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APPROVAL SPECIFICATIONS
FOR

(SRC – Electrical)

NOTED AND APPROVED

Name
Signature _____
Date

DATE **.**.**

MURATA MACHINERY, LTD.

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REV	DATE	DESCRIPTION			
			DOC.No.	[DOCUMENT NUMBER]	

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1. OUTLINE

1.1 General Construction

SRC system contains the main components for a standard intrabay AMHS designed to handle 300mm Wafer FOUPs. It provides the delivery of FOUPs from stocker to process tool or tool to tool with hoisting capability from the tool loadport.

SRC system comprises of the following:

SRC : Vehicle to transfer FOUPs
SRCC : SRC Controller
SCPS : Super Clean Power Supply

1.2 FCC Warning

This equipment includes the wireless communication unit inside. It is metal cased and located at the top area inside of this equipment. Three antennas are connected to it.

FCC WARNING

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

CAUTION

To keep proper efficiency, never use the parts such as wire harness which are not assembled originally.

To keep the frequency accuracy, avoid the mechanical shock.

NOTICE

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

This device is professionally installed and thus meets the antenna requirement of FCC 15.203.

2. General Specifications

2.1. Ambient Conditions

Designed shall be made under the following conditions:

☐ Atmosphere ☒ Special atmosphere (Clean room)

(1) Temperature : 0°C ~ 30°C

(2) Humidity : 30 ~ 80%RH

(Provided, without condensation)

(3) Illumination (color) : White or Yellow

2.2. Your Electric Specifications

☐ Absent Present ☒

2.3. Your Supplies

☐ Absent Present ☒

2.4. Drawing to be Submitted upon Completion

(1) Circuit development connection drawing

(2) Electric component list

(3) Panel surface device layout

(4) In-panel device layout

(5) Panel appearance drawing

(6) Wiring diagram

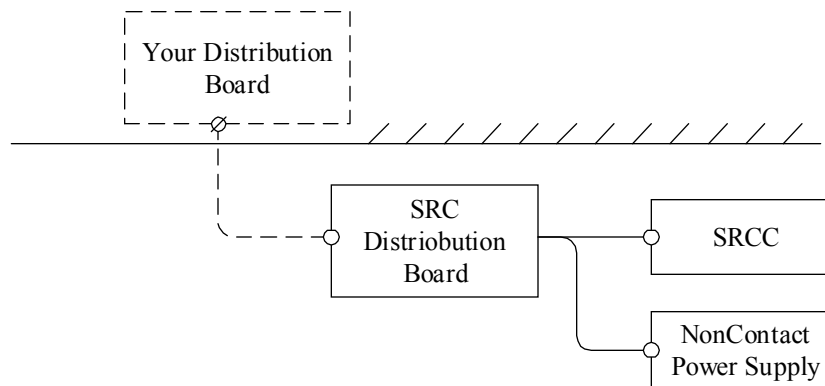
(7) Operation manual

2.5. Paint Color

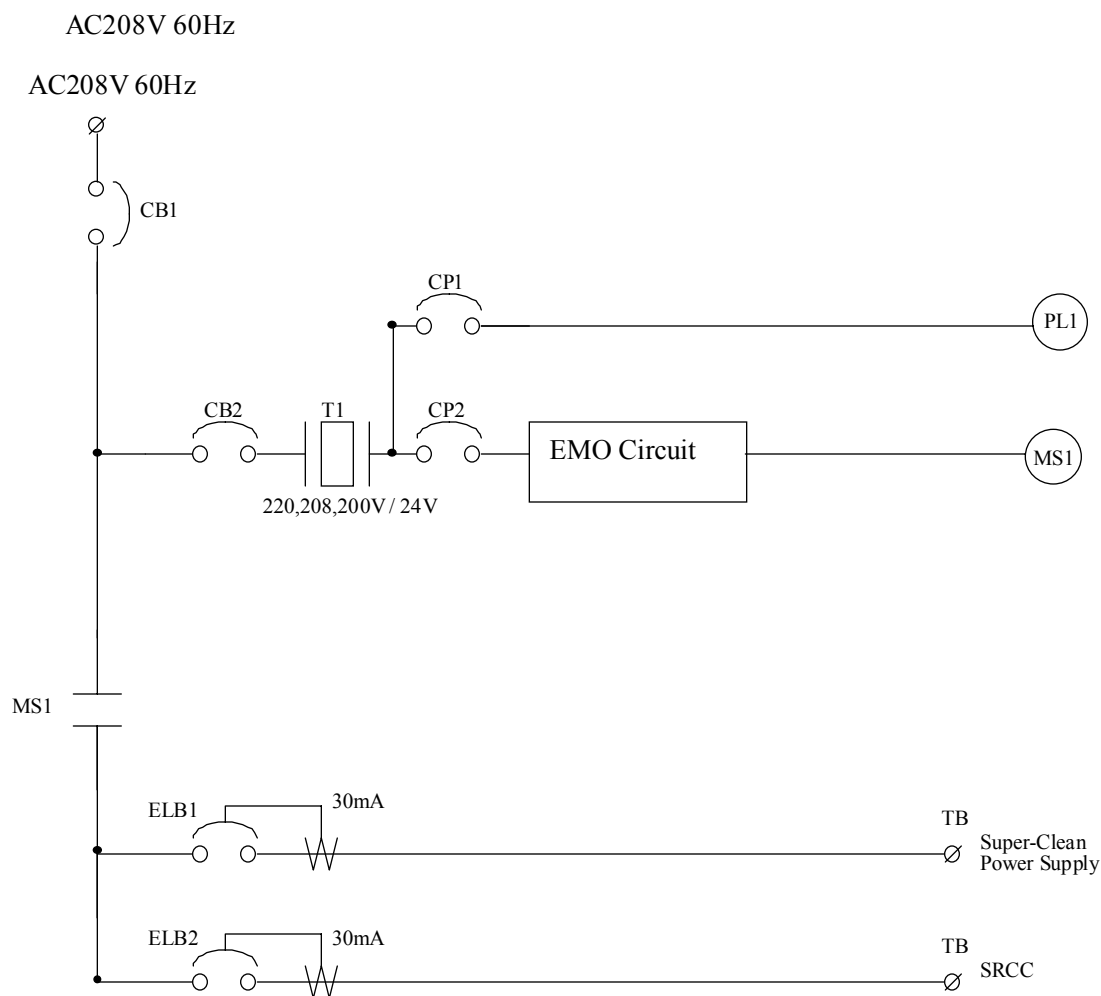
Painting shall be in accordance with painting confirmation specifications submitted by our SE department.

3. Electric Specifications

3.1. Diagram of Power Source



3.2. Single-line Diagram of SRC Distribution Board



- CB1 : Circuit Breaker
- ELB : Earth Leakage circuit Breaker
- CP : Circuit Protector
- T1 : Transformer
- CR1 : Current Relay
- MS1 : Electromagnetic Switch
- TB : Terminal Block

3.3. Supply Power Source

Supply power source under the following conditions even at the start:

Utilization	Phase	Voltage	Frequency	Capacity	Rated current (Peak)	Main Panel Breaker	Number of lines	Remark
SRC Distribution Board (SRCDB)	3	208V ± 5%	60Hz ± 1%	13KVA	26A (36A)	50A	1 per unit	
SRC Distribution Board (SRCDB)	Class 3 level protective grounding cable						1 per unit	

Please note that the above power supply is only for SRC.

Power supply to system is described in separate specifications.

3.4. Construction Division

Construction contents	Your construction	Our construction	Remark
SRC distribution board primary side wiring and grounding			
SRC distribution board after secondary side wiring			

3.5. Name Plate

(1) Panel surface name plate

Applicable name plate		Material	Paint color		Letter inscription	Remark
			Background color	Letter color		
General	Description name plate	Acrylic resin	Black	White	Inscription on back side	
	Device name plate					
	Indication name plate					
Solid name plate		Chlorinated vinyl laminated seal	Black	White	Printed	

(2) Internal and external device name plate

Internal : Letter corresponding to letter in development connection drawing is entered on seal.

External : Letter corresponding to letter in development connection drawing is entered on chlorinated vinyl laminated seal.(hand written)

Or, aluminum foil seal is stamped or printed in the case of small detector.

3.6. Internal Wiring of Panel

		Power circuit				Operation circuit Control circuit		Grounding circuit
Line type		UL1015				UL1015, UL1007		UL1015
Line size		2 or more				0.3 or more		2 or more
Line color		Black				AC	DC	Green,
						Red	Blue	Green/Yellow
Terminal processing	Insulation cap color	L1 (R)	L2 (S)	L3 (T)	DC	-----	-----	
		Red	Black	Blue	Black			
	Crimped terminal	Round type				Y-shape	Round type	
	Line number indication	Baked letters on white marking tube						
Wiring		Contained in chlorinated vinyl duct, partially bundled						

3.7. Exterior Wiring of Panel

		Power circuit	Operation circuit Control circuit	Grounding circuit	Electronics circuit	
Line type		UL STO	UL2464,VCT(-F)	UL STO, UL1015	Computer Cable UL2547	
Line size		AWG12 or more	AWG22 or more	AWG18 or more	AWG26 or more	
Line color		Cable according to standard core wire color				
Terminal	Crimped terminal	Round type	Y-shape	Round type	Y-shape	Connector
	Line number indication	Baked letters on white marking tube				None

NOTE1 : Cable attached to device or special cable does not conform to the above table.

