

# **AGV-EQP. I/F SPECIFICATION**

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**VER 1.0**



1 <sup>st</sup> Date : 20.09.09	<b>AGV-EQP. I/F Spec.</b>	Doc. No.:
Re-nual D: 20.09.09		Rev. : 1.0

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## Chapter 1. Common spec

### 1.1 Precondition

This document stipulates Transfer Interlock's act between Active and Passive.

### 1.2 Application

Specification in this document describes I/F's spec between AGV-EQP that responds to/correspondence with Carrier Transfer.

### 1.3 Từ ngữ chuyên môn

(1) Carrier

Between AGV – Port Up/Unloading Material (Tray, Box, etc.)

(2) EQP. Port

Mean the place that put Carrier above Equipment.

(3) Load

When AGV is Active and AGV moves Carrier from AGV and put it in EQP. Port.  
When AGV is Passive and EQP moves Carrier from EQP. Port and put it in AGV.

(4) Unload

When AGV is Active and AGV moves Carrier from EQP. Port and put it in AGV.  
When AGV is Passive and EQ moves Carrier from AGV and put it in EQP. Port.

(5) Return/Move (Transfer)

Generic name of Carrier's two-side directions Load, Unload.

(6) Active

The Equipment which has Transfer equipment (Robot Arm).

(7) Passive

The Equipment side which received Carrier from Transfer equipment (Robot Arm).

(8) EQP

Mean Loader/Unloader/ Stocker

(9) AGV

Equipment that move/transfer Carrier between EQP & EQP

(10) Combined optical Interface (Photo Coupled Interface)

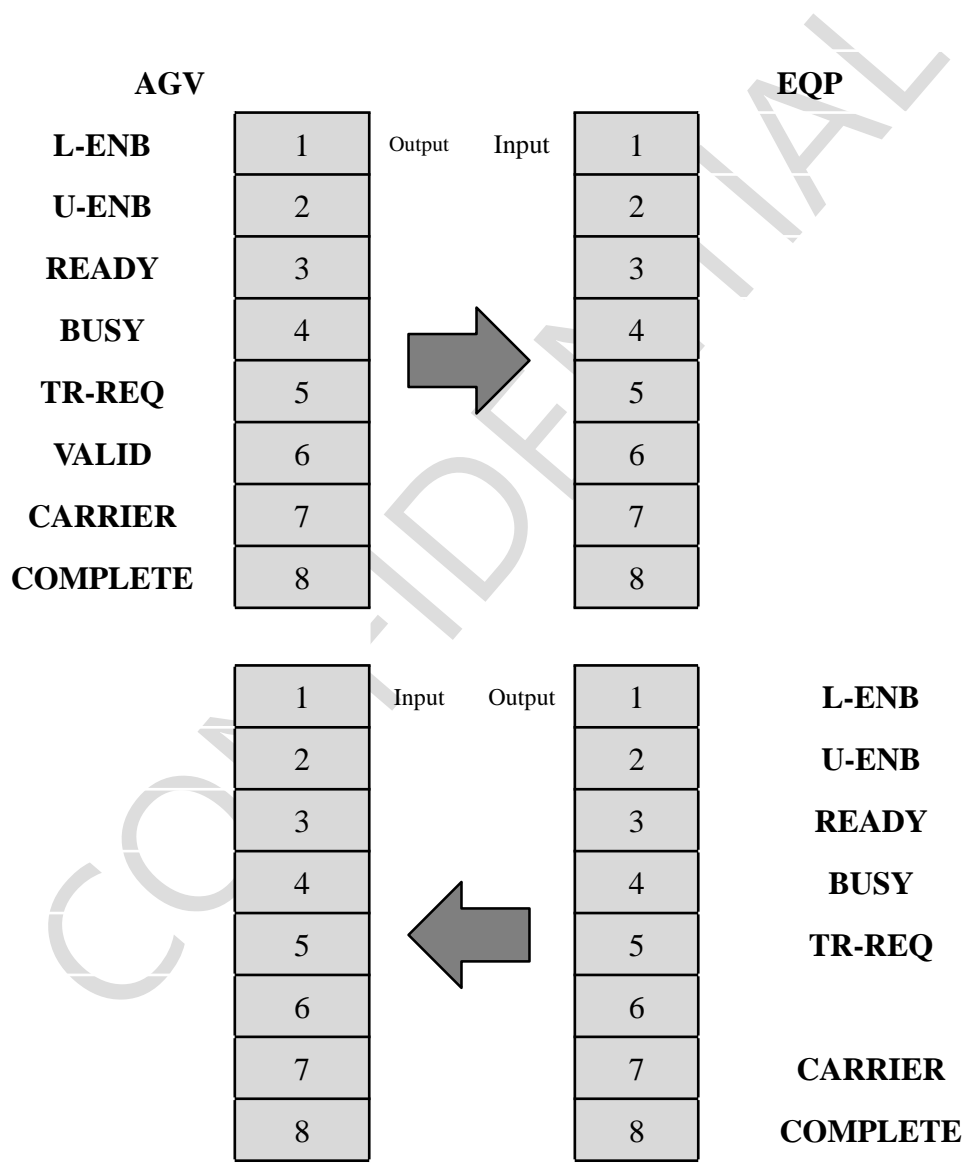
It is an Interface that sends/receives signals through non-contact spatial optical transmission between Parallel I/O inputs and outputs between two EQPs.

