CONFIDENTIAL

“SELOHT SOHT-300”

SYSTEM OPERATION MANUAL
of
SHINKO OHT SYSTEM

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Safety precautions

(1) General

- Prior to using this product, make sure the “Safety Precautions”, Maintenance Instruction Manual and other attached documents shall be well read and understood for appropriate application.
- Engage specialists in electrical works.
- Don’t improve the product by yourselves.
- Be sufficiently proficient with the equipment, the relevant safety knowledge and the precautions prior to using this product.

In the content of this “Safety Precautions”, items which need to be cautions of out shall be classified into “Danger” and “Warning”.

(2) Definitions of Danger and Warning

[Note 1] Medium degree of injuries or light injuries refers to injuries, e.g., burns and electric shock, which do not require hospitalization of or prolonged hospital visit by the victims. As material losses refers to expanded losses pertaining to the damage of property and equipment.

Note that, depending on the situation, the events described under “Warning” may also result in severe outcome. In either case, make sure that the advice is followed.
After reading, make sure this information shall be kept at places where it can always be read by users.

(3) Precautions on use

	Danger
	Follow the following advice strictly to avoid electric shock or burns. 1. Don't enter the operation area of the vehicle. Work on the ladder may collide to the vehicle and may cause injury. 2. Don't touch the vehicle on the track when Power Supply Panel output the power. 3. Don't touch the moving parts of the vehicle while it is in operation. Doing so may cause injuries. 4. Don't touch and Teaching and maintenance shall be done by a qualified person. 5. Make sure the earth terminals for the relate equipment shall be grounded. Not doing so may cause electric shock. 6. Don't break the cable, impose excessive stress, place heavy weights, or pinch it between items. Doing so may cause electric shock.
	Warning
	Don't use the equipment at locations where water, corrosive atmosphere, or flammable gas is present, or beside flammable items. Doing so may cause life and fails.

(4) Storage

	Prohibition
	1. Don't store the equipment at locations where it is subject to rain, water hazardous gas or liquid.
	Mandatory Implementation
	1. Store the equipment at locations in not subjected to sun shine. Store it at predetermined relative humidity and temperature. 0 50 ,90% RH and below, no dew.

(5) Transportation

	Warning
	1. Don't carry in a manner except for designated. Doing so may cause materiales loss or injuries.
	Mandatory Implementation
	1. The equipment may be broken when overloaded. Follow the advice of the display on the load.

(6) Installation

	Warning
	1. Don't climb on top of the equipment or place heavy items on it. Doing so may cause injuries. 2. Don't block the air inlet and outlet ports or allow foreign particles to enter them. Doing so may cause fire. 3. Follow the installation direction strictly as it is so design for dissipation of heat. fails or fire. 5. Don't hit the equipment with strong impact. Doing so may cause equipment fails.

(7) Operations

	Mandatory Implementation
	Install an external emergency circuit so that operations can be immediately stopped and power cut off when required

(8) Maintenance and Inspection

	Prohibition
	Don’t engage non-specialist technicians to disassemble and repair the equipment.
	Danger
	1. Maintenance of the vehicle shall be done on the ground. 2. Switch off the power and wait for 3 minutes or longer before carrying out wiring work or inspection. Not doing so may cause electric shock. (The printed circuit board in the driver applies 300V of high voltage parts)

1.General

1.1 Application

This document describes the operation of OHT Vehicle for “SELOHT SOHT-300”, Shinko OHT(Overhead Hoist Transport) System.

1.2 Related SEMI document

Following documents are parts of the specification:

(1) SEMI E10-0299 (1999) (RAM)
(2) SEMI E15.1-0299 (1999) (LOAD PORT)
(3) SEMI E30-0998 (1998) (GEM)
(4) SEMI Draft 2998 (Future E82-0999 (1999), IBSEM)
(5) SEMI E37.1-96 (1996) (HSMS-SS)
(6) SEMI E47.1-0299 (1999) (FOUP)
(7) SEMI E84-0699 (1999) (Extended P I/O)

1.3 Related Rules, Laws

(1) FCC Part15 Subpart C
(2) FCC Part 18

1.4 Abbreviations

(1) OHT : Overhead Hoist Transport
(2) OHV : Overhead Hoist transport Vehicle
(3) OHVC : Overhead Hoist Vehicle Controller
(4) CMC : Communication Modem Controller

2. Outline of OHT System

Fig. 2.1 System Construction

2.1 Construction of OHT system

Fig.2.1 shows a typical construction oh Shinko OHT system.

