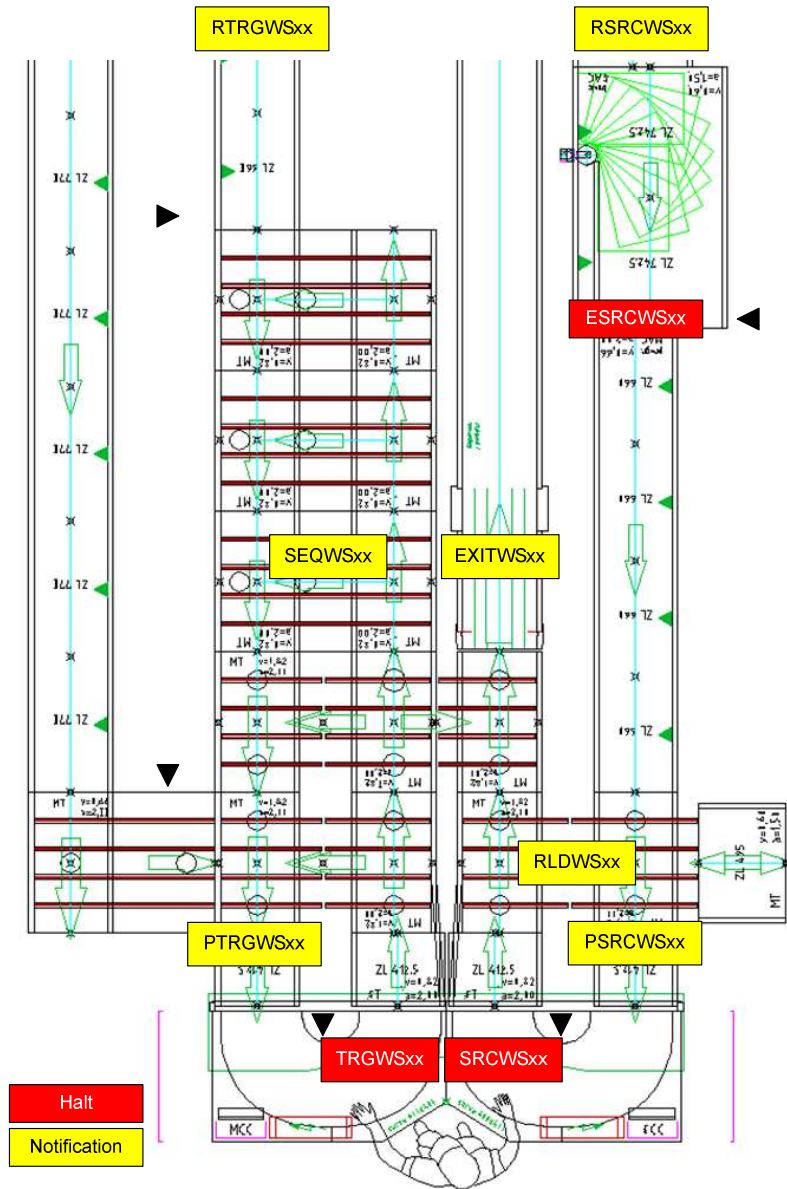# 1. Introduction

This document describes the messages that are exchanged between Commander PLC and a connected Material Flow Controller (e.g. Commander TS, iWACS.MFC) in order to manage the processes at a Pick Center ONE TS workstation.

The basic concept is that both source and target load carriers are tracked and managed on PLC level. Induction of empty target load carriers is also managed on PLC level.

MFC sends the source-target assignments and starts the movements from the source (pick) and target (put) position.

2. Communication Map

RTRGWSxx

RSRCWSxx

ESRCWSxx

SEQWSxx

EXITWSxx

RLDWSxx

PTRGWSxx

PSRCWSxx

TRGWSxx

SRCWSxx

Halt

Notification

Address	Name	Acknowledge	Description
RSRCWSxx[1]	Source Divert Notification	Yes	Source load carrier is diverted to the source lane and reported with LREP based on the loop tracking.
ESRCWSxx	Source Entry	No	Source load carrier is scanned and reported with LREP. MFC responds with a LCDT with the source-target assignment and a DLST to proceed to pre pick position.
PSRCWSxx	Source Preload	No	Source load carrier is reported with LREP based on the source lane tracking information. Based on this information data can be preloaded for the next pick.
SRCWSxx	Source (Pick Face)	No	Source load carrier is scanned and reported with LREP when moving into the pick position. PLC validate with tracking.
RTRGWSxx	Target Divert Notification	Yes	Target load carrier is diverted to the target lane and reported with LREP based on the loop tracking. Based on this information the retrieval of the corresponding source load carriers will be triggered.
PTRGWSxx	Target Preload	No	Target load carrier is reported with LREP based on the target lane tracking information. Based on this information data can be preloaded for the next pick.
TRGWSxx	Target (Put Face)	No	Target load carrier is scanned and reported with LREP when moving into the put position. PLC validate with tracking.
SEQWSxx	Target Sequencer	No	Load carriers within the target sequencer are managed on PLC level. This address is used only as destination as well as to periodically report target load carriers without an assigned source or where source is not present in the source queue.
EXITWSxx	Workstation Exit	Yes	Source and target load carriers are reported when leaving the workstation. LREP requires acknowledge (ACKN).
RLDWSxx	Source Reload	No	Destination is used to recirculate a source load carrier.
WSxx	Workstation	No	Address used for CTRL and STAT