1.4 Placement of signal PIN

SEMI size/spec(E23-96) is not definite until DEVICE, but 8Bit Type is used for input & output.

- Device that using on AGV : Hokuyo
- Type that EQP side needed : Hokuyo

Placement of Optical I/O PIN : The signal between AGV and EQP is shown in picture 1-1.  
Refer & choose suitable Interface Sequence with each equipment Type base on the Pin Map below



Picture 1-1 Placement of signal between AGV and EQP

1.5 Signal definition

	Signal	Signal direction	Description
AGV	<b>VALID</b>	AGV→EQP	AGV arrive alarm
	<b>L-ENB</b>	AGV→EQP	On when there is no Carrier on AGV & it is able to Load Carrier. AGV turns off when Carrier is detected. Or, if the Complete signal is On, it doesn't matter to be Off.
	<b>U-ENB</b>	AGV→EQP	On when there is a Carrier on AGV and it is able to Unload Carrier. AGV turns Off when no Carrier is detected. Or, if the Complete signal is On, it doesn't matter to be Off. However, if the Busy signal is not On and the Carrier is lifted, it is turned Off as it is.
	<b>TR-REQ</b>	AGV→EQP	On when AGV requests to Transfer and Off with Busy signal.
	<b>READY</b>	AGV→EQP	On when TR-REQ comes out from Active and EQP is available to Transfer. Off after Complete signal and Handshake ended.
	<b>BUSY</b>	AGV→EQP	While EQP status is Ready, On when AGV starts Transfer, and Off after Transfer ended. When the signal is On, EQP is not allowed to act in Transfer area.
	<b>CARRIER</b>	AGV→EQP	To tell apart Carrier Case & be ON only when it is CF Case
	<b>COMPLETE</b>	AGV→EQP	Turns on when AGV's Arm completes Transfer. Even if Ready signal of EQP is not Off, it will be end as normal process
EQP	<b>L-ENB</b>	AGV←EQP	On when there is no Carrier in the EQP's Port and & it is able to Load Carrier. EQP turns Off when Carrier is detected. Or, if the Complete signal is On, it may be Off
	<b>U-ENB</b>	AGV←EQP	On when there is a Carrier on EQP and it is able to Unloaded Carrier. EQP turns Off when no Carrier is detected. Or, if the Complete signal is On, it may be Off. However, if the Busy signal is not On and the Carrier is lifted, it is turned Off as it is.
	<b>TR-REQ</b>	AGV←EQP	On when EQP requests to Transfer and Off with Busy signal.
	<b>READY</b>	AGV←EQP	On when TR-REQ comes out from AGV and EQP is available to Transfer. Off after Complete signal and Handshake ended.
	<b>BUSY</b>	AGV←EQP	While AGV status is Ready, On when EQP starts Transfer, and Off after Transfer ended. When the signal is On, EQP is not allowed to act in Transfer area.
	<b>CARRIER</b>	AGV←EQP	To tell apart Carrier Case & be ON only when it is CF Case
	<b>COMPLETE</b>	AGV←EQP	Turns on when EQP completes Transfer. Even if Ready signal of AGV is not Off, it will be end as normal process

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## Chapter 2. AGV(Active)-EQP(Passive) Optical I/O spec

### 2.1 Applicated target

This Interface Transfer by EQP depends on AGV's Arm and Active AGV, Passive EQP.

