INSTRUCTION MANUAL

I/O Unit
(GPIB Parallel Interface Unit)

Model **TOS9010**

First Edition

KIKUSUI ELECTRONICS CORPORATION
(KIKUSUI PART NO. Z1-212-520)

M-91040

Power Requirements of this Product

Power requirements of this product have been changed and the relevant sections of the Operation Manual should be revised accordingly.
(Revision should be applied to items indicated by a check mark ☑.)

☐ Input voltage

The input voltage of this product is _____ VAC,
and the voltage range is _____ to _____ VAC. Use the product within this range only.

☐ Input fuse

The rating of this product's input fuse is _____A, _____VAC, and _____.

WARNING

- To avoid electrical shock, always disconnect the AC power cable or turn off the switch on the switchboard before attempting to check or replace the fuse.
- Use a fuse element having a shape, rating, and characteristics suitable for this product. The use of a fuse with a different rating or one that short circuits the fuse holder may result in fire, electric shock, or irreparable damage.

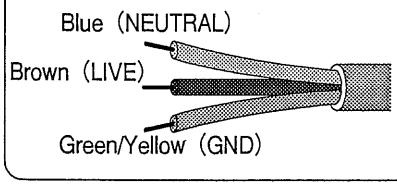
☐ AC power cable

The product is porvided with AC power cables described below. If the cable has no power plug, attach a power plug or crimp-style terminals to the cable in accordance with the wire colors specified in the drawing.

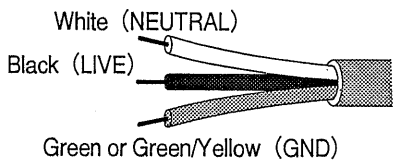
WARNING

- The attachment of a power plug or crimp-style terminals must be carried out by qualified personnel.

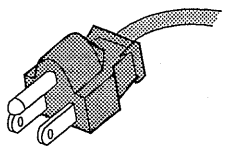
☐ Without a power plug



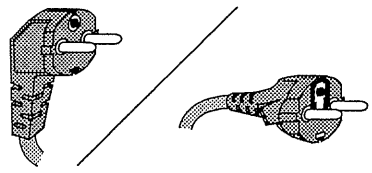
☐ Without a power plug



☐ Plugs for USA



☐ Plugs for Europe



☐ Provided by Kikusui agents

Kikusui agents can provide you with suitable AC power cable.
For further information, contact your Kikusui agent.

☐ Another Cable _____

 Kikusui Part No. Z9-000-027 IB001681

KIKUSUI

TOS Series Errata

KIKUSUI changed models in the following table to new models.
If the previous model names are described in this manual, read this manual replacing the previous model names with new model names.

Product	Previous Model	New Model
Resistance Box /UL	SPEC83903	RL01-TOS
Remoto Control Box	913A	RC01-TOS
Remoto Control Box	914A	RC02-TOS
H.V Test Probe	HTP-1.5A	HP01A-TOS
H.V Test Probe	HTP-3A	HP02A-TOS
H.V Test Probe	HP01-TOS	HP01A-TOS
H.V Test Probe	HP02-TOS	HP02A-TOS
High Voltage Test Leadwires	HTL-1.5W	TL01-TOS
High Voltage Test Leadwires	HTL-3W	TL02-TOS
High Voltage Test Leadwires	HTL-1.5WH	TL03-TOS
High Voltage Test Leadwires	HTL-1.5R	TL04-TOS
High Voltage Test Leadwires	HTL-1.5I	TL05-TOS
High Voltage Test Leadwires	HTL-1.5D	TL05-TOS
Warning Light Unit	9202	PL01-TOS
Warning Light Unit	9202S	PL01-TOS
Buzzer Unit	9203	BZ01-TOS
Buzzer Unit	9203S	BZ01-TOS

KIKUSUI ELECTRONICS CORP.

Contents

1. GENERAL

1.1 Outline

Model TOS9010 I/O Unit is a GPIB parallel interface unit with 24 input ports and 16 output ports. (See Figure 1.1)

The TOS9010 can be used as a general purpose I/O interface unit to cope with various types of situations, such as for computerized automatic measurements, for automatic control of robots or other mechanisms, etc.

A typical application of the TOS9010 is used with Model TOS9000 Automatic W/I Tester and Model TOS9020 H.V Scanning Unit, making up an unmanned automatic test system shown in Figure 1.2.

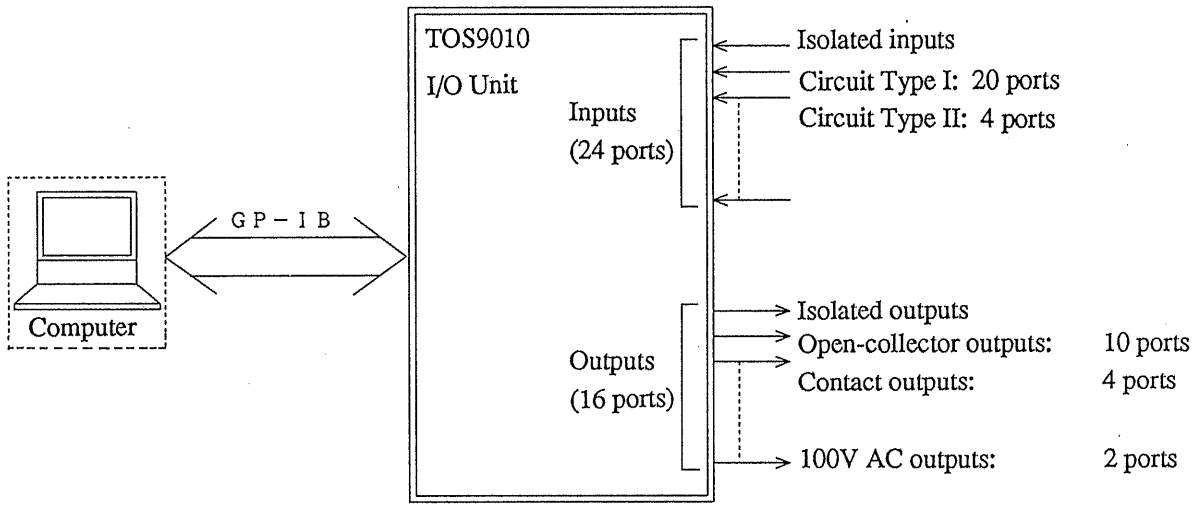


Figure 1.1

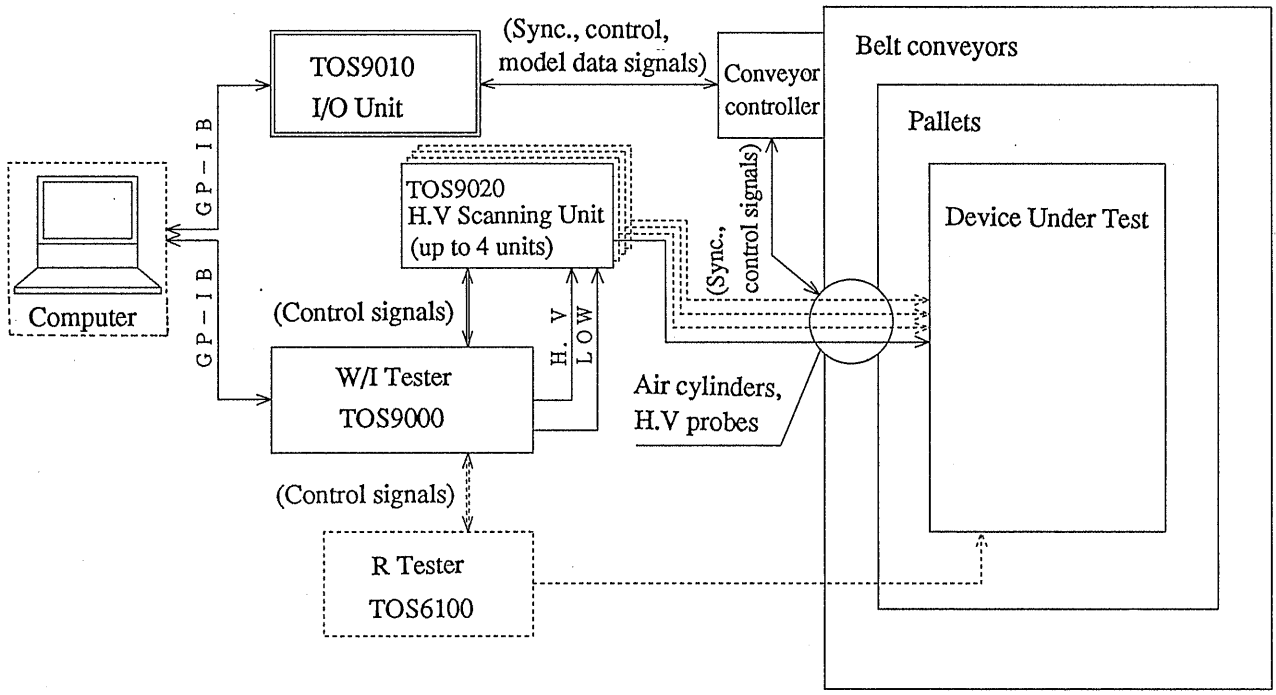


Figure 1.2

1.2 Features

(1) Simple GPIB Commands

Inputs and outputs can be controlled with ASCII strings corresponding to operation. Types of commands:

For control of service request

For control of each input

For control of each group (8 ports) of inputs

For control of each output

For control of each group (8 ports) of outputs

For reset

(2) Service Request Function

The TOS9010 can flag a service request (SRQ) in response to input signal change.

(3) Multiple Numbers of I/O Signals

Up to 24 input signals and up to 16 output signals can be controlled.

(4) Isolated I/O Signals

The input and output signals are isolated from the internal circuits of TOS9010.

(5) Isolated Power Supply

The TOS9010 provides an isolated power supply (+15V, 100mA) for external use.

(6) Signal Status Indicator LEDs

The statuses of each input and output signals (statuses that signals are being input to which ports or being output from which ports) are indicated by the respective LEDs on the front panel.