As shown in the Fig. , Shinko OHT system is composed from the equipment listed below.

OHT Vehicle

OHT Track

Power Supply Panel

Maintenance Shifter/lifter,

OHVC

Process tool (Stocker)

FOUP, etc.

(1)OHT Vehicle

Main device of the system is an OHT Vehicle, which is hung from the OHT track and travels through the track. OHV has a hoisting mechanism and a FOUP is hoisted down/up to the port of the process tool.

(2)OHT Track

OHT track is supported from the building ceiling, and OHV is hung from the track.
OHV travels by the linear motor power and the electricity is supplied from the track side by non-contact power supply system.

(3)Power Supply Panel

Power Supply Panel is composed from three portion.

(a) Power distribution Panel portion

Power source of the facility in the voltage of 208V is connected to the distribution Panel of the Power Supply Panel. And from hear, electric power is distributed to the OHT system components (i.e. Power supply portion of this panel, Maintenance shifter/lifter, OHVC. OHVC is operated in A.C.120 V, so voltage is transformed from 208V to 120 V in this panel.

(b) Power Supply portion:

Power supply panel generate 8.66kHz Alternative Current for the Non-contact power supply stem

(c) CMC(Communication Modem Controller) portion

Communication between OHT Vehicle and the ground side controller (OHVC) is realized by power line communication. About 300kHz - 350kHz signals are superposed on the power line of non-contact power supply power line.

(4) Maintenance Shifter/Lifter

To move in/out the OHT Vehicle to the OHT track, Maintenance Shifter/Lifter is used.

(5) OHVC(Overhead Hoist Vehicle Controller)

OHVC is a ground side controller which control the OHT Vehicle,

(6)Process tool (Stocker)

The port of the process tool is normally called load port. The specification of the load port is defined by SEMI standard.

Stocker is a special case of process tool.

(7)FOUP

Silicon wafers in diameter of 300mm are transferred from the process tool to process tool kept in a specific carrier called FOUP (Front Opening Unified Pod) in the clean room. This specification is defined by SEMI standard.

(8) Load Port

The port is normally called load port. The specification of the load port is defined by SEMI standard.

2.2 Non-contact power supply

The principle of non-contact power supply is an electro-magnetic coupling, and it can be understood as an special style of a transformer, by which electric power is supplied to the OHV.

There is a power cable on the track and alternate current is constantly supplied from the power supply panel on the ground (Normally it is 400V A.C and 5kW output). Shinko uses 8.66 kHz of the alternate current for the main power supply. About 300kHz and 350kHz signals are superposed on the 8.66 kHz main component for realizing the communication between OHV and ground controller.

Fig. 2.2. is a Cross sectional image of Non-contact power supply.

Fig. 2.2 Cross sectional image

2.3 FCC Rules

Structure of Shinko OHT System & FCC Rules

For OHT system, there are two FCC rules to be applied.

One is part15 subpart C, Intentional radiator portion is applied.

The other is Part 18, Power supply and related components are applied.

See fig. 2.3

Fig.2.3 FCC rules and OHT construction

3 Specification

3.1 GENERAL CONDITION

3.1.1 Transport carrier
(1) Name : 300mm wafer FOUP
(2) Type :
(3) Manufacturer :
(4) Material : Compliant with SEMI E47.1-0299 (1999)
(5) Color : Compliant with SEMI E47.1-0299 (1999)
(6) Weight : 8.7 kgf (Max., including 25 wafers)
(7) Dimension : 430mm (W) x 356 mm (L) x 338 mm (H)
(8) Outline shape : Compliant with SEMI E47.1-0299 (1999)

3.1.2 Transport unit
(1) 1 FOUP / 1 vehicle

3.1.3 Transport capacity
Based on the simulation.

3.1.4 Environment condition
(1) Cleanliness : Class 100 (0.2 um)
(2) Temperature : 23 Degrees Celsius
(3) Humidity : %
(4) Corrosive gas : Nil
(5) Floor surface : Punching plate
(6) Ceiling Material : ULPA filter
(7) Ceiling height : 12 feet -
(8) Required strength of the ceiling height
Refer to YDM-12075 for Customer specific condition.