[1] xx represents the workstation number from 01 to 99

3. Message Types

There are no new message types required. The entire communication can be done using existing Commander PLC messages. There are no extensions to the general message syntax but semantic extensions to error codes, custom data and actions.

3.1 Extensions to LCDT

To establish the link between a source load carrier and a target load carrier the existing Load Carrier Data message is used.

This message is sent to the PLC whenever the target load carrier(s) for a source have to be assigned or updated:

- When the source load carrier is reported at the entry point of the source lane (ESRCWS01).
  PLC does this using an LREP with status NLCD (need load carrier data)
- When a target load carrier is full and a new empty target is required for the current source and all other source load carriers in the source queue that were assigned to that target. MFC sends this when required.
- When the PLC has no target for a source load carrier because of manual intervention. PLC does this using an LREP with status NLCD (need load carrier data).

3.1.1 Target assignment

For the assignment custom key/value pairs are used.

Custom Key: TAR<n>[2]
Custom Value: Identifier of target load carrier[3]

3.1.1.1 Defined target

If the concrete target load carrier is already defined (already in sequencer, pre-cubing, pre-picked) then the concrete barcode is assigned. As the sources will be retrieved when the target diverts to the target lane the concrete load carrier is known.

Example:
TS01;F001;0;LCDT;"S1";[(TAR1:"T1")]

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[2] Commander standard allows up to 5 targets
[3] Commander standard allows load carrier identifiers up to 30 characters

3.1.1.2 Empty target

If the target load carrier has to be inducted from the empties lane the concrete load carrier will be selected as late as possible. Therefore, only a temporary identifier is assigned so that the PLC can distinguish between the same or a different empty target load carrier for a source. The temporary identifier consists of a question mark "?" an three digits.

Example: TS01;F001;0;LCDT;"S1";[(TAR1:"?001")]

3.1.1.3 Manual target

If the target load carrier has to be manually dropped by the user at the put face the PLC has to be informed in order to hold back targets so that the target position remains free and the user can drop the target. Therefore, a different temporary identifier is used which consists of an exclamation mark "!" and three digits.

Example: TS01;F001;0;LCDT;"S1";[(TAR1:"!001")]

3.1.1.4 Multiple targets

If a source is used for multiple targets the entry is repeated with increasing number.
If multiple targets are assigned PLC will sequence them based on the ordering in the assignment.

Examples:
TS01;F001;0; LCDT;"S1";[(TAR1:"T1.1"),(TAR2:"?002")]
TS01;F001;0; LCDT;"S2";[(TAR1:"T2.1"),(TAR2:"T2.2")]

3.1.1.5 No target required

Load carriers that are retrieved to the workstation for other purposes (cycle counting, manual retrieval) do not require a target. By this PLC knows that for this source there is no target required. When the source advances to the pick position, no target should be moved to the put position.

Example: TS01;F001;0; LCDT;"L1";[(TAR1:"NONE"]

3.2 Extensions to LREP

3.2.1 Empty target assignment

When using temporary identifiers for the targets inducted from the empties lane PLC links the concrete load carrier to the temporary identifier.
This information is sent for the first time when the empty load carrier is inducted from the empties lane and reaches the target preload position (PTRGWS01).
PLC has to keep (and report) this reference for the entire time the target remains in the target sequencer. When the target leaves the workstation the temporary load carrier can be reassigned.

This is done using custom data:

Key: TARG
Value: Temporary identifier that is replaced

Example:
*F001;;17;LREP;1;"T1";45;PTRGWS01;;[**(TARG:"?001")**]*
*F001;;17;LREP;1;"T1";45;PTRGWS01;;[**(TARG:"!002")**]*

3.2.2 Tracking mismatch

The entire source and target lane is managed with tracking on PLC level. So the scanners are used to check whether the tracking is plausible. In case of a mismatch this information will be reported when the source/target reaches the pick/put position with the LREP

Status Code: ETRC

Custom data informs about the identifier that was expected based on tracking.

Key: TRID
Value: Tracked identifier

Examples:
*F001;;0;LREP;1;"S1";;SRCWS01;**ETRC**;[**(TRID:"S3")**]*
*F001;;0;LREP;2;"T1";;TRGWS01;**ETRC**;[**(TRID:"T4")**]*

3.2.3 No-Read

If there is a no-read at any of the entry points to the workstations and there is tracking information available, then PLC should optimistically use the identifier of the tracking.
If no tracking information is available PLC should create a temporary no-read identifier and track and report this identifier.