NOTE2 : Connector number name plate is attached to connector case and so on.

3.8. Electric Work Method

Electric work method is properly selected from the following method:

Work method Applicable portion	Cable construction				Thin copper electric wire tube PLICA		Tro-reel	Remark
	Wiring pit	Cable rack	Metal duct	Body direct	Tube construction	Expose buried		
SRC vehicle body wiring work		○						
SRC track grounding work		○		○				
Inter panel wiring work		○						

3.9. Main Manufacturers of Electric Devices

Standard parts list

Name	Manufacturer	Type
Motor	Pittman	5200 series
	Olympus	BA524 series
Driver	Advanced	B30A8
Photo switch	Sunx, and so on	EX,PM,PX series
Limit switch	Omron	SS series
	Matsushita	AVT series
Circuit protector	Fuji	CP series
Circuit breaker	Fuji	BU-ESB series
Transformer	Nunome	
DC power supply	JT Electronics	ITM series
	Cosel	P series
Electromagnetic switch	Fuji	SZ series
Indication lamp	Izumi, and so on	
Operation switch	Izumi, and so on	
Relay	Omron	MY,LY series

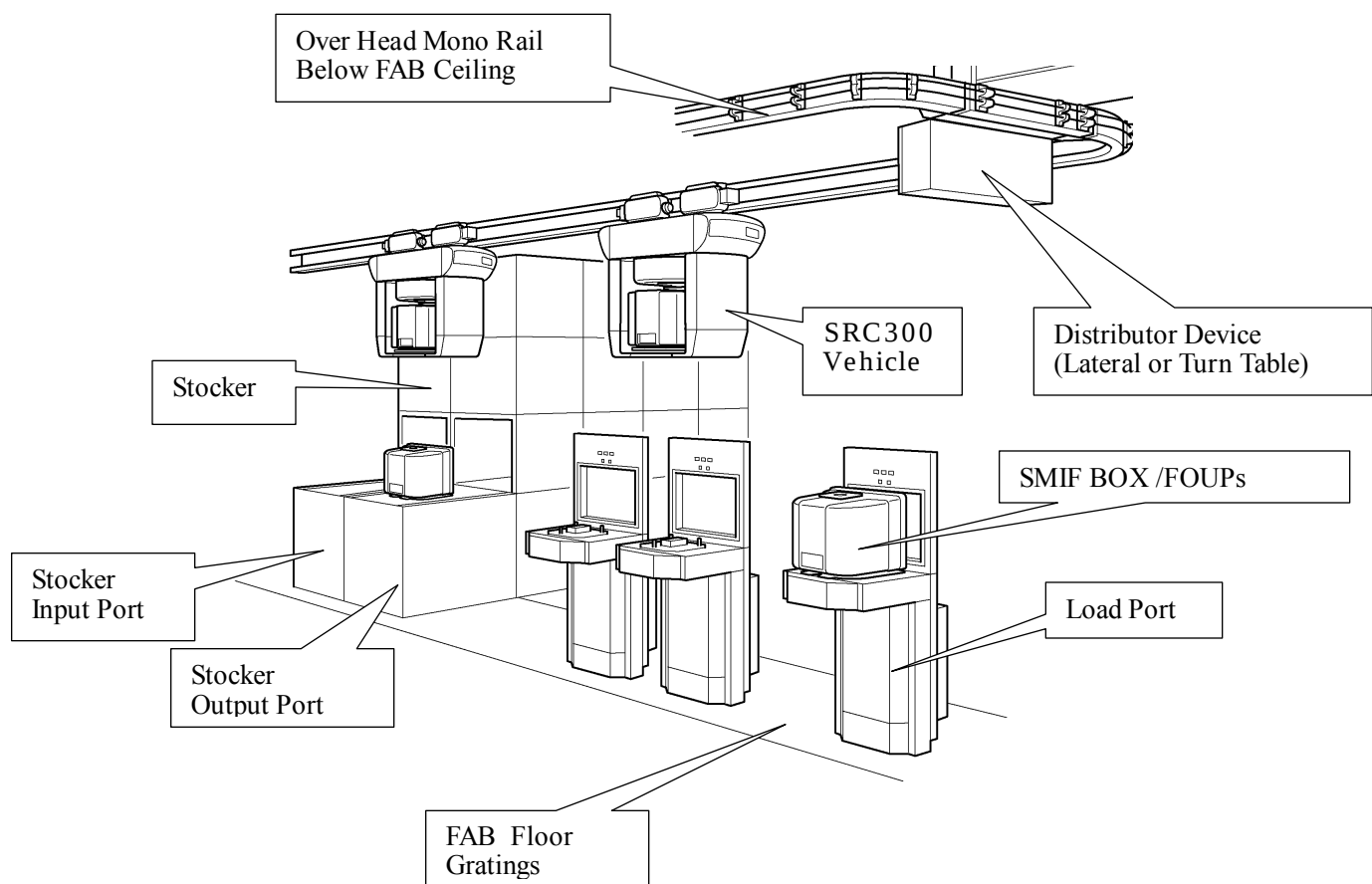
4. Control Specifications

4.1. Overview

SRC System is an Automatic Overhead Transportation System. This is developed complying SEMI standards for automatic transportation and handling of 300mm Wafer FOUPs.

The system consists of mainly Monorail path for travel, Vehicle(s) (SRC300), Turn / Lateral Table as the case may be and SRC300 vehicle directly transfers FOUP(s) between stocker to equipment or equipment to equipment or as required, under a Computer Configured Host system.

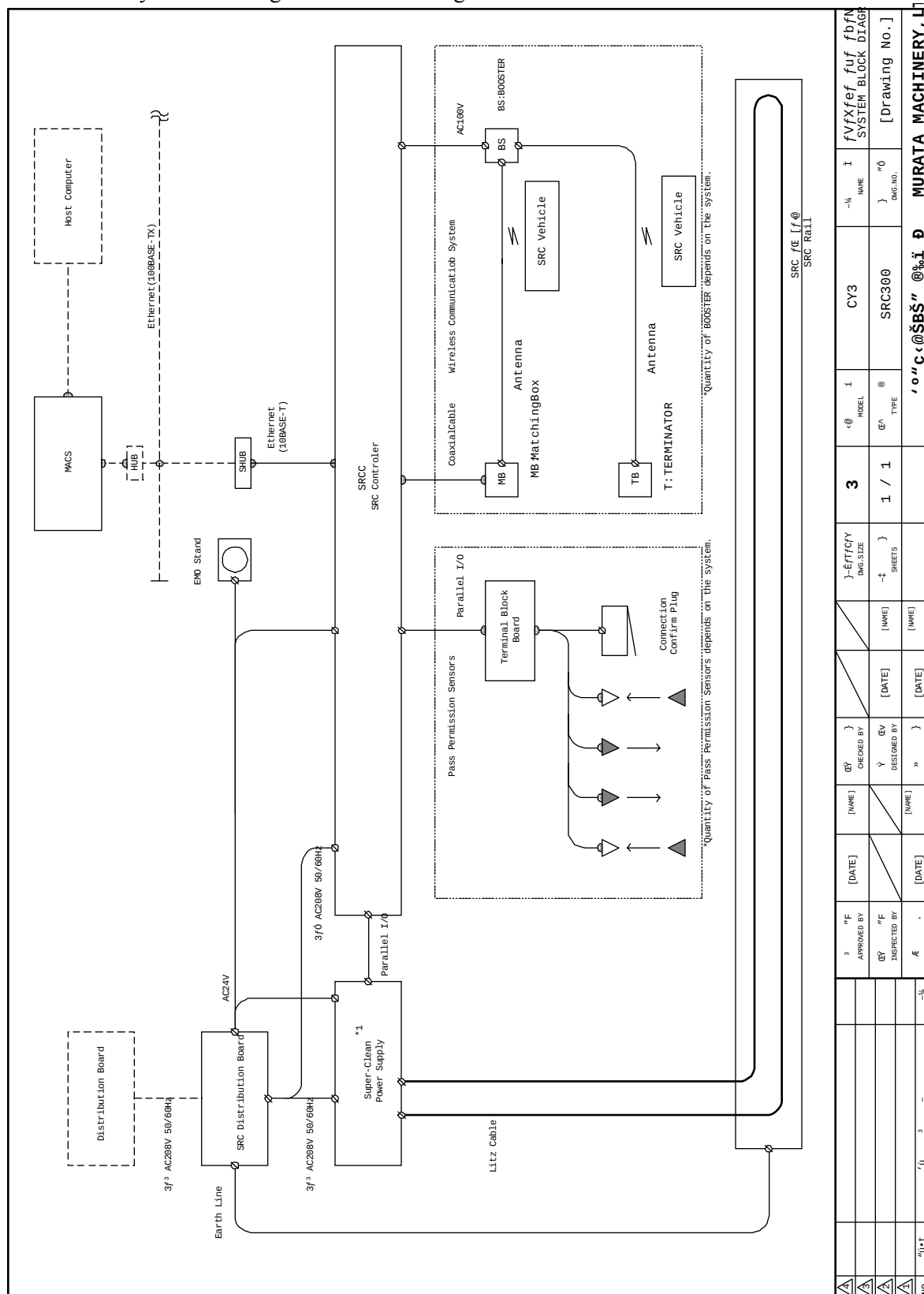
<Typical Sample>



* The system configuration decides if Turn/Lateral Table is equipped.

