SAP EWM MFS Communication Customizing & Master Data

Introduction

With the built-in component SAP EWM MFS, automated material handling equipment (MHE) of warehouses can be connected to and can be conducted by SAP EWM. To achieve this, information has to be exchanged between SAP EWM and the control systems of the automated MHE. This blog provides insight on how to set up the system.

Customizing Interface Type, PLC and Communication Channel

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Goods Issue Process	
) Internal Warehouse Processes	
Cross-Process Settings	
V Material Flow System (MF5)	
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Communication Channel	
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Define MFS Resource Type	

Define PLC Interface Type

For different devices like pallet conveyors, case conveyors, single load handling devices, multiple load handling devices, shuttles, robots or elevators you might want to use different telegram types and/or different telegram structures. For each different interface, you define an interface type for the warehouse. To each PLC such an interface type has to be assigned, and telegram structures have to be defined per warehouse, interface type and telegram type.

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Definition of PLC In	terface Type
War., intic.7ype	Description
QKB1 X	MFS Rack Feeder - xyRF001
QKB1 Y	MFS Case Conveyor - xyCS001

Define Programable Logical Control (PLC)

Each external communication partner (May it be PLC based, some micro controller, a PC or even a sub system) for a warehouse has to be defined.

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War., PLC	Description	Intfc.Type	Header Data Struct.	. Putawy-WPT	PType MFS	PType MP	STrans-WPT	ExcC MFS	Mapping	D	PLC Mode		
QKB1 AHCSOO1	MFS: PLC for case conveyors	Y	ZMFS_TELE_HDR	Q13	AH02	AHP1			V	EWMFSA	Case Conveyor System	v	A V

Attributes:

Interface Type

The interface type used to communicate with this PLC

Header Data Structure

The DDIC structure of the header of all telegrams used for this PLC as defined and named in the data dictionary.

Putaway WPT

Warehouse process type used for putaway warehouse tasks. Should be defined on communication point level, which is more granular. Used as fallback in case no putaway WPT is defined for a communication point.

PType MFS – Process Type Fault

Warehouse process type used for warehouse tasks in exception cases.

PType MP - Process Type MP

Warehouse process type used for postings of movements in a case conveyor context. This WPT is usually defined with the attributes immediate confirmation allowed, immediate confirmation proposed, and storage control is not relevant.

STrans-WPT – Stock Transfer WPT

Warehouse process type used for re-arrangement warehouse tasks in a multi deep storage scenario. If a HU in a deeper bin position cannot be accessed as it is blocked by one or more HUs in the front positions of the bin, these HUs a removed with transfer movements to other storage bins.

ExC MFS

The exception code used for warehouse task confirmation in case the actual destination bin differs from the destination bin in the warehouse task. This exception code should have the internal process code CHBD for the business context MF3 (MFS telegram) and execution step A0 (Background).

Mapping

For objects like bins, communication points or resources, you might want to use different names on EWM level than on PLC levels. E.g. on EWM level bin names should be readable by human beings like <storage type>-<aisle>-<stack>-<level> whereas the PLCs mostly prefer a format like <aisle><side><stack><level>.

If mapping is switched on

- it will be checked whether the table /SCWM/MFSOBJMAP (to be maintained as master data by transaction /SCWM/MFS_OBJMAP) contains appropriate entries
- a mapping BAdI will be executed, if implemented

Identification

This identification will be used to fill the field *sender* in the telegram header (as the PLC name will be used to fill the field *receiver* in the telegram header). If the field *check telegram* is ticked on channel level, the content of the field *receiver* in the header of the received telegram will be compared with this identification.

PLC Mode

There are three different modes.

Mapping:		
Identification:	EWMMFS	
PLC Mode:	A Case Conveyor System	~
	Pallet Conveyor System and Rack Feeder	1
	A Case Conveyor System	
	B Case Conveyor System and Rack Feeder	

If you are working in a push mode and driven by warehouse tasks (this especially applies for resources), you have to choose "Pallet Conveyor System and Rack Feeder".

If you are working in a pull mode and only react on telegrams from the PLC, you have to choose "Case Conveyor System".

If you have a hybrid scenario, you have to choose "Case Conveyor System and Rack Feeder".

In general, it is recommended to work with PLC mode "Case Conveyor System" where possible. Although there are some restrictions like missing capacity management for communication points the benefits outweigh this. Compared to the "Pallet Conveyor System and Rack Feeder" with the "Case Conveyor System" telegram processing can be significantly faster due to a slimmer warehouse task handling. E.g. warehouse task confirmations are decoupled to an asynchronous process. Also, the rough destination bin determination allows faster processing and later warehouse task creation and bin reservations.

Define Communication Channel

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[~] Q	New Entries	0	5	ET	e e	BC	Set Change Field Value	0	More 1	Y.				9	🖗 Display	Ext
Define C	ommunica	tion Channel																Ð
War_	PLC	Comm.chan.	Telegram Retrie	s Interval Te	ei. Retry	Highe	st Send Se	sg.No.	Highest Receiv:Seq.No.	Fill Char.	Hnd.	. Hn	HndShMode		S/R Switch	MxPr	Life Tel. Interva	111
QKB1 A	4HC\$001	1	3	5		9999			9999		с	н	A Send Complete Telegram	Ý	¥.	5	120	u 🗘
QKB1 A	4HRF001	1	3	5		9999			9999		C	н	A Send Complete Telegram	×	1		60	U
QK81 A	AHRF001	2	3	5		9999			9999		С	н	A Send Complete Telegram	×	V		60	U
QK81 A	4HRF001	3	3	5		9999			9999		C	н	A Send Complete Telegram	Y	9		60	u
QK81 /	AHRF001	4	3	5		9999			9999		С	н	A Send Complete Telegram	v			60	u
QKB1 A	AHRF001	5	3	5		9999			9999		C	н	A Send Complete Telegram		e.		60	U

Here you have to define the attributes of each single connection (named channel) that will be used.

