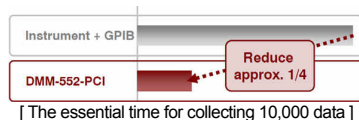
#### Miniaturization of examination device / Cost reduction

The function of high precision digital multi-meter is realized by the expansion board of personal computer. Examination devices can be gathered into one personal computer, measurement instruments and expansion boards for communication are not necessary.



#### Largely shortening of tact time because directly controlled by personal computer

Compare with the system which use a measurement instrument and a personal computer, the transmission time from measurement instrument to personal computer and the communication processing are reduced. Directly collect from personal computer can be judged immediately, so the tack time for examining is largely shortened.



#### 5 1/2 digits high precision, 2 channel simultaneous measurement function

24bit  $\Delta\Sigma$  Model A/D Converter is used, it is possible to measure (direct current voltage / current, alternating current voltage / current, resistance (only channel 1)) by maximum 5 1/2 digits. It is insulated between 2 channels. Therefore, even if there is a potential difference between channels, it is possible to measure simultaneously for 2 channels. And, continuously sampling can be realized with the maximum conversion speed that is 1500SPS \* 2 channels.

#### The Function of Auto Range

The function of auto range is that select the most suitable range automatically according to the input signal size. Therefore, when the signal which's size can not be distinguished is input, a measurement can be performed without range setting.

#### The Function of Level Judgment

Set a threshold level beforehand. Level can be judged without software. Load of CPU can be reduced. The types of threshold are OverRange, UnderRange, InRange, OutRange.

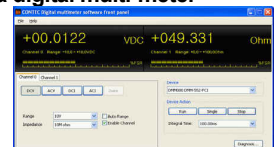
This product is a digital multi-meter board for PCI bus, which has 5 1/2 digits high precision, and has 2 channel simultaneous measurement function. It possesses five measurement functions that are direct current voltage / current measurement, alternating current voltage / current measurement, resistance measurement.

Collect data from personal computer directly, which contribute to largely shortening of tact time, miniaturization of examination device, cost reduction. The maximum conversion speed is 1500SPS, so it is possible to continuously sampling by 2 channels at the same time. The precision, integral time, sampling interval can be set by software.

The digital multi-meter of bench top type attaches to the application software [Front Panel Software]. It can be used as a Voltage/Current/Resistance measurement instrument. Windows API is also attached, so it is possible to program by Visual Basic and Visual C++.

#### [Front Panel Software] is used as a digital multi-meter

The digital multi-meter of bench top type attaches to the application software [Front Panel Software], which can be used as a Voltage/Current/Resistance measurement instrument. And, this application has the function of diagnosing and reporting the state of the board and device driver, so it can be used for make sure of the set up execution environment.



#### The Synchronization Control Connector for Synchronization Movement

In order to synchronization control maximum 16 boards, this board has a synchronization control connector. Therefore channels can be easily added only by adding boards. And, this board can work together with the others expansion board of our company which has a synchronization control connector. Such as analog I/O board, digital I/O board, counter board etc. Advanced real-time control can be performed without software.

#### Select a Input Impedance from 10M $\Omega$ or more than 10G $\Omega$

In the case of direct current voltage, range is 10V or 1V or 100mV, the input impedance can be selected from 10M $\Omega$  or more than 10G $\Omega$ . If you want to reduce the noise influence, select 10M $\Omega$ . If you want to reduce the influence of signal source's output impedance, select more than 10G $\Omega$ . Therefore, the measurement can be performed according to the measurement environment.

#### Software Trigger, Analog Edge Trigger, Hysteresis, Window Trigger, Digital Edge Trigger, Sampling Start / Stop condition of Event Control Output etc.

The control of sampling start can be selected from software trigger, analog edge trigger, hysteresis, window trigger, digital edge trigger, event control output. The control of sampling stop can be selected from software trigger, sampling times stop. The control of sampling start and sampling stop is absolutely independent. It can be individually set.

#### Use BNC Connector for Measurement Terminal

Use BNC connector for measurement terminal. It is easy to connect to the device which has BNC connector.

#### Windows compatible driver library API-PAC(W32) cTEST is attached.

Using the attached driver library makes it possible to create applications of Window.