4.1.1. System Configuration:

SRC System is configured with following basic devices shown below:

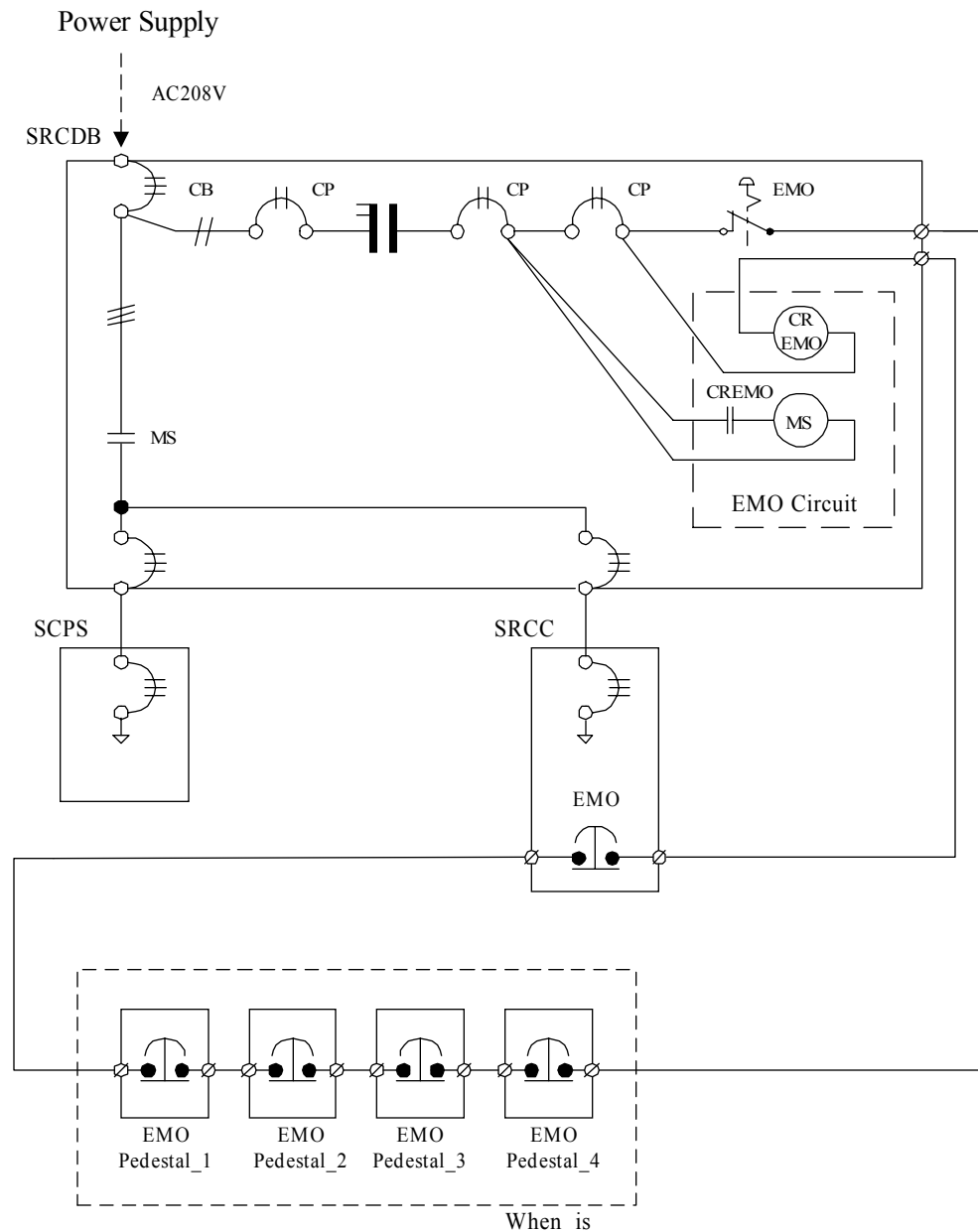


(1)Main Component List

	Item	Q'ty	Unit	Remark
1	SRCC	1	pcs	
2	SRC Distribution Board (SRCDB)	1	pcs	
3	Super Clean Power Supply (SCPS)	1	pcs	
4	EMO Pedestal	3 ?	pcs	
5	Feeder Comm Unit	1	set	
6	Vehicle	2	pcs	IR pendant 2pcs

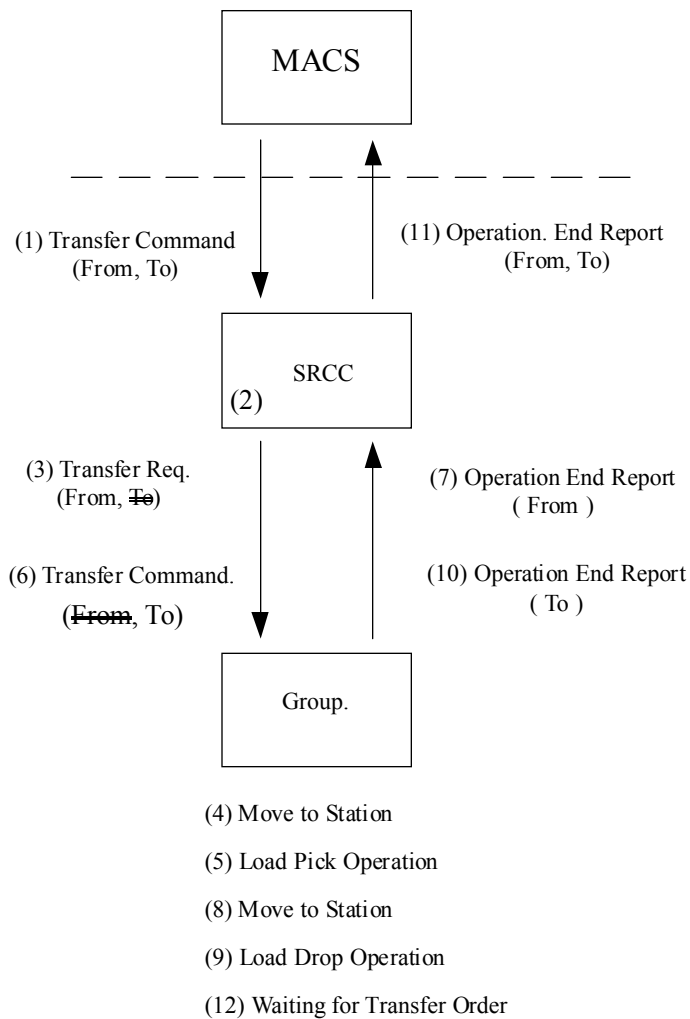
4.1.2. EMO Circuit:

SRC System has EMO switches on each control panel/ box and also EMO switches on each Pedestal spanned uniformly under the SRC rail /track/loop.



4.2. System Controls

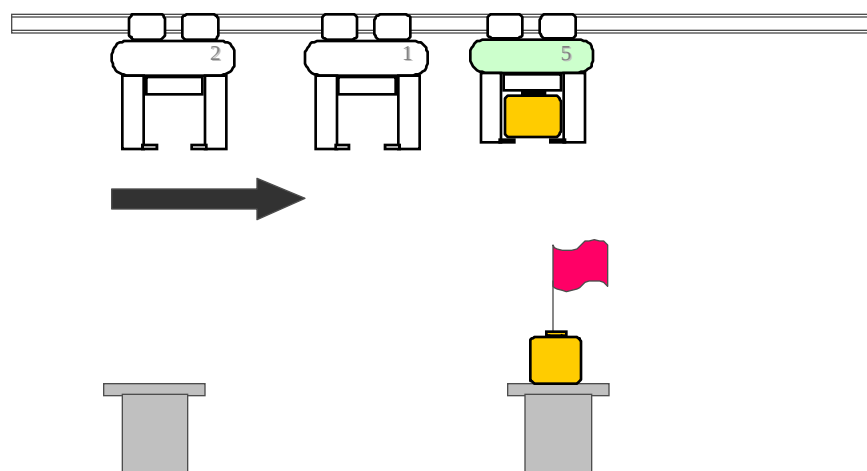
4.2.1. System Layers



4.2.2. Out Line of System Command Flow

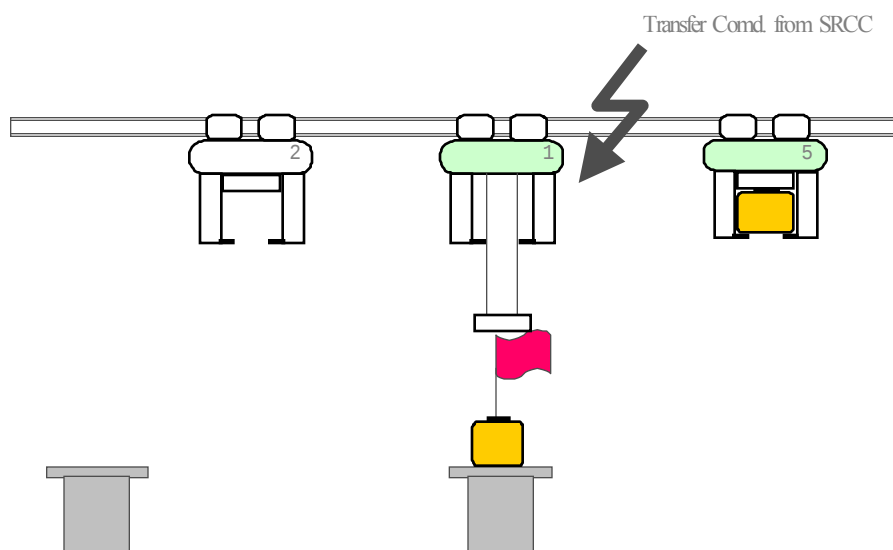
- (1) Transfer Command is issued / sent from MACS to SRCC
- (2) SRCC splits the transfer Command received from MACS to: Transfer Request & Operation Command.
- (3) SRCC broadcasts 'From' station command to SRC Group.
- (4) SRC(s) travel towards load fetch station requesting for a load transfer.
- (5) SRC which reaches first will execute Load/FOUP Pick Operation under E84 interlock condition.
- (6) SRCC sends a destination command to the SRC which is executing a Pick Operation.
- (7) As soon as Pick operation of FOUP is completed, SRC sends a ' From/Fetch Operation Complete' Report to SRCC.
- (8) SRC travels to the next destination stations for FOUP/Load delivery or place operation.
- (9) SRC performs the Load place operation under E84 interlock condition.
- (10) SRC sends a 'To /Destination Operation Complete' to SRCC.
- (11) SRCC sends Acknowledgment to SRC(s) about 'Transfer Operation Complete'
- (12) SRC(s) waits for next Transfer Command at system desired logical station(s).