2. SPECIFICATIONS

Structure of TOS9010

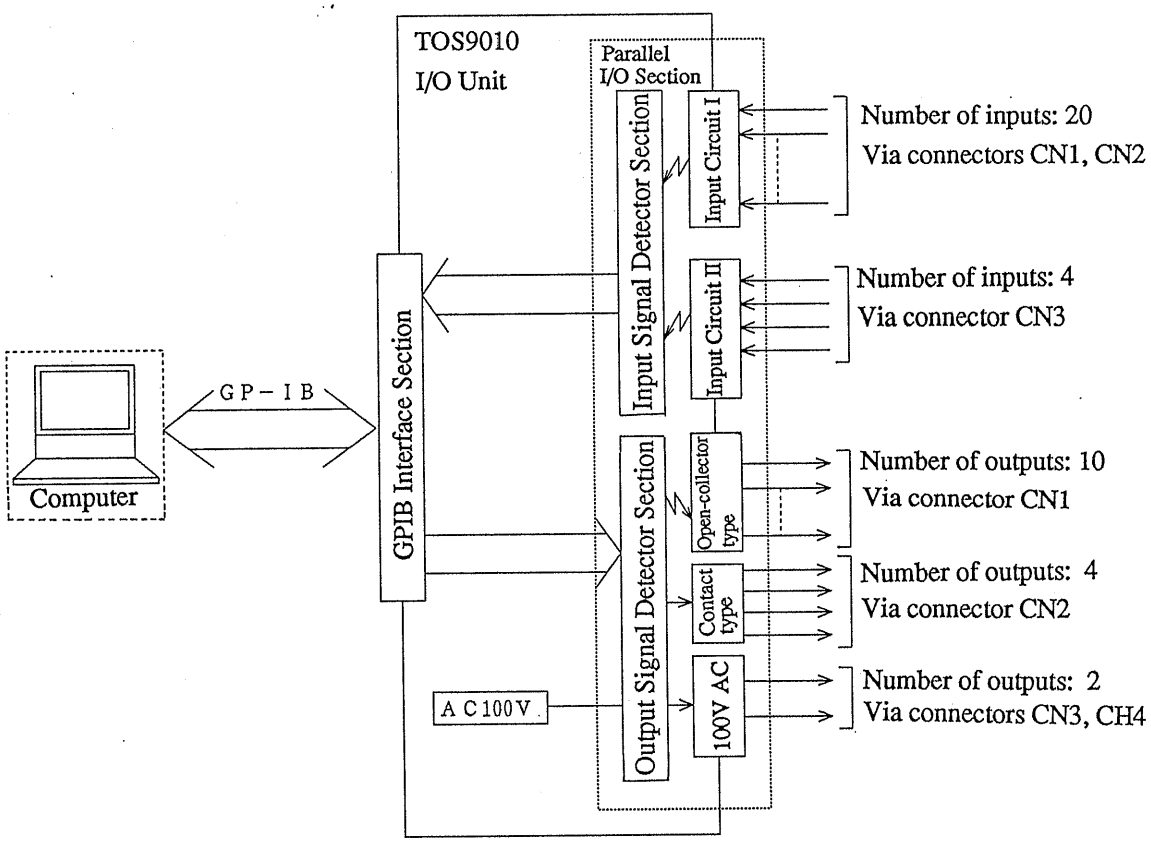


Figure 2.1

Note 1: The signals of Input Circuits I and II and open collector signals are isolated from the internal circuits of TOS9010 by photocouplers. The contact signals are isolated by internals of control relays themselves. The isolation ratings of these signal circuits are 30V DC or 30V AC rms (42.4V peak).

Note 2: The signals of Input Circuits I and II are not mutually isolated. They have a common return lines.

GPIB Interface Section

Interface Functions

(ANSI/IEEE-488-1978, IEC625)

SH1 : With source handshake function

AH1 : With acceptor handshake function

T6 : With basic talker function, serial polling function, and function of talker release by MLA

L4 : With basic listener function, and function of listener release by MTA

SR1 : With full service request function

RL0 : Without remote/local function

PP0 : Without parallel polling function

DC1 : With full device clear function

DT0 : Without device trigger function

Data Codes: ASCII

Delimiters

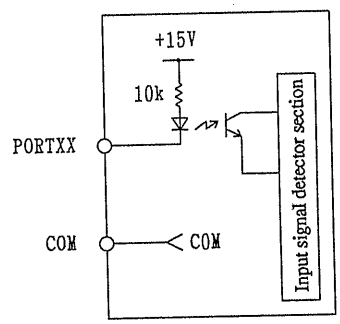
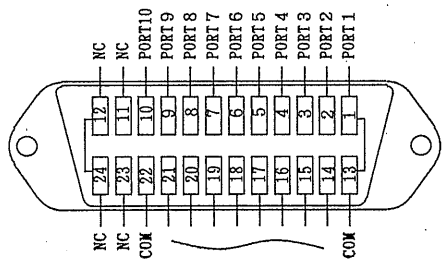
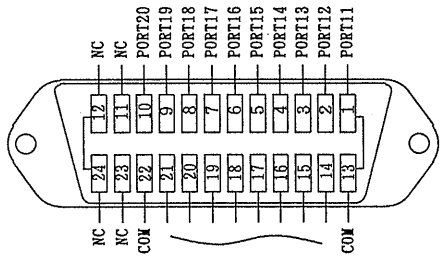
From a controller:	LF
	CR/LF
	LF(+EOI)
	CR/LF(+EOI)
	EOI
To a controller:	CR/LF(+EOI)

Parallel I/O Section

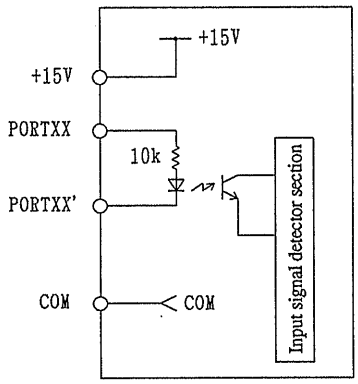
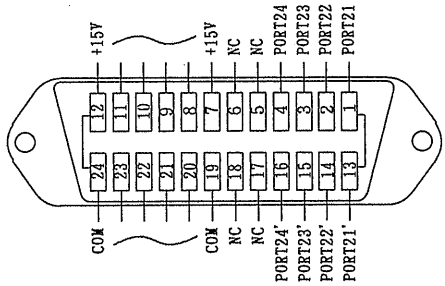
Input Signals

Number of Signals: 24 (Received via connectors IN/CN1, CN2, CN3 on rear panel)

Input Circuit I

Number of Ports	20 (Port Nos. 1 through 20)
Signal Isolation	With photocouplers
Indicators	LEDs on front panel (They light when signals are present.)
Circuitry (per port)	
Connector Pin Assignment (IN/CN1)	
Connector Pin Assignment (IN/CN2)	

Input Circuit II

Number of Ports	4 (Port Nos. 21 through 24)
Signal Isolation	With photocouplers
Indicators	LEDs on front panel (They light when signals are present.)
Isolated Power Supply	+15V, 100mA (in total)
Circuitry (per port)	
Connector Pin Assignment (IN/CN3)	

Output Signals

Number of Signals: 16

Open-collector Signals: 10

(delivered via connector OUT/CN1 on rear panel)

Ratings:	Allowable Voltage	: 30V DC
	Saturation Voltage	: Approx. 1.1V (at 25°C or 77°F)
	Maximum Output Current	: 100mA (in total)

Contact Signals: 4

(delivered via connector OUT/CN2 on rear panel)

Ratings:	Maximum Make/Break Ratings	: 24V DC/1A, 30V AC/1A
	Minimum Make/Break Ratings	: 150mV/100μA

100V AC Signals: 2

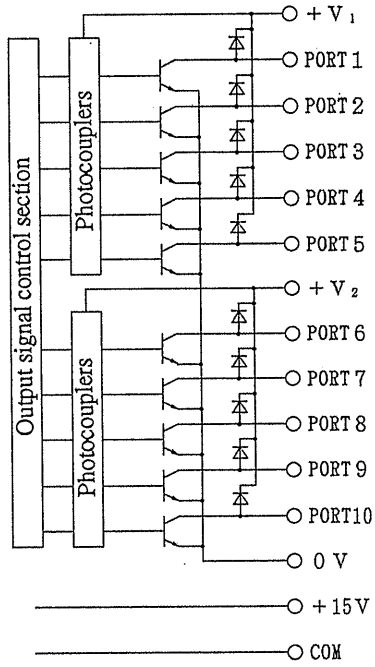
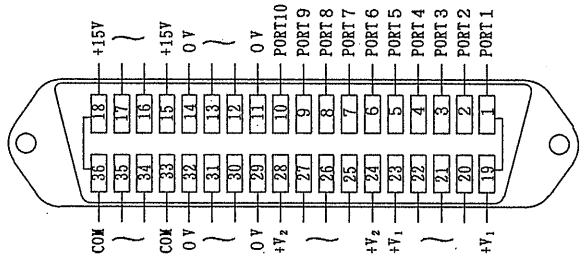
(delivered via connectors OUT/CN3 and CN4 on rear panel)

Ratings:	Maximum Output Current	: 0.2A (in total)

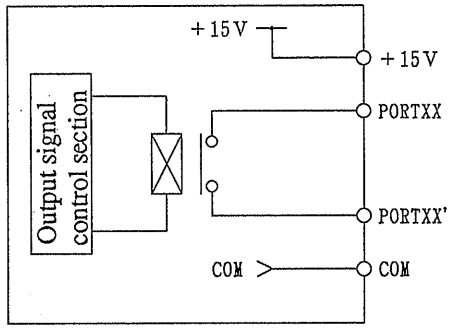
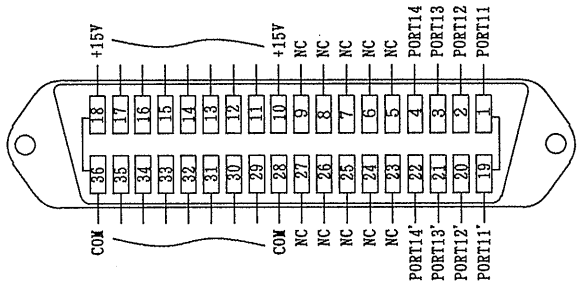
Isolated Power Supply: +15V, 100mA (maximum)

(delivered via connector IN/CN3 and connectors OUT/CN1 and CH2)

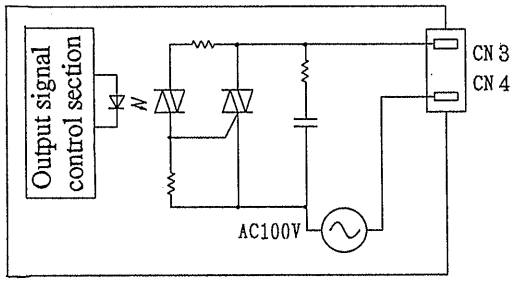
Open-collector Output Signals

Type of Signals	Open collector
Number of Ports	10 (Port Nos. 1 through 10)
Allowable Maximum Voltage	30V DC
Saturation Voltage	Approx. 1.1V (at 25°C or 77°F)
Maximum Output Current	100mA (in total)
Signal Isolation	With photocouplers
Indicators	LEDs on front panel (They light when signals are present.)
Isolated Power Supply	+15V, 100mA (in total)
Circuitry	
Connector Pin Assignment (OUT/CN1)	

Contact Signals

Type of Signals	Relay contact type
Number of Ports	4 (Port Nos. 11 through 14)
Maximum Make Break Ratings	24V DC/1A, 30V AC/1A
Minimum Make Break Ratings	150mV/100μA
Indicators	LEDs on front panel (They light when signals are present.)
Isolated Power Supply	+15V, 100mA (in total)
Circuitry (per port)	
Connector Pin Assignment (OUT/CN2)	

100V AC Signals

Type of Signals	100V AC
Number of Ports	2 (Port Nos. 15 and 16)
Allowable Maximum Voltage	Approx. 100V AC
Allowable Maximum Output Current	0.2A (in total)
Indicators	LEDs on front panel (They light when signals are present.)
Isolated Power Supply	+15V, 100mA (in total)
Circuitry (OUT/CN3, CN4)	

Ambient Temperature and Relative Humidity

To Meet Specifications	: 5 to 35°C (41 to 95°F), 20 to 85% RH
Operable Ranges	: 0 to 40°C (32 to 104°F), 20 to 90% RH
For Transportation or Storage	: –20 to 70°C (–4 to 158°F), up to 90% RH

AC Line Requirements

Line Voltage	: A: 90 - 110V B: 104 - 125V C: 194 - 236V D: 207 - 250V
Frequency	: 50/60Hz

Power Consumption : 60VA or less

Insulation Resistance : 30MΩ or more, with 500V DC

Withstanding Voltage : 1000V AC, for 1 minute

Overall Dimensions : 430W x 100H x 370D mm
16.93W x 3.90H x 14.57D in.