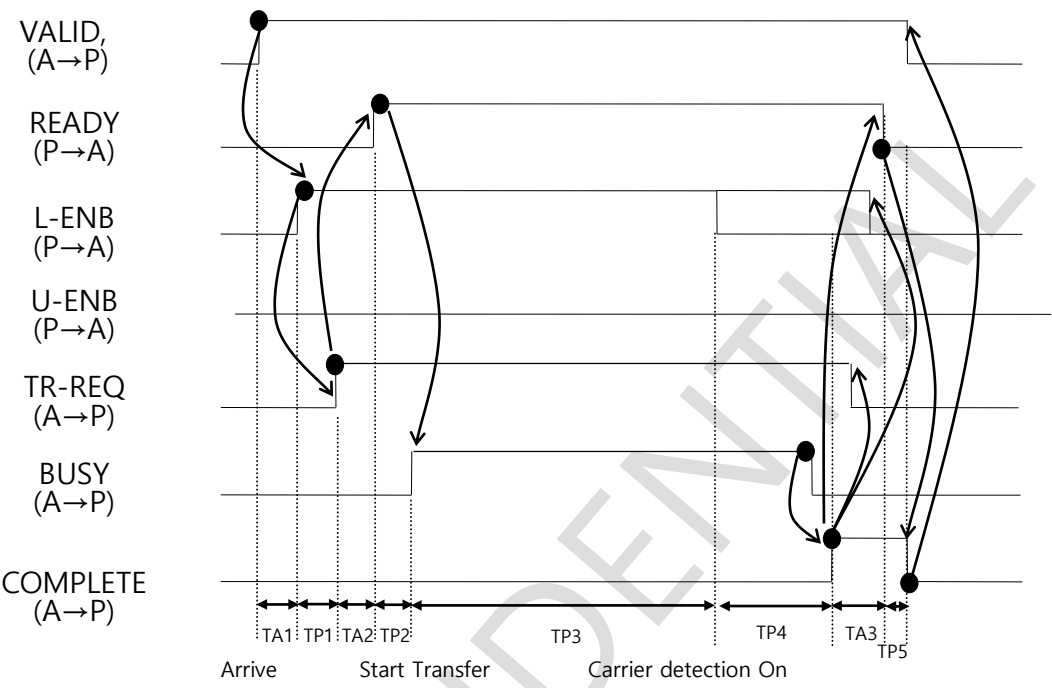
#### ❖Applicated equipment

- Carrier AGV Stocker (Passive Type)
- Carrier AGV Port (Passive Type)

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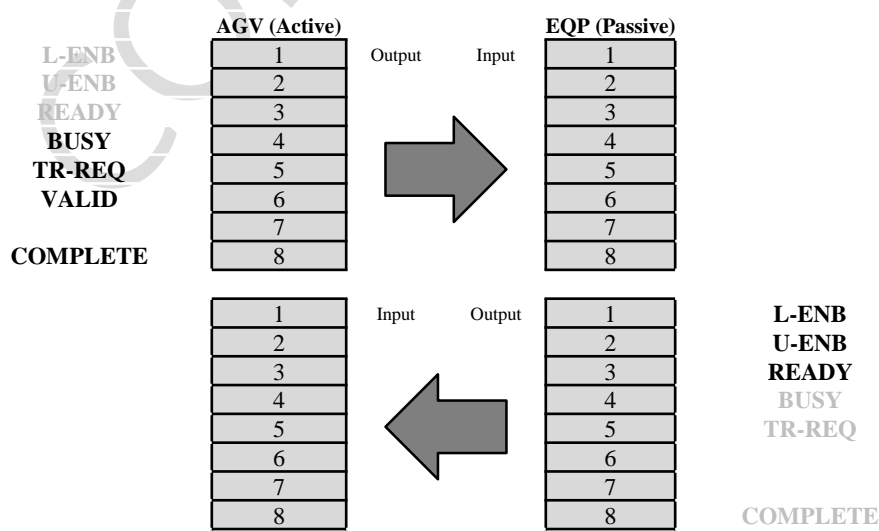
2.2 Handshake