3.1.5 Utility
Utility requirement is as below.
(1) Electricity
AC 208 V, 3 phases, 4 wire 60Hz for Power supply panel
(AC120V 1 phase 60Hz for OHVC (UPS) is generated from AC 208 V supplied by Customer internally)
The fluctuation of the voltage must be within +/- 10 %, that of frequency must be within +/- 1 Hz.

Electric Power Distribution idea is shown on Fig. 3.1.1

(Electric distribution)

Fig. 3.1.1 Electric Power Distribution

3.1.6 Total system configuration

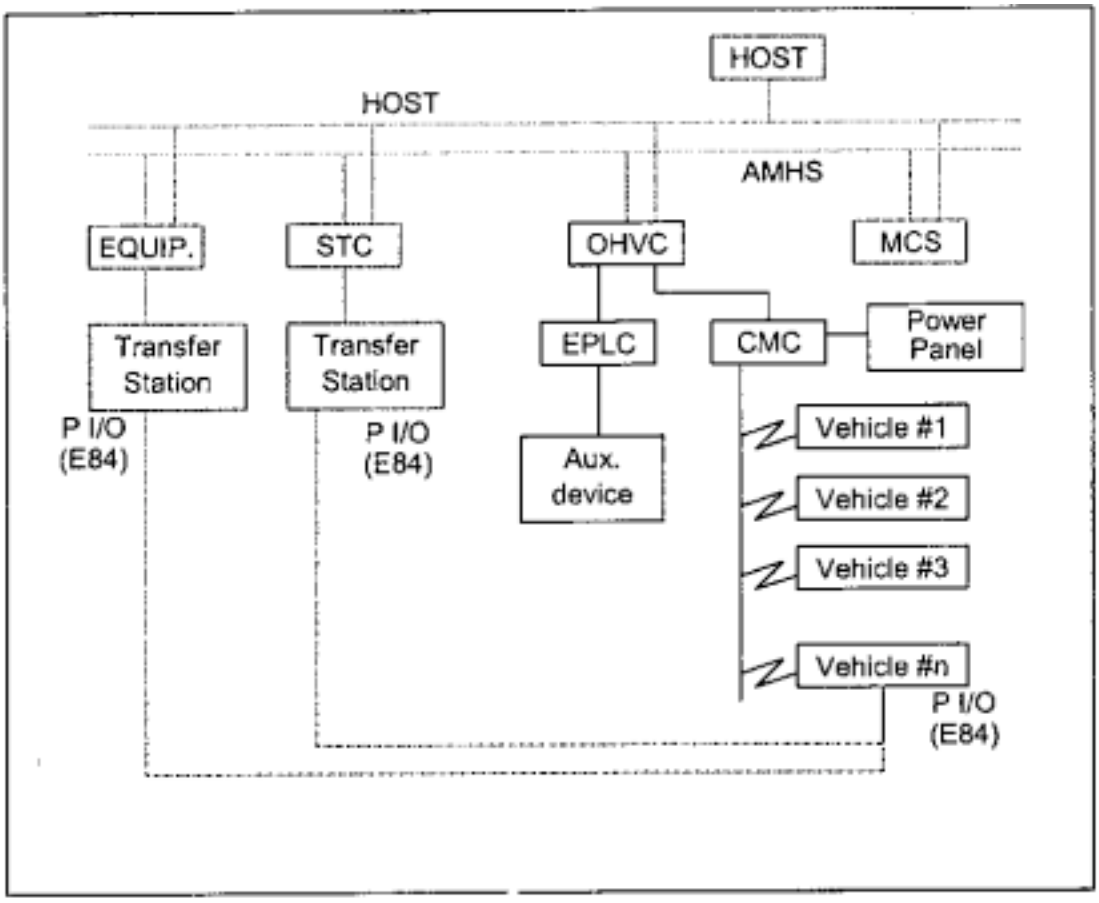

Fig. 3.1.2 System Configuration (1)

