



# Instruction Manual

# PWM

# CONVERTER

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## Optical Link Option for Parallel System

## OPC-VG7-SI

- If you purchase this product and ship a device or a control panel with a converter integrated with this product, make sure to provide the end user who actually uses this product with the instruction manual.
- The information in this instruction manual is subject to change for product improvement.

# Introduction

We thank you for your purchasing our PWM Converter RHC-C Parallel System Optical Link Option "OPC-VG7-SI". This instruction manual is designed to use when driving the main circuit insulated parallel system accompanying the insulation transformer. You can use OPC-VG7-SI with the converter units of standard specifications.

Read this instruction manual to understand how to use the product safely before you use. Incorrect handling may prevent normal operation, reduce lifetime, or cause failures.


This instruction manual describes only the optional feature. See also "RHC-C instruction manual (INR-HF51746\*)" for RHC-C and other optional features.


If you have any questions about the product or this instruction, contact the dealer or our nearest Fuji's sales office.

# Safety Instructions

For your safe operation, read and understand all safety information in this manual thoroughly before handling the product.


Note that the safety information is divided into the following two groups, "Warning" and "Caution".


 <b>WARNING</b>	Failure to observe this precaution could result in serious injury or death.
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 <b>CAUTION</b>	Failure to observe this precaution could result in slight to medium injury or property damage.
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Failure to observe an instruction, even if its signal word is "caution", may cause serious results depending on the situation. Since both WARNIG and CAUTION contain important factors, always follow their instructions

## Mounting and removal of option, and wiring

 <b>WARNING</b>	<ul style="list-style-type: none"> <li>▪ Before mounting or removing this option, turn OFF (open) the breaker for the converter power supply.</li> <li>▪ Even if the breaker is turned OFF (open), the smoothing capacitor is still charged. So, you get an electric shock if you touch it. Confirm that the CHARGE indicator lamp for the converter is OFF, and check the DC voltage of the converter with a tester to see that it has dropped to or below the safe level.</li> </ul>
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 <b>CAUTION</b>	<ul style="list-style-type: none"> <li>▪ Do not use the product if any part is damaged or missing. Injury or damage may result.</li> <li>▪ Improper operation during mounting or removal of the product may cause damage to it.</li> </ul>
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## Revision record

Instruction manual No.	Date of revision	Description of revision
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# Optical Option for Parallel System without Insulation-transformer

## 1 Product Introduction

### 1.1 Product Overview

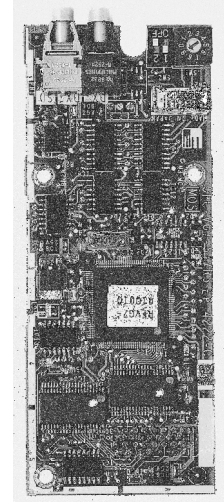
#### Driving of high capacity converter

The PWM Converter RHC-C Main Circuit Insulated Parallel System drives converters through the accompanied insulation transformer, by connecting multiple converter units (two or three) with the primary power supply insulated. This option unit is best fit to divide load of the connected converters.

RHC-C standard lineup covers up to 400kW (CT specifications). This sixfold multi-system, at maximum, can drive inverters having total capacity of as much as 2400kW.

#### Current sharing

It is necessary to install the optical link option in each converter to drive an inverter with two or more converters. This optical link transmits the current reference to share among the converter instantaneously. The current of each converter is controlled (feedback control), and it is possible that operating with sharing load according to driving ability of each converter.



#### Switching parallel system / single system

It is possible to switch to the usual single system driving by canceling the parallel system driving by parallel/single system switch function even if one converter breaks down when a parallel system is driven.

#### [Installing restriction]

Unavailable combinations of options (Procedure error)

Two SI cards cannot be installed at once, if that exists, operation procedure error "Er6" results.

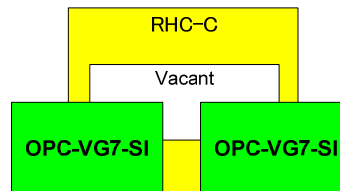


Fig. 1.1.1

## 1.2 Product Guarantee

The product guarantee period is either twelve months after your purchase or eighteen months after production date displayed on the name plate whichever comes first.

The following cases require paid service even during this guarantee period.

- Incorrect operation or improper repairing or alteration
- Operation out of the standard specification
- Drop or damage in shipment after purchase
- Earthquake, fire, wind and flood, lightning, abnormal voltage, and other natural disasters or the secondary disasters

## 1.3 Specification of Parallel System

**Tab. 1.3.1 Control specification**

Item	Specification
Applicable converter capacity	CT specifications (up to 2,400kW; six fold), VT specifications (up to 3,000kW; six fold)
Parallel control method	AVR constant control with DC ACR minor
Output voltage	320 to 355 VDC (for 200Vsystem), 640 to 710VDC (for 400V system)
Carrier frequency	5kHz to 15kHz variable (The allowable setting range is limited depending on the capacity.)
Input power supply	200 to 220V 50Hz, 220 to 230V 50Hz, 200 to 230V 60Hz 380 to 440V 50Hz, 380 to 460V 60Hz * The capacity must be reduced for systems of less than 400V.
Input power factor	Approx. 0.99 (under 100% load) * When power voltage is 420V (210V) or more and the system runs with 50% or more load, power factor reduces down to 0.95 (only for regenerative operation).
Input harmonic current	METI's solution guideline for harmonic suppression allows conversion coefficient $K_i=0$ .
Restart after momentary power failure	Output is shut off at instant stop. The converter automatically restarts at recovery of power.
Control function	The slave unit is partially subject to functional restrictions. (See 8.3.4.)

**Tab. 1.3.2 System specification**

Item	Specification	
Communication	Data transmission type	Asynchronous serial communication through plastic optical fiber (loop back type)
	Transmission rate	1Mbps
	Error check	Parity, framing, over-run, BCC, and time out monitoring
	Action on inter converter link error "Erb"	All units simultaneous alarm mode: KEYPAD panel alarm mode, "Erb" flashing display Alarm relay output: 30X output All converter units output shutoff simultaneously * All units refer to all converter units connected through optical link
Transmission distance	<b>Guaranteed distance 20m (0 to 70°C) /between converter</b> (Transmission exceeding 20m is not guaranteed due to transmission loss.)	
Protective function	Action for protective function	All units simultaneous alarm mode, KEYPAD panel alarm mode Alarm relay output: 30X output All units simultaneous converter output shutoff * Use external sequence to stop all units after coasting when 30X is activated.
	Operation procedure alarm function	Following conditions cause the operation procedure error "Er6". <ul style="list-style-type: none"> <li>• Overlapped setting for optional hardware switch SW1</li> <li>• The number of parallel slave <math>\neq</math> setting value of SW1</li> <li>• Setting value of SW1 is 6 or more</li> <li>• 2 SIR options are installed on 1 unit</li> </ul>
	Action for resetting protective function	All units are reset simultaneously when you give a reset command to any unit connected through the optical link option.