Attributes:

Telegram Retries

Defines how often a telegram will be re-sent, if no handshake for the telegram was received

Interval Tel. Retry

Defines after which period of time a telegram will be re-sent, if no handshake for the telegram was received

Highest Send. Seq. No.

Highest sequence number for outbound data telegram; after this number was reached, the sequence number for outbound will start again from 1.

Highest Recv. Seq. No.

Highest sequence number for inbound data telegram; after this number was reached, the next expected sequence number for inbound will be 1.

Fill Character

Space characters in telegrams will be replaced by this character.

HS Confirmation

Value for the header field handshake that indicates that the telegram is a handshake telegram

HS Request

Value for the header field handshake that indicates that the telegram is a data telegram

Handshake Mode

These are the valid options:

HS Confirmation:	c	
HS Request:	н	
Handshake Mode:	A Send Complete Telegram	
S/R Switch:	A Send Complete Telegram	
Max. Processes:	B Send Sender, Recipient, Telegram Type & Sequence Number	
Life Tel. Interval:	C Do Not Send Confirmation	
Life Tel. Type:	D Send Telegram Header	
Get Seq.No.:		

We recommend using the option A – Send Complete Telegram

S/R Switch

Indicates that sender and receiver are switched in a handshake telegram. We recommend ticking that option.

Admits parallel processing of received telegrams. If left empty, received telegram from one channel are processed one by one in the sequence they were received. Otherwise, up to the defined number of process can be run in parallel to process received telegrams. Be aware, that the defined number of processes is in balance with the number of overall available work processes.

Life Tel. Interval

Depending on the content of the attribute *Life Tel. Type* this value defines the period of time

- after which a LIFE telegram will be sent, if there was no traffic on the channel
- after which the connection will be re-started, if there was no traffic on the channel

Life Tel. Type

If filled, a LIFE telegram will be sent, if no traffic was on the channel for a defined period of time.

If not filled, the connection will be re-started, if there was no traffic on the channel for a defined period of time.

Note: If you use one channel just to receive data telegrams, so that EWM sends only handshake telegrams via this channel, this channel can be monitored by the system by defining a Life Telegram Interval and leaving the Life Telegram Type empty. In this case, the communication partner should send LIFE telegrams via this channel to make sure that there is some traffic on the channel within the Life Telegram Interval.

Get Seq. No.

Indicates, whether sequence number should be used for LIFE telegrams as well. We recommend ticking that option.

Start Character

You can define one or two characters that will be placed in the beginning of a telegram. If you set some start character you have to respect this in the definition of your telegram header structure.

End Character

You can define one or two characters that will be placed at the end of a telegram. This especially can be used, if you have telegrams with different length being exchanged on this channel. If you set some end character you have to respect this in the definition of your telegram structure.

Telegram Length

If you define a value here, all telegram structures have to be defined such that the length of all telegrams is the same. This applies not only to data telegrams but to handshake telegrams as well.

Check Telegram

If you set this attribute, sender and receiver will be checked on telegram receipt.

ExcCode MFS

Here you have to define the exception code that is set for a channel in case loss of connection is detected (No acknowledgement received after data telegram was repeatedly sent). If you use an exception code with the internal process code "REST", the system will close the connection and try to re-establish the connection.

Standard Error

Here you can define the error code that will be sent in an acknowledgement to the PLC in the header field *Protocol Error* (*comm_error*), when EWM detects some error for a received telegram on protocol level (invalid sequence number, wrong telegram length etc.). We recommend not to set this value, but to define specific error codes as described in one of the subsequent paragraphs. You might set this value to have a fallback in case you did not set up the value for the communication error for a specific exception situation.

No Synchron.

You can switch off the synchronizing mechanism, that can be executed when the connection is established. We strongly recommend ticking that option.

No Alive Check

You can switch of the Alive Check. Not recommended as this disables connection monitoring by the system.

Assign Communication Channel to Objects

If you use more than one channel to communicate with one PLC, you have to set up criteria for the channel determination. The decision, on which channel EWM MFS will send a telegram, is based on objects like resource, communication point or telegram type.

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Assignment Table	for Communicatio	n Channels		÷
War, PLC	Object Type	Channel Object	Comm	
QKB1 AHRF001	D Resource	V AHRF01	1	0
QKB1 AHRF001	D Resource	- AHRF02	2	1
QKB1 AHRF001	D Resource	- AHRF03	3	
QKB1 AHRF001	D Resource	- AHRF04	4	
QKB1 AHRF001	D Resource	~ AHRFOS	5	

Attributes:

Object Type

These are the object types used to determine a channel for telegram sending:



Channel Object

Contains the name of the object for channel determination.

Define Ranking Order of Communication Channel Objects

If you use more than one channel to communicate with one PLC, you have to set up in which order the objects of a telegram will be checked in order to determine the channel for sending the telegram.