1) Indicate Carrier Loading Handshake Sequence (Carrier Moving Direction : AGV→EQP)



Picture 2-1 Carrier Load Sequence

TA : Check at Active side ----- n sec  
TP : Check at Passive side ----- n sec  
↔ Able to adjust Time.

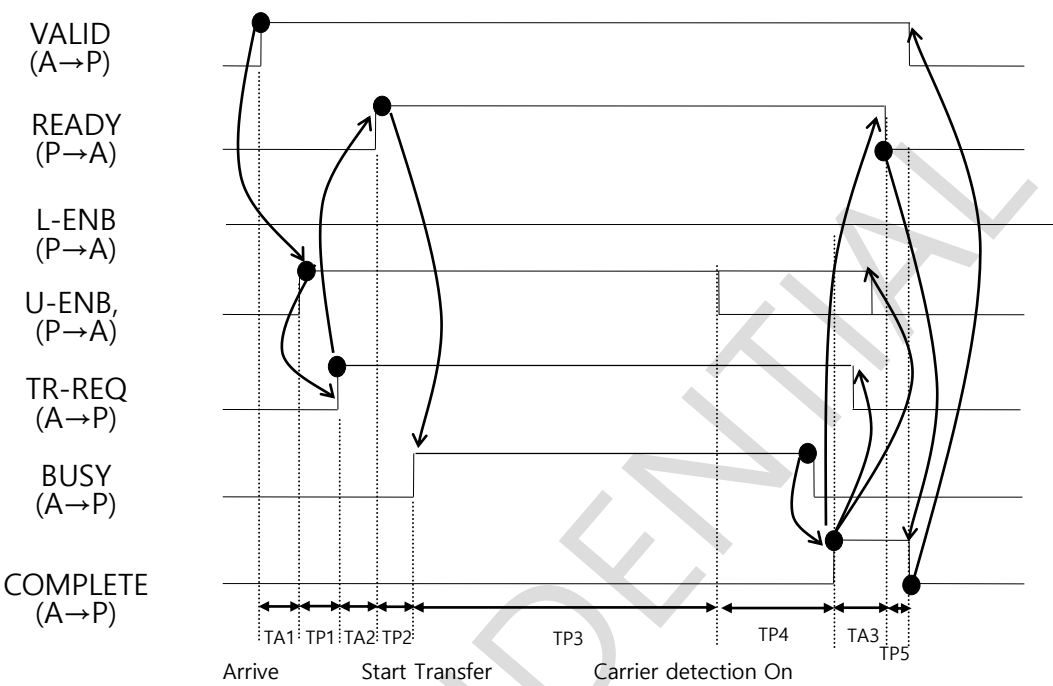


**Table 2-1 Carrier Loading Handshake Sequence**

Section	AGV/EQP	Signal name	Description
	AGV arrives in front of EQP (When arriving, check Off status of Passive signal (Ready, L-ENB, U-ENB))		
1	AGV→EQP	VALID [ON]	AGV Arrived
2	EQP→AGV	L-ENB [ON]	There is no Carrier at EQP Port
3	AGV→EQP	TR-REQ [ON]	Notice when start Transfer to EQP Port
4	EQP→AGV	READY [ON]	Status when AGV is able to Transfer Carrier to EQP Port
5	AGV→EQP	BUSY [ON]	AGV starts Transfer
6	EQP→AGV	L-ENB [OFF]	When there is a Carrier at EQP Port
7	AGV→EQP	BUSY [OFF]	AGV Transfer ended
8	AGV→EQP	COMPLETE [ON]	AGV Transfer ended
9	AGV→EQP	TR-REQ [OFF]	
10	EQP→AGV	READY [OFF]	
11	AGV→EQP	Complete [OFF]	If READY is not OFF, it will be forced to be Off after T2 and then it will be end as normal process.
12	AGV→EQP	VALID [OFF]	