Item		Specification
Exclusive function	Hardware setting	Setting of parallel system Sets the application of the option. Setting for parallel system is "SW2-1=ON and SW2-2=OFF".
		Station number setting Hardware switch of the option SW1 SW1=0: Master SW1≠0: Slave. Usually set slave 1 to "1", slave 2 to "2", and so on.
	Function setting	Parallel system You can switch single drive and parallel system by setting function code H12 "Parallel system" 0:parallel system invalid (factory shipping value) 1:parallel system valid Use the digital input signal [OPT-DI] to switch between single drive/ parallel system dynamically when the function code H12 "Parallel system" is set to "1".
		Setting of slave unit number Use the function code H12 "Parallel system" to set the number of slaves linked optically. When 2 units are linked, for example, the slave number is 1.

### 1.4 Main Circuit Insulated Parallel System Specifications

This system applies the optical link option to multiple converter units to synchronize control to the converters and control current division for reduction of load.

When connecting the DC circuit on the converter output to COMMON, the insulation transformer is required to insulate the main power supply.

The parallel system features excellent support of large load exceeding a single unit capacity.

For example, when driving three 200kW converters in parallel, 600kW converter output will be available.

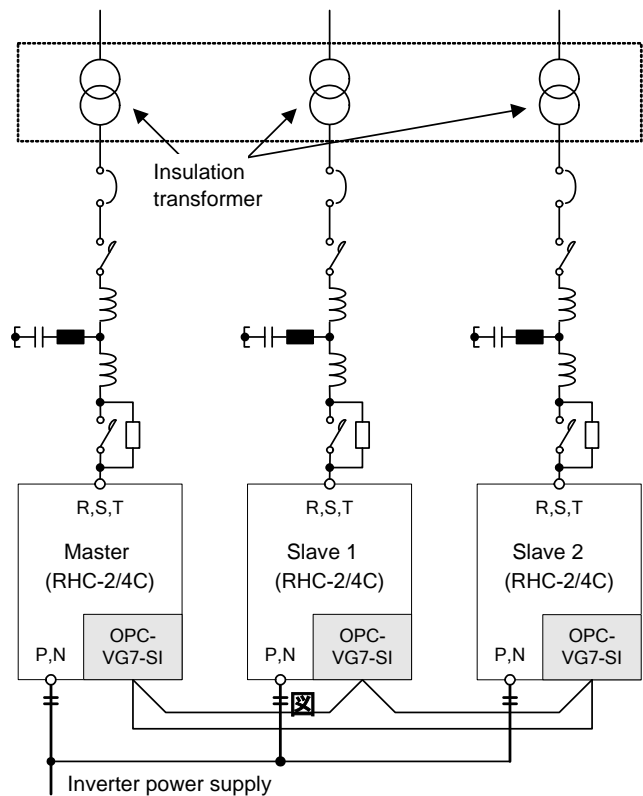
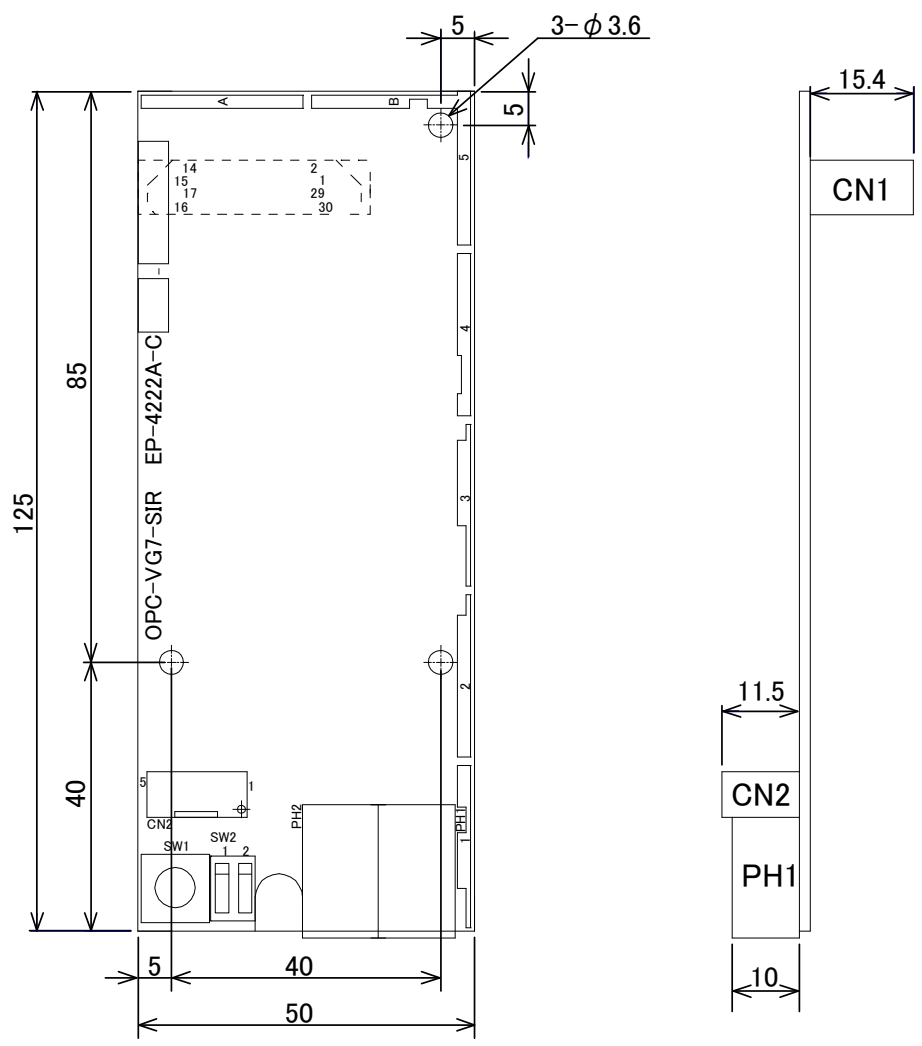


Fig.1.4.1

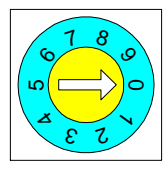
## 2 External Dimensions



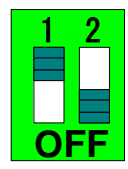
Unit : mm

**Fig. 2.1 External dimensions of optional print circuit board**

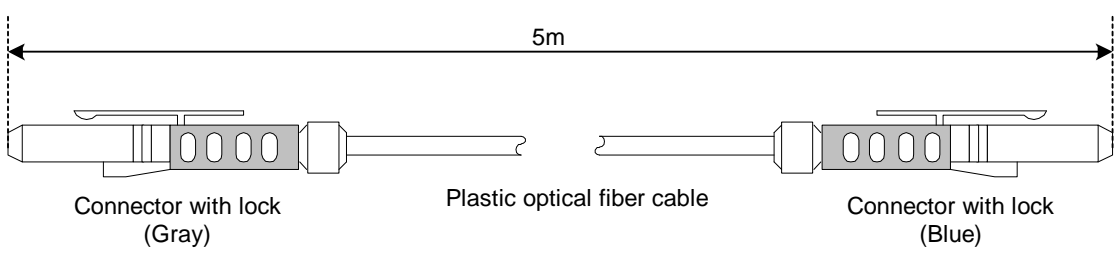
Set the station number switch to master/slave and set the function selection switch to the following fixed setting (parallel system).