(Maximums) : (430W x 115H x 433D mm)
(16.93W x 4.53H x 17.04D in.)

Weight : Approx. 5.6 kg (12.3 lbs.)

Accessories :

Input signal cables (24 pins, 5m or 16.5ft.)	3
Output signal cables (36 pins, 5m or 16.5ft.)	2
GPIB cable (2m or 6.6 ft.)	1
Power cable set	1
AC plug adapter*	1
Instruction Manual	1
Fuse, 1A (stored in fuse holder)	1
Fuses, 0.5A	2

(*: The AC plug adapter is provided only for using in Japan.)

Optional Items

408J1P5 GPIB Cable 50cm (1.6ft.)

408J101 GPIB Cable 1m (3.3ft.)

408J102 GPIB Cable 2m (6.6ft.)

408J104 GPIB Cable 4m (13.1ft.)

Model 9202S Alarm Unit

Model 9203S Buzzer Unit

BH2M-KSG Rack Mount Brackets (JIS Type)

3. GENERAL NOTES AND PRECAUTIONS

3.1 Receiving Inspection

Prior to the shipment from our factory, the unit has been subjected to electric and mechanical testing and guaranteed of satisfactory quality and performance.

Nevertheless, you are kindly requested to make a receiving inspection to see if the unit has any in-transit damage. If you find any, please inform our local dealer of such a damage.

3.2 Conditions for Operation

(1) The TOS9010 operates on one of the AC line voltages shown below, by selecting it with the AC line voltage selection plug on the rear panel. Before connecting the AC power cable to an AC line outlet, be sure that the setting of the selection plug conforms with the AC line voltage.

When changing the AC line voltage settings, change the fuses also by referring to below table.

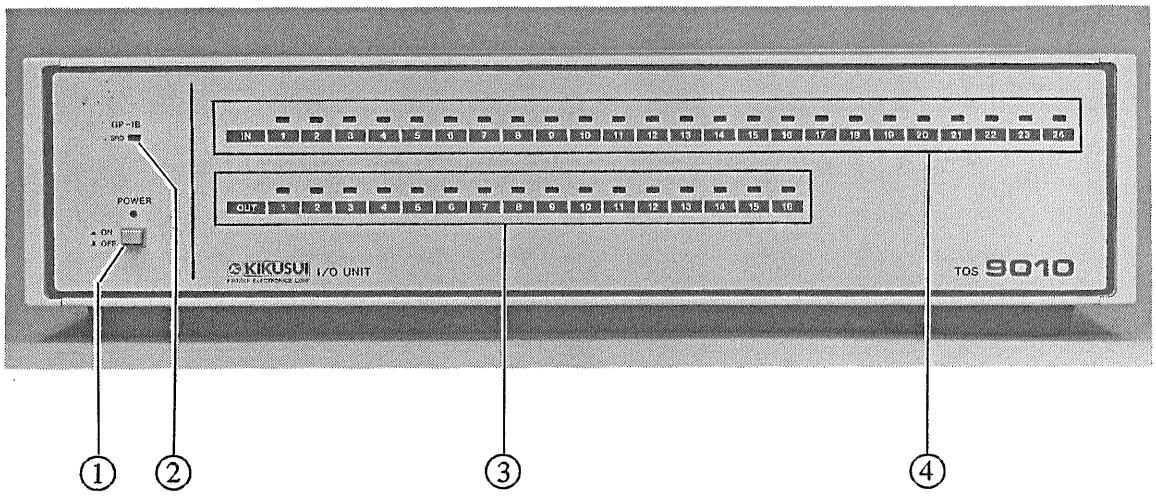
Be sure to operate the TOS9010 within the ranges shown in below Table. Note that the TOS9010 may not operate properly or may be damaged if you operate it outside the voltage ranges.

Setting	Typical Voltage	Operable Range	Fuse
A	100V	90 - 110V	1A
B	115V	104 - 125V	
C	215V	194 - 236V	0.5A
D	230V	207 - 250V	

(2) Do not use or store the instrument in adverse environments such as in direct sunlight, high temperature, high humidity, and/or dusty atmosphere.

4. OPERATION METHOD

4.1 Description of Front Panel



① POWER ON/OFF switch and LED

Turns on/off the AC power and, indicates it.

② GPIB SRQ LED

This LED lights up to indicate that the TOS9010 is sending a service request.

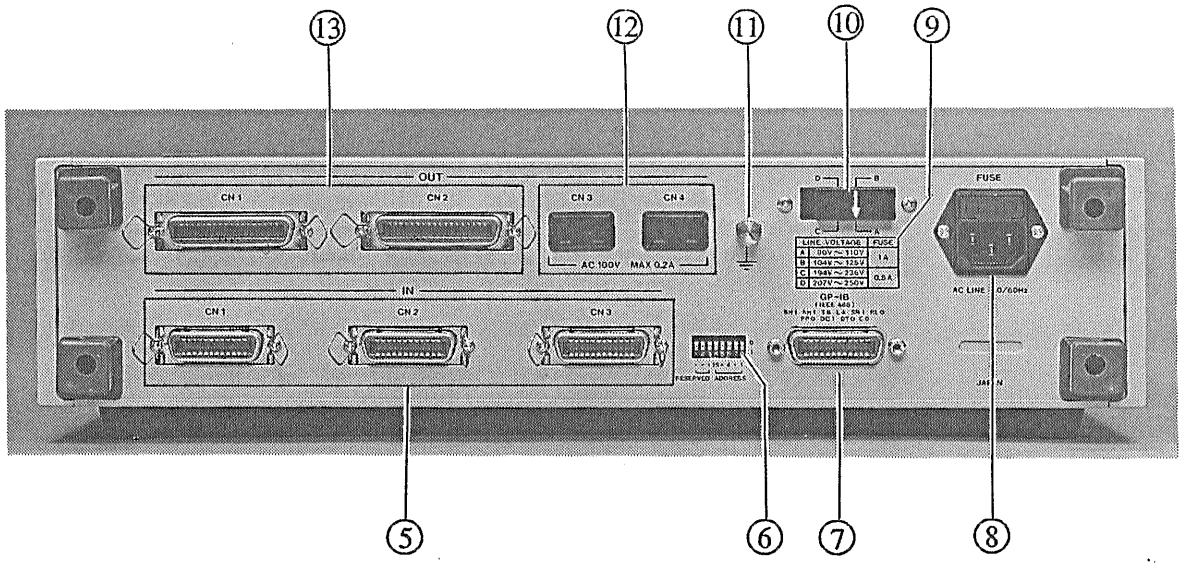
③ OUT indicator LEDs

These LEDs light up to indicate that respective output signals are present at output ports (1 through 16). They go out when signals are absent.

④ IN indicator LEDs

These LEDs light up to indicate that respective input signals are present at input ports (1 through 24). They go out when signals are absent.

4.2 Description of Rear Panel



⑤ IN/CN1, CN2, CN3 connectors

These connectors are used for the input signals. The accessory input cables (24-pins, 5m or 16.5ft.) can be connected to these connectors.

⑥ ADDRESS switches

This DIP switch is used for setting of the GPIB address number for the TOS9010. The leftmost three switches are reserved.

⑦ GPIB connector

This connector is used for a GPIB (IEEE-488) bus line.

⑧ AC LINE 50/60Hz inlet

This inlet is a 3-pin socket with a fuse holder. For the AC input power cable, use the cable which is an accessory of the TOS9010. Be sure to use a correct fuse conforming with the AC line voltage. To take out the fuse to change it, disconnect the power cable from the inlet and then ply the nail of the fuse using a screwdriver or other pointed tool.

⑨ LINE VOLTAGE table

This table shows the allowable AC line voltages and correct fuse ratings.

⑩ AC line voltage selection plug (A/B/C/D)

This plug selects an AC line voltage on which the TOS9010 is to be operated. Align the arrowhead mark with the corresponding AC line voltage (A, B, C or D) according to the LINE VOLTAGE table ⑨.

⑪ Protective GND terminal

This GND terminal is used for a protective grounding of the TOS9010 to the earth potential. Be sure to connect securely a ground line to the terminal by using an applicable tool.

⑫ OUT/CN3 and CH4 outlets

These outlets deliver a 100V AC signal, which can be used to drive Model 9202S Alarm Unit or Model 9203S Buzzer Unit.

Note: The TOS9010 can operate on one of the four AC line voltages. Despite the selected voltage, the outlets deliver a voltage signal of approximately 100V AC.

⑬ OUT/CN1 and CN2 connectors

These connectors deliver output signals of the TOS9010. For signal connection, use the signal output cables (36 pins, 5m or 16.5ft.), which are accessories of the TOS9010.

4.3 GPIB Interface Functions

4.3.1 GPIB Specifications

The TOS9010 supports GPIB interface functions of ANSI/IEEE 488-1978 shown in Table 4.1.

Table 4.1

SH1 : With source handshake function

AH1 : With acceptor handshake function

T6 : With basic talker function, serial polling function, and function of talker release by MLA

L4 : With basic listener function, and function of listener release by MTA

SR1 : With full service request function

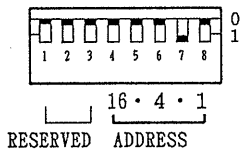
RL0 : Without remote/local function

PP0 : Without parallel polling function

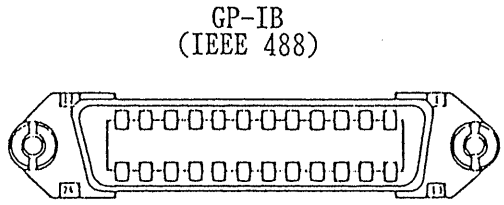
DC1 : With full device clear function

DT0 : Without device trigger function

4.3.2 Operation Method



DIP switch



GPIB connector

DIP switch : Specifies an address number for the TOS9010.

GPIB connector : A 24-pin connector for a GPIB cable.

Note: Up to three connectors can be stacked up in a piggy back manner at one location.

(1) Address Setting

You should specify an address number for the TOS9010 by using the rightmost five ADDRESS switches. The leftmost three switches are reserved. The allowable address number range is 0 to 30.