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Ranking Sequence for Communication Channel Objects	ê ^
War PLC Sequence Number Object Type	v
QKB1 AHRF001 1 D Resource ∨	× 48
C QKB1 AHRF001 2 C Communication Point	

Attributes:

Object Type

These are the object types used to determine a channel for telegram sending.

	War	PLC	Sequence Number	Object Type	
	QKB1	AHRF001	1	D Resource	~
	QKB1	AHRF001	2	A PLC	
1				B Telegram Type	
				C Communication Point	
				D Resource	

Master Data PLC and Channel

/SCWM/MFS_PLC Maintain Programmable Logical Controller

For each PLC you have to maintain the way EWM will communicate with this PLC.

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eis	Executive	RFC Destination	Sending TV	Starting FM	Septing FM	FM Status	lej.			
AMCSD01 AMMFDD1	SAF Communication Layer B SAF ABAP Push Channel TOP So.	- ZEWM, MFS_PCD_CONN_AH - ZPF_MFS_TELEGRAM					100			, i

Attributes:

Communication Layer

These are the options:

AHCS001	SAP Communication Layer	ZEWM_MFS_PCO_CONN_AH
AHRF001	B SAP ABAP Push Channel TCP Socket Communication Layer	ZPF_MFS_TELEGRAM
	SAP Communication Layer	
	A Proprietary Communication Layer	
	B SAP ABAP Push Channel TCP Socket Communication Layer	

SAP Communication Layer – You chose this option in case you use PCo as an RFC- TCP/IP converter

Proprietary Communication Layer – You chose this option in case you use an RFC- TCP/IP converter

SAP ABAP Push Channel TCP Socket Communication Layer – You chose this option, if EWM MFS communicates via pure TCP/IP with the PLC

Note: We recommend the usage of the ABAP Push channels as you do not need an additional System (like PCo) anymore. Furthermore, by using the dialogue APC TCP Log in the Warehouse Management Monitor you can directly analyze what happened on the TCP/IP level.

Further details on the communication layers can be found in the following guides:

- ABAP Push Channel
- <u>SAP Plant Connectivity</u>

RFC Destination

Either a TCP/IP RFC connection (in case a RFC – TCP/IP converter is used) or an ABAP RFC connection (in case ABAP Push Channels are used) set up via SM59.

Sending FM

Only to be defined in case of a proprietary communication layer – Function module called for sending a telegram.

Starting FM

Only to be defined in case of a proprietary communication layer – Function module called for establishing a connection.

Stopping FM

Only to be defined in case of a proprietary communication layer – Function module called for shutting down a connection.

FM Status

Only to be defined in case of a proprietary communication layer – Function module called for checking the connection status.

Log

Switch on the logging of telegrams in table /SCWM/MFSTELELOG. We strongly recommend ticking that option.

/SCWM/MFS_CCH Maintain Communication Channel

For each connection to be used, you have to define the IP address and the port of the socket server:

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	e [~	17 17 18 M	ore ~	
Weste	use No.: QKB1			
Maintain Co	mmunication Chan	nel		
PLC	Cumm.chan.	Host	Port	
AHCS001	1	10.88.190.30	8801	
AHRFOOI	1	10.88,190.33	8871	
AHRFOOL	2	10.58.190.33	8872	
AHRF001	3	10.88.190.33	8873	
AHRF001	4	10.88,190.33	8874	
AHRF001	5	10.88,190.33	8875	
A				

Attributes:

Host

IP address of the socket server

Port

Port, on which the socket server is listening

Customizing Telegram structure

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	Structure		
	> 64	Logistics Execution	
	Ψ.	SCM Extended Warehouse Management	
	×.	Extended Warehouse Management	
	0	🕼 😳 Enable Decentralized EWM	
	>	Master Data	
	3	Goods Receipt Process	
	>	Goods tasue Process	
	3	Internal Warehouse Processes	
	2	Cross-Process Settings	
	~	Material Flow System (MFS)	
		Master Data	
	:3	Storage Control	
		Routing for Case Conveyor Systems	
		 Telegram Processing 	
		🕼 🛞 Define MFS Actions	
		🕼 💮 Find MFS Actiona	
		🚯 💮 Define Telegram Structure	
	.)	> Exception Handling	
	5	Labor Management	
		Billing	
	2	Dock Appointment Scheduling	
		Monitoring	
	3	Interfaces	
	2	Mobile Data Entry	
	2	Business Add-Ins (BAdIs) for Extended Warehouse Management	

Define Telegram Structure

Per warehouse and PLC interface type you have to define, which telegram types are used, and which structure is used for which type.