**Fig. 2.2 Station number switch (SW1)**



**Fig. 2.3 Function selection switch (SW2)**



**Fig. 2.4 Plastic optical fiber cable**

### 3 Inspection on Arrival

When your product arrives, check the following items.

- (1) Check if the product you have is the product you ordered. See the type printed on this option.

Description of model ; OPC-VG7-SI

\*This product is common with vector inverter VG7S.

Name of option ; SI → Optical option card for parallel system

parallel system optical link option card.

- (2) Check damages during delivery.

- (3) Check if all accessories are included.

Accessories: Spacer : 3

Screw (M3) : 3

Optical fiber cable : 1 (for transmitting/receiving)



#### CAUTION

Do not use a damaged part or a product with a missing part.  
Injury or damage may result

### 4 Storage

#### 4.1 Temporary Storage

Store in the environment in the following table 4.1.1

**Tab. 4.1.1 Storage environment**

Item	Specification	
Ambient temperature	-10 to +50°C	Place free from condensation or icing caused by abrupt temperature changes
Storage temperature <sup>(Note1)</sup>	-25 to +65°C	
Relative humidity	5 to 95% <sup>(Note2)</sup>	
Atmosphere	Place without dust, direct sunshine, corrosive or flammable gases, oil mist, vapor, water drops, or vibration. Place without much salt.	

Note 1: The storage temperature indicates the temperature at which the option is kept in a short time for purposes such as transportation.

Note 2: Even if the humidity is within the specification limits, condensation or icing occurs at places with abrupt temperature changes. Avoid such places.

- (a) Do not place the option directly on the floor.
- (b) In adverse atmosphere, pack in vinyl sheet, packing polyethylene film or the like when storing.
- (c) If humidity may cause ill effects, pack the option, as described in (b), with a drying agent such as silica gel.



## 4.2 Permanent Storage

The method for storing the option over a long period after purchase due to no schedule of operation varies according to the environment of the storage site. If strict storage is necessary, specify the concrete environment specification and contact the dealer or nearest Fuji's sales office.

The general storing method is described below.

- (a) Satisfy the conditions for temporary storage.
- (b) Carefully pack to prevent intrusion of moisture. Place a drying agent (such as silica gel) in the package. For the amount of the drying agent, refer to JIS Z 0310 (moisture preventive packing method). Keep the relative humidity inside the package within approximately 70%.
- (c) If this option is installed in the RHC installed to a unit or control panel and left there, especially at a construction site, the option is likely to be exposed to vapor or dust. In such a case, remove the option together with the RHC converter and move it in a regulated environment to satisfy the conditions specified in this instruction manual.

## 5 Installation



### WARNING

- Before mounting or removing this option, turn OFF (open) the breaker for the converter power supply.
- Even if the breaker is turned OFF (open), the smoothing capacitor is still charged. So, you get an electric shock if you touch it. Confirm that the CHARGE indicator lamp for the converter is OFF, and check the DC voltage of the converter with a tester to see that it has dropped to or below the safe level.

## 5.1 Operating Environment

Use in an environment satisfying the conditions described in the following table 5.1.1.

Tab. 5.1.1 Operating environment

Item	Specification
Site	Indoors
Ambient temperature	-10 to +50°C
Relative humidity	5 to 95% (without condensation)
Atmosphere	Place without dust, direct sunshine, corrosive or flammable gases, oil mist, vapor, water drops, or vibration. Place without much salt. No condensation caused by abrupt temperature changes.
Altitude	1000m or less
Vibration	5.9m/s <sup>2</sup> [0.6g] or less

Note) If these environmental conditions are not satisfied, it will make the performance or the lifetime decrease and might cause failures.

## 5.2 How to Install

### CAUTION

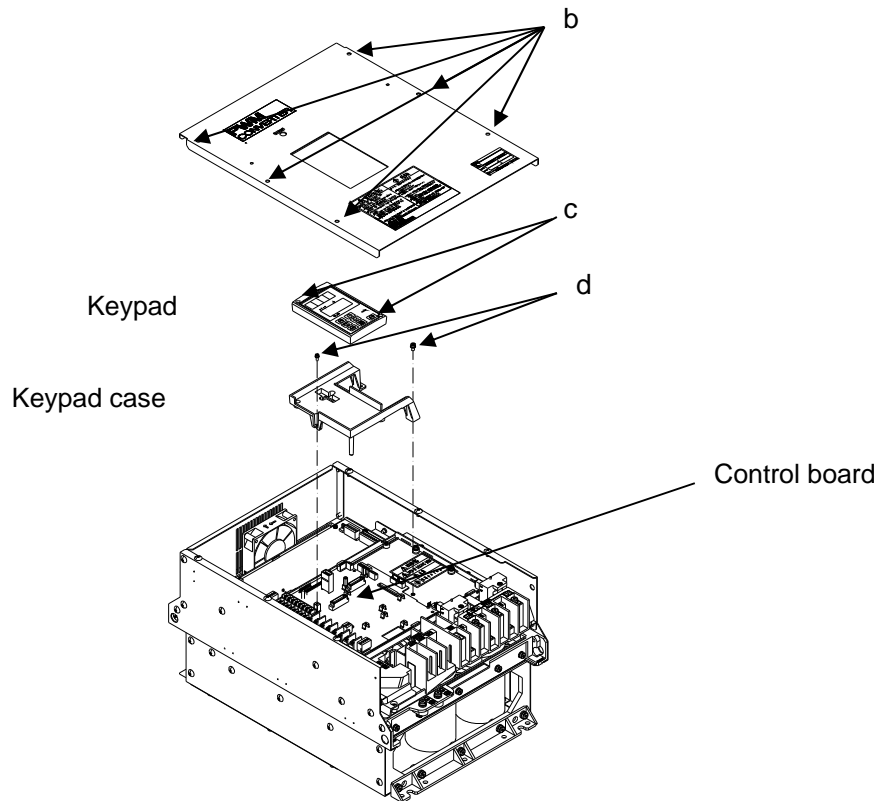
- Turn OFF the breaker on the power supply side of the converter before you mount/dismount this option.
- When the breaker is OFF, a smoothing capacitor is still charged and touching it will cause an electric shock.
- Make sure the CHARGE lamp of the converter is off and the DC voltage of the converter decreases under a safe voltage with your tester or the like.

### A. How to Remove the Front Cover

Remove the front cover of the converter as described in the figures below.

Applicable converter model (capacity)  
RHC18.5-2/4 (18.5kW) or higher

- Remove the front cover mounting screws at b (the number of screws varies according to the capacity) to remove the front cover as shown in Fig.5.2.2.
- Remove two screws at c to remove the keypad.
- Remove two screws at d to remove the keypad case.