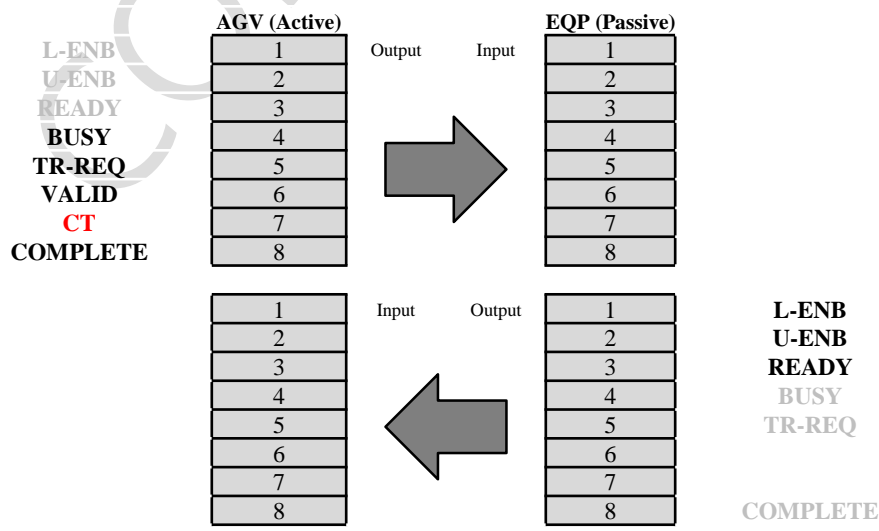


2) Indicate Carrier Unloading Handshake Sequence (**Carrier Moving Direction : AGV←EQP**)



**Picture 2-2 Carrier Unload Sequence**

TA : Check at Active side ----- n sec  
 TP : Check at Passive side ----- n sec  
 ↩ Able to adjust Time.



**Table 2-2 Carrier Unloading Handshake Sequence**

Section	AGV/EQP	Signal name	Description
	AGV arrives in front of EQP (When arriving, check Off status of Passive signal (Ready, L-ENB, U-ENB))		
1	AGV→EQP	VALID [ON]	AGV Arrived
2	EQP→AGV	U-ENB [ON]	There is no Carrier at EQP Port
3	AGV→EQP	TR-REQ [ON]	Notice when start Transfer to EQP Port
4	EQP→AGV	READY [ON]	Status when AGV is able to Transfer Carrier to EQP Port
5	AGV→EQP	BUSY [ON]	AGV starts Transfer
6	EQP→AGV	U-ENB [OFF]	When there is no Carrier at EQP Port
7	AGV→EQP	BUSY [OFF]	AGV's Arm Transfer ended
8	AGV→EQP	COMPLETE [ON]	AGV Transfer ended
9	AGV→EQP	TR-REQ [OFF]	
10	EQP→AGV	READY [OFF]	
11	AGV→EQP	Complete [OFF]	If READY is not OFF, it will be forced to be Off after T2 and then it will be end as normal process.
12	AGV→EQP	VALID [OFF]	

### 2.3 Description of AGV's activity for each signal

#### 1) General

AGV checks signal Reset status at EQP side before [VALID] is ON.

[L-ENB], [U-ENB] and [READY] do not monitor ON and OFF signal at all times.  
[L-ENB], [U-ENB] and [READY] ON are checked only just before starting ARM's act (Transfer).

[L-ENB] OFF is checked only when AGV puts Carrier on Port.  
[U-ENB] OFF is checked only when AGV picks Carrier up from Port.  
[READY] OFF is checked only at the moment when ARM's act (Transfer) ended.

So after [READY] ON is checked, regardless of [READY] ON/OFF, the ARM has started act  
Will execute till the end as long as there is no error from AGV.

#### 2) Process when TIME OUT

When Interlock, Timeout must be processed for each signal and the Time value is able to adjust

※ T1~T3 is able to select 1~100 seconds

When I.F Error occurred between AGV<->EQP, AGV will execute according as Flow.