If there is a no-read at the source (SRCWS01) or target (TRGWS01) position the PLC reports this as the Commander standard messaging. In addition, PLC reports the expected load carrier identifier as custom data.

Examples:
*F001;;0;LREP;1;" NOREAD00121401056";N;SRCWS01;;[**(TRID:"S3")**]*
*F001;;0;LREP;1;" NOREAD00121401056";N;TRGWS01;;[**(TRID:"T1")**]*

Based on this a source (see 3.3) or target (see **Fehler! Verweisquelle konnte nicht gefunden werden.**3.4) rotation will be executed.

3.2.4 No Target

If for any reason a source arrives at the pick position (SRCWS01) but none of the assigned targets is present (or known) in the target sequencer the PLC reports this with a status code.

Status Code: NOTA

Example:
*F001;;LREP;1;"S1";;SRCWS01;**NOTA**;[]*

In this case MFC sends the source to exit.

3.2.4 3.2.5 Periodic information about load carriers in target sequencer

To make sure that target load carriers do not loop endlessly within the target sequencer PLC will inform periodically about load carriers that are in the target sequencer and are not assigned to a source or where the assigned source is not present in the source lane.
Based on this message the MFC is able to instruct PLC to move no longer used targets to the exit.

If PLC detects a tracking mismatch in the source queue these messages should be suppressed until the tracking has been reestablished.

Example: F001;;0;LREP;1;"T1";;SEQWS01;;[]

3.3 Extensions to CTRL / STAT

3.3.1 Rotation mode

When identifying a tracking mismatch PLC will switch to a target rotation mode. This is reported using a STAT message with the corresponding bit set.

Bit 2.0: Rotation Mode On (1) / Off (0)

Then the targets are sent to the sequencer using DLST. PLC makes sure to bring all targets to the put position in this mode until the tracking has been rebuilt. Then PLC switches back to target sequencing mode and reports a STAT message with the corresponding Bit unset.

Example:
F001;;0;STAT;WS01;$80000100

3.3.2 Replace mode

The replace mode is used for two scenarios:
- Replace source or target load carrier
- Manually feed empty target load carrier at put face

Formatiert: Text mit Einzug

Formatiert: Text mit Einzug

Formatiert: Englisch (USA)

Formatiert: Schriftart: Kursiv

Formatiert: Text mit Einzug

Formatiert: Schriftart: Kursiv

Kommentiert [MA1]: do we need to distinguish whether there is no source assigned or if the source is not present?

MFC requests that PLC switches to "replace mode" with a CTRL message and PLC confirms this with the STAT message with the corresponding bit set. For simplicity the same bit is used in both directions.

Bit 2.1: Source replace mode on (1) / Off (0)
Bit 2.2: Target replace mode on (1) / Off (0)

When a damaged source or target load carrier arrives at the pick or put position the user is able to replace the load carrier. MFC will request that PLC changes to replace mode for the corresponding position (source or target). PLC switches to replace mode and holds back the next load carriers when the user removes the damaged load carrier and drops the replacement.

Example:
TS00;F001;18;CTRL;WS01;$00000200
F001;;19;STAT;WS01;$80000200

When an empty target has to be manually dropped at the put face, PLC will hold back target load carriers and automatically switch to replace mode in the target position when the user is allowed to drop the empty target.

Example:
F001;;19;STAT;WS01;$80000400

3.3.3   Confirm button

The button to confirm that a task has been completed at the pick center is connected to the PLC. PLC will trigger that STAT message whenever the button is pressed/released.

Bit 2.3: Confirm button pressed (1) / released (0)

Will change from 0 → 1 when the button is pressed, will change from 1 → 0 when the button is released.

3.4   Source Entry Line

A tracking is used from the source entry point ESRCWSxx to the bypass. The fill level of the source accumulation conveyor is send to IT..

ESRCWSxx = source entry

Example:
F001;TS00;CFIL;ESRCWS01;3

5.4. Use cases

All examples use the prefix "T" for target load carriers, "?xxx" for empty target load carriers, "!xxx" for manual fed target load carriers and "S" for source load carriers.

5.14.1 Defined targets

In the configurations with a target induct lane or when the target has already been used for previous picks and is waiting in the target sequencer the concrete load carrier identifiers will be used for the target assignment.