Series of Transfer Sequence (1)
 < Operation to Acquire Order due to Transfer Request >



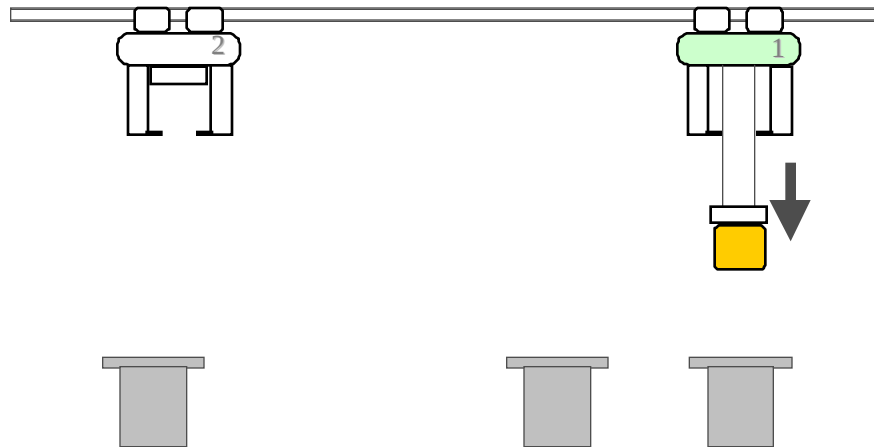
SRC which is Free and not under SRCC Allocation Control will execute the Order Acquisition from a Station requesting a transport operation.

Series of Transfer Sequence (2)
 < Acquisition of Order >



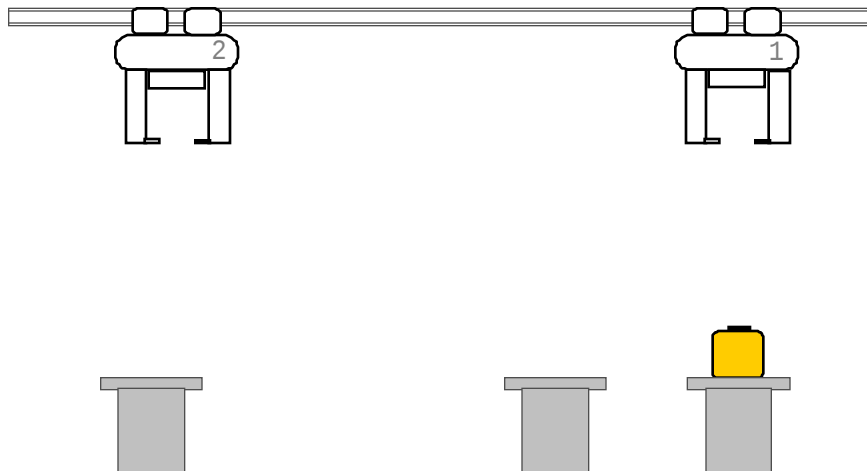
SRC which has acquired the order (vehicle executing Picking Operation) gets destination allocation command (To-Destination) from SRCC during Picking & supervised under SRCC allocation Control until transfer operation is completed.

Series of Transfer Sequence (3)
< Execution of transfer Command >



SRC executes transfer command (Delivery/Drop)
operation under SRCC allocation Control.

Series of Transfer Sequence (4)
< FREE from SRCC >



SRC vehicle which completes the delivery operation and receives
operation complete acknowledgment is Free from SRCC Command.

4.2.3. SRC Vehicle Characteristics

(1) Based on vehicle resident layout information, vehicles travel independently in layout per order.

- As SRC houses the layout MAP with details required for executing the transfer commands, it is capable of executing required tasks autonomously when a transfer request is generated and without being minutely commanded or supervised by its superior level computer controller.

(2) SRC Vehicles perform following autonomous operations.

- Transfer Request Acquisition Operation

On Receiving Transfer Request (From) command from SRCC, vehicle performs autonomous operations like [Travel to source position + Pick Load activating Hoist functions (based on Load port Orientation & Hoist distance etc)].

- Automatic Push Control Function that enables Idle or Free or Empty SRCs to release rail track for a busy allocated vehicle to execute transfer command.

To prevent Idle/Free vehicles obstructing or occupying the path, free vehicle make necessary moves autonomously by releasing path/track(s) for busy vehicles based on imbedded layout map of the system.

- Cycle Stop Operation is executed.

Vehicles automatically switch status to ‘Waiting or Free’ in-anticipation and to respond to next transfer command and to execute order acquisition task.

4.2.4. Transfer Request

Meaning of Transfer request can be interpreted as where (at which station) , what kind of Job with what level of priority.

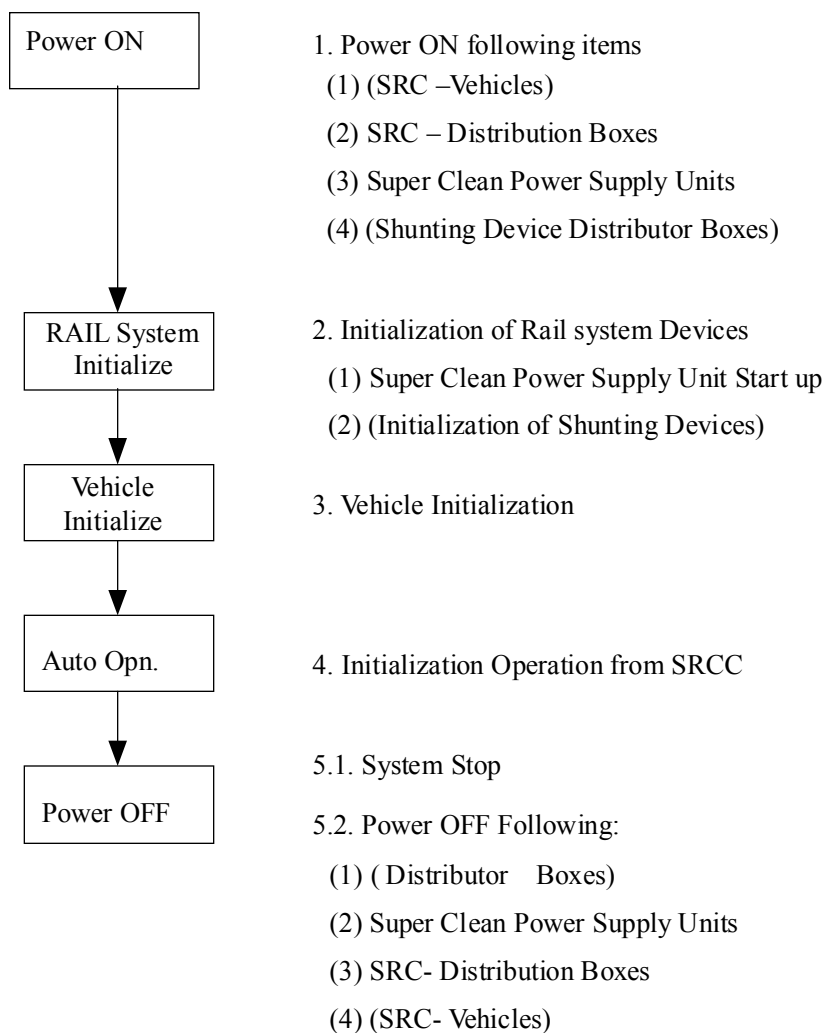
Priority of Transfer Request has Three levels: [HOT or Top Priority or Emergency], [Time-Bound, Urgent or Quick],[Normal/ FIFO] and periodically, SRCC sends the updated priority status to SRC Vehicles. Further, as soon as a given vehicle commences the Pick Operation at a particular station, then no more transfer request command could be issued for that station.

4.2.5. Cycle Stop Operation

When all the transfer request commands are executed and no vehicle is being under the execution of push operation to free the track for busy vehicle(s). All vehicles are at rest in normal status anticipating new order acquisition, then SRCC vehicles switch to “ Cycle Stop” Status. Further, based on the resident layout map information, during cycle stop operation, SRC vehicles travel autonomously before rest to a nearest station predicting the most likely station that would generate next transfer request .