The ADDRESS switches are marked with "16•4•1," which is an abbreviation for "16, 8, 4, 2, 1." The address number is the sum of the significance of the five switches, which are set to position 1. For example, assume that you set the address number at 19. Since 19 = 16+2+1, set to position 1 the switches of significance "16", "•" (which stands for "2"), and "1."

Note: When the TOS9010 is shipped from the factory, its default address number is set at "2."

The GPIB address number is detected from the ADDRESS switches only once at the turning power on. Thereafter, the detected address number remains unchanged even if the setting of the ADDRESS switches is altered.

(2) Delimiters

When you send a command from the controller, all five delimiters LF, CR/LF, LF(+EOI), CR/LF(+EOI) and EOI are available without requiring any selecting procedure.

① When you have sent EOI signal, it is taken unconditionally to mean the end of data,

② When you read back the data from TOS9010, the delimiter is always CR/LF(+EOI).

(3) When you send DCL (Device Clear) or SDC (Selected Device Clear) from the controller, the TOS9010 responds as follows:

① Clears the status byte (sets all bits of the status byte to 0).

② Turns off all output signals.

Note: The DCL and SDC do not initialize the Service Request Mask Register of TOS9010.

(4) Major functions

① To send a service request to the controller

② Reading back the statuses of input ports with the controller

③ Turning on and off the output signals for output ports with the controller

① To send a service request to the controller

The TOS9010 flags a service request (SRQ) in order to notify the controller of an event occurred in the TOS9010. Then, the SRQ LED on the front panel of TOS9010 lights up.

When the SRQ is being flagged, the bits of the status byte which correspond to each event are assigned to 1. This allows you to identify the type of event by reading back the status byte. The format of the status byte and the meanings of each bit are as follows.

Status byte

7	6	5	4	3	2	1	0	Bit
0	RQS	0	0	0				

Bit 0 : Group 1 (input ports 1-8) input signal has changed.
Bit 1 : Group 2 (input ports 9-16) input signal has changed.
Bit 2 : Group 3 (input ports 17-24) input signal has changed.
Bit 3 : Reserved (always 0)
Bit 4 : Reserved (always 0)
Bit 5 : Reserved (always 0)
Bit 6 : Sending SRQ (service request)
Bit 7 : Reserved (always 0)

② Reading back the statuses of input ports with the controller

To read back the input ports, you must send a query command such as IN or ING to the TOS9010.

IN command: For readback of the input ports

ING command: For readback of a group of the eight input ports at once

By the controller, TOS9010 acts as a listener and accepts the query command via the GPIB bus. After interpretation of the query command, the TOS9010 writes the readback data on to its sending queue. When the TOS9010 is specified to a talker, the readback data is sent to the controller.

Note: When you use a service request function to observe an input signal changing, the expected data may not be attained. After an SRQ flagging caused by input signal changing, the controller executes the serial polling. After that, when the controller reads back the data of input ports, the corresponding input signal may be absent because of quick variance.

③ Turning on and off the output signals for output ports with the controller

To deliver the output signals to external devices, you must send a command such as OUT or OUTG to the TOS9010.

OUT command: For control of each output port

OUTG command: For control of a group of eight output ports at once

By the controller, the TOS9010 acts as a listener and accepts the command via the GPIB bus. After that TOS9010 sends out the parallel signals to external devices. The corresponding OUT LEDs on the front panel of TOS9010 light up.

4.3.3 Table of Commands

The TOS9010 has GPIB commands shown in Table 4.2.

Table 4.2

Header	Primary argument	Secondary argument	Function
SRQMASK	0 - 7		Masks or unmasks service request occurrence, in the unit of a group of ports.
	?		Reads back the service request mask status.
IN	1 - 24	?	Reads back the status of each input port.
ING	1 - 3	?	Reads back the statuses of a group of input ports at once.
OUT	1 - 16	ON or 1	Turns on each output port.
		OFF or 0	Turns off each output port.
		?	Reads back the status of each output port.
OUTG	1 - 2	0 - 255	Controls a group of output ports at once.
		?	Reads back the statuses of a group of output ports at once.
RESET			Turns off all output ports at once.

Notes: Command Formats

GPIB commands must be syntactically correct. Otherwise, TOS9010 ignores them. The syntax of commands, including formats and abbreviations and mnemonics, is introduced here.

<statement>: The argument enclosed in the angle brackets denotes numeric data to be placed after the header. For example, the format for IN command is shown as follows:

IN <port_number> ?

The term <port_number> means that a port number must be specified here. To specify port number 3, for example, the command should be written as follows:

"IN 3 ?"

The argument to be specified as a numeric data is indicated with angle brackets in this manual.

{aaa|bbb} Braces and vertical bars are used to indicate that you must select one of the items separated by the bars. The braces enclose arguments and a bar separates the selectable items. One of the items must be selected. For example, the secondary argument of an OUT command is shown as follows:

{ON|1|OFF|0|?}

Either ON, 1, OFF, or 0 should be selected to turn on or off the output, or ? should be selected to read back the data.

Uppercase or lowercase letters in commands

Both uppercase and lowercase letters, even mixing of them, can be used in commands. For examples, all the following commands are valid.

"In 7 ?"

"out 15 off"

"sRqMAsk ?" (Even mixed use of uppercase and lowercase letters is acceptable.)

Spaces in command format

One or more consecutive spaces (ASCII code 20hex) in a command string are taken to be a single blank. Thus, for example, the following command is valid.

"ING 2 ?"

(1) SRQMASK command

Format

SRQMASK {<maskcode>|?}

Function

This command writes a masking condition of SRQ or reads it onto/from the Service Request Mask Register. You can mask (disable) or unmask (enable) the SRQ occurrence for each event.

<maskcode>: 0 - 7 (integer)

The argument <maskcode> is for writing data onto the Service Request Mask Register. If 0 (unmask) is assigned to a bit of the Service Request Mask Register, SRQ occurrence for the corresponding bit is enabled; if 1 (mask) is assigned to a bit, it is disabled. The <maskcode> must be a decimal value, which is converted from a binary code corresponding to the Service Request Mask Register.

The correspondences between the Service Request Mask Register bits and the decimal mask code are shown as below:

Service Request Mask Register

7	6	5	4	3	2	1	0	Bit
0	0	0	0	0				

2	1	0		<maskcode>
0	0	0	.....	0
0	0	1	.....	1
0	1	0	.....	2
0	1	1	.....	3
1	0	0	.....	4
1	0	1	.....	5
1	1	0	.....	6
1	1	1	.....	7

Bit 0 : Group 1 (input ports 1-8) input signal has changed.
Bit 1 : Group 2 (input ports 9-16) input signal has changed.
Bit 2 : Group 3 (input ports 17-24) input signal has changed.
Bit 3 : Reserved (always 0)
Bit 4 : Reserved (always 0)
Bit 5 : Reserved (always 0)
Bit 6 : Reserved (RQS, always 0)
Bit 7 : Reserved (always 0)

Example: Assume that SRQ occurrence caused by an input signal changing of input ports 1-8 is to be enabled and that of input ports 9-24 is to be disabled.

Here, the Group 1 should be unmasked and the Groups 2 and 3 should be masked. Or, the data "00000110 (B)" should be assigned to the Service Request Mask Register. Therefore, you must send a following command to the TOS9010:

"SRQMASK 6"

?: This character is used to read back the current mask code from the Service Request Mask Register. The readback data is a decimal value of the Service Request Mask Register.

Example: Assume that SRQ occurrence by Groups 1 and 2 are already masked and only Group 3 is unmasked.

(Service Request Mask Register = "00000011 (B)")

Here, you will read back "3" as the data value of the Service Request Mask Register from the TOS9010 in response to the "SRQMASK ?" command.

Note 1: Service request function

TOS9010, in order to notify an internally-occured event to the controller, can flag a service request (SRQ). During the period the TOS9010 is flagging the SRQ, the SRQ LED on the front panel lights up. Then you should execute a serial polling to get the status byte.

When flagging an SRQ, the individual bits of the status byte are assigned to each type of events. The bit which is corresponding to the occurred event is assigned to 1. By reading back the status byte, you can identify the type of event which has caused the service request. The "1" status of the status byte denotes occurrences of the below-mentioned events, respectively.

Status byte

7	6	5	4	3	2	1	0	Bit
0	RQS	0	0	0				

Bit 0 : Group 1 (input ports 1-8) input signal has changed.
Bit 1 : Group 2 (input ports 9-16) input signal has changed.
Bit 2 : Group 3 (input ports 17-24) input signal has changed.
Bit 3 : Reserved (always 0)
Bit 4 : Reserved (always 0)
Bit 5 : Reserved (always 0)
Bit 6 : Sending an SRQ (service request)
Bit 7 : Reserved (always 0)

Note 2: Correspondences between SRQ occurrence and status byte

Each of bits 0 through 2, which indicate the status of event is assigned to 1 when a corresponding event has occurred, even though any events are masked for SRQ occurrence. However, the SRQ can be flagged only when the corresponding bit of the Service Request Mask Register is assigned to 0 (unmasked). If it is assigned to 1 (masked), SRQ will not be flagged.

Note 3: Clearing the status byte

The status byte is cleared when one of the below-mentioned actions has been done. Then, all the bits are cleared to 0 and the SRQ LED on the panel goes out.

① The AC power is turned on.

② The DCL (Device Clear) or SDC (Selected Device Clear) is sent from the controller.

③ In response to SRQ flagged by the TOS9010, a serial polling is executed.

Note 4: Action taken if another event has occurred while SRQ flagging

If another event has occurred before serial polling when TOS9010 is flagging SRQ, the corresponding bit of the status byte is overwritten by the new event occurrence. Thus, the status byte is constantly updated.

Note 5: Masking for the service request function

The service request function can be masked (disabled) by setting 1 to the corresponding bit of the Service Request Mask Register. If 0 is assigned, the function is unmasked (enabled). For the command for setting the Service Request Mask Register, refer to the paragraph, "SRQMASK command."

Service Request Mask Register

7	6	5	4	3	2	1	0	Bit
0	0	0	0	0				

Bit 0 : Group 1 (input ports 1-8) input signal has changed.
Bit 1 : Group 2 (input ports 9-16) input signal has changed.
Bit 2 : Group 3 (input ports 17-24) input signal has changed.
Bit 3 : Reserved (always 0)
Bit 4 : Reserved (always 0)
Bit 5 : Reserved (always 0)
Bit 6 : Reserved (RQS, always 0)
Bit 7 : Reserved (always 0)

Note 6: Initialization of Service Request Mask Register

As the power-on default state, the Service Request Mask Register is initialized to the state shown below—that is, occurrence of service requests is masked (disabled).

Service Request Mask Register

7	6	5	4	3	2	1	0	Bit
0	0	0	0	0	1	1	1	 7

Note 7: Service request control command

To write a masking condition of SRQ onto the Service Request Mask Register, you should send the above-mentioned service request control command, SRQMASK, to the TOS9010. Refer to the paragraph, "SRQMASK command."

(2) IN command

Format

IN <port_number> ?

Function

This command reads back the data of each input port.

<port_number>: 1-24 (integer)

The argument <port_number> is for the input port number, which you want to read back.