Transfer Division	Transfer Sequence status	CST location	Report AGV -> AGVC	Return information processing	Information Processing after T/O
UNLOAD	AGV arrived ~ VALID	Above AGV	Time Out (T/O)	Abnormal End	Perform the next return
	VALID ~ READY	Above AGV	Time Out (T/O)	Abnormal End	Perform the next return
	BUSY	Above AGV	Time Out (T/O)	Abnormal End	User action
	Compt ~ Transfer completed	Above EQP	Time Out (T/O)	Normal End	Ignore T/O and perform normal return
LOAD	AGV arrived ~ VALID	Above EQP	Time Out (T/O)	Abnormal End	Perform the next return
	VALID ~ READY	Above EQP	Time Out (T/O)	Abnormal End	Perform the next return
	BUSY	Above EQP	Time Out (T/O)	Abnormal End	User action
	Compt ~ Transfer completed	Above AGV	Time Out (T/O)	Normal End	Ignore T/O and perform the next return

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**Chapter 3. AGV(Passive)-EQP(Active) Optical I/O spec**

**3.1 Applicated target**

This Interface Transfer by EQP depends on AGV's Arm and Active AGV, Passive EQP

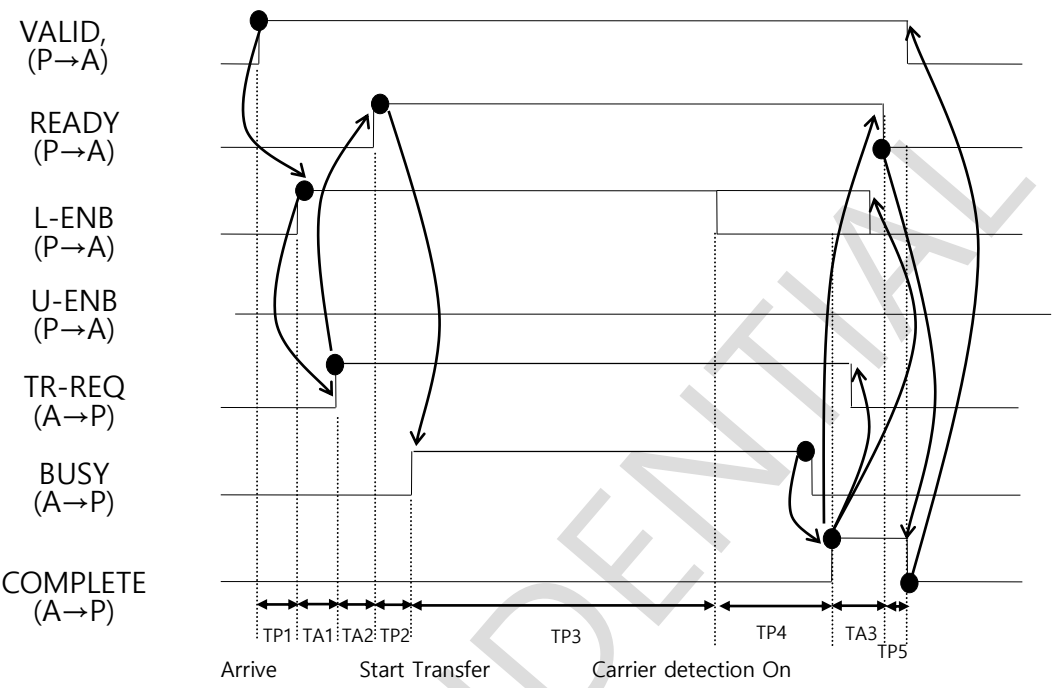
**❖Applicated equipment**

- Carrier AGV Stocker (Active Type)