4.3. System Operation

4.2.6. Outline of Operation



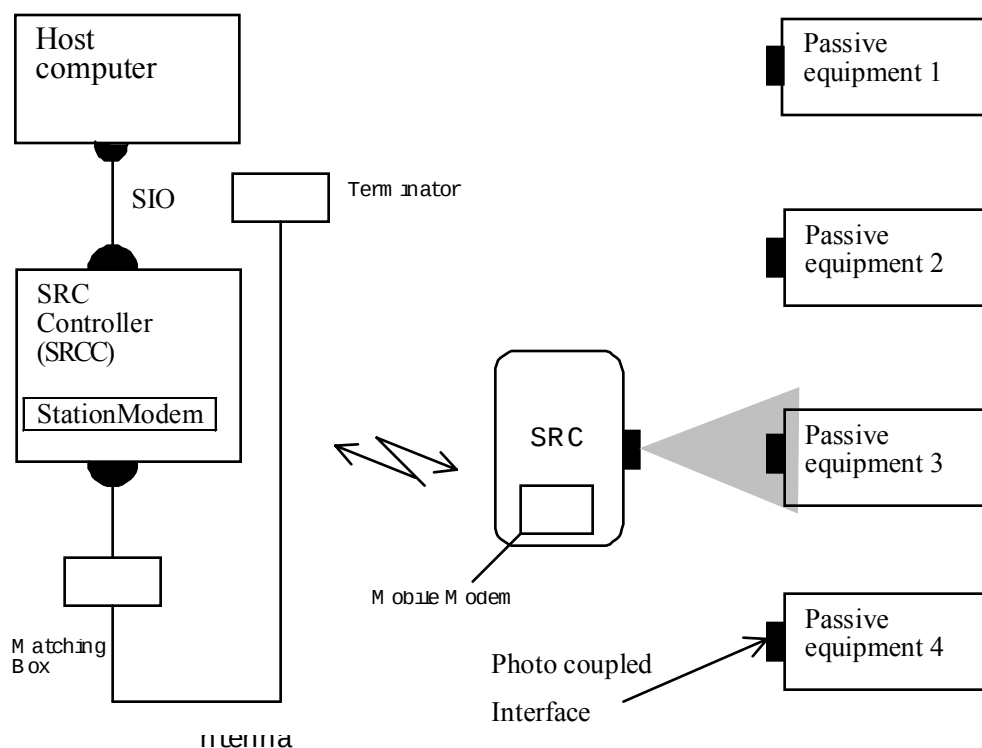
(For Manual Operation & Error Recovery Procedures
Please Refer to Operation Manual)

5. Interlock Signal Between the SRC And the Passive Equipment

5.1. Purpose

This document describes the condition of the wafer on the passive equipment needed for the safe transport of the automated carrier (SRC), the interlock signals needed for handoff, the status signal of the device, and the electrical specifications for other related signals using photo coupled interface.

5.2. Configuration and Connection



The photo coupled interface device is an optical data transmitter of manufactured by Hokuyo Denki.

Type DM-HB1 (Side On Type)
 And DM-GB1 (Pendant type)

Mode The optical data transmitter is equipped with modes. Put the passive equipment in Receive Mode when using.

Refer to the manufacturers catalog for details.

5.3. Photocoupler Parallel I/O Interface signal

Signal name	SRC / Process device	Description
VALID	SRC → Passive equipment	Indicates that the interface communication is valid. ON: Communication is valid. OFF: Communication is not valid. Before this signal is turned ON, the load port must be specified by the signal CS_0 and/or CS_1.
CS_0	SRC → Passive equipment	Specify the left load port for the handoff. ON: Use left load port. OFF: Do not use left load port. This signal specifies the load port for continuous handoff or simultaneous handoff. This signal must be ON when the PI/O interface is dedicated only to a load port.
CS_1	SRC → Passive equipment	Specify the right load port for the handoff. ON: Use right load port. OFF: Do not use right load port. This signal specifies the load port for continuous handoff and simultaneous handoff. This signal must be ON when the PI/O interface is dedicated only for one load port.
TR_REQ	SRC → Passive equipment	Indicates handoff request from the SRC to the Passive equipment. ON: Handoff request from the SRC. OFF: No handoff request from the SRC. This signal is turned OFF when the BUSY signal transition to Off.
L_REQ	Passive equipment → SRC	Indicates that load port is assigned to load a carrier. ON: Carrier is in loaded condition. OFF: Carrier is not in loaded condition. This signal is turned ON when the load port is specified by CS_0 and/or CS_1 and the VALID signal is turned ON. This signal is turned OFF when the load port detects the carrier in the correct position. In simultaneous handoff, the carrier on both load ports shall not be present when this signal is turned ON, and the carriers shall be present in correct position on both load ports when this signal is turned OFF.
U_REQ	Passive equipment → SRC	Indicates that load port is assigned to unload a carrier. ON: Carrier is in unloaded condition. OFF: Carrier is not in unloaded condition. This signal is turned ON when the load port is specified by CS_0 and/or CS_1, and the VALID signal is turned ON. This signal is turned OFF when the carrier on the load port is removed. In simultaneous handoff, the carrier on both load ports shall be present in correct position when this signal is turned ON, and the carriers shall not be present on both load ports when this signal is turned OFF.

READY	Passive equipment → SRC	Indicates that the passive equipment has received a transport request from the SRC. ON: Handoff operation can be done. OFF: Handoff operation cannot be done. This signal will be ON when the passive equipment receives a transport request, and will be OFF when the COMPT signal is put OFF.
BUSY	SRC → Passive equipment	Indicates the passive equipment has accepted the transfer request from the SRC. ON: The handoff is in progress. OFF: No handoff is in progress. This signal is turned ON when the SRC starts handoff operation. READY must be ON when BUSY is turned ON. It must be turned OFF after the SRC has completed the handoff and the SRC resource position is outside the handoff conflict area. The passive equipment must not perform any mechanical action in the handoff conflict area while this signal is ON. The SRC turns the BUSY OFF after confirming the L_REQ or U_REQ OFF.
COMPT	SRC → Passive equipment	Indicates the SRC has completed the handoff operation. ON: The handoff is completed. OFF: The handoff is not completed. This signal is turned ON when the SRC has completed the handoff (BUSY OFF), and it is turned OFF after the passive equipment has completed the handoff operation (READY OFF).
CONT	SRC → Passive equipment	Specifies the handoff is continuous handoff. ON: Continuous handoff. OFF: Not continuous handoff. This signal is turned ON by BUSY ON for the first carrier handoff, and it is turned OFF by BUSY ON for the last carrier handoff operation. If the passive equipment has the mechanism which interferes the handoff (such as a shutter door), the mechanism must be maintained not interfered (the door must be open) while the continuous handoff.
HO_AVB L	Passive equipment → SRC	Indicates the passive equipment is not available for the handoff operation. It may also indicate error in the passive equipment. ON: Handoff is available. OFF: Handoff is unavailable with any error This signal is ON while the passive equipment's operation is normal. This signal is turned OFF by VALID ON or TR_REQ ON when the passive equipment detects some exceptions at the load port specified by CS_0 and/or CS_1. This signal might be kept OFF, when other load ports of the passive equipment detects exceptions. The exceptions include: -- Carrier detection not correct. -- The passive equipment has been changed to manual access mode --The passive equipment is in handoff unavailable state. This signal indicates the SRC, the state of the passive equipment before the start of handoff operation.