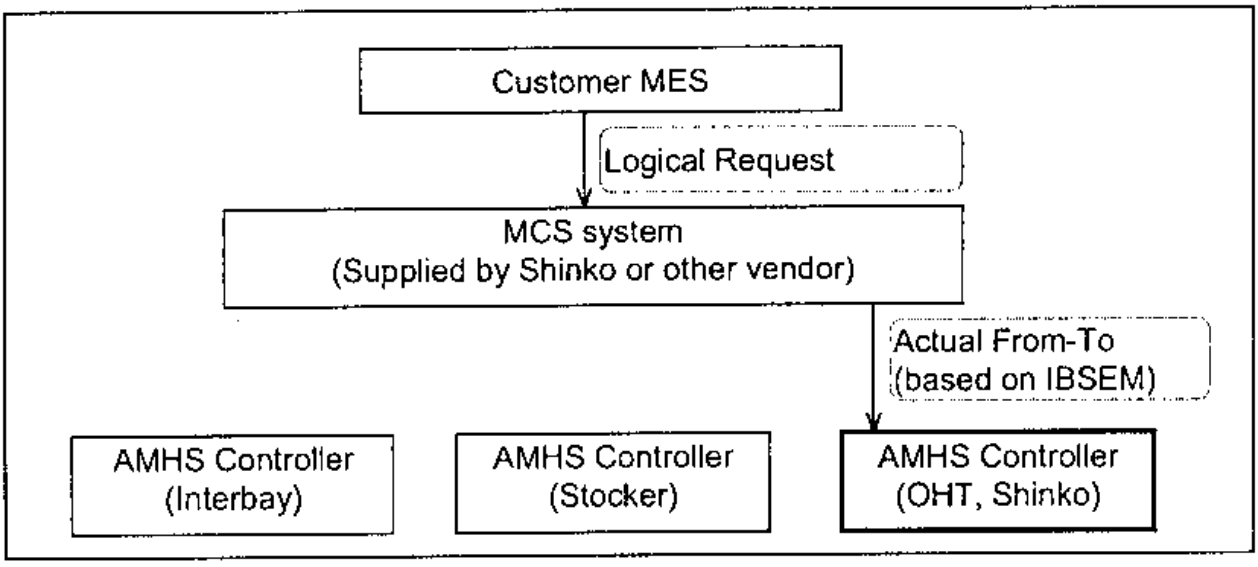

Fig. 3.1.3 System Configuration (2)

Total system configuration is shown on Fig. 3.1.2 and Fig. 3.1.3.
Shinko OHT system does act for Intrabay transportation under the MCS, whether the MCS is Shinko made or supplied by other vendors. Because OHVC (System controller of Shinko OHT) is fully compliant with IBSEM (SEMI E82-0999) scenario, open vendor system can be realized easily.

3.1.7 Transport rule

Customer's HOST system shall send the transport requests to OHVC based on IBSEM procedure (SEMI E82-0999). Refer to Chap. 7 for transport flow.

3.2 System Component and construction

3.2.1 System configuration

Table 3.2.1 shows the general condition of the system configuration limitation.