PLC	MFC
T1 is diverted towards the target lane. Retrieval of corresponding source totes is triggered	
F001;;1;LREP;1;"T1";ACKN;RTRGWS01;;[]	
Acknowledge for T1	
	TS01;F001;1;ACKR;1;RTRGWS01;LREP
S1 is diverted to the source lane	
F001;;2;LREP;2;"S1";ACKN;RSRCWS01;;[]	
Acknowledge for S1	
	TS01;F001;2;ACKR;2;RSRCWS01;LREP
S1 arrives at the entry point to the source lane tracking	
F001;;3;LREP;3;"S1";;ESRCWS01;NLCD;[]	
S1 is linked to T1	
	TS01;F001;3;LCDT;"S1";[(TAR1:"T1")]
Now as T1 is linked to the first source, PLC move it into the sequencer.	
F001;;4;LREP;4;"T1";;SEQWS01;;[]	
S1 is reported at the source preload position.	
F001;;5;LREP;5;"S1";;PSRCWS01;;[]	
T1 is reported at the target preload position.	
F001;;6;LREP;6;"T1";;PTRGWS01;;[]	
S1 arrives at the source position.	
F001;;7;LREP;7;"S1";;SRCWS01;NDIR;[]	
T1 arrives at the target position	
F001;;8;LREP;8;"T1";;TRGWS01;NDIR;[]	

User confirms pick. This was the last pick for T1:.

PLC	MFC
S1 is sent to the exit	
	TS01;F001;5;DLST;"S1";[EXITWS01];[]
T1 is sent to the exit	
	TS01;F001;6;DLST;"T1";[EXITWS01];[]
S1 passes the exit	
F001;;9;LREP;9;"S1";;EXITWS01;ACKN;[]	
Acknowledge for S1	
	TS01;F001;7;ACKR;9;EXITWS01;LREP
T1 passes the exit	
F001;;10;LREP;10;"T1";;EXITWS01;ACKN;[]	
Acknowledge for T1	
	TS01;F001;8;ACKR;10;EXITWS01;LREP

User confirms pick. There are remaining picks for T1:

PLC	MFC
S1 is sent to the exit	
	TS01;F001;5;DLST;"S1";[EXITWS01];[]
T1 is sent back to the sequencer	
	TS01;F001;6;DLST;"T1";[SEQWS01];[]
T1 arrives in the sequencer	
F001;;9;LREP;9;"T1";;SEQWS01;;[]	
S1 passes the exit	
F001;;10;LREP;10;"S1";;EXITWS01;ACKN;[]	
Acknowledge for S1	
	TS01;F001;7;ACKR;9;EXITWS01;LREP

5.24.2 Empty targets

In the configurations with an empties induct lane temporary identifiers will be used for the target assignment. When PLC inducts the empty load carrier the concrete load carrier identifier is reported. After that the concrete load carrier identifier will be used for target assignments.

PLC	MFC
S1.1 arrives at the entry point to the source lane tracking	
F001;;1;LREP;1;"S1.1";;ESRCWS01;NLCD;[]	
S1.1 requires an empty target load carrier. Based on this information PLC knows that it will need an empty LC - temporarily called "?001" and can decide when to move it to the pre-pick position	
	TS01;F001;1;LCDT;"S1.1";[(TAR1:"?001")]

S1.2 arrives at the entry point to the source lane tracking	
F001;;2;LREP;2;"S1.2";;ESRCWS01;NLCD;[]	
S1.2 requires an empty target load carrier. Based on this information PLC knows that this is the same empty target LC as the for the previous source load carrier.	
	TS01;F001;3;LCDT;"S1.2";[(TAR1:"?001")]
S2 arrives at the entry point to the source lane tracking	
F001;;3;LREP;3;"S2";;ESRCWS01;NLCD;[]	
S2 requires an empty target load carrier. Based on this information PLC knows that this is another empty target load carrier.	
	TS01;F001;5;LCDT;"S2";[(TAR1:"?002")]
S1.1 is reported at the source preload position	
F001;;4;LREP;4;"S1.1";;PSRCWS01;;[]	
T1 is reported at the target preload position. This load carrier is used for ?001.	
F001;;5;LREP;5;"T1";;PTRGWS01;;[(TARG:"?001")]	
S1.1 arrives at the source position	
F001;;6;LREP;6;"S1.1";;SRCWS01;NDIR;[]	
S1.2 is reported at the source preload position	
F001;;7;LREP;7;"S1.2";;PSRCWS01;;[]	
T1 arrives at the target position	
F001;;8;LREP;8;"T1";;TRGWS01;NDIR;[(TARG:"?001")]	
User confirms pick. S1.1 is sent to the exit	
	TS01;F001;7;DLST;"S1.1";[EXITWS01];[]
S1.2 arrives at the source position	
F001;;9;LREP;9;"S1.2";;SRCWS01;NDIR;[]	
S2 is reported at the source preload position	
F001;;10;LREP;10;"S2";;PSRCWS01;;[]	
T2 is reported at the target preload position. This load carrier is used for ?002	
F001;;11;LREP;11;"T2";;PTRGWS01;;[(TARG:"?002")]	

5.3~~4~~.3 Manual target

Similar to the target from empties lane there is also the option to manually drop empty load carriers directly to the put position. The process is similar to ~~0~~4.~~2~~ but a different symbol is used for the temporary identifier.