Readback data from TOS9010:

{1|0}

1: The input signal is on.

0: The input signal is off.

Example: Assume that, the input signal of input port 4 is on. You can read back the input data of input port 4 by using an IN command.

Command to be sent to TOS9010 "IN 4 ?"

Readback data from TOS9010: "1"

(3) ING command

Format

ING <group_number> ?

Function

This command reads back the data of a group of 8 ports at once.

<group_number>:1-3 (integer)

The argument <group_number> is for the group number, which you want to read back. Specify one of the group numbers shown below:

1: Group 1 (input ports 1-8)

2: Group 2 (input ports 9-16)

3: Group 3 (input ports 17-24)

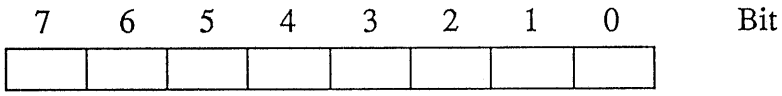
Readback data from TOS9010:

<ddd>: 0-255 (integer in decimal notation)

All input ports are divided into three groups of 1 through 3. Each group consisting of eight ports to which bit 0 through bit 7 are assigned. Each bit of the specified group as <group number> is set to 1 if the input signal of the corresponding port is on. It is set to 0 if the input signal is off. The <ddd> readback data denotes the decimal value obtained by adding these binary values. Thus, it is of a binary-coded decimal value. For examples, if all the input signals of a group are off, the value is 0; if all the input signals are on, the value is 255.

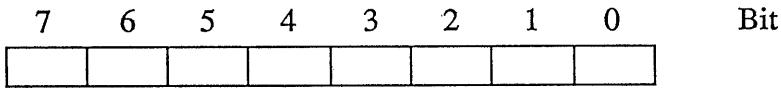
The correspondences between the bit numbers and the input port numbers of each group are shown in Tables 4.3, 4.4 and 4.5, respectively.

Table 4.3: Group 1



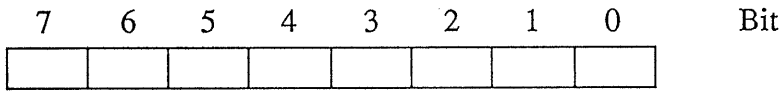
Bit 0 : Input port 1
Bit 1 : Input port 2
Bit 2 : Input port 3
Bit 3 : Input port 4
Bit 4 : Input port 5
Bit 5 : Input port 6
Bit 6 : Input port 7
Bit 7 : Input port 8

Table 4.4: Group 2



Bit 0 : Input port 9
Bit 1 : Input port 10
Bit 2 : Input port 11
Bit 3 : Input port 12
Bit 4 : Input port 13
Bit 5 : Input port 14
Bit 6 : Input port 15
Bit 7 : Input port 16

Table 4.5 Group 3



Bit 0 : Input port 17
Bit 1 : Input port 18
Bit 2 : Input port 19
Bit 3 : Input port 20
Bit 4 : Input port 21
Bit 5 : Input port 22
Bit 6 : Input port 23
Bit 7 : Input port 24

Example: Assume that the combination of the input ports is shown as below. You can readback the input statuses of the Group 2 (input ports 9-16) by using an ING command.

Group 2

7	6	5	4	3	2	1	0	Bit
1	0	1	1	0	0	1	0	····· B2 hex(178)

Bit 0 : Input port 9
Bit 1 : Input port 10
Bit 2 : Input port 11
Bit 3 : Input port 12
Bit 4 : Input port 13
Bit 5 : Input port 14
Bit 6 : Input port 15
Bit 7 : Input port 16

Command to be sent to TOS9010: "ING 2 ?"

Readback data from TOS9010: "178"

(4) OUT command

Format

OUT <port_number> {ON|1|OFF|0|?}

Function

This command controls each output port. It also reads back the output status of the specified output port.

<port_number>: 1-16 (integer)

The primary argument <port_number> is for the output port number, which you want to control or read back.

{ON|1|OFF|0|?}

These secondary arguments specify whether the selected output port is to be turned on or off.

ON or 1: Turns the output on.

OFF or 0: Turns the output off.

Examples: To turn on output port 12, the following command should be sent to the TOS9010:

"OUT 12 ON" or "OUT 12 1"

To turn off output port 5, the following command should be sent to the TOS9010:

"OUT 5 OFF" or "OUT 5 0"

?: This character is used to read back data of the specified output port.

Note: The data of the register which represents the internal output status is read back. It does not directly represent the true output port status.

Readback data from TOS9010 in response:

{1|0}

1: The output signal is on.

0: The output signal is off.

Example: Assume that, the output port 12 is already turned on. You can read back the status of output port 12.

Command to be sent to TOS9010: "OUT 12 ?"

Readback data from TOS9010: "1"

(5) OUTG command

Format

OUTG <group_number> {<ddd>|?}

Function

This command controls a group of 8 output ports at once. It also reads back the output statuses of 8 ports of the specified group at once.

<group_number>: 1-2 (integer)

The primary argument <group_number> is for the group number, which you want to read back. Specify one of the group numbers shown below:

1: Group 1 (output ports 1-8)

2: Group 2 (output ports 9-16)

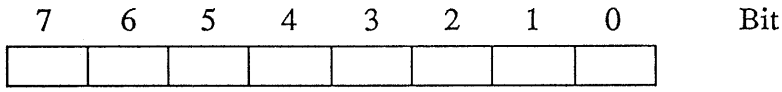
{<ddd>|?}

<ddd>: 0-255 (integer in decimal notation)

All output ports are divided into two groups of 1 and 2. Each group has eight bits, 0 through 7. To turn on the output ports of a group, you should specify 1 for the ports to be turned on or 0 for turned off. The secondary argument <ddd> must be a value obtained by adding these binary values. Thus, it must be a binary-coded decimal value. For example, if all the output signals of a group are to be turned off, you should specify 0; if all the output signals are to be turned on, you should specify 255.

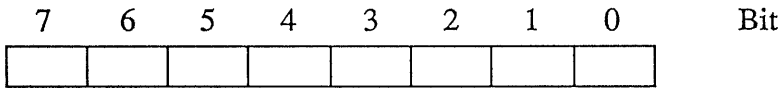
The correspondences between the bit numbers and the output port numbers of each group are shown in Tables 4.6 and 4.7.

Table 4.6: Group 1



Bit 0 : Output port 1
Bit 1 : Output port 2
Bit 2 : Output port 3
Bit 3 : Output port 4
Bit 4 : Output port 5
Bit 5 : Output port 6
Bit 6 : Output port 7
Bit 7 : Output port 8

Table 4.7: Group 2

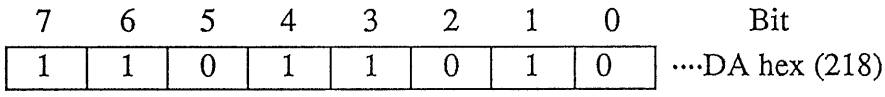


Bit 0 : Output port 9
Bit 1 : Output port 10
Bit 2 : Output port 11
Bit 3 : Output port 12
Bit 4 : Output port 13
Bit 5 : Output port 14
Bit 6 : Output port 15
Bit 7 : Output port 16

Example: Assume that the output statuses of the Group 1 (output ports 1-8) should be as shown below. Then, the following command should be sent to the TOS9010:

"OUTG 1 218"

Group 1



Bit 0 : Output port 1
Bit 1 : Output port 2
Bit 2 : Output port 3
Bit 3 : Output port 4
Bit 4 : Output port 5
Bit 5 : Output port 6
Bit 6 : Output port 7
Bit 7 : Output port 8

?: This character is used to read back the data of the specified output port.

Note: The data of the register which represents the internal output status is read back. It does not directly represent the true output port status.

Data returned by TOS9010

<ddd>: 0-255 (integer in decimal notation)

All output ports are divided into two groups. Each group has eight bits, 0 through 7. When reading back the output statuses of a group, 1 is set to the bits of which corresponding ports are ON or 0 is set to the bits of which corresponding ports are OFF. The <ddd> readback data denotes the value obtained by adding these binary values. Thus, it is of a binary-coded decimal value. For example, if all the output signals of a group are off, the value is 0; if all the output signals are on, the value is 255.

Example: Assume that the combination of the output ports is shown as below. You can read back the output statuses of the Group 2 (output ports 9-16) by using an OUTG command.

Command to be sent to TOS9010: "OUTG 2 ?"

Readback data from TOS9010: "77"

Group 2

7	6	5	4	3	2	1	0	Bit
0	1	0	0	1	1	0	1	.....4D hex (77)

Bit 0 : Output port 9
Bit 1 : Output port 10
Bit 2 : Output port 11
Bit 3 : Output port 12
Bit 4 : Output port 13
Bit 5 : Output port 14
Bit 6 : Output port 15
Bit 7 : Output port 16

(6) RESET command

Format

RESET

Function

This command turns off all output ports (ports 1 through 16). When this command is given, all OUT LEDs on the front panel go out.

4.4 Parallel I/O Section

The parallel I/O section is for interfacing of up to 24 input signals and up to 16 output signals between the TOS9010 and the controlled devices.

The TOS9010 provides an isolated DC power (+15V, 100mA) for controlling purposes.

The ON/OFF states of the input and output signals are indicated with LEDs on the front panel.

4.4.1 Input Signals

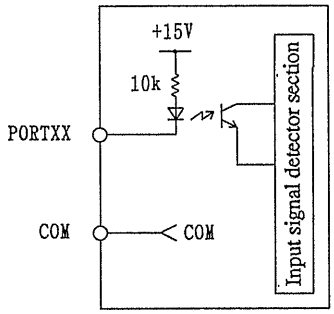
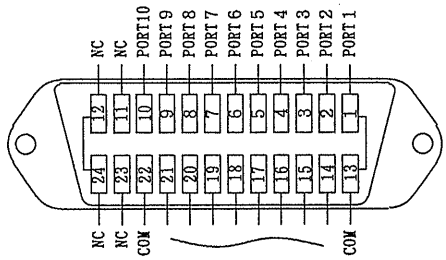
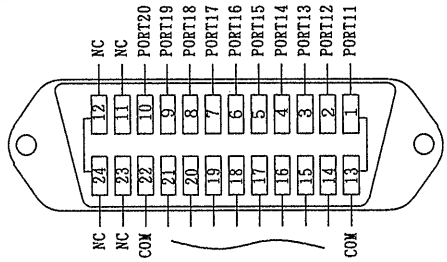
The term "Input Signals" as used here means the signals, which are fed from external devices to the TOS9010. The TOS9010 has 24 parallel input ports, numbered as "Input Port 1" through "Input Port 24" to accept 24 input signals, numbered as "Input Signal 1" through "Input Signal 24."

The ports are grouped in the unit of 8, namely, "Group 1" for ports 1 through 8, "Group 2" for ports 9 through 16, and "Group 3" for ports 17 through 24. The signals of the Groups 1, 2 and 3 are fed via the respective connectors such as ⑤ IN/CN1, CN2 and CN3 on the rear panel.