## Specification

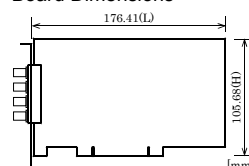
Item	Specification
<b>Measurement function</b>	
<b>DC voltage</b>	
Range*1	300V, 100V, 10V, 1V, 100mV
Measurement method	$\Delta F$ Conversion mode
Input impedance	<10V, 1V, 100mV range> 10M $\Omega$ ±2% or >10G $\Omega$ (selectable) <300V, 100V range> 10M $\Omega$ ±2%(fixed)
Max. input voltage	±350V peak no break for all ranges
<b>AC voltage</b>	
Range*1	300V, 30V, 3V, 300mV
Measurement method	AC coupled effective value*2
Crest Factor	Max. 3:1
Measurement frequency range	30Hz - 100kHz
Input impedance	10M $\Omega$ ±2% // < 150pF
Max. input voltage	310Vrms, 450V peak no break for all ranges
<b>Resistance(CH1 only)</b>	
Range*1	10M $\Omega$ , 1M $\Omega$ , 100k $\Omega$ , 10k $\Omega$ , 1k $\Omega$ , 100 $\Omega$
Measurement method	2-wire Ohms method
Voltage among open terminals	Max. 15V
Max. input voltage	±350V peak no break for all ranges
<b>DC current</b>	
Range*1	3A, 1A, 100mA, 10mA
Measurement method	Direct connection to shunt resistor
Input impedance	< 5.5 $\Omega$ : 100mA, 10mA range < 0.5 $\Omega$ : 3A, 1A range
Input protection	3.15A, 125V(Fast Blow fuse) (Square body fuses[R4533.15 (Littelfuse)] equivalent)
<b>AC current</b>	
Range*1	3A, 300mA, 30mA
Measurement method	Direct connection to shunt resistor. Measuring AC coupled effective value
Input impedance	< 5.5 $\Omega$ : 30mA range < 0.5 $\Omega$ : 3A, 300mA range
Measurement frequency range	40Hz to 500Hz
Input protection	3.15A, 125V(Fast Blow fuse) (Square body fuses [R4533.15(Littelfuse)] equivalent)
<b>Operation feature</b>	
Conversion speed	1500SPS [0.67ms]
Resolution	5 1/2 digits (When integration time 100ms is set) About 18bits equivalent
Buffer memory	4k data shared by 2 channels
Conversion start trigger	software/Input data comparison/External trigger/Event controller output
Conversion stop trigger	Specified sampling data stored/Software
External start input signal	LVTTL level (rising/falling signal edge can be selected by software)
External clock input signal	LVTTL level (rising/falling signal edge can be selected by software)
External status output signal	Open-collector output, sampling clock output (negative logic)
External status output voltage	30VDC
External status output current	40mA (per channel) (Max.)
Response time	Within 200nsec (change by pull-up resistor value)
<b>Digital I/O</b>	
Number of input channels	Un-Isolated input 4ch (LVTTL level, positive logic)
Number of output channels	Un-Isolated input 4ch (open-collector output, negative logic)
Output voltage	30VDC
Output current	40mA (per channel) (Max.)
Response time	Within 200nsec (change by pull-up resistor value)
<b>Synchronization bus section</b>	
Control output signal	Selection of output signal with the software when specifying a sync master board
Control input signal	Selection of sync factor with the software when specifying sync slave boards
Max. board count for connection	16 boards including the master board
Connector(CN5, CN6)	PS-10PE-D4T1-B1 [mfd. By JAE] or equivalent x 2
<b>Common</b>	
I/O address	64 ports x 1 region
Interrupt level	Errors and various factors. One interrupt request line as INTA
Connector (for measuring)	Target: CH0_V, CH0_I, CH1_V, CH1_I Connector type: BNC connector Model: B-901(W) [mfd. By INSERT ENTERPRISE] or equivalent
Connector (for digital)	Target: CN7 Connector type: 16pin PIN header connector Model: PS-16PE-D4T1-B1 [mfd. By JAE] or equivalent
Current consumption	5VDC, 700mA (Max.)
Operating condition	0 - 50°C, 10 - 90%RH (No condensation)
Bus specification	PCI(32bit, 33MHz, Universal key shapes supported *3)
Dimensions (mm)	176.41(L) x 105.68(H)
Weight	300g

\*1: The peak of measurement voltage including DC offset voltage does not exceed 450V.