**Fig. 5.2.1 How to remove the front cover  
(RHC18.5-2/4C(18.5kW) or higher)**

## **B. How to install the Communication Option**

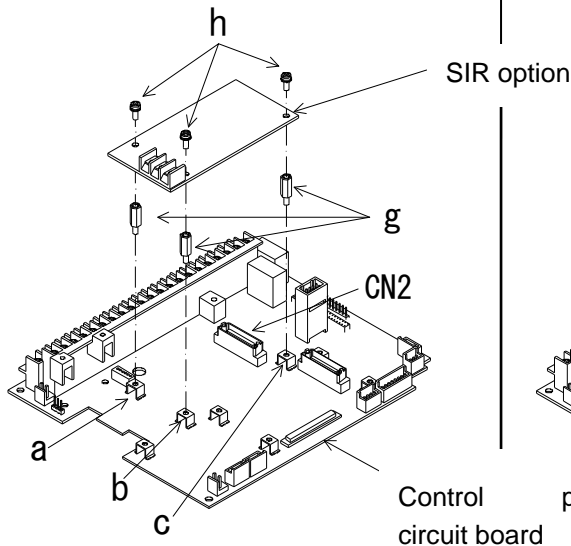
Following restrictions are applied to installing this option.

- ◆ Install this option card in either of two installation positions (CN2 on the left side or CN3 on the right side) on the control board while referring to "(a) Installation Method 1-1" described below. However, if an analog card is installed on the same control board, be sure to install the option card at CN2 and install the analog card at CN3.

[Installation method]

### **(Installing at CN2 to the left)**

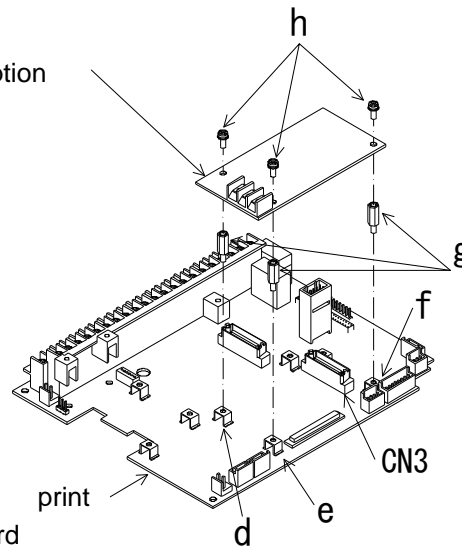
- (1) Install spacers g (three) included in this option to the mounting attachments (a, b, and c) on the control print circuit board.
- (2) Install this option so that the connector (CN1, on the reverse side) on this option mates the connector (CN2) on the control print circuit board.
- (3) Tighten three included screws h (three) at the mounting holes to fix this option.
- (4) See "A. Removing front cover" to install the front cover to assemble as the reverse procedure of removing the front cover.



**Fig. 5.2.2 How to install this option**  
(Installing at CN2)

### **(Installing at CN3 to the right)**


- (1) Install spacers g (three) included in this option to the mounting attachments (d, e, and f) on the control print circuit board.
- (2) Install this option so that the connector (CN1, on the reverse side) on this option mates the connector (CN3) on the control print circuit board.
- (3) Tighten three included screws h (three) at the mounting holes to fix this option.
- (4) See "A. Removing front cover" to install the front cover to assemble as the reverse procedure of removing the front cover.




**Fig. 5.2.3 How to install this option**  
(Installing at CN3)


## 6 Connection

See the Instruction manual (INR-HF51746\*-E) of the converter for mounting/dismounting the front cover

 <b>WARNING</b>	<ul style="list-style-type: none"> <li>Improper wiring operation causes disasters such as electric shock and fire. A specialist should conduct the wiring. Turn OFF the breaker on the power supply side when you touch the electric circuit for wiring operation after power is supplied.</li> <li>When the breaker is OFF, a smoothing capacitor is still charged and touching it will cause an electric shock. Make sure the CHARGE lamp of the converter is off and the DC voltage of the converter decreases under a safe voltage with your tester or the like.</li> </ul>
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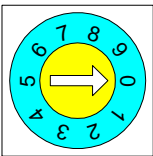
 <b>CAUTION</b>	<ul style="list-style-type: none"> <li>Do not use the product if any part is damaged or missing. Injury or damage may result.</li> <li>Improper operation during mounting or removal of the product may cause damage to it.</li> </ul>
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### 6.1 Setting Switches

 <b>CAUTION</b>	<ul style="list-style-type: none"> <li>If the switches (SW1, SW2) on the option are not set correctly, a parallel system does not operate properly. Read the following setting thoroughly to set correctly.</li> </ul>
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**Tab. 6.1.1 Switch on the card (SW1)**

Parts number	SW1 setting	Function	Remark
SW1 Rotary switch	0	Master	Operation sequence including main circuit wiring is required as well as the standard product.
	1 to 5	Slave 1 to 5	Only the current control operates, and the main circuit wiring and the wiring of the driving sequence are necessary as well as master *Number of maximum parallel system is 3. 3 to 5 cannot be set.
	6 to 9	Invalid	Avoid this setting. Setting to the left causes operation procedure alarm "Er6".

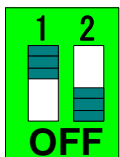


The settings of the station number switches should not overlap on the connected converters. To avoid mistakes, set the station numbers consecutively as the order of connecting cables (master 0, slave 1, slave 2,...).

A unit with SW1=0 is defined as master and units with SW1 ≠0 are defined as slaves.

**Tab. 6.1.2 Switch on the card (SW2)**

Parts number	SW2-1setting	SW2-2setting	Function	Remark
SW2 Dip switch	OFF	OFF	—	Avoid this setting
	ON	OFF	Parallel system	Use this setting for all optical link options to be installed regardless master or slave.
	OFF	ON	—	Avoid this setting
	ON	ON	—	



Actual setting is indicated to the left. This is the default factory setting.  
With this setting, you can use the optical link option as parallel system

## 6.2 Connecting Optical Fiber Cables

### CAUTION

If you keep the plastic optical fiber bent 35mm or less in curvature for a long period, the converter may present the inter-converter link error "Erb" and enter into an alarm state. This will shut down the converter output and stops motor after coasting. Make sure to wire the plastic optical fiber at 35mm or more in curvature.