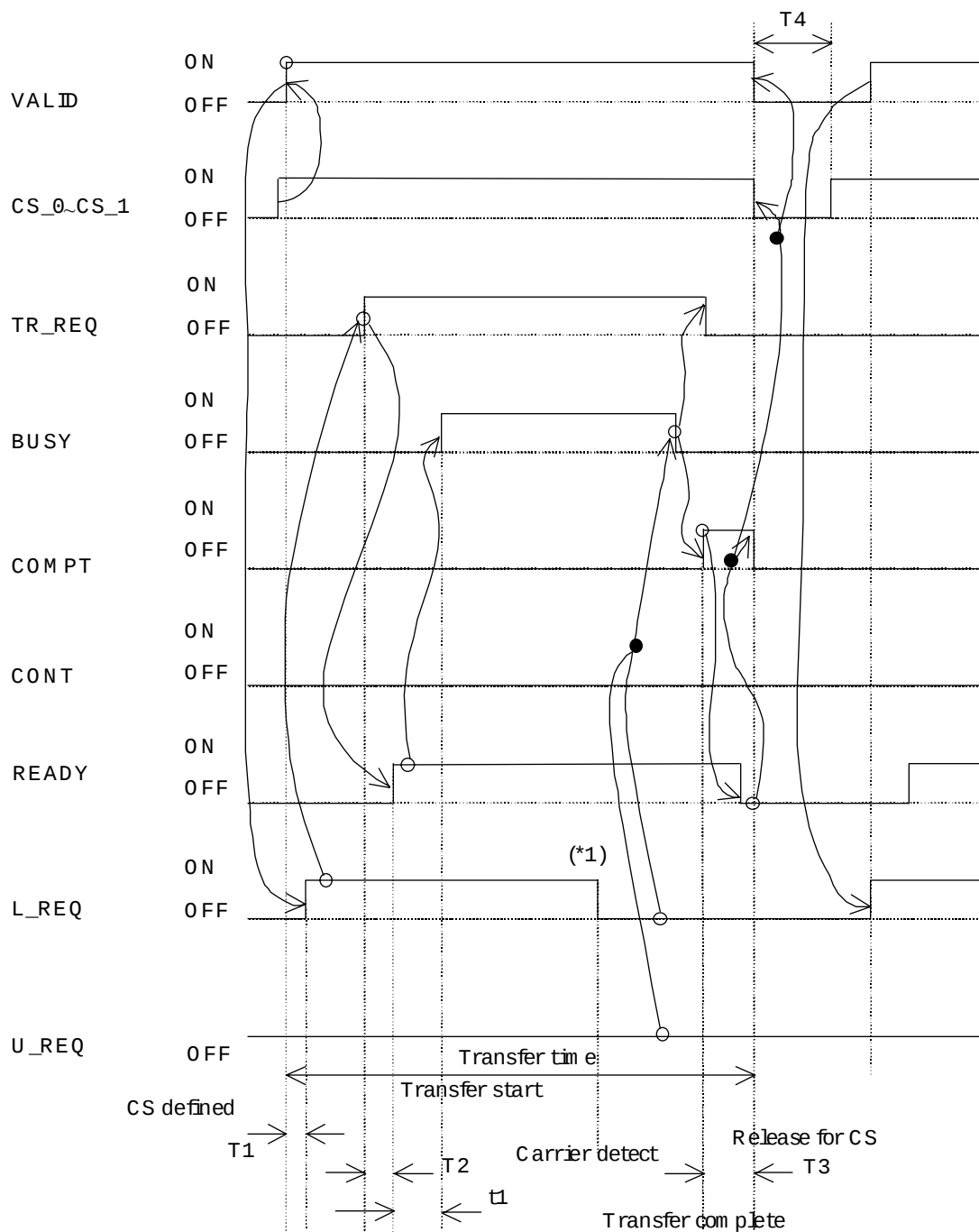
ES	Passive equipment → SRC	Request to stop active equipment activity immediately. ON: Normal operation OFF: Stop request Normally active equipment may monitor the ES signal from VALID ON to VALID OFF. This signal is turned OFF to stop the handoff operation immediately when a hazardous situation is detected by the passive equipment. Hazardous situations include possible harm to material, product, or operation. This signal is ON while the passive equipment's operation is normal. It turns OFF when the passive equipment needs to stop the activity of the SRC. The passive equipment may turn the ES signal off when the ES button is pressed or, a handoff interlock abnormal has occurred.
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5.4. Timing chart

Timing chart during Load/Unload

Signal timing during Load/Unload

During Loading (Carrier is delivered from the SRC → Passive equipment)



T1=10 sec.(Standard) T2=T3=120 sec.(Standard)

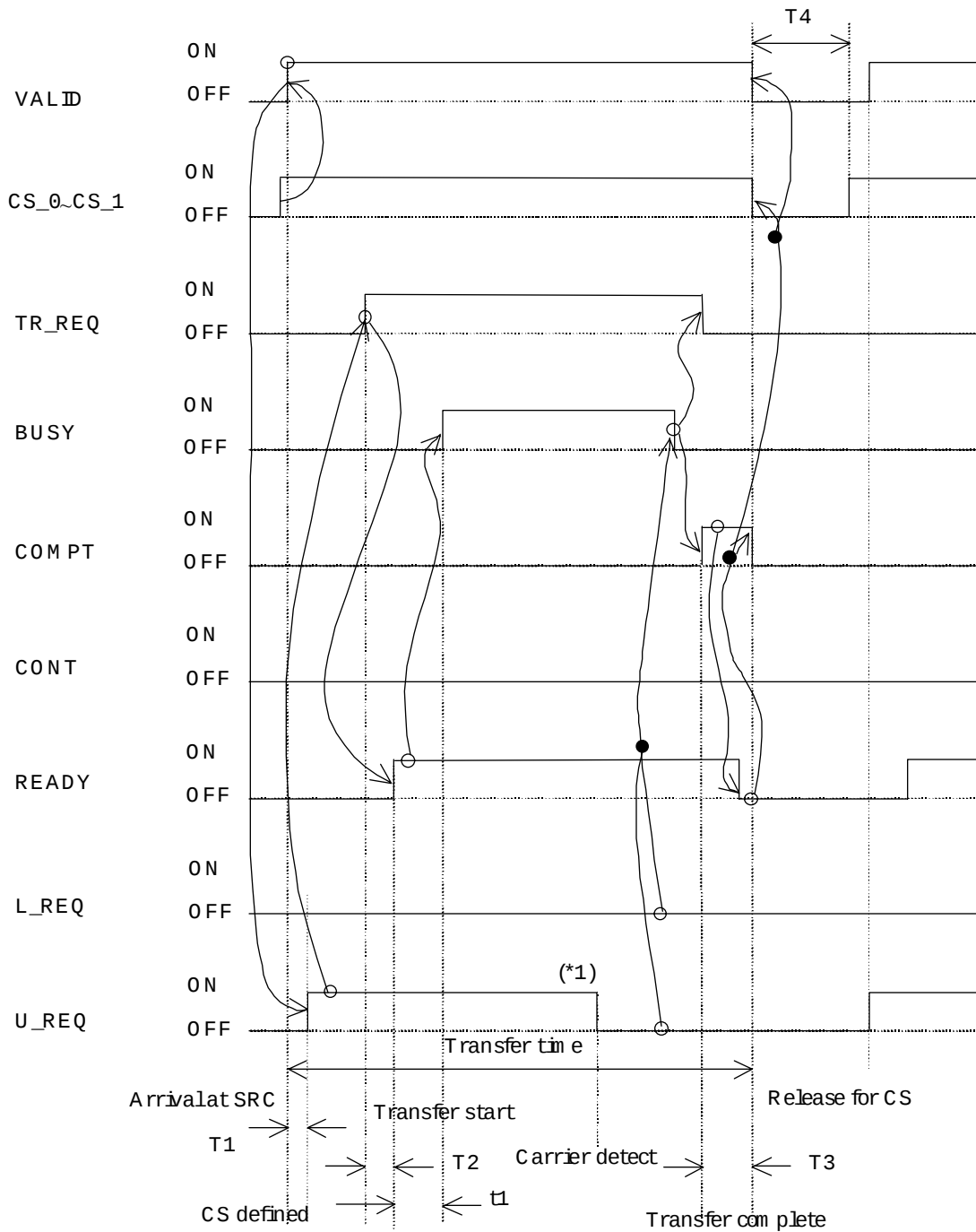
t1=10 sec.(Max.) T4=0.2 sec or more.(Standard) t=0.2 sec.(Standard)

(*1) Chattering may occur in the Carrier detection signal. Take care to see that no error is caused by the chattering.

(*2) The max. value of T1,T2,T3 is 999sec.

(*3) The SRC may change by the signal timing without any warning or handshake with the device, so do not monitor from the device.

During Unloading (The carrier is delivered from the passive equipment → SRC)



T1=10.sec.(Standard) T2=T3=120sec.(Standard)

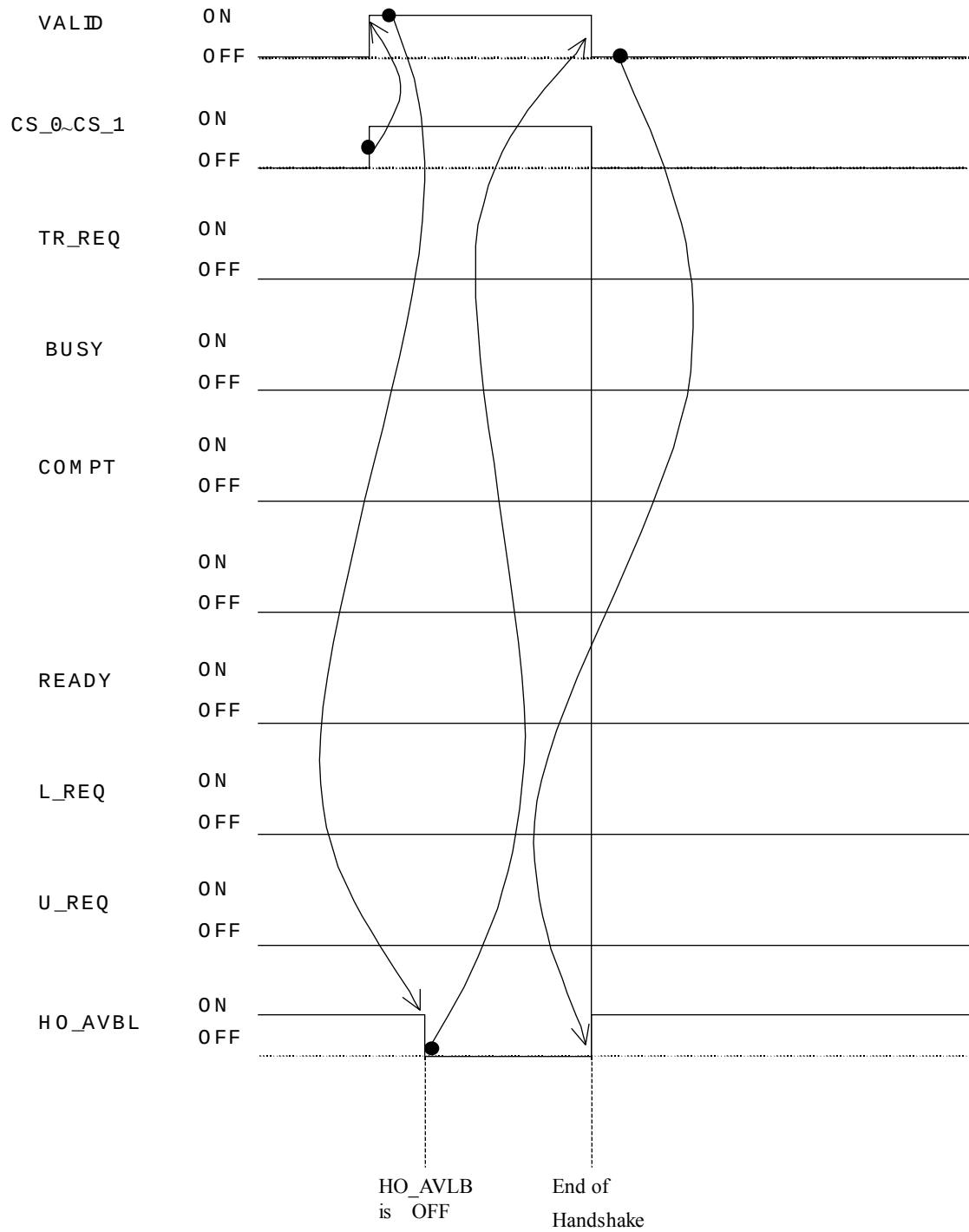
t1=10 sec.(Max. value) T4=0.2 sec or more.(Standard) t=0.2 sec.(Standard)

(*1) Chattering may occur in the Carrier detection signal. Take care to see that no error is caused by the chattering.