\*2: Depending on the cable specification, the method may not be used in case of high voltage and large current.

\*3: This board requires power supply at +5V from an expansion slot (it does not work on a machine with a +3.3V power supply alone).

## Board Dimensions



The standard outside dimension (L) is the distance from the end of the board to the outer surface of the slot cover.

## Support Software

You should use CONTEC support software according to your purpose and development environment.

### Windows version of digitizer driver API-DMM(WDM)

[Stored on the bundled CD-ROM driver library API-PAC(W32) cTEST]  
The API-DMM(WDM) is the Windows version driver library software that provides products in the form of Win32 API functions (DLL). Various sample programs such as Visual Basic and Visual C++, etc is provided.

### Windows version of application software Front panel software

[Stored on the bundled CD-ROM driver library API-PAC(W32) cTEST]  
The front panel software is an application which can be used as a digital multi-meter of bench top type. It also has the function of diagnosing the state of the board and its driver. Moreover, you may use the "Diagnosis Report" feature reports the driver settings, the presence or absence of the board, I/O status, and interrupt status.

### Windows version of application software Configuration software

[Stored on the bundled CD-ROM driver library API-PAC(W32) cTEST]  
By configuration software, you may create a configuration file of acquisition conditions for this product in a wizard form.

### < Operating environment >

OS Windows 7, Vista, XP, Server 2003, 2000  
Adaptation language Visual Basic, Visual C++, Visual C#  
For more details on the supported OS, applicable language and how to download the updated version, please visit the CONTEC's Web site (<http://www.contec.com/apipac/>).

## Optional Cables and Connectors

### < For analog I/O >

One Side BNC Medium Curly Clip : BNC-W60 (0.6m)  
BNC Cable : BNC-B100 (1m)  
: BNC-B200 (2m)  
: BNC-B300 (3m)

### <For digital I/O>

16-pin Post Header 15-pin D-SUB Bracket Cable (150mm)  
: DT-E3  
16-pin Flat Cable (1.5m) : DT/E1  
Shielded Cable with Connector on both sides for 15-pin D-SUB Connector : PCB15PS-0.5P (0.5m)\*1\*2  
Shielded Cable with Connector on both sides for 15-pin D-SUB Connector : PCB15PS-1.5P (1.5m)\*1\*2  
15-pin D-SUB 15-pin Flat Cable : PCA15P-1.5 (1.5m)\*1  
Flat Cable with Connector on both sides for 15-pin D-SUB Connector : PCB15P-1.5 (1.5m)\*1\*2

\*1 DT-E3 is necessary.

\*2 FTP-15 is necessary only in using.

## Accessory

Screw-type Terminal (M3 Screw, 15 Points) : FTP-15 \*1

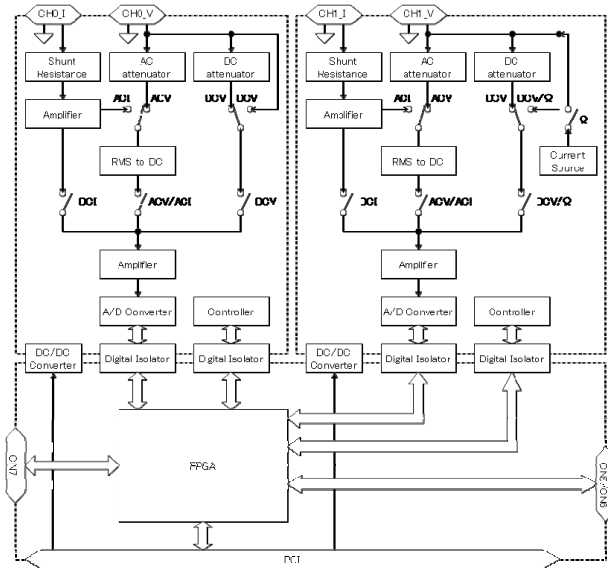
\*1 Cable DT-E3 and PCB15P-1.5 are necessary separately.