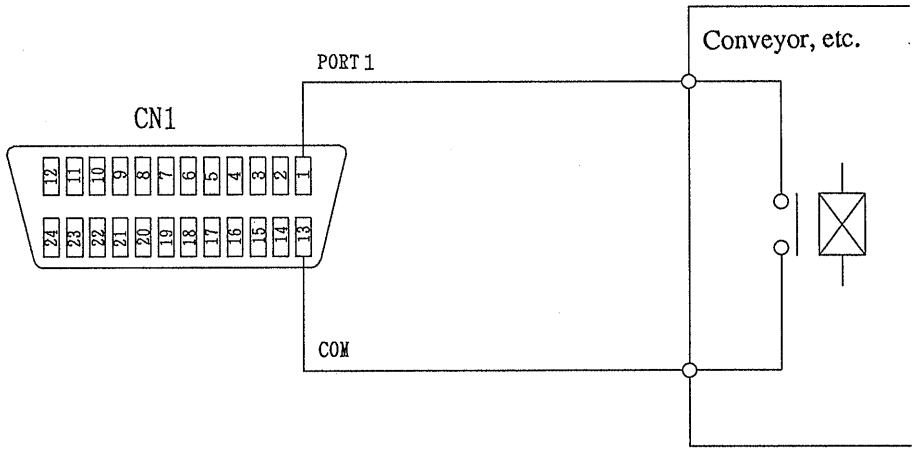
There are two types of input circuit, namely, "Input Circuit I" and "Input Circuit II." The isolated power supply is also delivered via the IN/CN3 connector.

The specifications of the input circuits are shown in Tables 4.8 and 4.9.

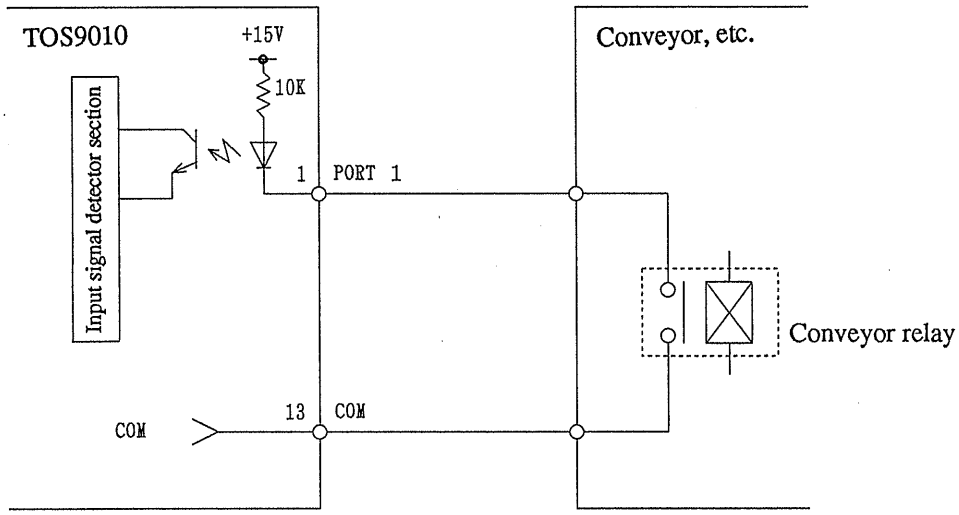
Table 4.8 Input Circuit I (input ports 1-20)

Number of Ports	20 (Port Nos. 1 through 20)
Signal Isolation	With photocouplers
Indicators	LEDs on front panel (They light when signals are present.)
Circuitry (per port)	
Connector Pin Assignment (IN/CN1)	
Connector Pin Assignment (IN/CN2)	

CN1 Connection Example

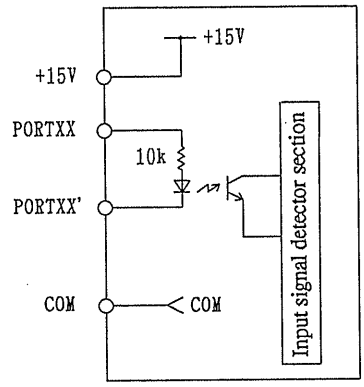
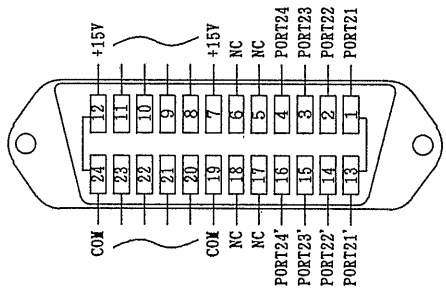


Operation

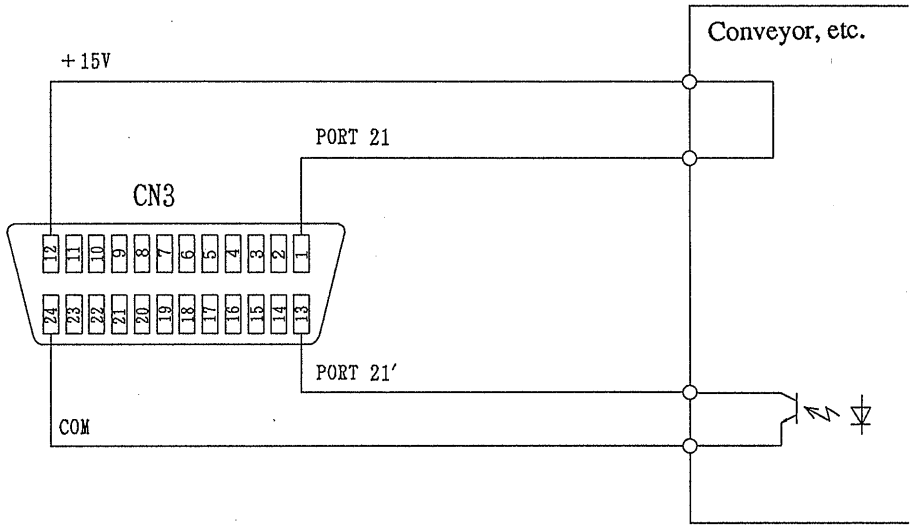


In the above diagram, as the conveyor relay is energized and its contact is made, the input signal detector section detects the fact that the input signal is applied to input port 1. The made state of the signal input contact denotes the state that an input signal is present at the input port. In this case, after an "IN 1 ?" command is sent from the controller, the TOS9010 will answer back the data "1" to the controller.

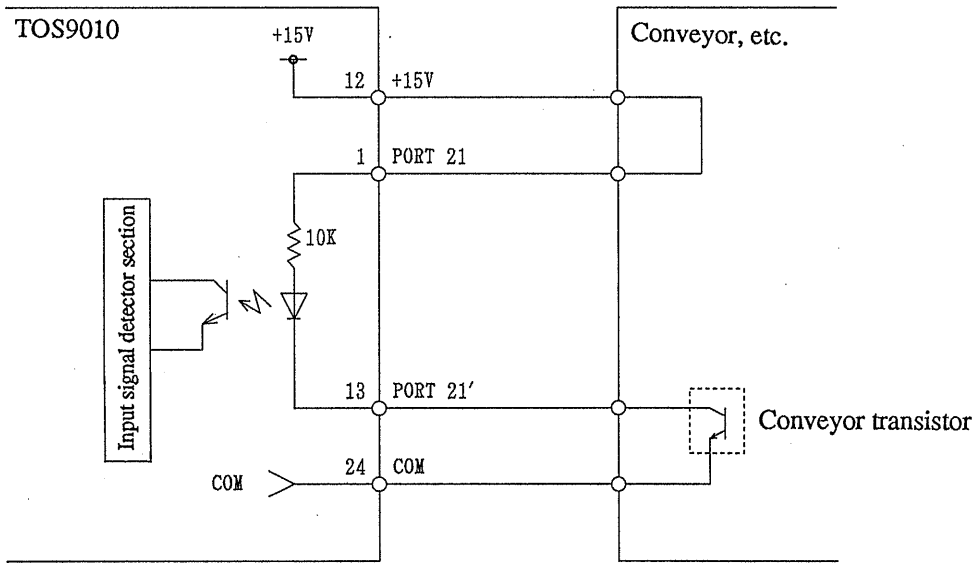
Table 4.9 Input Circuit II (input ports 21-24)

Number of Ports	4 (Port Nos. 21 through 24)
Signal Isolation	With photocouplers
Indicators	LEDs on front panel (They light when signals are present.)
Circuitry (per port)	
Connector Pin Assignment (IN/CN3)	

CN3 Connection Example

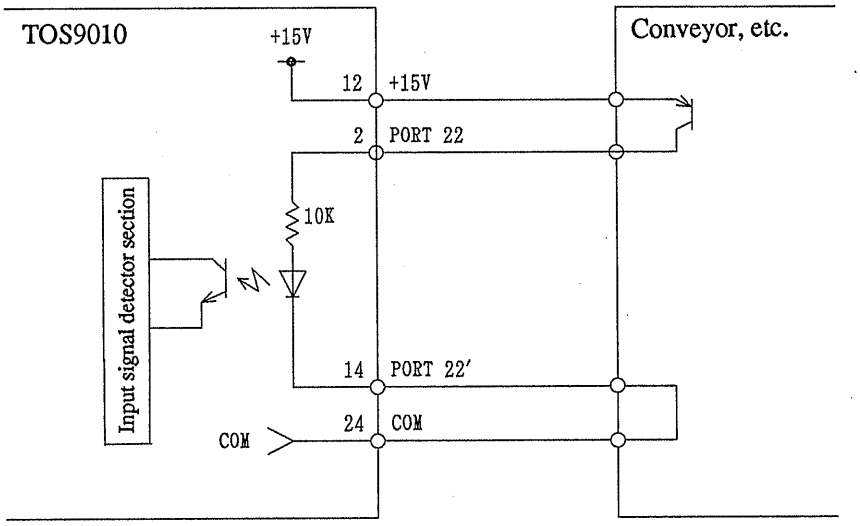


Operation

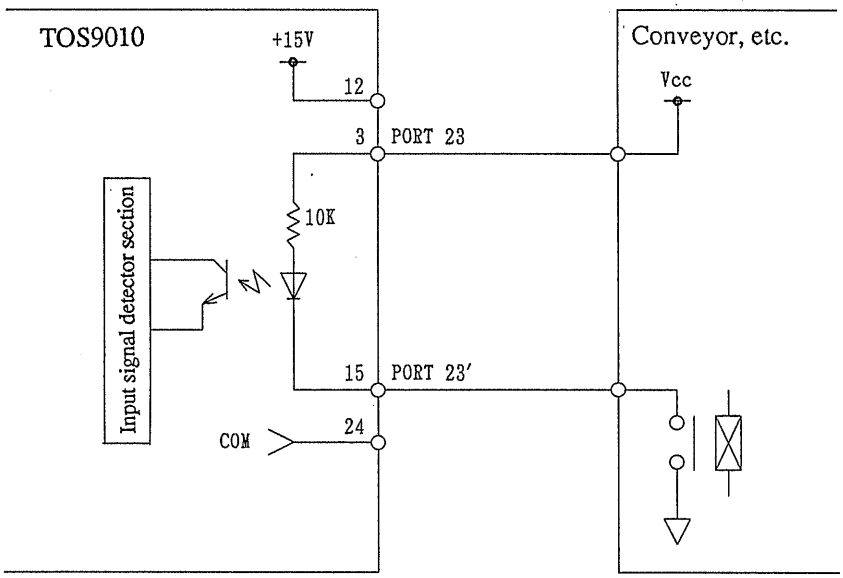


In the above diagram, as the conveyor transistor is driven and its collector-to-emitter potential becomes low level, the input signal detector section detects the fact that the input signal is applied to input port 21. In this case, after an "IN 21 ?" command is sent from the controller, the TOS9010 will answer back the data "1" to the controller.