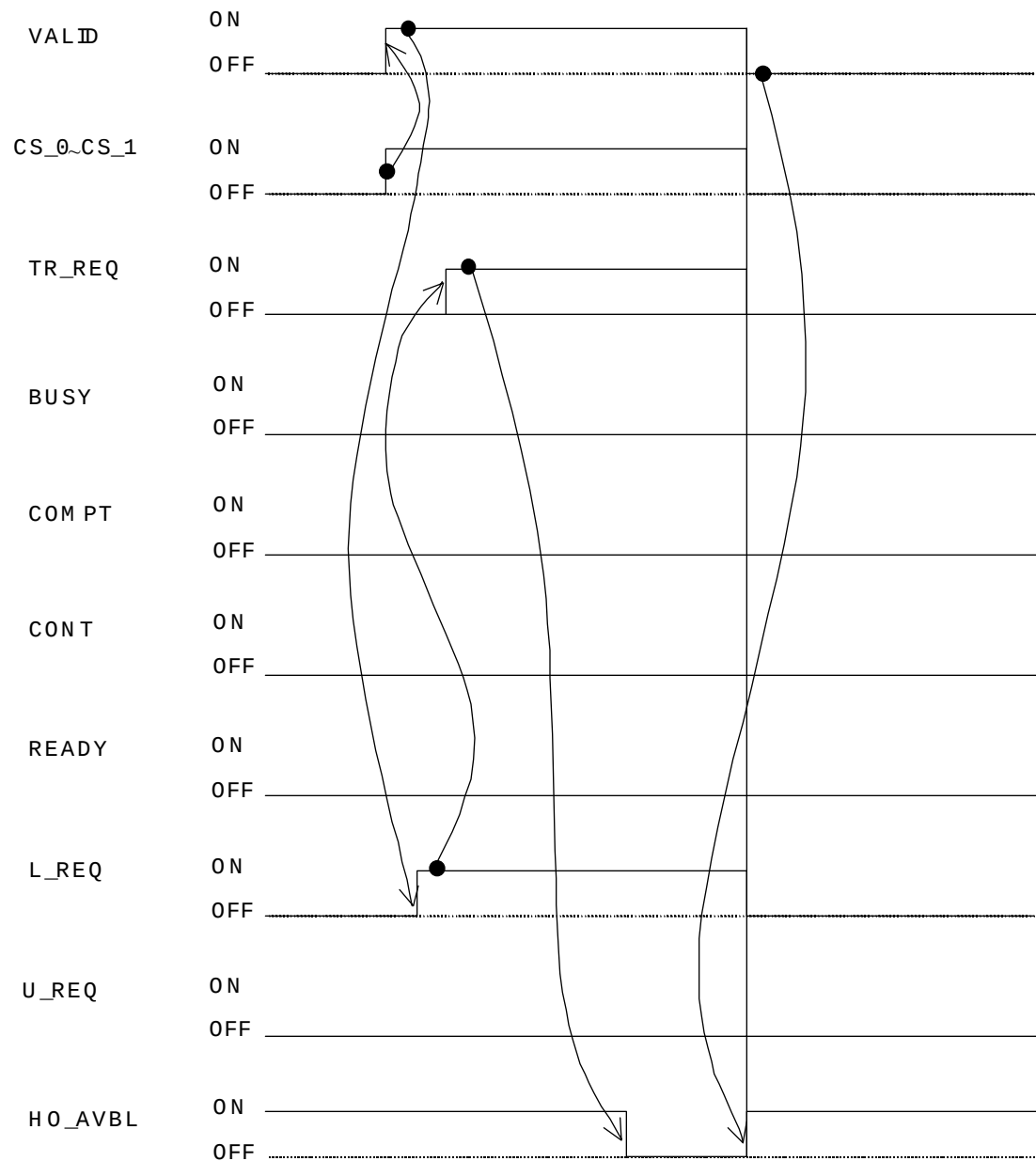
(*2) The max. value of T1,T2,T3 is 999sec.

(*3) The SRC may change by the signal timing without any warning or handshake with the device, so do not monitor from the device.

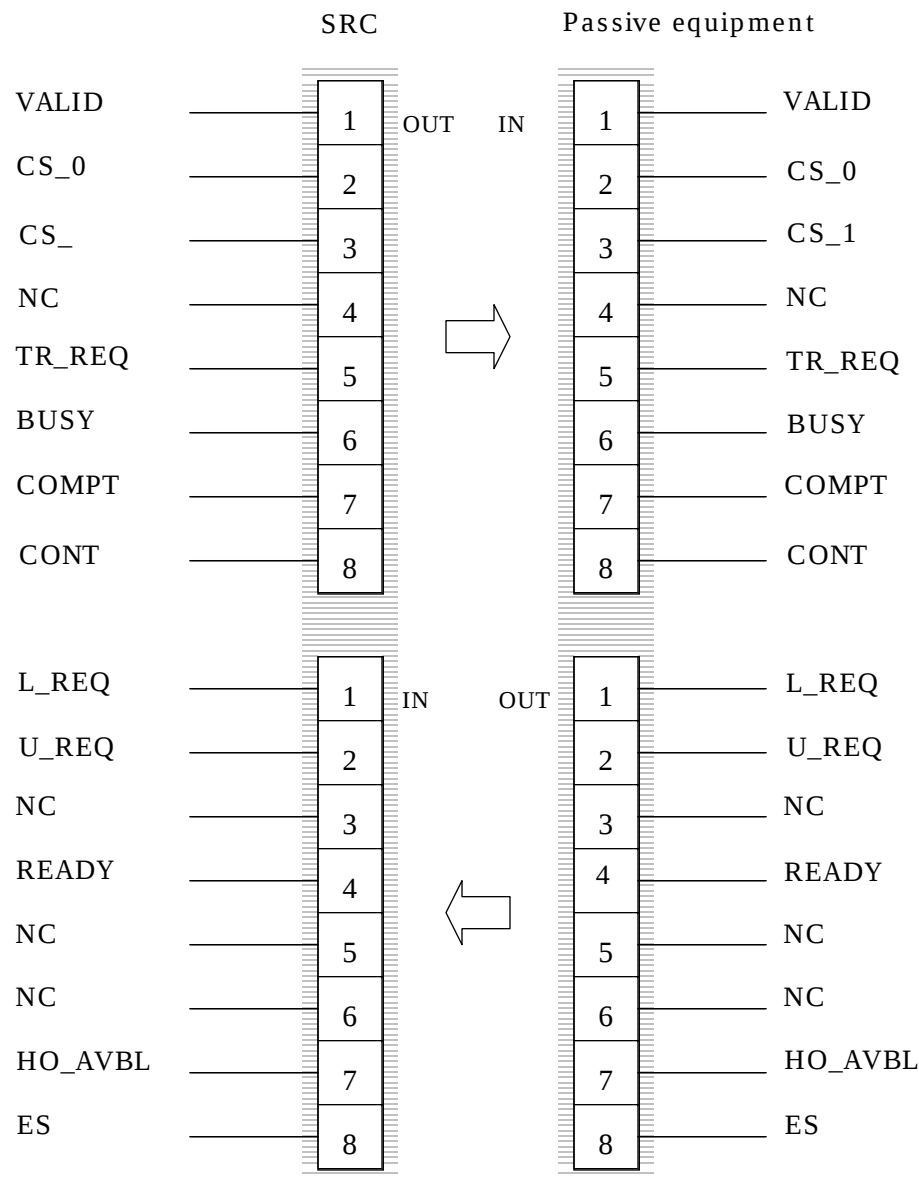
Eg1. Handoff Available Signal



Eg.2. Handoff Available Signal

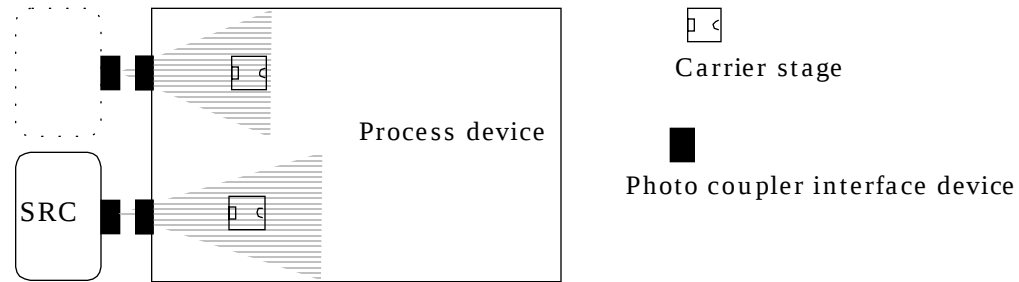


5.5. Photo couplerParallel I/O interface Bit arrangement of the photocoupler device.



*NC : Not Connected

5.6. Photo coupler interface device of the passive equipment corresponding to the SRC.



The installation position for the photo coupler interface device to the passive equipment is described in a separate drawing.