ITEM	SPECIFICATION	REMARKS
Configuration	OHVC : 1 unit/ system (=bay) OHV (Vehicle) : 60 units / system (Max.)	It is a logical restriction. Power supply panel shall be designed and supplied separately if more than six vehicles are introduced.
Cover area	OHV : within the close loop rail Track length : 100 m – (Length of Feeder Cable between Power Supply Panel to Track connection point) / one Power Supply Panel	By introducing multiple Power Supply Panel, the track length can be multiplied . (In standard design maximum four Power Supply Panel can be introduced).
Communication	HOST-OHVC : ETHERNET (SEMI E37.1 HSMS-SS) OHVC – OHV : Power line communication (EIA RS232C) Tool - OHV : Photo I/O (SEMI E84)	
Power Supply Panel (Normal, 5kW)	One panel covers the following components Rail length : 100 m – (Length of Feeder Cable between Power Supply Panel to Track connection point) Power supply panel to Rail :100 m OHV (Vehicle) : 6 units	Distance Between Power Supply Panel to Rail can be extended if the total length of Rail and this is less than 100m.
Power Supply Panel	(It is internally considered. But not included in this specification. Followings are the preliminary description) One panel covers the following components Rail length : 100 m – (Length of Feeder Cable between Power Supply Panel to Track connection point) Power supply panel to Rail :100 m OHV (Vehicle) : 18 units	

Table 3.2.1 System configuration

3.2.2 Component outline and quantity restriction

No	Name	Q'ty	Description
1	Track Rail	1	A track rail has no electric instrument for controlling the vehicle running. Maintenance station (including lifting mechanism) is included in the rail.
2	Power supply panel	1	Input : Three phase AC 200V (standard) or AC400V(Optional) Output : 8.66 kHz (A.C 300 V to 400V, it depends on the demand), single phase 5 kW, Air cooling
3	CMC	1	Communication unit between OHVC and vehicles EIA RS485, 19.2 kBPS (TX/RX/CS procedure)
4	OHVC	1	OHV controller IBM PC based Personal computer RAID 1 Harddisk Operating System : Microsoft Windows NT 4.0, US version 1 OHVC covers only 1 bay (= 1 close loop)
5	Vehicle	Max. 60	Vehicle with hoist mechanism Driven by LDM Main Controller : One board CPU IBM PC compatible Operating System : Microsoft MS-DOS
6	Tool	Max. 60	Load / Unload of a FOUP is done at the Load Port of tools.(Customer's facility)
7	Stocker	Max. 10	Load / Unload of a FOUP is done at this stage. (Customer's facility)

Table 3.2.2 Component outline

3.2.3 Control System Interface

No	Name	Media	Protocol	Remarks
1	OHVC-MCS	ETHERNET (10MBPS)	HSMS-SS	Software scenario is based on IBSEM (SEMI E30.4)
2	OHVC-EPLC	RS232C / RS485 (19200BPS)	Original	PLC supplier base Maximum distance : 200m
3	OHVC-Vehicle (Via CMC)	RS232C / RS485 (19200BPS)	Original	Shinko original Maximum distance : 200m
4	Vehicle-Tool (or stocker)	Photo I/O 8 bit	SEMI E84	Based on SEMI

Table 3.2.3 System interface

3.2.4 Basic technical specification

ITEM		SPECIFICATION	REMARKS
Track structure		One loop	
Driven method		LDM (Linear Direct-currency Motor)	
Max. payload (kg-F)		10	
Running speed, at straight (m/s)		Max. 1.5	
Running speed, at curve (m/s)		0.5	
Running acceleration (m/s^2)		1.0	
Hoisting speed (m/s)		1.0	
Hoisting acceleration (m/s^2)		1.0	
Hoist stroke (m)		Max. 2.4	
Carrier position repeatability	Horizontal X,Y(mm)	+/- 1	
	Height (mm)	+/- 1	
Vehicle stop position compensation	Lateral(mm)	+/- 30	
	Rotational (degree) (horizontal space)	+/- 10	
Cleanliness		Less than CLASS 100 (0.2um)	
Track radius (mm/r)		500 (at the center)	
Carrier vibration		0.5G	
Power supply to Vehicle		Non contact , electro-magnetic coupling	
Communi -cation	Controller to vehicle	Power line communication continuous, all area	
	Vehicle to Load port	P I/O (E23, E84)	
Track & support	Material	Aluminum & Stainless Steel	
	Cross section of track	270 (W) x 130 (H)	
Vehicle structure	Frame material	Steel(Surface finishing) Stainless steel & aluminum plate Anti flammable plastic	
	Gripper	Stainless steel & aluminum plate Anti flammable plastic	
	Weight (kg)	80	
	Outline dimension (mm)	490(W) x 675(L) x 892(H)	
Power supply panel (Normal one)	INPUT/OUTPUT	INPUT : AC208 V (three phase) OUTPUT: (AC300V to 400V) , 8.66kHz, 5kW (Standard)	Optional large power unit can be offered. (Output voltage depends on Demand)
	Outline dimension & structure	500(W) x 500(D) x 1600(H) Air-cooling, Steel plate enclosure	
Controller (OHVC)	Hardware	PC/AT compatible Window NT PC	
	Software	O/S : Window NT 4.0 HOST I/F : IBSEM compatible (based on SEMI E30.4-0699) Communication : HSMS (Ethernet)	