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Define Telegram	Structure	(for PLE Interface Type)		
Wor_ intritype	: TeleTyp	Tel. Gal.	Shuckeeneme	
0481 X	.CR	2 Starting Point	- DHFS_TELE_FOS	6
GHBI N		N. Life Tolegram	- ZHFS_TELE_HOR	1
Q481 X	MR	G Confirmation of the Warehouse Task	- DHFS_TELS_POS	
QK81 K	TM	E varehouse Task	- DIPS_TELE_FOS	1
0481 Y	AF	0 Actual Routing - Case Conveyor System	- 2HFS_TELE_POS	
QKB1 V	Ce .	M Mouting Request - Case Conveyor System	- DHFS_TELE_FOI	
QKR1.Y	M	K Life Telegram	- 2HFS_TELE_HOR	
QAB1 Y	#1	N Flanned Routing - Case Conveyor System	- ZNFS_TELE_FOS	
Attribut	es:			

Telegram Category

These are the valid options:

Denne	receptoin	Juncture	(ior ree intendee Type)	
War	Intfc.Type	TeleTyp	Tel. Cat.	Structure name
QKB1	x	DR	J Starting Point	VZMFS_TELE_POS
QKB1	х	u	K Life Telegram	ZMFS_TELE_HDR
QKBI	x	MR	C Status Message	CZMFS_TELE_POS
QKB1	х	TM	D Synchronization End	ZMFS_TELE_POS
QKB1	Y	AF	E Warahaura Tack	ZMFS_TELE_POS
QKB1	Y	DR	E warenouse rask	ZMFS_TELE_POS
QKB1	Y	u	F Cancellation Request for Warehouse Task	ZMFS_TELE_HDR
QKB1	Y	RT	G Confirmation of the Warehouse Task	ZMFS_TELE_POS
			H Confirmation of Cancellation Request for Warehouse Task	
			1 Storage Bin Empty	
			J Starting Point	
			K Life Telegram	
			L Status Request	
			M Routing Request - Case Conveyor System	
			N Planned Routing - Case Conveyor System	
			O Actual Routing - Case Conveyor System	
				W.

Define Telegram Structure (for PLC Interface Type)

Structure Name

DDIC structure that was defined in the data dictionary

Note: If you use fields in that structure that are not member of the structure /SCWM/S_MFS_TELETOTAL, you have to define those fields in an enhancement structure of /SCWM/S_MFS_TELETOTAL as well.

Customizing Protocol errors and exceptions

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	< SAP		Display IMG
			More 🛩
	Structure		
	200 6	palistics Execution	
	~ s	CM Extended Warehouse Management	
	~	Extended Warehouse Management	
	63	C Enable Decentralized EWM	
	>	Master Data	
	>	Goods Receipt Process	
	>	Goods Issue Process	
	>	Internal Warehouse Processes	
	>	Cross-Process Settings	
	~	Material Flow System (MFS)	
	>	Master Data	
	>	Storage Control	
	3	Routing for Case Conveyor Systems	
	2	Telegram Processing	
	0	Exception Handling	
	11 3	 EWM Exceptions 	
		B C Define EWM Exception for PEC Errors	
		🚯 🛞 Define EWM Exception for PLC Access Control Errors	
		3 (S) Define EWM Exceptions for Communication Errors	
		🕼 🕑 Assign Telegram Errors to PLC Errors	

Define EWM Exceptions for Communication Errors

Here you have to define exception codes for protocol errors received in handshake telegrams from the PLC:

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Define EWM Excep	tions for Communicatio	on Errors					0
War_ infcJype	Communic. Error	Exc.Comm.					
PT96 G	1	MSEQ					1
PT96 G	L						
PT96 G	R						
PT96 G	5						
PT96 G	x						

Attributes:

Exception Code Communication

For each value defined for the protocol error in your interface specification you have to make an entry here – even if you do not assign an exception code. Exception code MSEQ in the example above can be used in case the PLC complains about a wrong sequence number. EWM MFS then sets the sending sequence number of the channel to zero and then re-sends the telegram with this sequence number.

Assign Telegram Errors to PLC errors

Per warehouse and PLC Interface Type, you have to define which protocol error (header field *comm_error*) has to be set in a handshake telegram for which exception on protocol level.

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Assign Telegram En	rors to PLC Errors			٥
War Intfc.Type	Telegram Error	E Teli	e Restart	
PT96 G	B End Sequence Incorrect	VL		0
PT96 G	C Telegram Length Incorrect	YL		
PT96 G	D Sequence Number Incorrect	~1		
PT96 G	E Recipient Identification Incorrect	~R		
PT96 G	F Sender Identification Incorrect	vs		
PT96 G	G Sequence Number Retry	~		
PT96 G	H Sequence Number Cannot Be Checked; Telegram Being	. v		
🗌 PT96 G	I Telegram Contains Invalid Content	∼ x		

Attributes:

Telegram error

The protocol error that occurred; these are the possible values:

Assign 1	Telegram Er	rors to PLC Errors		
War	Intfc.Type	Telegram Error	E Tele	Restart
PT96	G	B End Sequence Incorrect	<u> </u>	
PT96	G	A Start Sequence Incorrect	L	
PT96	G	B End Sequence Incorrect	1	
PT96	G	C Telegram Length Incorrect	R	
PT96	G		S	
PT96	G	D Sequence Number Incorrect		
PT96	G	E Recipient Identification Incorrect		
PT96	G	F Sender Identification Incorrect	×	
		G Sequence Number Retry		
		H Sequence Number Cannot Be Checked; Telegram Being Processed		
		1 Telegram Contains Invalid Content		

E Tele :The value, which will be set in the protocol error field of the handshake telegram.

Restart : Here you can define, whether the connection should be reset.

In case you missed it, you can find the introduction to the entire blog series <u>here</u>.

SAP EWM MFS Receiving and Processing Telegrams

Introduction

With the built-in component SAP EWM MFS, automated material handling equipment (MHE) of warehouses can be connected to and can be conducted by SAP EWM. To achieve this, information has to be exchanged between SAP EWM and the control systems of the automated MHE. This blog provides insight into the mechanisms of receiving information and processing received information.