## Packing List

- Board [DMM-552-PCI] ...1
- First step guide ...1
- CD-ROM \*1 [API-PAC(W32) cTEST] ...1
- Synchronization control cable (10cm) ...1

\*1 The CD-ROM contains the driver software and User's Guide (this guide)

## Block Diagram



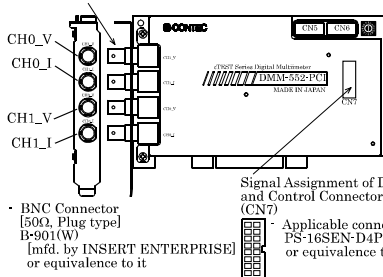
## How to connect the connectors

### Connector shape

To connect an external device to this product, plug the cable from the device into the interface connector (CH0\_V, CH0\_I, CH1\_V, CH1\_I, CN7) shown below. Interface connector are Measurement Connector (CH0\_V, CH0\_I, CH1\_V, CH1\_I), Digital I/O Control Connector (CN7).

### < Interface Connector Shape >

Measurement Connector  
(CH0\_V, CH0\_I, CH1\_V, CH1\_I)

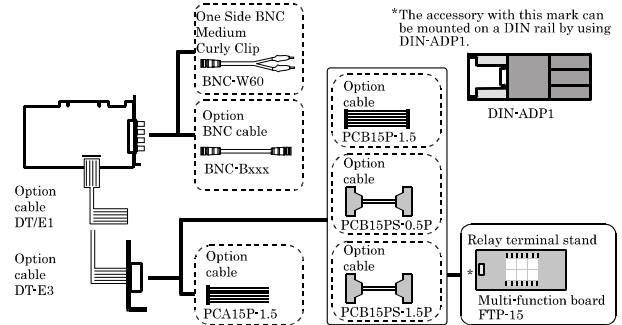


Signal Assignment of Digital I/O and Control Connector (CN7)

Applicable connector  
PS-16SEN-D4P1-1C [mfd. by JAE]  
or equivalence to it

\* Please refer to P.3 for more information on the supported cable and accessories.

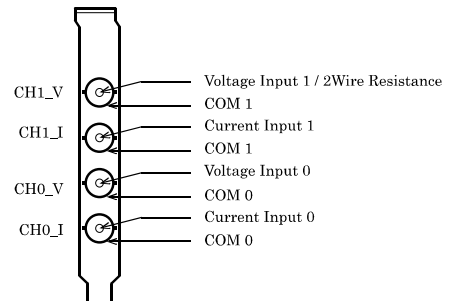
### < Examples of Connecting Options >



\* Please refer to P.3 for more information on the supported cable and accessories.

### Connector Pin Assignment

Signal Assignment of Measurement Connector (CH0\_V, CH0\_I, CH1\_V, CH1\_I)



Voltage Input 0	HIGN side of voltage measurement terminal. The numbers correspond to channel numbers.
Voltage Input 1 / 2 Wire Resistance	HIGN side of voltage measurement terminal. HIGN side of 2 terminal method resistance measurement terminals. The numbers correspond to channel numbers.
Current Input 0 - 1	HIGN side of current measurement terminal. The numbers correspond to channel numbers.
COM 0-1	LOW side of voltage, current, resistance measurement terminal. The numbers correspond to channel numbers. In the case of voltage and resistance measurement, use the COM x terminal of CHx_V. In the case of current measurement, use the COM x terminal of CHx_I. (x is channel number)

### ⚠ CAUTION

- In the case of voltage and resistance measurement, you must use the COM x terminal of CHx\_V (x is channel number).  
If you use the terminals of others COM x side, the measurement precision may be influenced.
- In the case of current measurement, you must use the COM x terminal of CHx\_I (x is channel number).  
If you use the terminals of others COM x side, it can result in a fault.

## Signal Assignment of Digital I/O and Control Connector (CN7)

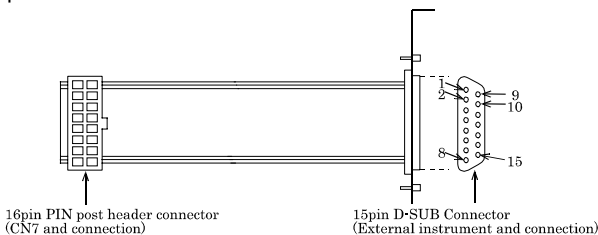
	B08	N.C.	A08	Reserved
	B07	Digital Ground	A07	AI Status Output
	B06	External Sampling Clock Input	A06	Reserved
	B05	External Start Trigger Input	A05	Digital Input 3
	B04	Digital Input 2	A04	Digital Input 1
	B03	Digital Input 0	A03	Digital Ground
	B02	Digital Output 3	A02	Digital Output 2
	B01	Digital Output 1	A01	Digital Output 0