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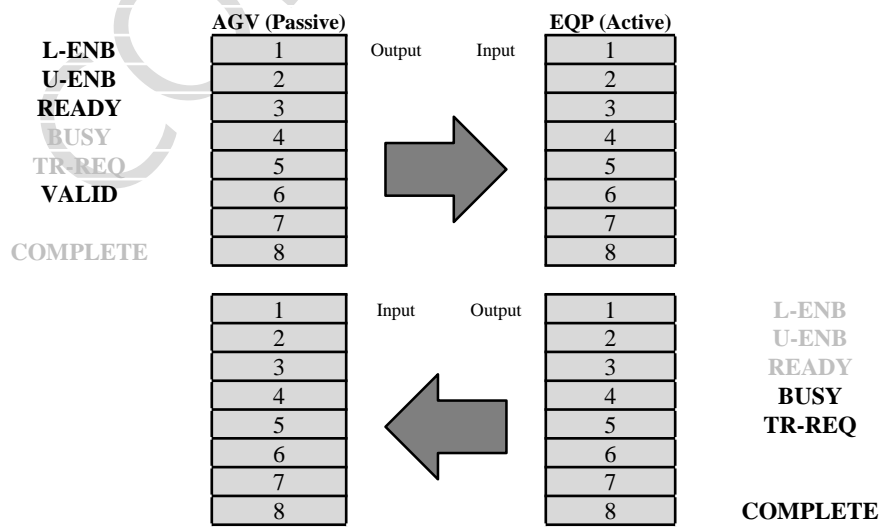
3.2 Handshake

1) Indicate Carrier Loading Handshake Sequence (Carrier Moving Direction : AGV←EQP)



Picture 3-1 Carrier Load Sequence

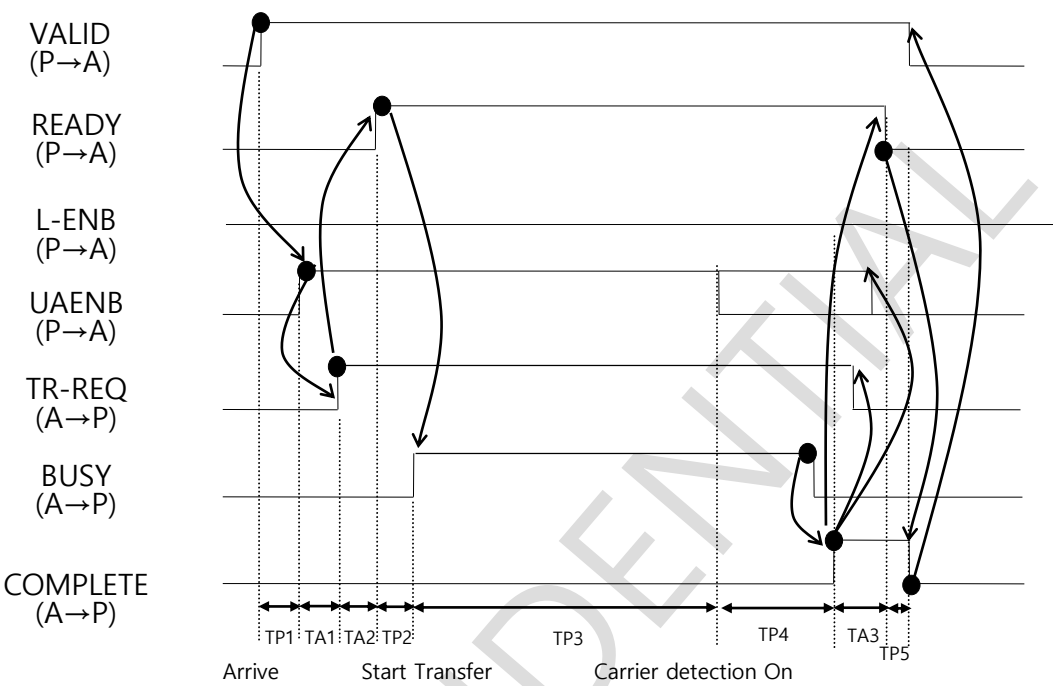
TA : Check at Active side ----- n sec  
TP : Check at Passive side ----- n sec  
Able to adjust Time.