3.2.5 Transfer station

The transfer stations shall be prepared by Customer and be compliant with SEMI E15.1-0998 (1998). The input/output ports of stockers shall also be based on SEMI E15.1-0998(1998) in shape and the height of them shall be mutually discussed.

All the center of the Load ports (including stocker I/O ports) shall be correctly under the center of the OHT track within the predetermined accuracy (+/- 30mm in lateral, +/- 10 degrees in the horizontal surface). If the Load port is precisely under the track, Shinko OHT vehicle can suddenly start the load/unload operation after the vehicle is stopped, but if the load port position is not precisely under the track, position compensation movement is necessary and the total performance might be lowered. All the docking port of Load ports shall be in the direction (i.e. outer side of the loop).

P I/O device (based on SEMI E84) will be fixed on the track by Shinko at installation stage based on the document supplied by Customer I advance, and the connection of the cables between P I/O and the manufacturing tools shall be done by Customer.

3.2.6 Safety consideration

Following considerations may be supplied by Shinko based on the mutually agreed discussion.

3.2.6.1 EMO (Emergency Power OFF)

EMO switch is installed on the front surface of Power Supply Panel. By pressing this button, power supply to all the vehicle in that system (generally in the bay) will be suddenly stopped and all the vehicles will be suddenly stopped (stopped within three seconds at worst).

Same function EMO switches can be added to the system optionally. Shinko will supply the predetermined quantity of EMO switches and the installation (fixing in adequate position) in the bay shall be done by Customer.

(Remarks)

Fixing position of EMO switch shall be decided by Customer considering the FAB operation. According the SEMI S8 and other standards, the EMO position shall be between 81 cm to 165 cm in height if the operators are standing position in work.

3.2.6.2 P I/O interlock with manufacturing tool

Shinko system is fully compliant with SEMI E84 in P I/O hand shaking. If ES (Emergency Stop) signal from Passive side (Manufacturing tool) is activated, hoisting movement of the corresponding vehicle will be suddenly stopped.

3.2.6.3 Estop on Vehicle

Estop button is installed on each vehicle. By pressing this button, vehicle movement (traveling and hoisting gripping) will be suddenly stopped.

3.2.6.4 Envelope sensor

Each vehicle has a sensor system monitoring the envelope of its traveling area. By this system, obstacles in front of the vehicle is detected and the collision will be avoided. Refer to YDM-11859.

3.2.6.5 Fall protection arm

Each vehicle has fall protection arms, which tries to protect the FOUP in vehicle and traveling position falling in the case of FOUP breakage.

3.2.6.6 Look down sensor

Each vehicle can be optionally added a look down sensor, which detects the obstacles under the vehicle between the load port.
(It is under development, not yet completed.)

3.2.7 Separation of vehicles and operators

Even the Shinko system has the safety system offering above, it is strictly expected to Customer for considering the separation of vehicles and operators, such as adding partition or doors on the load port , or inhibit the operators moving into the bay.

3.2.8 Teaching

For registering the precise load port positions to vehicles, teaching operation is necessary at the stage of Shinko adjustment work.
Refer to KEN72-3644(E) for details.