Digital Input 0 - Digital Input 3	Digital input signals
Digital Out 0 - Digital Output 3	Digital output signals
External Start Trigger Input	External trigger input signal for starting sampling
External Sampling Clock Input	External sampling clock input signal
AI Status Output	Output the status signal
Digital Ground	Common digital ground for each signal
Reserved	Reserved pin
N.C.	No connection to this pin

### ⚠ CAUTION

- Do not connect any of the outputs to the digital ground.
- Neither connect outputs to each other. It can result in a fault.
- Digital terminals are non-insulated. The digital ground is being connected to the ground of personal computer.

### Option Cable DT-E3

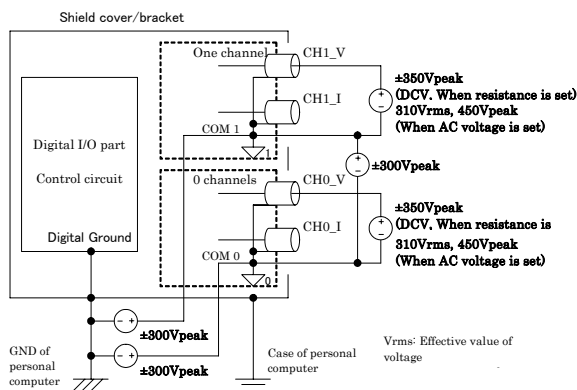


Digital Output 0	1	9	Digital Output 1
Digital Output 2	2	10	Digital Output 3
Digital Ground	3	11	Digital Input 0
Digital Input 1	4	12	Digital Input 2
Digital Input 3	5	13	External Start Trigger Input
Reserved	6	14	External Sampling Clock Input
AI Status Output	7	15	Digital Ground
Reserved	8		

## Connect to Measurement Object

### Maximum Input Voltage of each Part

It is insulated between this product's terminals of COM 0 - COM 1, COM 0 - Digital Ground, COM 1 - Digital Ground. Applied voltage should not exceed the maximum input voltage of each part.



### ⚠ CAUTION

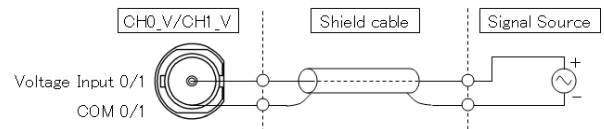
- The voltage applied to the measurement terminal should not exceed

the maximum input voltage which bases on the potential of this board's COM x terminal (x is channel number). If it exceeds the maximum voltage, the board may be damaged.

- The potential of signal which is connected to this board's COM x terminal (x is channel number) should not exceed the maximum input voltage which bases on the ground potential of the used personal computer. If it exceeds the maximum voltage, the board may be damaged.
- If the power of this board is off, do not input signal to the measurement terminals (CHx\_V, CHx\_I (x is channel number)). Otherwise, it can result in a fault.
- In this state, if signal is input, insert relay etc. between the terminals and signals to separate the signal line.
- FG (shield cover / bracket) of this product is connected to the ground of personal computer.

### DC or AC Voltage Measurement

The following figure shows an example of shield cable connection. Connect BNC connector of CH0\_V / CH1\_V for each measurement channel respectively, the wick line to the plus side and the shield braid to the minus side.



### ⚠ CAUTION

- If the COM terminal side connected to the measurement object is not ground potential, do not touch the measurement terminals (BNC connector) with your hands. Otherwise, there is danger of a shock.
- When the board's measurement terminals (BNC connector) are input signals to, do not touch the measurement terminals with your hands. Otherwise, there is danger of a shock.