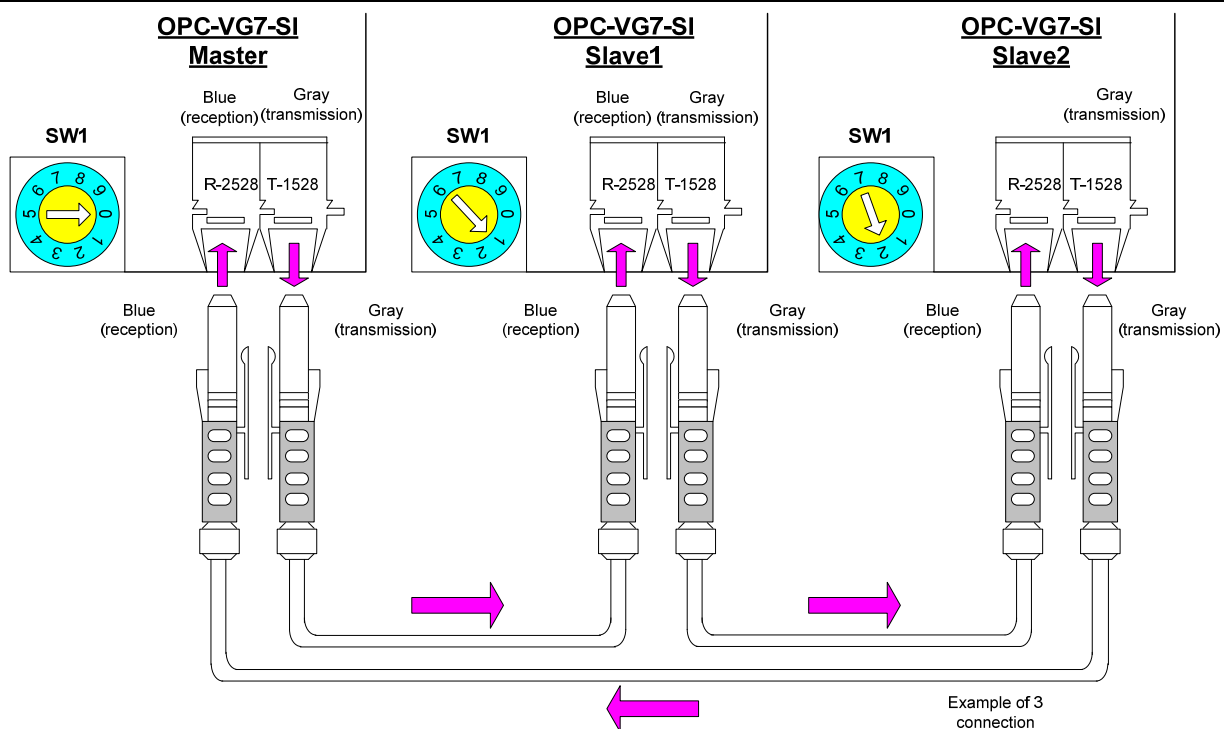
Since this option has a principle to use optical phenomena, an alarm may occur due to transmission errors if the option card or the optical fibers are exposed to direct sunlight, strobe flash, search light or any other strong light. When installing the option unit, take due consideration on light shielding, for example, storage into a control board.

Use the optical fiber cable included in the converter to connect the OPC-VG7-SI card on the individual converters.

The optical fiber cable has plugs in different colors, gray and blue on each side. Connect them to the connectors with the same colors on the individual cards. Connect to form a loop running through the entire system. For example, when you connect three units (1, 2, and 3), use three cables to form a loop as 1→2→3→1.

**Tab. 6.2.1 Optical communication connector on option card**

Parts number	Name	Color	Description
T-1528	TX	Blue	Transmitter (optical communication transmission)
R-2528	RX	Gray	Receiver (optical communication reception)



**Fig. 6.2.1**

**Tab. 6.2.2 Absolute maximum rating of plastic fiber cable**

Item	Minimum	Maximum	Unit	Remark
Storage temperature range	-40	+75	°C	
Tension		50	N	30 minutes or less
Short time bent radius	10	—	mm	The system becomes out of operation in less than one hour and the inter-converter link error "Erb" occurs.
Long time bent radius	35	—	mm	The inter-converter link error "Erb" may occur when you bend at 35mm or less for a long time. Make sure to bend 35mm or more in curvature.
Tensile strength (long time)	—	1	N	
Flexibility	—	1000	Times	Bend 90° on 10mm mandrel (mandrel, spindle)
Shock	—	0.5	kg	Shock test based on MIL-1678, Method 2030, Procedure
Guaranteed minimum distance	20		m	Guaranteed minimum value due to transmission loss (0 to 70°C)
Mass	4.6		g/m	

\*Plastic optical fiber cable from Mitsubishi Rayon is used (accessory)

## 6.3 Switching parallel system driving/ single driving

### 1. Outline of function

You can use the external digital input signal [OPT-DI] to cancel parallel system operating with high-speed serial card "OPC-VG7-SI", and then it could be changed single system by 1 unit driving.

It uses as an urgent backup to decrease the load only with the normal converter when the converter that composes parallel system breaks down and to continue driving.

The function code to switch parallel system is H12 "Parallel system".

The below Fig. 6.3.1 indicates the connection overview for switching

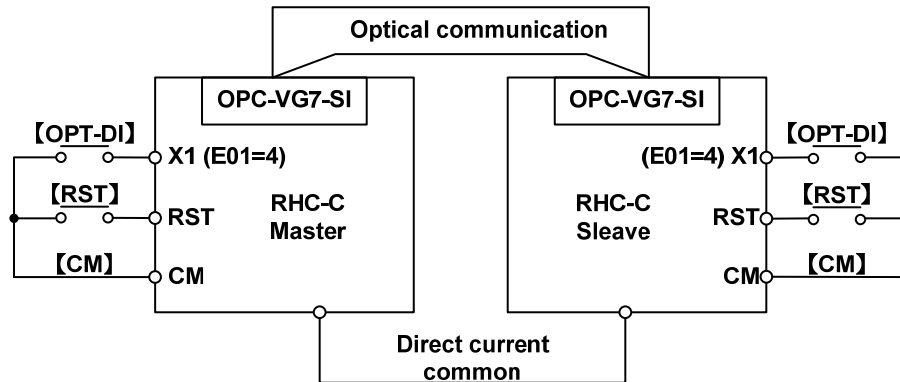


Fig. 6.3.1

### 2. Specification of switching

Parallel / single driving is switched by function code H12 and digital input [OPT-DI]

When function code H12 = 1 "parallel system" and X1 terminal is set normal open, [OPT-DI]= ON (close) makes the system single (parallel system is canceled), [OPT-DI] = OFF (open) makes the system parallel.