Telegram Receiving



As a precondition for receiving telegrams in SAP EWM MFS the TCP/IP connection between a PLC (or a sub system) and SAP EWM MFS has to be established by SAP EWM MFS.

Technically, the receipt of telegrams is done with the function module /SCWM/MFS_RECEIVE2. This function module is either called from the SAP socket layer (ABAP Push Channel) or from PCo (or another TCP/IP<->RFC-converter) on the receipt of a telegram.

We distinguish between data telegrams and acknowledgement telegrams (indicated by the field handshake in the telegram header).

A data telegram contains application data that should be processed by the communication partner. An acknowledgement telegram is used on protocol level to indicate positive receipt of a data telegram or the refusal to accept a received data telegram.

For more information about MFS protocol please refer to the second blog in the series, SAP EWM MFS Communication [HYPERLINK TO BLOG 2].

The function module is called with these parameters: lgnum, plc, channel, ipaddress, port and telegram, where either the pair plc and channel or the pair ipaddress and port is set.

Parameter Name	Typing	Associated Type	Optional	Description
IV_LGNUM	TYPE	/SCWM/LGNUM	Х	Warehouse Number
IV_PLC	TYPE	/SCWM/DE_MFSPLC	Х	PLC
IV_CHANNEL	TYPE	/SCWM/DE_MFSCCH	Х	Communication Channel
IV_IPADDRESS	TYPE	/SCWM/DE_MFS_HOST	Х	IP address
IV_PORT	TYPE	ME_PORT	Х	Port
IV_TELEGRAM	TYPE	/SCWM/DE_MFSTELE		Telegram

Functional description of /SCWM/MFS_RECEIVE2

- Check lgnum, plc and channel or determine plc and channel, if ipaddress and port have been passed
- Read attributes (Customizing, Master Data) for plc and channel
- Replace filler character with "space" in received telegram (FM /SCWM/MFS_TELE_FORMAT)
- Move content of received telegram into the teletotal-structure (contains all fields of all used telegrams /SCWM/S_MFS_TELETOTAL) (FM /SCWM/MFS_MOVE_STR2TELETOTAL)
 - Get telegram header from PLC-customizing, get telegram type from telegram header of received telegram

Note: If the header structure cannot be determined or the telegram structure cannot be determined by the telegram type in the telegram, an exception will be thrown and an alert entry will be written (/SAPAPO/AMON1). No telegram log will be written.

• Move corresponding fields from received telegram into overall structure:



The internal structure /SCWM/S_MFS_TELETOTAL containing a superset of telegram fields used in project specific telegrams was introduced to enable a generic interface for internal processing

- Check, whether telegram logging is activated (strongly recommended) (FM /SCWM/MFS_CHECK_LOGGING). If yes,
 - Try to get applicable warehouse task
 - Write telegram log (table /SCWM/MFSTELELOG) and commit work (FM /SCWM/MFS_TELE_LOG)
- Now a BAdI for manipulating the content of the received telegram (teletotal-structure) is called (SCWM/EX_MFS_TELE_RCV).

Note: Please be aware that you have to handle the PLC names of EWM objects here as mapping was not executed yet.

- Next, telegram is checked (FM /SCWM/MFS_TELE_CHECK)
 - Sequence number is checked (if received telegram is a data telegram)
 - Telegram length, start character and end character are checked
 - If check is set on customizing data of PLC, sender and receiver will be checked
 - If an error was detected, send acknowledgement telegram with com. error determined by detected error and customizing (Extended Warehouse Management -> Material Flow System (MFS) -> Exception Handling -> Assign telegram errors to PLC errors) Stop telegram processing in case of certain errors detected
- Perform mapping for telegram content (objects like CP, Resource, Bin), if set in customizing (PLC level) (FM /SCWM/MFS_TELE_MAP)
 - Call a BAdI for mapping (SCWM/EX_MFS_TELEPLC2EWMOBJ)
 - Select entries in mapping table (master data table /SCWM/MFSOBJMAP)
- In case, a data telegram was received
 - Update channel data (received sequence number, timestamp for last receipt of a telegram)
 - \circ $\;$ $\;$ Check synchronization, check, whether received telegram is a LIFE telegram
 - Call BAdI for CP determination (SCWM/EX_MFS_TELE_DET_CP)
 - Store telegram in table /SCWM/MFSTELEQ; commit work
 - Send acknowledgement telegram (FM /SCWM/MFS_SEND)
 - Initiate processing of telegram in /SCWM/MFSTELEQ by calling /SCWM/MFS_PROCESS_TELE_Q (which is done asynchronously in case /SCWM/MFS_RECEIVE2 is not called in an APC environment)
- In case, an acknowledgement telegram was received
 - Check synchronization and update channel data accordingly
 - Check, whether com. error is set in the received acknowledgement telegram; if set, determine exception (customizing Extended Warehouse Management -> Material Flow System (MFS) -> Exception Handling -> EWM exceptions -> Define EWM exceptions for communication errors) and internal process code (customizing Extended Warehouse Management -> Cross-Process Settings -> Exception handling -> Define exception codes) and handle exception according to internal process code (FM /SCWM/MFS_ACK_EXCEPTION)

Note: If the mapping between the value of the field comm_error in the telegram and an exception is not defined, an exception will be thrown and an alert entry will be written (/SAPAPO/AMON1).