PLC	MFC
S1 arrives at the entry point to the source lane tracking	
F001;;1;LREP;1;"S1";;ESRCWS01;NLCD;[]	
S1 requires an empty target load carrier that has to be manually dropped to the target position. Based on this information PLC knows that an empty LC - temporarily called "!001" will be manually dropped and can hold back the next targets when this source reaches the pick position	
	TS01;F001;1;LCDT;"S1";[(TAR1:"!001")]
S1 is reported at the source preload position	
F001;;4;LREP;4;"S1";;PSRCWS01;;[]	
T1 is reported at the target preload position.	
F001;;5;LREP;5;"T1";;PTRGWS01;;[]	
S1 arrives at the source position.	
F001;;6;LREP;6;"S1";;SRCWS01;NDIR;[]	
T1 is held back and PLC turns target replace mode on.	
F001;;7;STAT;WS01;$80000400	
User drops the empty target load carrier T2. PLC reports the detected load carrier with a LREQ message.	
F001;;8;LREQ;8;TRGWS01;;[1]	
PLC is notified that the load carrier is T2.	
	TS01;F001;8;LNOT;8;TRGWS01;[{"T2";1}]¶
PLC sends a LREP message to confirm. PLC reports that this load carrier replaces !001 and requests a destination.	
F001;;9;LREP;9;"T2";;TRGWS01;NDIR;[TARG :!001]	
User confirms pick. S1 is sent to the exit	
	TS01;F001;7;DLST;"S1";[EXITWS01];[]
PLC turns target replace mode off.	
F001;;10;STAT;WS01;$80000000	
T2 is sent to the exit.	
	TS01;F001;9;DLST;"T2";[EXITWS01];[]

5.44.4 Unexpected target full with source rotation

When the situation occurs that the target load carrier is full before all items could be picked an additional empty load carrier is required. If the next source load carrier is for a different target load carrier then the current source load carrier (with unfinished picks) will rotate using the shortcut. While the next pick is performed the new empty load carrier will be inducted and the pick can be completed next.

PLC	MFC

S1 arrives at the source position	
F001;;1;LREP;1;"S1";;SRCWS01;NDIR;[]	
T1 arrives at the target position	
F001;;2;LREP;2;"T1";;TRGWS01;NDIR;[]	
User identifies that there is not enough capacity in T1 and requests a new empty LC. S1 is linked to a new empty load carrier ?001	
	TS01;F001;2;LCDT;"S1";[(TAR1:"?001")]
T1 is sent to the exit.	
	TS01;F001;1;DLST;"T1";[EXITWS01];[]
S1 is sent to reload	
	TS01;F001;3;DLST;"S1";[RLDWS01];[]
S1 is reported at the source preload position	
F001;;3;LREP;3;"S1";;PSRCWS01;;[]	
T2 is reported at the target preload position	
F001;;4;LREP;4;"T2";;PTRGWS01;;[(TARG:"?001")]	
S1 arrives at the source position again	
F001;;5;LREP;5;"S1";;SRCWS01;NDIR;[]	
T2 arrives at the target position	
F001;;6;LREP;6;"T2";;TRGWS01;NDIR;[(TARG:"?001")]	

5.54.5 Unexpected target full with target rotation

When the situation occurs that the target load carrier is full before all items could be picked an additional empty load carrier is required. If the next source load carrier was also planned to be picked into the same target load carrier then the current target leaves the workstation. The new empty target will be inducted. As the next target cannot be used at the moment it is sent back to the sequencer and will rotate over the shortcut and positioned behind the new empty target.

PLC	MFC
S1.1 arrives at the source entry	
F001;;1;LREP;1;"S1.1";;ESRCWS01;NLCD;[]	
S1.1 is linked to T1.1	
	TS01;F001;1;LCDT;"S1.1";[(TAR1:"T1.1")]
S1.2 arrives at the source entry	
F001;;2;LREP;2;"S1.2";;ESRCWS01;NLCD;[]	
S1.2 is linked to T1.1	
	TS01;F001;3;LCDT;"S1.2";[(TAR1:"T1.1")]
S2 arrives at the source entry	
F001;;3;LREP;3;"S2";;ESRCWS01;NLCD;[]	