Tab. 6.3.1

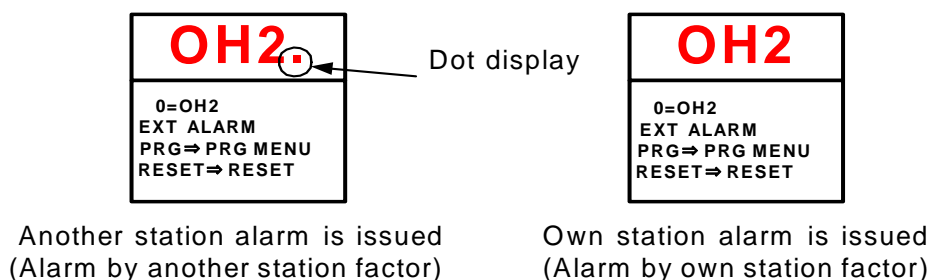
Function code H12"Parallel system"	[OPT-DI]	Driving system
0 : valid	OFF	Single
	ON	Single
1 : invalid	OFF	Parallel
	ON	Single

<Note>

- 1.The switch input is invalid while the converter operates, and when the converter stops it is reflected.
- 2.This function works only when the X1 terminal is allocated to [OPT-DI] and high-speed serial card is installed.
- 3.Only one unit that composes parallel system can get single operating by using this switching function.  
Do not operate the plural units at the same time with the single system.
4. In case of 2 units parallel system driving, after 1 unit break down in the 3 units parallel system, by rewiring optical fiber cable, and changing station number setting on the option card and function cord, you have to reconstruct the system as a 2 units parallel system

## 6.4 Alarm Display of Parallel System

When a converter unit at parallel system issues the alarm, all units enter into an alarm state, and stop. Same alarm code of the first alarm factor is displayed to LED on the keypad panel at the same time. The unit where the alarm is issued can be discerned by the displayed alarm code. Only the first alarm factor is displayed as other station alarm, even if several alarms are issued at once. The alarm history display is similar to the standard product.



## 6.5 Setting Number of Units to be connected

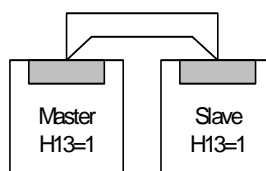
You have to set the number of slave units connected through the optical fiber to the function code. Do not set include the master into this number.

**Tab. 6.5.1 Number of units and function**

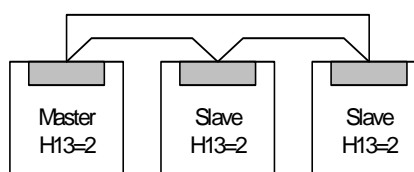
Item	Function	Setting value of H13	Remark
Function code H13	Number of slave station in parallel system	1	Set for master 1 + slave 1 = 2 units system
		2	Set for master 1 + slave 2 = 3 units system
		3	Set for master 1 + slave 3 = 4 units system
		4	Set for master 1 + slave 4 = 5 units system
		5	Set for master 1 + slave 5 = 6 units system

Examples of setting

2 units system  
Set to H13 = 1 for all units



3 units system  
Set to H13 = 2 for all units



**Fig. 6.5.1**

If H13 setting value is wrong, it causes alarm, and parallel system cannot operate. Be sure to set correct value.

## 6.6 Basic Wiring Diagram

The following figure shows a basic wiring diagram (3 units system).

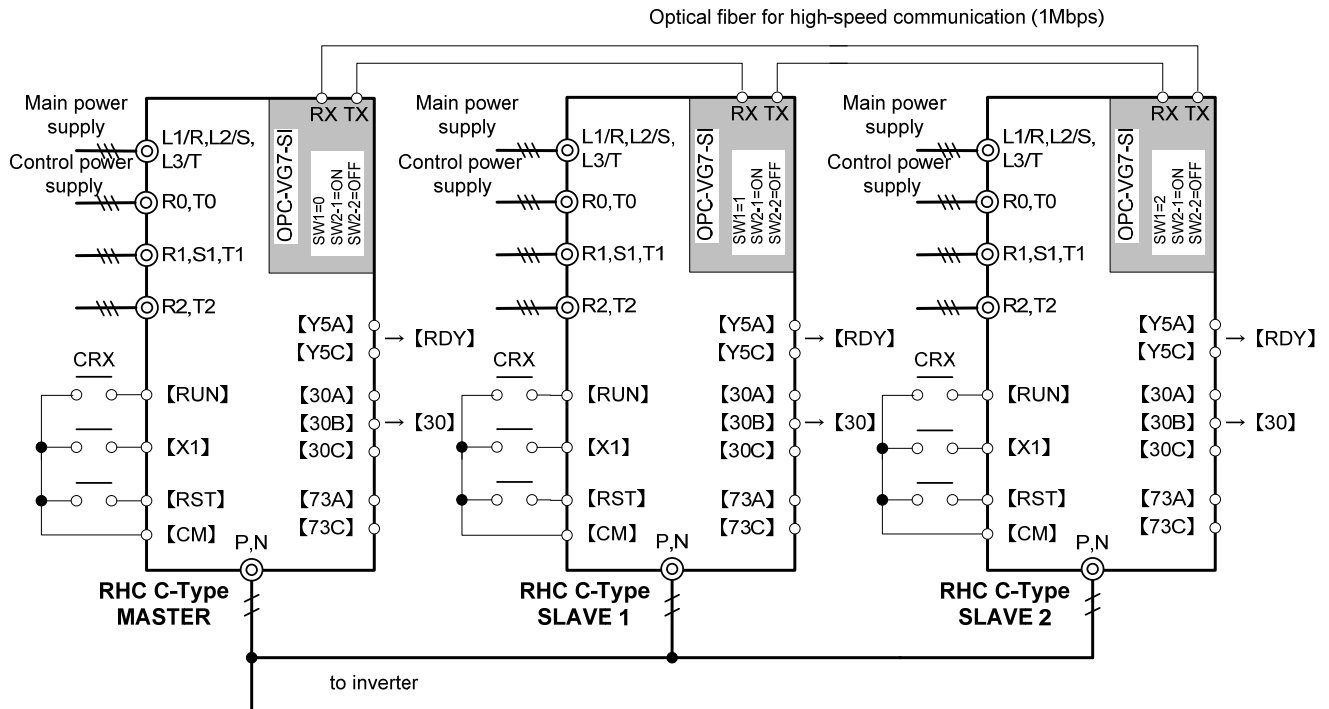


Fig. 6.6.1

### Special notes

1. When the alarm is issued in the parallel system, all units become alarm states (30X is activated), at the same time, however turn off the RUN command of all converters for safety.
2. Build the sequence that the RUN signal is supplied to the inverter after confirming operation ready output [RDY] of all converter units.
3. Reset signal [RST] from any of units can make all units alarm reset. Under single driving, only the unit that inputs the reset signal [RST] is reset.
4. If you use switching function (parallel system / single system), sitting [OPT-DI] function to the X1 terminal.

When switching to the single system, input [OPT-DI] and build the sequence circuit whose alarm circuit of other units are bypassed except for single drive unit, and whose operation command is given only single drive unit.