5.7. Carrier Stage No.(CSs)

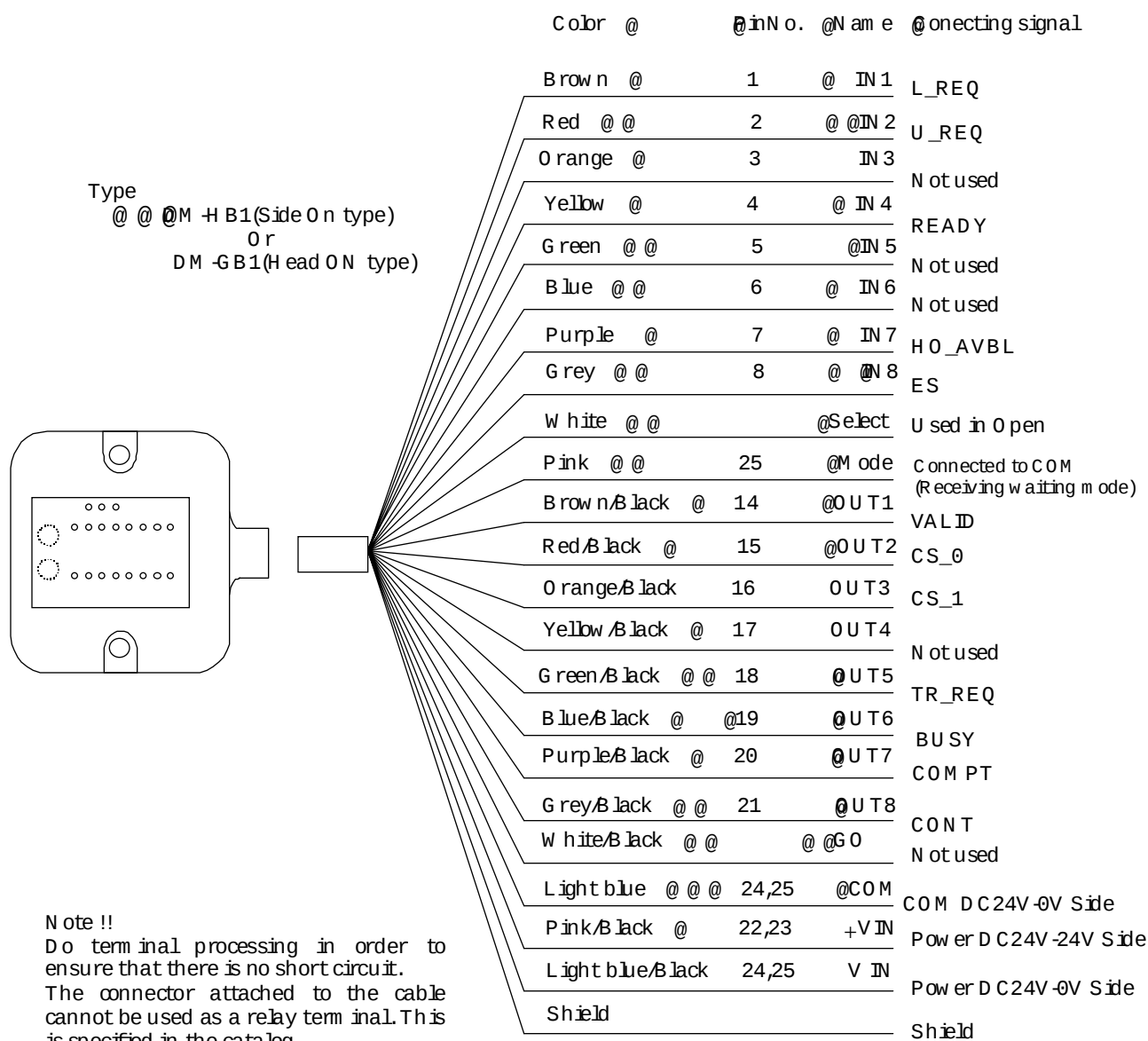
The carrier stage no. for the SRC is fixed at 1.

CS_0 ON

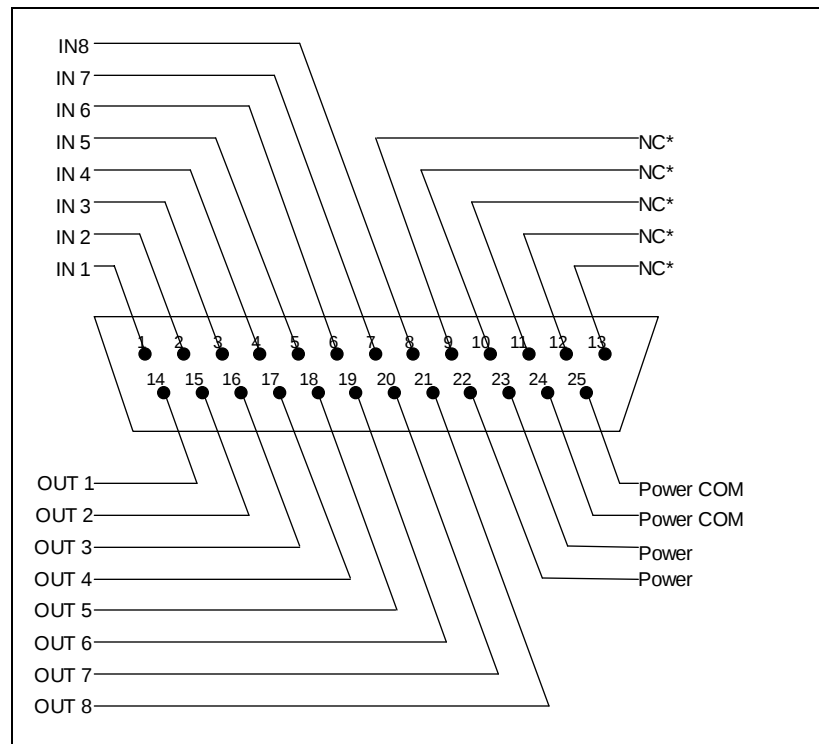
CS_1 OFF (Not Used)

5.8. Connection of the Photo coupler Interface device with the passive equipment.

The following cables are attached to the photo coupler interface device. Do the connection as shown in the below drawing.

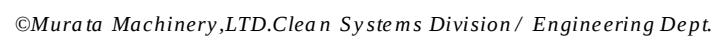


Pin Assignment for Connector of Passive Equipment side.



*NC = Not Connected

(E g.)H andoff (U nload)



5.10. Error detection by SRC

- (1) Monitors the time till the L_REQ/U_REQ comes On after the VALID signal is ON.
- (2) Monitors the time till the READY comes ON after the TR_REQ is ON.
- (3) Monitors the time (T3) from BUSSY OFF to READY OFF.
- (4) Monitors the READY ON till the BUSY signal is ON.
- (5) Puts the BUSY, TR_REQ OFF and the COMPT ON after checking that the L_REQ/U_REQ is OFF.
- (6) HO_AVBL starts the joining of the interlock and monitors till the READY signal is ON. When the HO_AVBL is off, there will be an error.
- (7) ES monitors from the time the VALID_ON till the VALID_OFF.
ES OFF will result in an emergency stop.

Interlock Error Number	Load Operation	Unload Operation
(1),(2),(6)	After Handshake is Stopped, SRC perform retry or travel etc. operation according to SRCC.	After Handshake is Stopped, SRC perform travel operation to transport request station.
(3),(4),(5),(7)	Error stop	Error stop

5.11. Recover in the event of an Interlock error

When the SRC detects an error, the Error display on the SRC will flash, and the error code will be displayed.

Operation status of the SRC on the occurrence of error.	Load at station	Recover procedure for equipment	SRC operation after recovery
Unloading operation	Yes	Press the forced completion SW	Travel operation will be performed without executing the sequence.
	No	No	Executes sequence from the Initial status. (Proceed by forced operation up to the step where an error occurs.
Loading operation	Yes	No	Executes sequence from the Initial status. (Proceed by forced operation upto the step where an error occurs.
	No	Press the forced completion SW	Travel operation will be performed without executing the sequence.

[Supplement]

When the carrier detects an error, the interlock output signal on the side of the carrier will become off.

When the passive equipment detects an error, the Interlock output signals on the side of the passive equipment will be off.

6. Appendix

- External appearance of Distribution Board.

OUTLINE DRAWING	CY0-CB004-10M
CIRCUIT DIAGRAM	CY0-CB004-10E
PARTS LAYOUT DRAWING	CY0-CB004-10D

- External appearance of SCPS

OUTLINE DRAWING	Y11-R0021-A01-00
CIRCUIT DIAGRAM	Y11-R0020-Q01-01