S2 is linked to T2	
	TS01;F001;5;LCDT;"S2";[(TAR1:"T2")]
S1.1 arrives at the source position	
F001;;4;LREP;4;"S1.1";;SRCWS01;NDIR;[]	
S1.2 is prepared behind S1.1	
F001;;5;LREP;5;"S1.2";;PSRCWS01;;[]	
T1.1 arrives at the target position	
F001;;6;LREP;6;"T1.1";;TRGWS01;NDIR;[]	
T2 is prepared behind T1.1	
F001;;7;LREP;7;"T2";;PTRGWS01;;[]	
User identifies that there is not enough capacity in T1.1 and requests a new empty LC. S1.1 is linked to a new empty load carrier ?001.	
	TS01;F001;8;LCDT;"S1.1";[(TAR1:"?001")]
S1.2 is also linked to a new empty load carrier ?001	
	TS01;F001;8;LCDT;"S1.2";[(TAR1:"?001")]
T1.1 is sent to the exit	
	TS01;F001;7;DLST;"T1.1";[EXITWS01];[]
T2 arrives at the target position	
F001;;8;LREP;8;"T2";;TRGWS01;;[]	
T1.2 is prepared behind T2	
F001;;9;LREP;9;"T1.2";;PTRGWS01;;[(TARG:"?001")]	
T2 is sent back to the sequencer	
	TS01;F001;9;DLST;"T2";[SEQWS01];[]
T1.2 arrives at the target position	
F001;;10;LREP;10;"T1.2";;TRGWS01;NDIR;[(TARG:"?001")]	

5.6 4.6 Bypass

The bypass position will be used to avoid unnecessary target rotations when the sources for alternating targets arrive in the source lane.

PLC	MFC
S1.1 arrives at the source lane	
F001;;1;LREP;1;"S1.1";;ESRCWS01;NLCD;[]	
S1.1 is linked to T1	
	TS01;F001;1;LCDT;"S1.1";[(TAR1:"T1")]
S2.1 arrives at the source lane	
F001;;2;LREP;2;"S2.1";;ESRCWS01;NLCD;[]	
S2.1 is linked to T2	
	TS01;F001;3;LCDT;"S2.1";[(TAR1:"T2")]
S1.2 arrives at the source lane	

PLC	MFC
F001;;3;LREP;3;"S1.2";;ESRCWS01;NLCD;[]	
S1.2 is linked to T1	
	TS01;F001;5;LCDT;"S1.2";[(TAR1:"T1")]
S2.2 arrives at the source lane	
F001;;4;LREP;4;"S2.2";;ESRCWS01;NLCD;[]	
S2.2 is linked to T2	
	TS01;F001;7;LCDT;"S2.2";[(TAR1:"T2")]
S1.1 advances to the source position. PLC autonomously detects that S2.1 should be taken to the parking position. S1.1 arrives at the source position	
F001;;5;LREP;5;"S1.1";;SRCWS01;NDIR;[]	
S1.2 is prepared behind S1.1. S2.2 is stopped before the divert to the parking position	
F001;;6;LREP;6;"S1.2";;PSRCWS01;;[]	
T1 arrives at the target position	
F001;;7;LREP;7;"T1";;TRGWS01;NDIR;[]	
T2 is prepared behind T1	
F001;;8;LREP;8;"T2";;PTRGWS01;;[]	
User confirms pick. S1.1 is sent to the exit.	
	TS01;F001;9;DLST;"S1.1";[EXITWS01];[]
T1 remains in the target position. S1.2 arrives at the source position	
F001;;9;LREP;9;"S1.2";;SRCWS01;NDIR;[]	
S2.1 is unparked and prepared behind S1.2	
F001;;10;LREP;10;"S2.1";;PSRCWS01;;[]	
User confirms pick. S1.2 is sent to the exit	
	TS01;F001;10;DLST;"S1.2";[EXITWS01];[]
T1 is sent to the exit	
	TS01;F001;11;DLST;"T1";[EXITWS01];[]
S2.1 arrives at the source position	
F001;;11;LREP;11;"S2.1";;SRCWS01;NDIR;[]	
S2.2 is prepared behind S2.1	
F001;;12;LREP;12;"S2.2";;PSRCWS01;;[]	
T2 arrives at the target position	
F001;;13;LREP;13;"T2";;TRGWS01;NDIR;[]	

5.74.7 Multiple targets

If the same source load carrier contains picks for multiple targets (e.g. multiple orders or because of weight conditions) then multiple targets will be assigned. These can be either existing targets from the target induct lane, in target sequencer or new empty load carriers from the empties lane.