**Table 3-1 Carrier Loading Handshake Sequence**

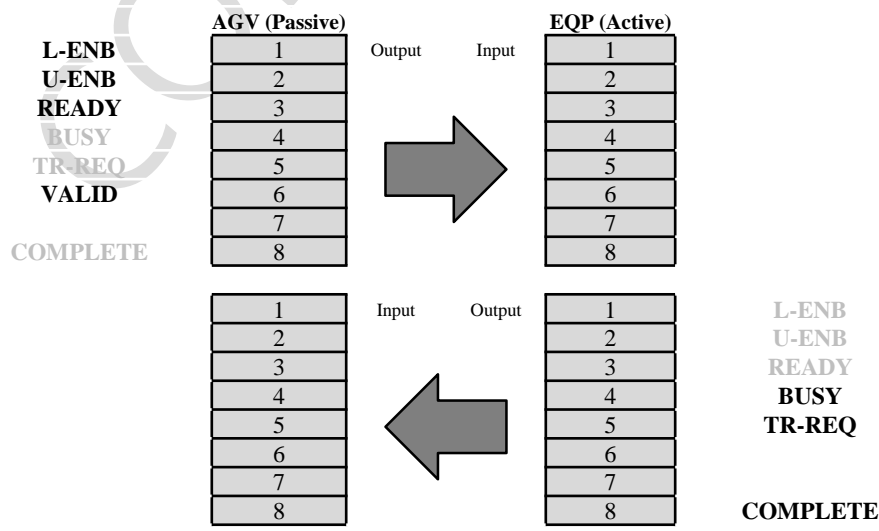
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1	AGV→EQP	VALID [ON]	AGV Arrived
2	AGV→EQP	L-ENB [ON]	When there is a Carrier at EQP Robot Arm
3	EQP→AGV	TR-REQ [ON]	Notice when start Transfer to EQP
4	AGV→EQP	READY [ON]	Status when EQP is able to Transfer Carrier to AGV
5	EQP→AGV	BUSY [ON]	EQP Robot Arm starts Transfer
6	AGV→EQP	L-ENB [OFF]	There is a Carrier on AGV
7	EQP→AGV	BUSY [OFF]	EQP Robot Arm Transfer ended
8	EQP→AGV	COMPLETE [ON]	EQP Transfer ended
9	EQP→AGV	TR-REQ [OFF]	
10	AGV→EQP	READY [OFF]	
11	EQP→AGV	Complete [OFF]	If READY is not OFF, it will be forced to be Off after T2 and then it will be end as normal process.
12	AGV→EQP	VALID [OFF]	

2) Indicate Carrier Unloading Handshake Sequence (**Carrier Moving Direction : AGV→EQP**)



**Picture 3-2 Carrier Unload Sequence**

TA : Check at Active side ----- n sec  
 TP : Check at Passive side ----- n sec  
 ↳ Able to adjust Time.



**표 3-2 Carrier Unloading Handshake Sequence**

Section	AGV/EQP	Signal name	Description
	AGV arrives in front of EQP (When arriving, check Off status of Passive signal (Ready, L-ENB, U-ENB))		
1	AGV→EQP	VALID [ON]	AGV Arrived
2	EQP→AGV	U-ENB [ON]	When there no Carrier at EQP Robot Arm
3	AGV→EQP	TR-REQ [ON]	Notice when start Transfer to AGV
4	EQP→AGV	READY [ON]	Status when AGV is able to Transfer Carrier to EQP Port
5	EQP→AGV	BUSY [ON]	EQP Robot Arm starts Transfer
6	EQP→AGV	U-ENB [OFF]	There is no Carrier on AGV
7	EQP→AGV	BUSY [OFF]	EQP Robot Arm Transfer ended
8	EQP→AGV	COMPLETE [ON]	EQP Transfer ended
9	AGV→EQP	TR-REQ [OFF]	
10	EQP→AGV	READY [OFF]	
11	EQP→AGV	Complete [OFF]	If READY is not OFF, it will be forced to be Off after T2 and then it will be end as normal process.
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	VALID ~ READY	Above AGV	Time Out (T/O)	Abnormal End	Perform the next return
	BUSY	Above AGV	Time Out (T/O)	Abnormal End	User action
	Compt ~ Transfer completed	Above EQP	Time Out (T/O)	Normal End	Ignore T/O and perform the next return