Other Connection Examples



To operate on a power supply provided by the conveyor side



4.4.2 Output Signals

The term "Output Signals" as used here means the signals, which are fed from the TOS9010 to external devices. The TOS9010 has 16 parallel output ports, numbered as "Output Port 1" through "Output Port 16" to deliver 16 output signals, numbered as "Output Signal 1" through "Output Signal 16."

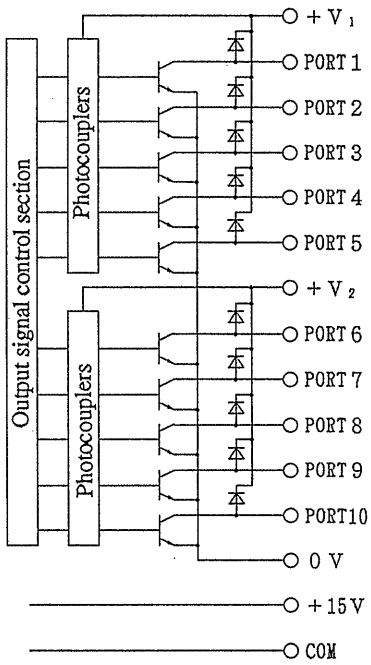
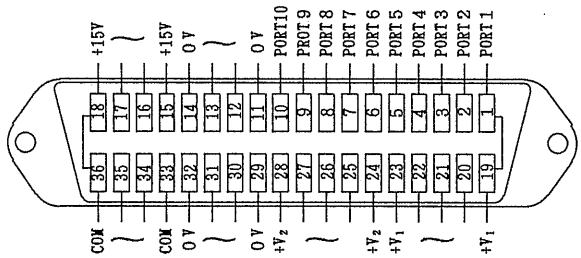
The ports are grouped in the unit of 8, namely, "Group 1" for ports 1 through 8 and "Group 2" for ports 9 through 16.

The output signals are available in three types, namely, "Open Collector Type," "Contact Type," and "100V AC type."

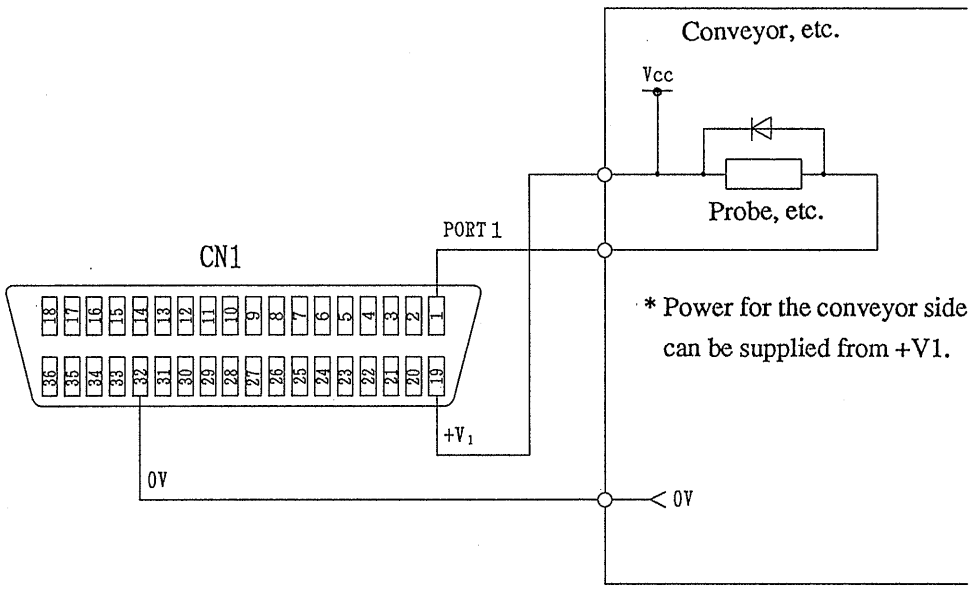
The open collector signals are delivered via OUT/CN1 connector, the contact signals via CN2 connector, and the 100V AC signals via CN3 and CN4 outlets. The OUT/CN1 and CN2 connectors also deliver the isolated power supply.

The specifications of the output circuits are shown in Tables 4.10, 4.11 and 4.12.

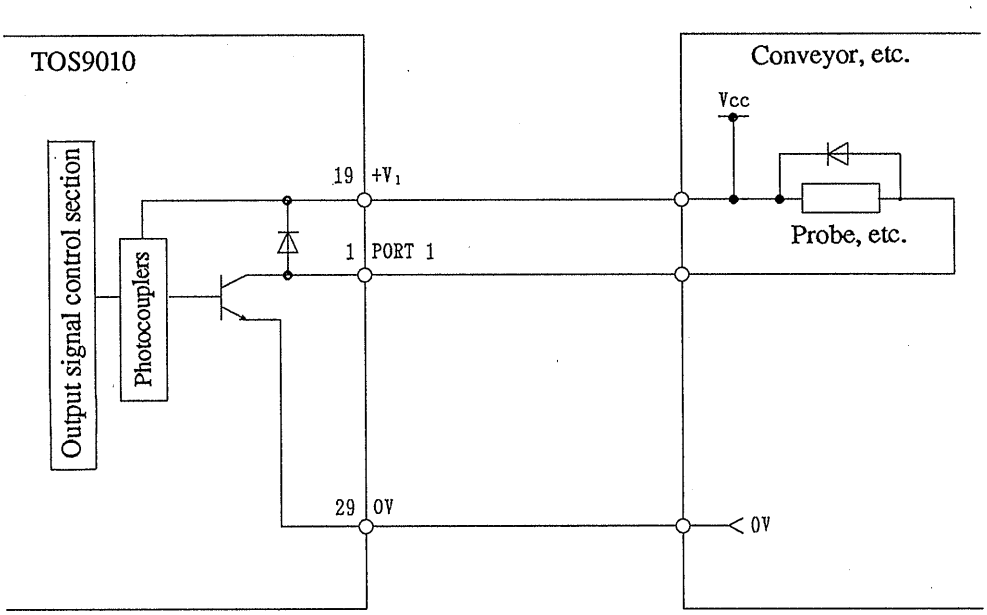
Table 4.10 Open-collector Signals (output ports 1-10)

Type of Signals	Open collector
Number of Ports	10 (Port Nos. 1 through 10)
Allowable Maximum Voltage	30V DC
Saturation Voltage	Approx. 1.1V (at 25°C or 77°F)
Maximum Output Current	100mA (in total)
Signal Isolation	With photocouplers
Indicators	LEDs on front panel (They light when signals are present.)
Isolated Power Supply	+15V, 100mA (in total)
Circuitry	
Connector Pin Assignment (OUT/CN1)	

CN1 Connection Example



Operation

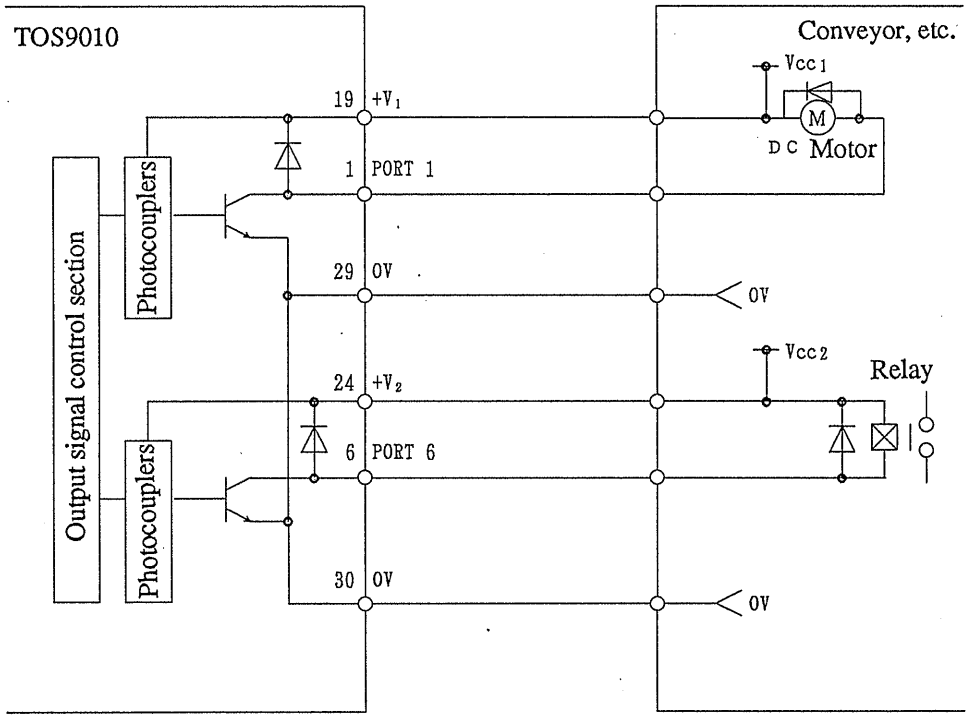


In the above diagram, as a command to deliver an output signal to port 1 is given, the output signal control section makes the potential of PORT1 low level. Then, output signal is delivered via output port 1, and a potential between 0V and Vcc is applied to the probe of the conveyor.

To let the TOS9010 deliver the output signal as above, you should send a command "OUT 1 ON" or "OUT 1 1" from the controller via the GPIB bus. To let it stop delivering the signal, a command "OUT 1 OFF" or "OUT 1 0" should be given.