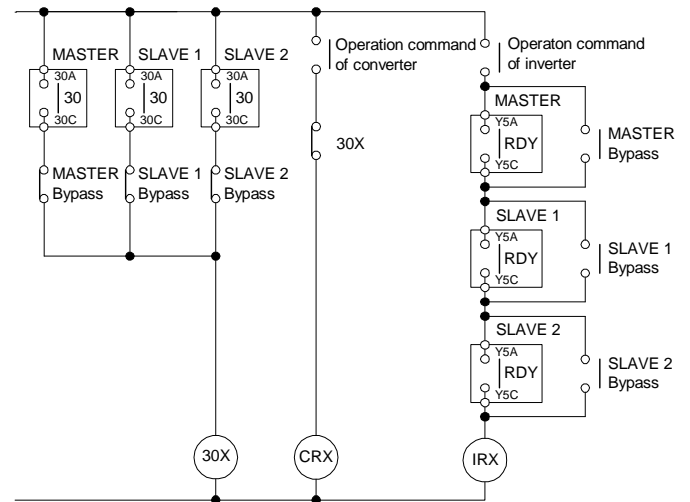



Fig. 6.6.2




## 7 Preparation for Operation

 <b>CAUTION</b>	<ul style="list-style-type: none"><li>• Check the following items before you turn on after you have installed, wired, and set switches.</li><li>(1) No wiring errors</li><li>(2) No wire chips or screws left</li><li>(3) No loose screws and terminals</li><li>(4) No contact of core wires from crimped terminals to neighboring terminals</li><li>(5) No setting error for SW1 and SW2</li></ul>
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See "Section 4 Preparation for Operation" of instruction manual of converter (INR-HF51746\*-E)


## 8 Operation

### 8.1 Turning Power ON

 <b>CAUTION</b>	<ul style="list-style-type: none"><li>• An inter-converter link error "Erb" occurs when you start operation while even one unit is not turned on in a parallel system. This alarm does not occur until operation starts</li></ul>
--	---

You do not have to turn on simultaneously. There is no order to follow to turn on, either. An alarm is not detected before starting operation, and you can turn on in an order you like.

### 8.2 Setting before Operation

 <b>CAUTION</b>	<ul style="list-style-type: none"><li>• Some function codes require the same setting both for master and slaves. Without this setting, you cannot operate properly.</li></ul>
---	---

Provide the following function codes with the same setting both for master and slaves. Though they are given the same setting for delivery, check the setting again.

Code requiring same setting	Function	Remark
F03	Current rating switching	Always set to same value
E15	Current limiter value	Always set to same value
H12, H13	Special code for parallel system	Always set to same value

## 8.3 How to Operate

### CAUTION

- Input driving command 'RUN' to both master and slave.  
When only the master side or the slave side is given, it doesn't start.  
Some setting of functions and display on KEYPAD panel in the slave unit are invalid.
- When control power is turned ON, it cannot be operate almost 10 seconds for initializing. The power supply is turned on with the driving command input, them it will start in almost ten seconds.**

### 8.3.1 RUN/STOP Command

Both master and slave need run/stop command.

You can assume multiple slave units connected through the optical link as hardware conducting only the current control.

How to supply run/stop command is the same as those for a standard product. For more details see instruction manual (INR-HF51746\*-E).

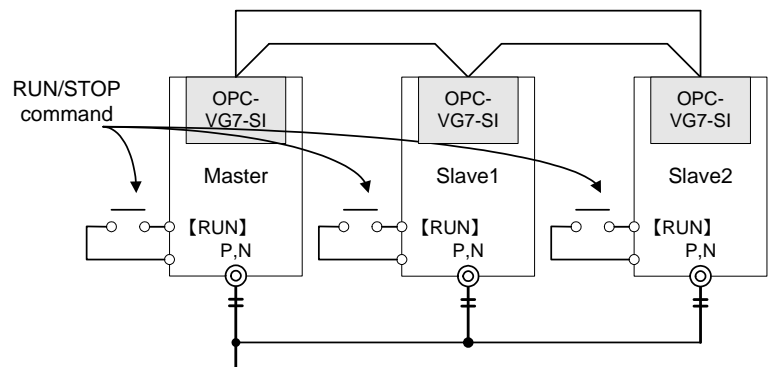


Fig. 8.3.1

### 8.3.2 I/O Function

Master can be used as a standard product

The slave has function restriction as follows:

Tab. 8.3.1 Valid I/O function on slave side

	Valid functions for slave in parallel system (Functions not described are invalid)	Symbol	Remark
DI	RUN · STOP command	【RUN】	
	Alarm reset	【RST】	Resets all units in system
	External alarm	【THR】	
	73 answerback	【73ANS】	
	Option DI	【OPT-DI】	Parallel/single driving system is switched.
DO	Alarm relay output	【30A,30B,30C】	
	Converter running	【RUN】	[Operation command from master] [RUN signal of terminal / communication] works above AND condition
	Operation ready output	【RDY】	
	Lifetime alarm	【LIFE】	Own lifetime
	Heat sink overheat early warning	【PRE-OH】	
	Overload early warning	【PRE-OL】	
	Power running	【DRV】	
	Regenerating	【REG】	
	Source frequency synchronization	【SY-HZ】	
	Alarm indication	【AL1~3】	Outputs including alarm information from master
Option DO	【OPT-DO】		
AI	All are invalid	—	
AO	Input power	【PWR】	The input electric power that oneself calculates is output.
	Input current rms value	【I-AC】	Voltage and the Current that oneself detects are output.
	Input voltage rms value	【V-AC】	
	DC link voltage	【V-DC】	DC link voltage that oneself detects is output
	Source frequency	【FREQ】	Frequency that oneself detects is output
	+10, -10V output test	【P10,N10】	

### 8.3.3 KEYPAD panel function

Not only master but also slave can be used as a standard product without the restriction.

### 8.3.4 Function code (F to H)

You can use the master as a standard product except for carrier frequency setting (F08). The functions of a slave are restricted. See the following table to make sure the restrictions on a slave. You have to provide the master and slaves with the same setting for codes indicated as "1".

- 0; Setting is invalid
- 1; Setting is valid (code requiring the same setting as the master)
- 2; Setting is valid (code not requiring the same setting as the master)
- 3; Setting is valid (code requiring a setting specific to parallel system)

**Table 8.3.2 Slave side function code**

Code	Type	Code	Type	Code	Type	Code	Type	Code	Type	Code	Type	Code	Type
F00	2	E01	2	E10	2	E19	2	H01	2	H10	2	H19	0
F01	0	E02	2	E11	2	E20	2	H02	2	H11	2	H20	0
F02	0	E03	2	E12	2	E21	2	H03	2	H12	3		
F03	1	E04	2	E13	2	E22	2	H04	2	H13	3		
F04	2	E05	2	E14	2	E23	2	H05	2	H14	2		
F05	2	E06	2	E15	1	E24	2	H06	2	H15	0		
F06	2	E07	2	E16	2	E25	2	H07	2	H16	0		
F07	2	E08	2	E17	2	E26	2	H08	2	H17	0		
F08	0	E09	2	E18	2	E27	2	H09	2	H18	0		


### 8.3.5 Function code (S; Reference data)

You can use the master as a standard product. Only S01 "Operation method " is valid on a slave. However, they are restricted as described in "8.3.2 I/O functions".

### 8.3.6 Function code (M; Monitor)


You can use both master and slave as a standard product.

## 9 Protective Functions



**WARNING**

- If one of two or more converters consisting of a parallel system enters into an alarm state, you may not obtain sufficient capacity and may not operate the machine system properly, if you continue operation with remaining units. Avoiding this situation, all units connected through the optical link option would enter into an alarm state immediately (with in a few ms). In corresponding to this feature, you should use 30X (alarm relay output) to design a sequence to stop all units.
- When you reset an alarm while the operation command is still ON after you remove the source of an activated converter protective function, the converter will start. Reset the alarm after you make sure that the operation command is OFF to avoid injuries.