PLC	MFC
S4 arrives at the source entry	

F001;;1;LREP;1;"S4";;ESRCWS01;NLCD;[]	
S4 is linked to T4	
	TS01;F001;1;LCDT;"S4";[(TAR1:"T4")]
S1 arrives at the source entry	
F001;;2;LREP;2;"S1";;ESRCWS01;NLCD;[]	
S1 requires two empty target load carrier	
	TS01;F001;3;LCDT;"S1";[(TAR1:"?001"),(TAR2:"?002")]
T4 arrives at the target position	
F001;;3;LREP;3;"T4";;TRGWS01;NDIR;[]	
T1.1 is prepared behind T4	
F001;;4;LREP;4;"T1.1";;PTRGWS01;;[(TARG:"?001")]	
S4 arrives at the source position	
F001;;5;LREP;5;"S4";;SRCWS01;NDIR;[]	
S1 is prepared behind S4	
F001;;6;LREP;6;"S1";;PSRCWS01;;[]	
User confirms pick. S4 is sent to the exit.	
	TS01;F001;5;DLST;"S4";[EXITWS01];[]
T4 is sent back to sequencer	
	TS01;F001;6;DLST;"T4";[SEQWS01];[]
S1 arrives at the source position	
F001;;7;LREP;7;"S1";;SRCWS01;NDIR;[]	
T1.1 arrives at the target position	
F001;;8;LREP;8;"T1.1";;TRGWS01;NDIR;[]	
T1.2 is prepared behind T1.1	
F001;;9;LREP;9;"T1.2";;PTRGWS01;;[(TARG:"?002")]	
User confirms first pick S1 -> T1.1. T1.1 is sent to the exit	
	TS01;F001;7;DLST;"T1.1";[EXITWS01];[]
T1.2 arrives at the target position	
F001;;10;LREP;10;"T1.2";;TRGWS01;NDIR;[(TARG:"?002")]	
User confirms second pick S1 -> T1.2. S1 is sent to the exit	
	TS01;F001;8;DLST;"S1";[EXITWS01];[]
T1.2 is sent back to sequencer	
	TS01;F001;9;DLST;"T1.2";[SEQWS01];[]

5.84.8 Cancellation

In case an order gets cancelled the corresponding load carriers have to leave the workstation as they are no longer required. Source load carriers will sent to the exit when the arrive at the pick position. Target load carriers will immediately be sent to the exit and should leave the target sequencer as soon as possible (based on the current position within the sequencer).

PLC	MFC
S1 is sent to the exit when it reaches the pick position as there is no other way to move.	
	TS01;F001;47;DLST;"S1";[EXITWS01];[]
T1 is sent to the exit and should leave the sequencer. Multiple messages are sent for all targets that are affected	
	TS01;F001;48;DLST;"T1";[EXITWS01];[]

~~5.9~~4.9 Load carrier retrieval without picking

When a load carrier is requested manually to the workstation it is done using the source lane. In order to have the load carrier continue its movement from the source entry to the pick position the PLC has to be informed that no target is needed.

PLC	MFC
LC is diverted to the source lane	
F001;;1;LREP;1;"LC";ACKN;RSRCWS01;;[]	
Acknowledge for LC	
	TS01;F001;1;ACKR;1;RSRCWS01;LREP
LC arrives at the entry point to the source lane tracking	
F001;;2;LREP;2;"LC";NLCD;ESRCWS01;;[]	
LC data is sent without any target. By this PLC knows that this load carrier doesn't need a target.	
	TS01;F001;2;LCDT;"LC";[(TAR1:"NONE")]
S1 is diverted to the source lane	
F001;;3;LREP;3;"S1";ACKN;RSRCWS01;;[]	
Acknowledge for S1	
	TS01;F001;4;ACKR;3;RSRCWS01;LREP
S1 arrives at the entry point to the source lane tracking	
F001;;4;LREP;4;"S1";NLCD;ESRCWS01;;[]	
S1 is linked to T1	
	TS01;F001;5;LCDT;"S1";[(TAR1:"T1")]
LC is reported at the source preload position.	
F001;;5;LREP;5;"LC";;PSRCWS01;;[]	
T1 is reported at the target preload position.	
F001;;6;LREP;6;"T1";;PTRGWS01;;[]	
LC arrives at the source position.	
F001;;7;LREP;7;"LC";;SRCWS01;NDIR;[]	
S1 is reported at the source preload position.	
F001;;8;LREP;8;"S1";;PSRCWS01;;[]	
T1 is held back in the preload position until LC leaves the source position.	
	TS01;F001;7;DLST;"LC";[EXITWS01];[]

S1 arrives at the source position.	
F001;;9;LREP;9;"S1";;SRCWS01;NDIR;[]	
T1 arrives at the target position	
F001;;10;LREP;10;"T1";;TRGWS01;NDIR;[]	

5.104.10   No-Read in source position

In case of a no-read in the pick position there could be a chance to read the barcode on the other side of the load carrier. To do this the load carrier will rotate via the shortcut to switch its orientation. This is only possible if a curve is used.

PLC	MFC
Scan of expected source S1 fails and is reported with a temporary no-read identifier.	
F001;;0;LREP;4;" *NOREAD00121401056";N;SRCWS01;;[(TRID:"S1")]*	
Temporary load carrier is sent to reload.	
	TS01;F001;3;DLST;" *NOREAD00121401056";[RLDWS01];[]*
S1 is reported at the source preload position.	
F001;;5;LREP;5;"S1";;PSRCWS01;;[]	

Scan of barcode on other side succeeds:

PLC	MFC
S1 is reported at the source position	
F001;;5;LREP;6;"S1";;SRCWS01;;[]	
Process continues as usual	

Second scan also fails:

PLC	MFC
Reported again with a temporary no-read identifier	
F001;;0;LREP;7;" *NOREAD00121401057";N;SRCWS01;;[(TRID:"S1")]*	
Temporary load carrier is sent to the exit.	
	TS01;F001;5;DLST;" *NOREAD00121401057";[EXITWS01];[]*
Corresponding target is sent to the target sequencer (if remaining picks) or to exit (if no more picks).	