Other Connection Examples

- To make use of two external power supplies



- To make use of the +15V power supply of TOS9010

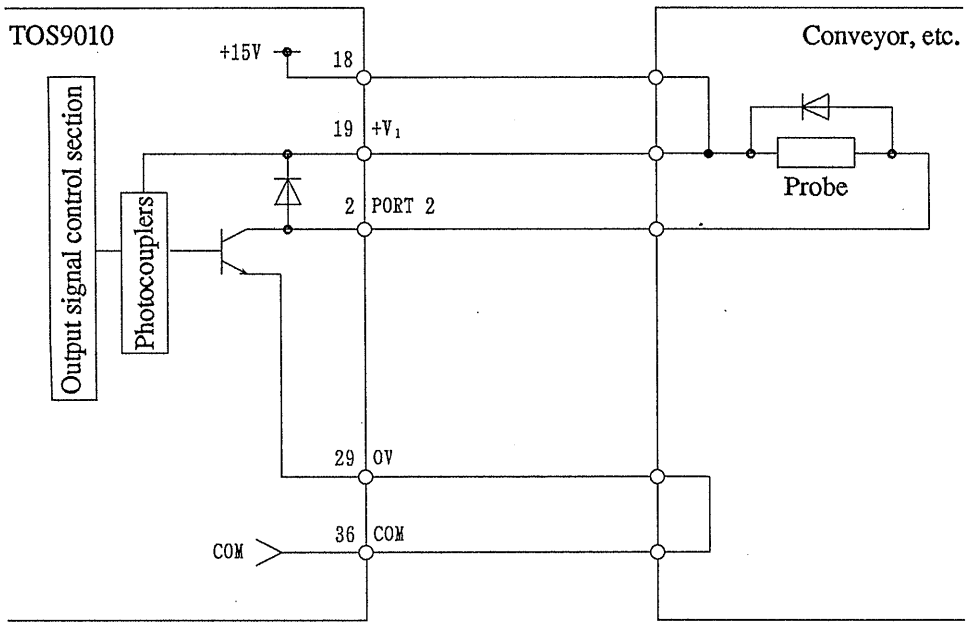
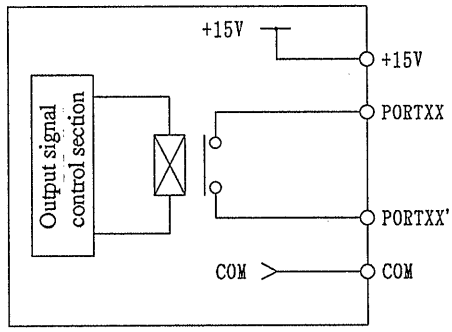
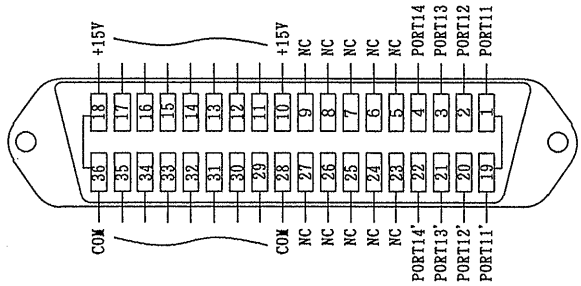
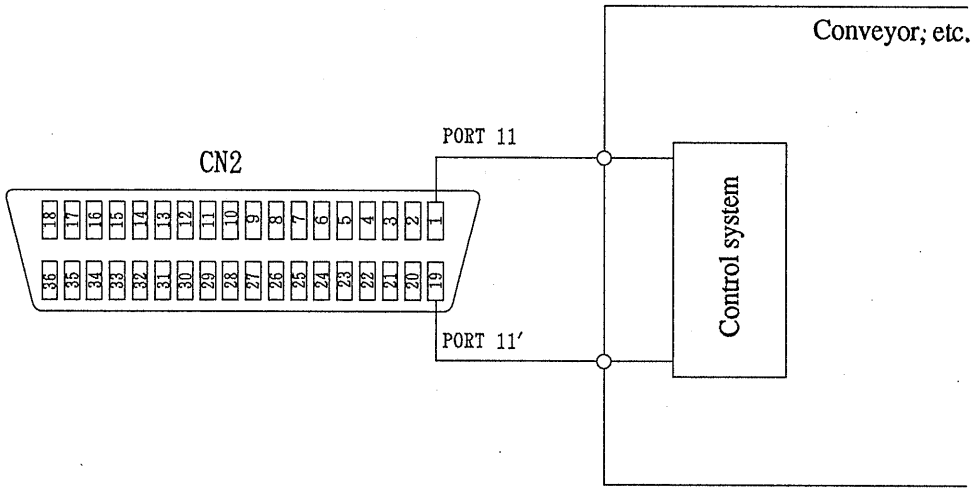


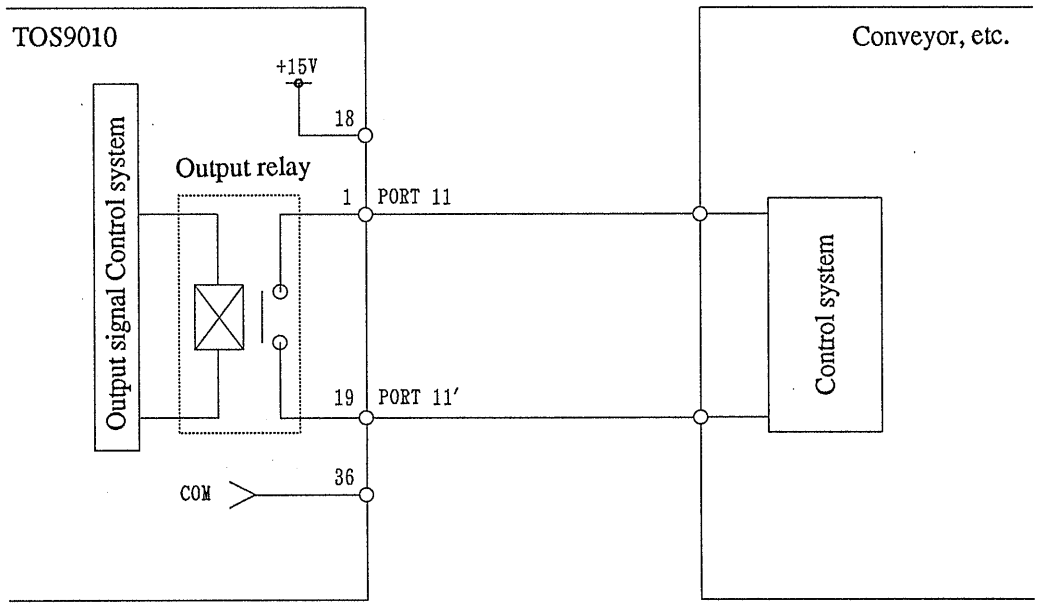
Table 4.11 Contact Signals (output ports 11-14)

Type of Signals	Relay contact type
Number of Ports	4 (Port Nos. 11 through 14)
Maximum Make Break Ratings	24V DC/1A, 30V AC/1A
Minimum Make Break Ratings	150mV/100μA
Indicators	LEDs on front panel (They light when signals are present.)
Circuitry (per port)	
Connector Pin Assignment (OUT/CN2)	

CN2 Connection Example



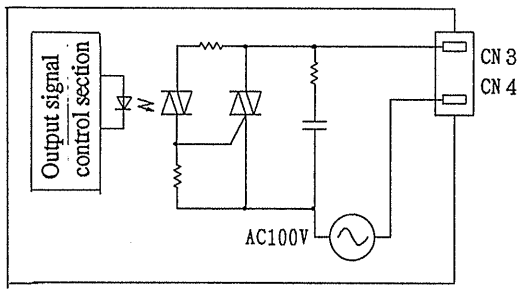
Operation



In the above diagram, as a command to deliver an output signal to port 11 is given, the output signal control section makes the port 11 output relay energized. The corresponding contact signal is delivered to the conveyor control system.

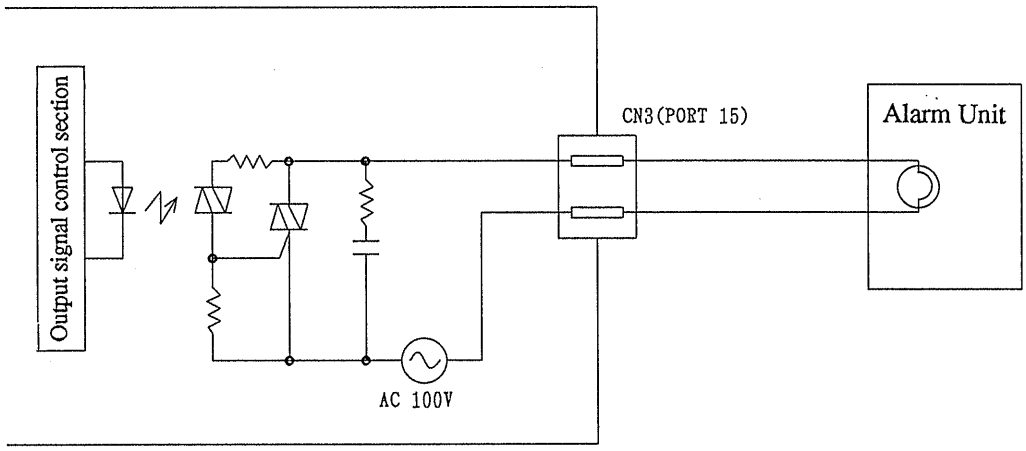
To let the TOS9010 deliver the output signal as above, you should send a command "OUT 11 ON" or "OUT 11 1" from the controller via the GPIB bus. To let it stop delivering the signal, a command "OUT 11 OFF" or "OUT 11 0" should be given.

Table 4.12 100V AC Signals (output ports 15 and 16)

Type of Signals	100V AC
Number of Ports	2 (Port Nos. 15 and 16)
Allowable Maximum Voltage	Approx. 100V AC
Allowable Maximum Output Current	0.2A (in total)
Indicators	LEDs on front panel (They light when signals are present.)
Circuitry (OUT/CN3, CN4)	

Note: You can use the 100V AC signal only for Model 9202S Alarm Unit or Model 9203S Buzzer Unit. Do not use it as an AC power supply for other electrical devices. The signal voltage is always 100V irrespective of the line voltage on which the TOS9010 is operating. It is independent of setting of the AC line voltage.

Operation



In the above diagram, as a command to deliver an output signal to port 15 is given, the output signal control section makes the 100V AC signal delivered from the OUT/CN3 outlet. Thus, the Alarm Unit is turned on.

To let the TOS9010 to deliver the output signal as above, you should send a command "OUT 15 ON" or "OUT 15 1" from the controller via the GPIB bus. To let it stop delivering the signal, a command "OUT 15 OFF" or "OUT 15 0" should be given.

OPTIONAL ITEMS

☐ 408J1P5 Cable

GPIB cable complying with IEEE-488-1978, approx. 50cm (1.6ft.)

☐ 408J101 Cable

GPIB cable complying with IEEE-488-1978, approx. 1m (3.3ft.)

☐ 408J102 Cable

GPIB cable complying with IEEE-488-1978, approx. 2m (6.6ft.)

☐ 408J104 Cable

GPIB cable complying with IEEE-488-1978, approx. 4m (13.2ft.)

☐ Model 9202S Alarm Unit

A unit which indicates that the test is being executed. The unit can be connected to the OUT/CN3 or OUT/CN4 outlet of TOS9010.

☐ Model 9203S Buzzer Unit

A unit which generates a loud alarm sound that the test is being executed. The unit can be connected to the OUT/CN3 or OUT/ CN4 outlet of TOS9010. The unit may be used when the loudness of the internal electronic buzzer of the tester is not sufficient to serve the purpose.

☐ BH2M-KSG Rack Mount Brackets (JIS)

Brackets for mounting the TOS9010 on an instrument rack, complying with JIS (mm size)