- If no error occurred, get telegram category and check, whether a WT is affected. If yes, update KZSUB (FM /SCWM/MFS_ASYNC_KZSUB_UPD).
 and delete telegram from /SCWM/MFSDELAY (as the PLC has confirmed to take over responsibility for the telegram by sending a positive acknowledgement telegram)
- o If no WT is affected, delete telegram from /SCWM/MFSDELAY

Standard Enhancement Possibilities in /SCWM/MFS_RECEIVE2

Receive-BAdI /SCWM/EX_MFS_TELE_RCV (method tele_rcv)

In this BAdI you can manipulate the content of the received telegram – already in the teletotal-structure. Be aware that names are PLC names as the mapping between PLC names and EWM names was not performed yet.

Parameter	Туре	Pass Value	Optional	Typin	Associated Type De	efault Val	Description
IV_LGNUM	Importing			Туре	/SCWM/LGNUM		Warehouse Number/Warehouse Complex
IV_PLC	Importing			Туре	/SCWM/DE_MFSPLC		PLC Programmable Logic Controller
IV_CHANNEL	Importing			Туре	/SCWM/DE_MFSCCH		Communication Channel for PLC
IV_TELE_RCV	Importing			Туре	/SCWM/DE_MFSTELE		Telegram
CS_TELE_RCV	Changing			Туре	/SCWM/S_MFS_TELETOTAL		Mapping Structure for Standard Action
CV_CONT_ERR	Changing		\checkmark	Туре	XFELD		Telegram contains invalid field contents

Sample applications:

- Field RSRC is not filled in received telegram by the PLC partner. The field RSRC has to be filled either by using information from the fields SOURCE or DEST or from the field CP (if the PLC partner fills both resource and communication point into that field). It is crucial for the determination of the action function module that should process the telegram (Based on warehouse number, telegram type and resource type)
- PLC handles HU type information different than EWM (container type, container width, container length and container height versus EWM HU type). Such, the field HU type is not filled in the incoming telegram.
- If you are using trays or totes that have internal compartments, the ident on the label contains not only the HU ident but some orientation information in addition (e.g. some L and R or 1 and 2 for left and right). So, the Field HU IDENT contains both the HU ident and the orientation information. Use the BAdI to have only the HU ident in the field HU IDENT and move the orientation information into some other field.

Tele-Check-BAdI /SCWM/EX_MFS_TELE_CHECK_MAP (method tele_check_map)

In this BAdI you can

- Change the communication error the system has detected here called mfs_error
- Change the exception code the system has detected
- Decide, whether to re-start the connection of this channel
- Accept a received sequence number (although the system would not)

Parameter	Туре	Pass Value	Optional	Typing Method	Associated Type	Default Value	Description
IV_LGNUM	Importing	0	Ŭ	Туре	/SCWM/LGNUM		Warehouse Number/Warehouse Complex
IV_PLC	Importing		Ď	Туре	/SCWM/DE_MFSPLC		PLC Programmable Logic Controller
IV_CHANNEL	Importing		<u>D</u>	Туре	/SCWM/DE_MFSCCH		Communication Channel for PLC
IV_TELEGRAM	Importing		Ũ	Туре	/SCWM/DE_MFSTELE		Telegram
IV_TELE_ERROR	Importing		<u>D</u>	Туре	/SCWM/DE_MFS_TELE_CHECK		Telegram Error
IS_TELEGRAM	Importing		<u>D</u>	Туре	/SCWM/S_MFS_TELETOTAL		Mapping Structure for Standard Action
CV_MFS_ERROR	Changing	0	<u>D</u>	Туре	/SCWM/DE_MFS_ERROR		Error in Telegram
CV_EXCCODE	Changing	0	Ũ	Туре	/SCWM/DE_EXCCODE		Exception Code
CV_FLG_RESTART	Changing		Ũ	Туре	/SCWM/DE_MFS_RESTART		Controls Whether Communication Is to Be Restarted
CV_SEQU_NO_ERROR	Changing		Ű.	Туре	XFELD		Checkbox

Sample applications – none.

Mapping-BAdI /SCWM/EX_MFS_TELE_PLC2EWMOB (method plc2emwob)

In this BAdI you can map the PLC names of objects like communication point, resource or storage bin.

Parameter	Туре	Pass Value	Optional	Typing Method	Associated Type	Default Value	Description
IV_LGNUM	Importing	Ω		Туре	/SCWM/LGNUM		Warehouse Number/Warehouse Complex
IV_PLC	Importing	Π		Туре	/SCWM/DE_MFSPLC		PLC Programmable Logic Controller
IV_PLCOBJ	Importing			Туре	/SCWM/DE_MFSPLCOBJ		PLC Object
IV_OBJTYPE	Importing			Туре	/SCWM/DE_MFSOBJTYPE		Object Category
IS_TELEGRAM	Importing			Туре	/SCWM/S_MFS_TELETOTAL		Mapping Structure for Standard Action
CV_EWMOBJ	Changing			Туре	/SCWM/DE_MFSEWMOBJ		EWM Object

Sample applications:

Convert bin names
 PLC: AASXXXYYZ (<u>a</u>isle, <u>s</u>ide, <u>X</u>-coordinate, <u>Y</u>-coordinate and <u>Z</u>-coordinate)

 EWM: TTTT-AA-S-sss-ll (storage <u>type</u>, <u>a</u>isle, <u>s</u>ide, <u>s</u>tack, <u>l</u>evel) plus logical position

CP-Determination-BAdI /SCWM/EX_MFS_TELE_DET_CP (method det_cp)

In this BAdI you can change or fill the content of the field CP (required for action function module determination).