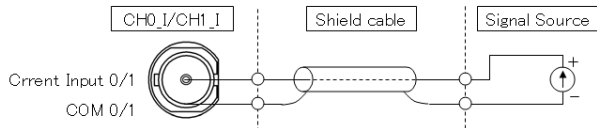
### ⚠ CAUTION

- If this board and the measurement object receive noise or the distance between this board and the measurement object is too long, measurement may not be performed properly.
- In the case of voltage measurement, do not connect the current input connector (CH0\_I, CH1\_I) of used channels to anything. Otherwise, the board may malfunction, overheat, or cause a failure.
- When DC voltage measurement and the range is less than 10V, if the voltage more than 15V is input, the over-voltage protection circuit is activated. In order to reduce the input impedance to 100 kΩ degree, increase the current flowing to the measurement terminals.
- If the input voltage exceeds the maximum input voltage, the over-voltage protection circuit is activated, large current may be flowed to the measurement terminals. And, in the case of exceeding the maximum input voltage, there is a damage which does not reach the wide area of over-voltage, so the activated over-voltage protection circuit can not prevent from the damage of this board itself. When the activated state of protection circuit is continuous, even if there is not a problem in the measurement function, you should repair it for security.
- Just after the personal computer starts up (several seconds after the power is on), do not supply voltage.
- Just after the personal computer starts up (several seconds after the power is on), the input impedance is over 10GΩ.
- Just after the personal computer starts up (several seconds after the power is on), the range setting etc. is uncertainty.



### DC or AC Current Measurement

The following figure shows an example of shield cable connection. Connect BNC connector of CH0\_I / CH1\_I for each measurement channel respectively, the wick line to the plus side and the shield braid to the minus side.



#### ⚠ CAUTION

- If the COM terminal side connected to the measurement object is not ground potential, do not touch the measurement terminals (BNC connector) with your hands. Otherwise, there is danger of a shock.
- When the board's measurement terminals (BNC connector) are input signals to, do not touch the measurement terminals with your hands. Otherwise, there is danger of a shock.
- Make sure that the measurement object device does not exceed the rated voltage (125V) of fuse.

In the case of over-current, the fuse will melt down, overheat, firing.

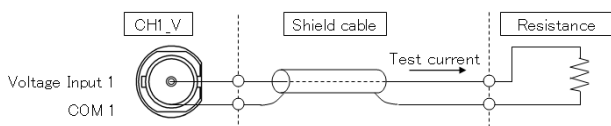
- There is the case that the contact resistance of BNC connector becomes larger. When using, you must make sure whether the BNC connector is connected properly and whether the connector is abnormally heat or not.

#### ⚠ CAUTION

- If this board and the measurement object receive noise or the distance between this board and the measurement object is too long, measurement may not be performed properly.
- In the case of current measurement, do not connect the voltage input connector (CH0\_V, CH1\_V) of used channels to anything. Otherwise, the board may malfunction, overheat, or cause a failure.
- If the input current exceeds the maximum input current, the inner fuse will melt down and the measurement terminal will be open.
- In the case of current measurement, the measuring current flows in resistance, the current value is gotten by measuring the voltage of the both sides. If the current flow, which exceeds measurement range largely, the over-voltage protection circuit is activated. At this time, lower the resistance value so that the measuring voltage value does not rise. Originally, even if in this case, the current measurement doesn't change the current value. But, if the output signal source which's voltage is stationary, the resistance is lowered then the current rises. If the signal source cannot drive that current, the signal source may break down.
- Just after the personal computer starts up (several seconds after the power is on), the range setting etc. is uncertainty.

### Resistance Measurement (Channel 1)

The following figure shows an example of shield cable connection. Connect BNC connector of CH1\_V for measurement channel to resistance. The measurement current (Test current) flows from wick line side to the shield braid side.



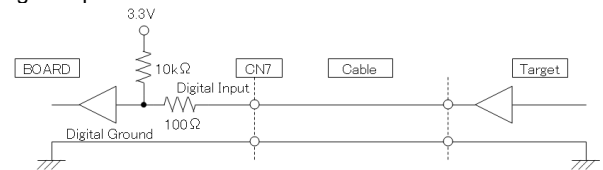
#### ⚠ CAUTION

- If this board and the measurement object receive noise or the distance between this board and the measurement object is too long, measurement may not be performed properly.
- In the case of resistance measurement, do not connect the current input connector (CH1\_I) of used channels to anything. Otherwise, the board may malfunction, overheat, or cause a failure.
- If perform the resistance measurement with being inserted a relay etc, short-circuit the measurement terminals. Just after the short circuit, there is a maximum 15V voltage between the measurement terminals (CH1\_V terminal to COM terminal). If the resist pressure of measurement object is low, the measurement object may be damaged.
- Just after the personal computer starts up (several seconds after the power is on), the range setting etc. is uncertainty.