4. Transportation Control

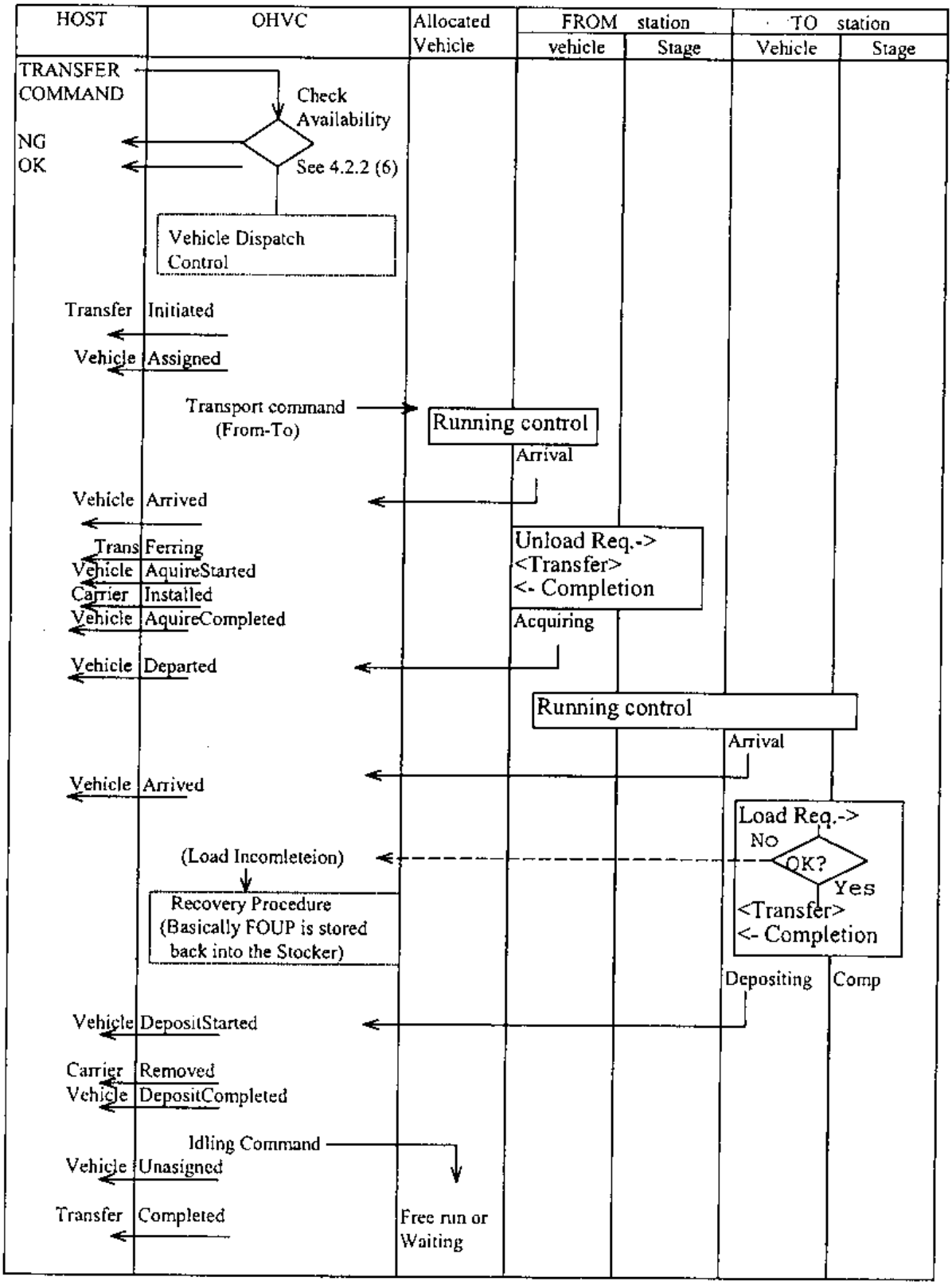

Fig. 4.1 Basic transport flow

5. ERROR HANDLING

5.1 General

(1) The basic classification and handling is summarized in Table 5.1.