Parameter	Туре	Pass Value	Optional	Typing Method	Associated Type D	Default Value	Description
IV_LGNUM	Importing			Туре	/SCWM/LGNUM		Warehouse Number/Warehouse Complex
IV_PLC	Importing			Туре	/SCWM/DE_MFSPLC		PLC Programmable Logic Controller
IV_CHANNEL	Importing		8	Туре	/SCWM/DE_MFSCCH		Communication Channel for PLC
IV_TELECAT	Importing		8	Туре	/SCWM/DE_MFSTELECAT		Telegram Category
IS_TELEGRAM	Importing		0	Туре	/SCWM/S_MFS_TELETOTAL		Mapping Structure for Standard Action
CV_CP	Changing		0	Туре	/SCWM/DE_MFSCP		Communication Point for Conveyor Technique

There is a fallback implementation in class /SCWM/CL_EI_MFS_TELE_DET_CP, which depends on the telegram category ('G' WTCO warehouse task confirmation) of the received telegram type and uses the telegram field DEST and the communication point bin assignment (/SCWM/TMFSCP).

Sample applications:

• Field CP (required for action function module determination) not filled in received telegram

Acknowledge-BAdI /SCWM/EX_MFS_TELE_ACK (method tele_ack)

In this BAdI you can manipulate the content of the acknowledgement telegram that you send:

Parameter	Туре	Pass Value	Optional	Typing Method	Associated Type	Default Val	Description
IV_LGNUM	Importing			Туре	/SCWM/LGNUM		Warehouse Number/Warehouse Complex
IV_PLC	Importing	1		Туре	/SCWM/DE_MFSPLC		PLC Programmable Logic Controller
IV_PRE	Importing		\checkmark	Туре	/SCWM/DE_MFSPREPROC		BAdl is Executed Before SAP Logic
IS_TELEGRAM	Importing			Туре	/SCWM/S_MFS_TELETOTAL		Mapping Structure for Standard Action
IS_TMFSCCH	Importing			Туре	/SCWM/TMFSCCH		Definition Table of the Communication Channel
EV_SKIP_STD	Exporting			Туре	/SCWM/DE_MFSSKIP_STD_PROC		No SAP Logic to Be Processed After BAdl
CS_TELEGRAM	Changing			Туре	/SCWM/S_MFS_TELETOTAL		Mapping Structure for Standard Action

Sample applications:

• In modernization projects, sometimes dedicated telegram types have to be used for positive ("ACK") and negative ("NAK") acknowledgments. With this BAdI you can build such telegrams.

Com.Error-Mapping-BAdI /SCWM/EX_MFS_TELE_ERROR_MAP (method error_map)

Pass Value Optional Typing Method Parameter Type Associated Type Default Value Description Warehouse Number/Warehouse Complex IV_LGNUM Type /SCWM/LGNUM importing IV_PLC /SCWM/DE_MFSPLC PLC Programmable Logic Controller Importing Type IV_CHANNEL /SCWM/DE_MFSCCH Communication Channel for PLC Importing Type IS TELEGRAM Importing Type /SCWM/S_MFS_TELETOTAL Mapping Structure for Standard Action /SCWM/DE_MFS_ERROR IV MFS ERROR 1 Type Error in Telegram Importing IV_COMM_ERROR importing 1 Type /SCWM/DE_MFS_COMM_ERROR Error During Telegram Communication IT_TELE_HU 1 /SCWM/TT_MFS_TELE_HU Table Type for Mapping Structure for HUs in Telegram Importing Type IO LOG 1 Type Ref To /SCWM/CL_LOG Importing Log CV_EXCCODE /SCWM/DE_EXCCODE Exception Code Changing Type CV_FLG_RESTART Changing /SCWM/DE_MFS_RESTART Controls Whether Communication Is to Be Restarted Type

In this BAdI you can map the received communication error to an exception.

Sample applications – none

Note: This mapping can be done by customizing as well (Table /SCWM/TMFSCERMPI)

Telegram Processing

Technically, the processing of telegrams is done with an action function module. Here you can use a function module provided by the SAP standard or you can use a custom function module.

Inbound telegrams to be processed are stored in the table /SCWM/MFSTELEQ by /SCWM/MFS_RECEIVE2. The telegram content is stored by using the overall internal telegram structure /SCWM/S_MFS_TELETOTAL. The processing of a received telegram is initiated by the function module /SCWM/MFS_PROCESS_TELE_Q. This function module is regularly called by /SCWM/MFS_RECEIVE2 on the receipt of a telegram. In addition, it can be called by /SCWM/MFS_PERIODCHK (Retry telegram processing) for telegram retries or from the warehouse management monitor manually.

Parameter Name	Typing	Associated Type	Optional	Description
IV_LGNUM	TYPE	/SCWM/LGNUM		Warehouse Number
IV_PLC	TYPE	/SCWM/DE_MFSPLC		PLC
IV_CHANNEL	TYPE	/SCWM/DE_MFSCCH		Communication Channel
IV_RETRY	TYPE	/SCWM/DE_MFS_RETRY_FLG	Х	Retry Telegram

The function module is called with these parameters: lgnum, plc, channel and retry.