5.114.11   No-Read in target position

In case of a no-read in the put position there could be a chance to read the barcode on the other side of the load carrier. To do this the load carrier will rotate via the shortcut to switch its orientation.

This is only possible if a curve is used.

PLC	MFC
Scan of expected target T1 fails and is reported with a temporary no-read identifier.	
F001;;0;LREP;4;" NOREAD00121401056";N;TRGWS01;;[(TRID:"T1")]	
Temporary load carrier is sent to sequencer.	
	TS01;F001;3;DLST;" NOREAD00121401056";[SEQWS01];[]
Load carrier is reported in the sequencer with the no-read identifier and the tracked identifier.	
F001;;5;LREP;5;"NOREAD00121401056"::SEQWS01;;[(TRID:"T1")]	
PLC knows that this was a no-read and moves it directly to the target preload position.	
F001;;5;LREP;5;"T1";;PTRGWS01;;[]	
Next waiting target moves into target position. If there are picks from the current source to this target they are performed. If not the target is sent to the target sequencer.	
F001;;6;LREP;5;"T2";;TRGWS01;;[]	

Scan of barcode on other side succeeds:

PLC	MFC
T1 is reported at the target position	
F001;;5;LREP;7;"T1";;TRGWS01;;[]	
Process continues as usual	

Second scan also fails:

PLC	MFC
Reported again with a temporary no-read identifier	
F001;;0;LREP;7;" NOREAD00121401057";N;TRGWS01;;[(TRID:"S1T1")]	
Temporary load carrier is sent to the exit.	
	TS01;F001;5;DLST;" NOREAD00121401057";[EXITWS01];[]
Corresponding source is sent to exit.	

5.124.12 Replace source load carrier

In case of a damaged load carrier it may be replaced in the pick position.

PLC	MFC
S1 arrives at the source position.	
F001;;7;LREP;7;"S1";;SRCWS01;NDIR;[]	
User recognizes that load carrier has to be replaced and request source exchange. MFC requests that PLC turns source replace mode on.	
	TS00;F001;18;CTRL;WS01;$00000200
PLC turns source replace mode on	
F001;;19;STAT;WS01;$80000200	
User removes the load carrier and drops a replacement S2. PLC reports the detected load carrier with a LREQ message.	
F001;;8;LREQ;8;SRCWS01;;[1]	
User manually scans the load carrier S2 and confirms the pick. PLC is notified that the load carrier is S2	
	TS01;F001;8;LNOT;8;TRGWS01;[{"S2";1}]
PLC sends a LREP message to confirm.	
F001;;9;LREP;9;"S2";;SRCWS01;;[]	
PLC turns source replace mode off.	
F001;;10;STAT;WS01;$80000000	
S2 is sent to the exit.	
	TS01;F001;9;DLST;"S2";[EXITWS01];[]

5.134.13 Replace target load carrier

In case of a damaged load carrier it may be replaced in the put position.

PLC	MFC
T1 arrives at the target position.	
F001;;7;LREP;7;"T1";;TRGWS01;NDIR;[]	
User recognizes that load carrier has to be replaced and request target exchange. MFC requests that PLC turns target replace mode on.	
	TS00;F001;18;CTRL;WS01;$00000400
PLC turns target replace mode on	
F001;;19;STAT;WS01;$80000400	
User removes the load carrier and drops a replacement T2. PLC reports the detected load carrier with a LREQ message.	
F001;;8;LREQ;8;TRGWS01;;[1]	
User manually scans the load carrier T2 and confirms the pick. PLC is notified that the load carrier is T2.	
	TS01;F001;8;LNOT;8;TRGWS01;[{"T2";1}]¶
PLC sends a LREP message to confirm.	
F001;;9;LREP;9;"T2";;SRCWS01;;[]	

PLC turns target replace mode off.	
F001;;10;STAT;WS01;$80000000	
T1 is sent to the exit.	
	TS01;F001;9;DLST;"T2";[EXITWS01];[]

5.144.14   Mismatch in Tracking at Source

In case of a mismatch of the scanned barcode and the tracking data the tote is moved to the exit.

PLC	MFC
T1 arrives at the target position. However T2 is available in the tracking. PLC exchanges the read barcode T1 with the tracking data T2.	
F001;;7;LREP;7;"T1";;SRCWS01;ETRC;[(TRI D:"T2")]	
IT recognizes the mismatch and due to the exception handling the tote has to leave the workplace.	
	TS01;F001;9;DLST;"T1";[EXITWS01];[]
T1 moves with the new tracking information T1 moves to the exit.	
F001;;9;LREP;19;"T1";;EXITWS01;ACKR;[]	
Acknowledge for T1 at the exit.	
	TS01;F001;8;ACKR;19;EXITWS01;LREP