(2) When a vehicle was moved by outer power such as operator's hand, following recovery operation is necessary.

(2-1) Place all the vehicles on a normal position (where it is not on branching position, collecting position, etc. In case of OHT there is almost no need for consideration, because the rail is simple loop.). If the moved distance of the vehicle can be neglected small, it is not necessary. In case of moving, in front of the Bar code is recommended.

Name	Contents	Handling	Recovery
Heavy error	The vehicle cannot continue running	Total system mode is changed to PAUSE and all the vehicles stop	(1) Recover the error or remove the error device such as removal of the error vehicle (2) Then change the mode to Auto
Medium error	The vehicle can re-start by operator's assist (1) A vehicle can run by himself (2) Recover within 1 hour	Total system keeps the same mode and the failed devices are stopped	(1) Recover the error or remove the error device such as removal of the error vehicle
Light error	No needs for operator's assist for re-start	Total system and the failed device continue Error event log is kept in the OHVC	

Table 5.1 Error group

5.2 Error handling

Error handling procedure is summarized in Table 5.2.1 and 5.2.2

Name	Device	Cause	Countermeasure	Recovery procedure
Heavy Error	Vehicle	-Servo error -Bar code read error -Power unit error -CPU failure -Load /Unload error	(1) OHVC 1) Mode is moved to PAUSED 2) ERROR indication (2) Vehicle (error) 1) Emergency stop 2) Error reported to OHVC 3) Error indication by LED (3) Vehicles (normal) Paused	(1) Check and confirm the error cause (2-1) Recovery can be expected soon 1) Reset of Vehicle power, Reset of other unit 2) OHVC is changed to Auto mode again (2-2) Recovery might be long term 1) Remove the error unit such as error vehicle removal 2) Cancel the command which cannot be continued 3) OHVC is changed to Auto mode again
	OHVC	-OHVC-Vehicle communication error -Watch dog of transport command		
	Others	Power Supply Panel error		(1) Check and confirm the error cause (2) Confirm the vehicle position is OK (3) Restart of the system
Medium Error	Vehicle	Time-over of Obstacle Detection sensor	(1) OHVC Continues Auto mode operation (2) Vehicle (error) Continue operation Error report to OHVC (3) Vehicles (normal) Continues normal operation	(1) Check and confirm the error cause (2-1) Recovery can be expected by operator assist 1) Recovery by operator such as removal of obstacles 2) Continues the process In case detect sensor : automatic restart (2-2) Recovery cannot be expected 1) Mode changed to PAUSING by OHVC operation 2) same with Heavy error recovery
	OHVC			

	OTHERS			

Table 5.2.1

Name	Device	Cause	Countermeasure	Recovery procedure
Light Error	Vehicle		(1) OHVC 1) Auto mode operation continues 2) Event is kept by OHVC (2) Vehicle (error) 1) continue normal operation 2) Error reported to OHVC (3) Vehicles (normal) Continues normal operation	(1) No assist necessary (2) In case of special failure special procedure might be done (such as Carrier status error, automatic transport to stocker)
	OHVC	- Transport request rejected - Host communication error		
	OTHERS			

Table 5.2.2

5.3 Recovery procedure in case of Heavy error of a vehicle

HOST/STC	OHVC	Vehicle	Operator action

Fig. 5.3 Error recovery procedure

6. Operation

The documents listed in Table 6.1 are operation manual of components.
Regarding the operation of the OHT system, refer to these documents.

Table 6.1 Related Documents

No	Name	Document Number	Rev.	Remarks
1	OHT Vehicle Operation Manual	KEN72-3699 (E)	0	
2	OHT Teaching Manual	KEN72-3644(E)	1	
3	Power Supply Operation Manual	YTE7-1002		
4	Operation Manual of OHVC	CRP6T3142-01E	A	
5	Remote Control Box Operation Manual	KEN72-3502(E)	1	
6				

Revision Note

#	Revision	Month/Day/Year	Contents	Author
#1	Rev.0	Sept. 3, 1999	The first edition(Preliminary)	Masanao Murata