Available action function modules:

몶 Rep	ository Browser	
Pack /SCW	age 💙 MMFS × 💌 🚱	
()		
0	bject Name	Description
	Function Modules	
	/SCWM/MFSACT_CASE_AISLE_DET	Routing Decision - Case Conveyor System
	/SCWM/MFSACT_CASE_A/SLE_DET_AS	LOCAL Routing Decision - Case Conveyor System - Remote Enabled
	/SCWM/MFSACT_CASE_ATF	Movement Posting - Case Conveyor System
	/SCWM/MFSACT_CASE_ATF_ASYNC	LOCAL Movement Posting - Case Conveyor System - Remote-Enabled
	/SCWM/MFSACT_CASE_DST_BIN	Re-Determination of Destination - Case Conveyor System
	/SCWM/MFSACT_CASE_DST_BIN_ASYN	LOCAL Re-Determination of Destination - Case Conveyor System - RFC
	/SCWM/MFSACT_CASE_ROUTE	Routing Decision - Case Conveyor System
	/SCWM/MFSACT_CASE_RSRC_PP	Resource Pick-Up Point - Case Conveyor System
	/SCWM/MFSACT_CASE_SP	HU Check - Case Conveyor System
	/SCWM/MFSACT_CASE_WT_CREA	Determination of Destination - Case Conveyor System
	/SCWM/MFSACT_CASE_WT_CREA_ASYN	LOCAL Determination of Destination - Case Conveyor System - Remote-Enabled
	/SCWM/MFSACT_LOC_EMPTY	Empty Location: Telegram (Category I)
	/SCWM/MFSACT_REPLENISH	Trigger Replenishment (Category I)
	/SCWM/MFSACT_SP	ID Point Telegram (Category J)
	/SCWM/MFSACT_STATUS	Telegram Status (Category C)
	/SCWM/MFSACT_WT_CONFIRM	Confirm Warehouse Task (Category G)
	/SCWM/MFSACT_WT_CONFIRM_CANC	Cancel Warehouse Task (Category H)
	/SCWM/MESACT_WT_CONFIRM_RSRC	Confirm Warehouse Task from RSRC (Category G)

If you create , the coding should be like that of an SAP action function module. All those function modules share a common interface as they are called dynamically by /SCWM/MFS_PROCESS_TELE_Q.

```
CALL FUNCTION ls_tmfsactd-action_fm
EXPORTING
  iv_lgnum = iv_lgnum
  iv_plc = <teleq_2>-plc
  iv_channel = <teleq_2>-channel
  is_telegram = <teleq_2>-telegram
  iv_wtnum = <teleq_2>-talegram
  iv_rsrc_cnt = <teleq_2>-rsrc_cnt "counter reduced
  iv_retry = iv_retry
IMPORTING
  ev no async = lv no async.
```

Functional description of /SCWM/MFS_PROCESS_TELE_Q

- Check number of processes already working on plc and channel in /SCWM/MFSTELEQ and number of allowed processes (customizing Extended Warehouse Management -> Material Flow System (MFS) -> Master Data -> Communication Channel -> Define Communication Channel)
- Read records from /SCWM/MFSTELEQ sorted by timestamp
- Determine and lock next record to be processed Note: Even if you have set up more than one work process to process received telegrams of a channel, telegrams for the same communication point or for the same resource will not be processed in parallel. This re-builds reality, where objects cannot jump over another at one communication point or resource.
- Determine function module for telegram processing using lgnum, plc, cp, rsrc, dest and teletype (plus function module for additional asynchronous processing)

Wa	СРТур	Rsrce Type	TeleTyp	Action	ActionFunction	Asynch. Action Funct. Module
QKB1		AHSR	MR	AR	/SCWM/MFSACT_WT_CONFIRM_RSRC	
QKB1	AHAD		DR	A1	/SCWM/MFSACT_CASE_AISLE_DET	/SCWM/MFSACT_CASE_ATF_ASYNC
QKB1	AHAF		AF	AF	/SCWM/MFSACT_CASE_ATF	
QKB1	AHAF		AR	AF	/SCWM/MFSACT_CASE_ATF	
QKB1	AHDB		DR	AB	/SCWM/MFSACT_CASE_DST_BIN	
QKB1	AHPP		DR	A2	/SCWM/MFSACT_CASE_RSRC_PP	
QKB1	AHRD		AF	AF	/SCWM/MFSACT_CASE_ATF	
QKB1	AHRD		DR	AD	/SCWM/MFSACT_CASE_ROUTE	
QKB1	AHS1		DR	AP	/SCWM/MFSACT_CASE_SP	/SCWM/MFSACT_CASE_ATF_ASYNC
QKB1	AHS2		DR	AP	/SCWM/MFSACT_CASE_SP	/SCWM/MFSACT_CASE_ATF_ASYNC

Find MFS Action

• The function module is then executed; according to the result the record in /SCWM/MFSTELEQ is updated or deleted

• If a function module for asynchronous processing was determine, this one is called then

Standard Enhancement Possibilities in /SCWM/MFS_PROCESS_TELE_Q

There are no BAdIs available. Launching telegram processing with the rules for parallel and sequential processing shall not be modified.

Content of telegrams can be manipulated by using the BAdIs called in /SCWM/MFS_RECEIVE2. The processing of telegrams can be influenced by defining the processing function module via customizing, using BAdIs of the MFS standard action function modules or using your own customer specific function modules.