**CAUTION**

- If optical cables connecting units are disconnected during operating converters, you cannot continue normal operation. Then, the converter is forced to enter into an alarm state (Erb: inter-converter link error). This alarm is not activated while a converter stops.

## 9.1 Optical Network Error (Erb)

When an optical fiber cable is disconnected or disengaged from a connector, all units become an alarm state due to the optical network error (Erb). If the external alarm condition of the inverter is a converter alarm output, the inverter becomes an alarm state, and the motor stops after coasting

You cannot reset the alarm state if you enter a reset command (KEYPAD panel, terminal, communication) while the cause of the alarm is not removed. Make sure to investigate the cause of the alarm before you reset.

### Trouble shooting for "Erb"

When an alarm of Erb occurs, the following states can be the source of the alarm. Identify the actual source.

- (1) An optical fiber cable is not connected, or inserted into a connector incompletely.
- (2) An optical fiber cable is tied or bent 35mm or less in curvature.
- (3) The color (gray or blue) of a connection plug of an optical fiber cable does not match the color of a connector on a print circuit board.
- (4) The connection of optical fiber cables does not form a loop. Make sure that the signal from the master loops back to the master.

When you cannot remove the alarm of "Erb" after checking the sources above, the source can be the optical cable or the optical link option print circuit board. Contact nearest sales office or the service center.

## 9.2 Operation Procedure Error

When you set the hardware switches as described below, a converter enters an alarm state. This alarm is a preventive measure against an improper action due to an improper setting.

Error condition is as follows:

- The optical link option hardware station number SW1 is set to 6 or more.
- The optical link option hardware station number SW1 is set to a number more than H13 "Slave unit number".
- Two optical link options is installed.

## 9.3 Alarm relay Output Processing

When the master unit enters an alarm state, all stations display the same alarm, conduct 30X action and shut off the converter output.

## 9.4 Reset Processing

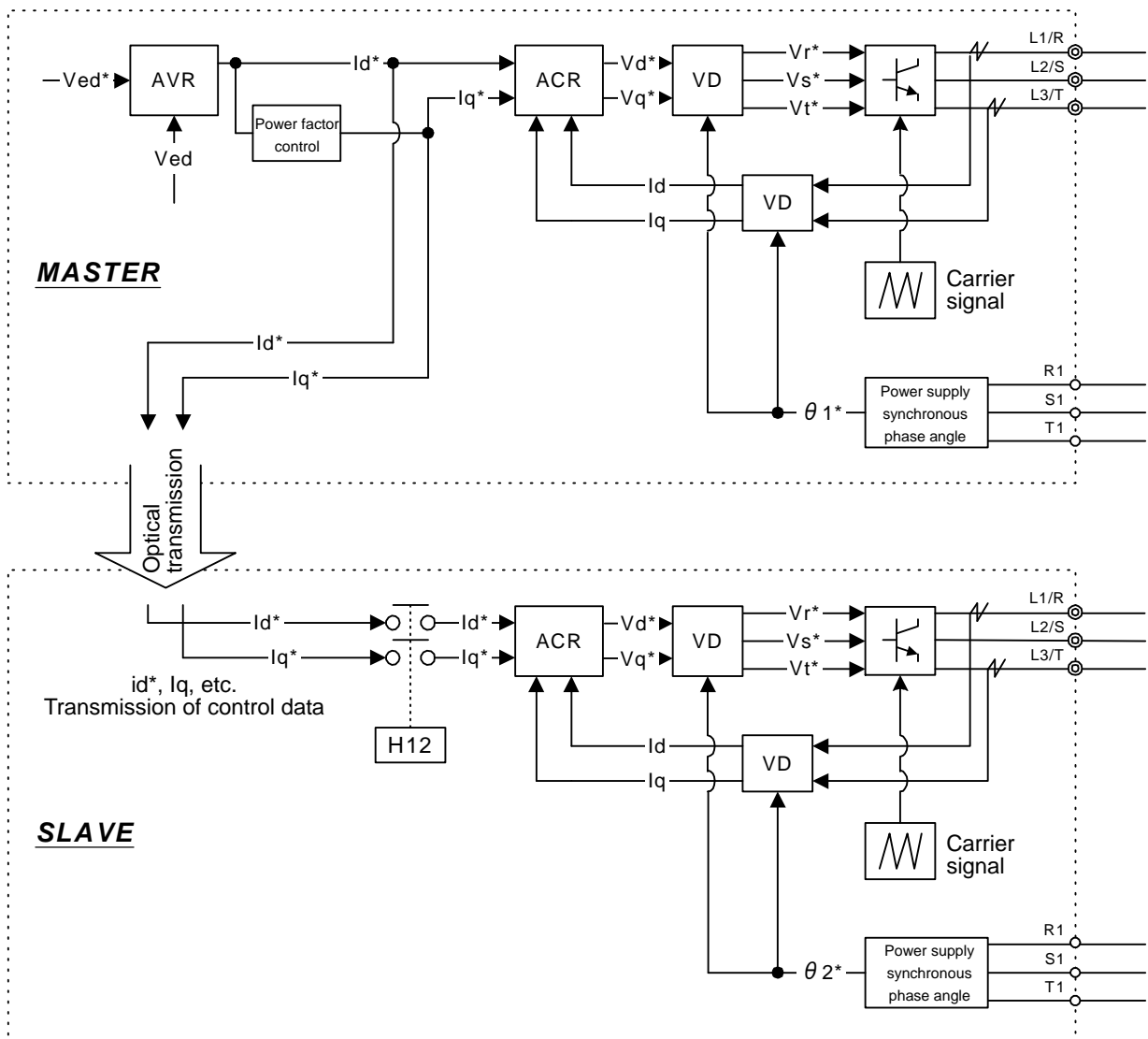
A reset command from the master (slave) will reset all stations simultaneously as long as the cause of the alarm is removed.

**Tab. 9.4.1 Object of Reset**

	Alarm state of master	Alarm state of slave	Object of reset
Reset command from master	Valid	Valid	All units
Reset command from slave	Valid	Valid	All units

## Parallel System Control Block

The Parallel System is established by transmitting current command data controlled by Master to Slave.



$I_d^*$ ; Active current command     $I_q^*$ ; Reactive current command  
 $\theta 1^*$ ; Power supply synchronous phase angle command (Master)  
 $\theta 2^*$ ; Power supply synchronous phase angle command (Slave)  
 $V_{ed}^*$ ; DC voltage command value     $V_{ed}$ ; DC voltage detected value  
 $I_d$ ; Active current detected value     $I_q$ ; Reactive current detected value  
 $V_d^*$ ; Active voltage command value     $V_q^*$ ; Reactive voltage command value  
 $V_r^*$ ; R phase voltage command value     $V_s^*$ ; S phase voltage command value     $V_t^*$ ; T phase voltage command value  
 AVR; Voltage adjuster    ACR; Current adjuster    VD; Vector rotator