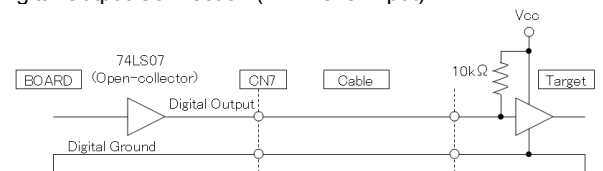
### Digital I/O Signals, Control Signals

The following sections show examples of how to connect digital I/O signals, control signals (external trigger input signals, sampling clock input signals, etc.) with flat cables. Connect CN7 to an external device with a separate sale flat cable (DT/E1), 15-pin D-SUB bracket cable (DT-E3). When the device is on the status of working, output the synchronized pulse (pulse width is about 10μsec) to the External Status Output Signal (AI Status Output terminal) with the internal sampling clock. But, if the sampling clock setting is set to be External Sampling Clock Input, then it is [OFF]. Digital input signals, control input signals are TTL level signals. Digital output signals, external status output signals are open collector output.

#### Digital Input Connection

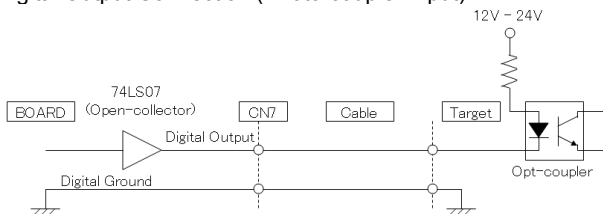


#### Digital Output Connection (TTL Level Input)



If the signal line isn't pulled up at the connect position of digital output signal, it is necessary to connect a pull-up resistance in the outside.

#### Digital Output Connection (Photo-coupler Input)



#### ⚠ CAUTION

- Each input can be input to 5V TTL signal.
- When the PC is turned on, all the output are reset to OFF.

## Synchronization Control Connectors

### SC Connectors

Controlling simultaneous operations between boards or controlling in sync with events is in part dependent on software performance. In order to enhance the reliability of the entire system and to solve these problems, the board is equipped with SC (Synchronization Control) connectors (CN5, CN6). Connecting the SC connectors allows boards of the same or different models to operate in sync with one another.

From the boards connected with the SC cable, select one master board and use others as slaves. On the master board, set the signal to be supplied to the slave boards with the software. On the slave boards, the signal from the master board can be set to either the pacer clock operation start or stop factor.

All board operations can also be stopped with a stop request from the master in case of an error, for example, or when requested from a slave board. A maximum of 16 boards can be connected including the master.

For more information on the setup procedure, see the driver software online help.

**Example 1:** When sampling clock start and stop requirements are set the same for multiple boards

In order to synchronize master sampling clock start and stop with slave boards you can build a synchronous system which does not depend on software processing capabilities.

If the board model is the same, data remains synchronized among boards even when channels are expanded. When board models are different, data still remains compatible since sampling clock start and stop are dependent on the master.

- (1) Connect the SC cable.
- (2) Designate master/slave with the software.
- (3) Assign to the connectors the sampling clock start and stop signals to be output from the master.
- (4) Set up slave boards so they can utilize all signals.
- (5) Start in order of slave to master boards.

#### ⚠ CAUTION

- When sampling clock signals are assigned to the synchronization control connector, the maximum clock frequency is restricted to 1500SPS (0.67ms or more).
- When signals are assigned to the synchronization control connector, a delay of approximately 100nsec occurs at the slave board.

**Example 2:** When controlling slave operations with master's internal events

By outputting an internal event (interrupt) occurring on the master board, the slaves can start operating in sync with that signal.

- (1) Connect the SC cable.
- (2) Designate master/slave with the software.
- (3) Assign to the connector the event signal to be output from the master.
- (4) Set signals from the master to the start requirements on the slave boards.
- (5) Start in order of slave to master boards.

### Connecting the SC Connectors (CN5, CN6)

This product is equipped with sync signal control connectors (CN5, CN6) for connecting a sync signal cable. When the cable is connected, multiple boards can operate in sync with one another.

### Connection Procedure

Connect the sync signal cable when two or more boards need to operate in sync with one another. Connect CN5 with a smaller ID number to CN6 with a greater ID number with the cable. You should only use the cable that came with the board.

