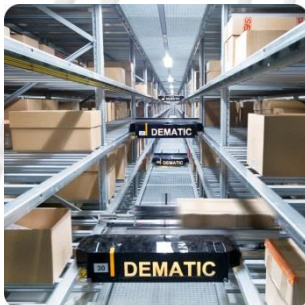


Virtual Flow Controller User Guide

Revision A
2016-10-21



We **Optimize** Your Supply Chain

DEMATIC

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1 Getting Started

VFC is a Dematic desktop application that simulates Warehouse Control System (WCS) messages being sent to Programmable Logic Controllers (PLCs) or other controllers (either using emulation software or with real systems). VFC performs a similar function as the WCS Simulator Tool, which you may be familiar with. However, VFC is more robust and user-friendly. VFC is designed to assist in the testing of emulation models and site installations prior to fully integrated testing. VFC is a reactive tool for creating missions and messaging scenarios to test equipment being installed on site.

VFC is designed for developers performing in-house testing (in conjunction with Demo3D), as well as commissioning engineers on site. To begin using VFC, download and install the latest version of the application from the [Virtual Flow Controller](#) wiki page. If you are installing a newer version of VFC, uninstall the old version of VFC before installing the new version.

The first time you use VFC you will need to add the proper plugins. To do this, perform the following steps:

1. Select **Edit > Add Remove Plugins** from the menu bar. The Add Remove Plugins window is displayed.
2. Click **Add** and navigate to C:\Program Files (x86)\Dematic\Virtual Flow Controller.
3. Select all of the .dll files and click **Open**. You can ignore any error messages that might be displayed.

1.1 Navigating VFC

Figure 1 VFC

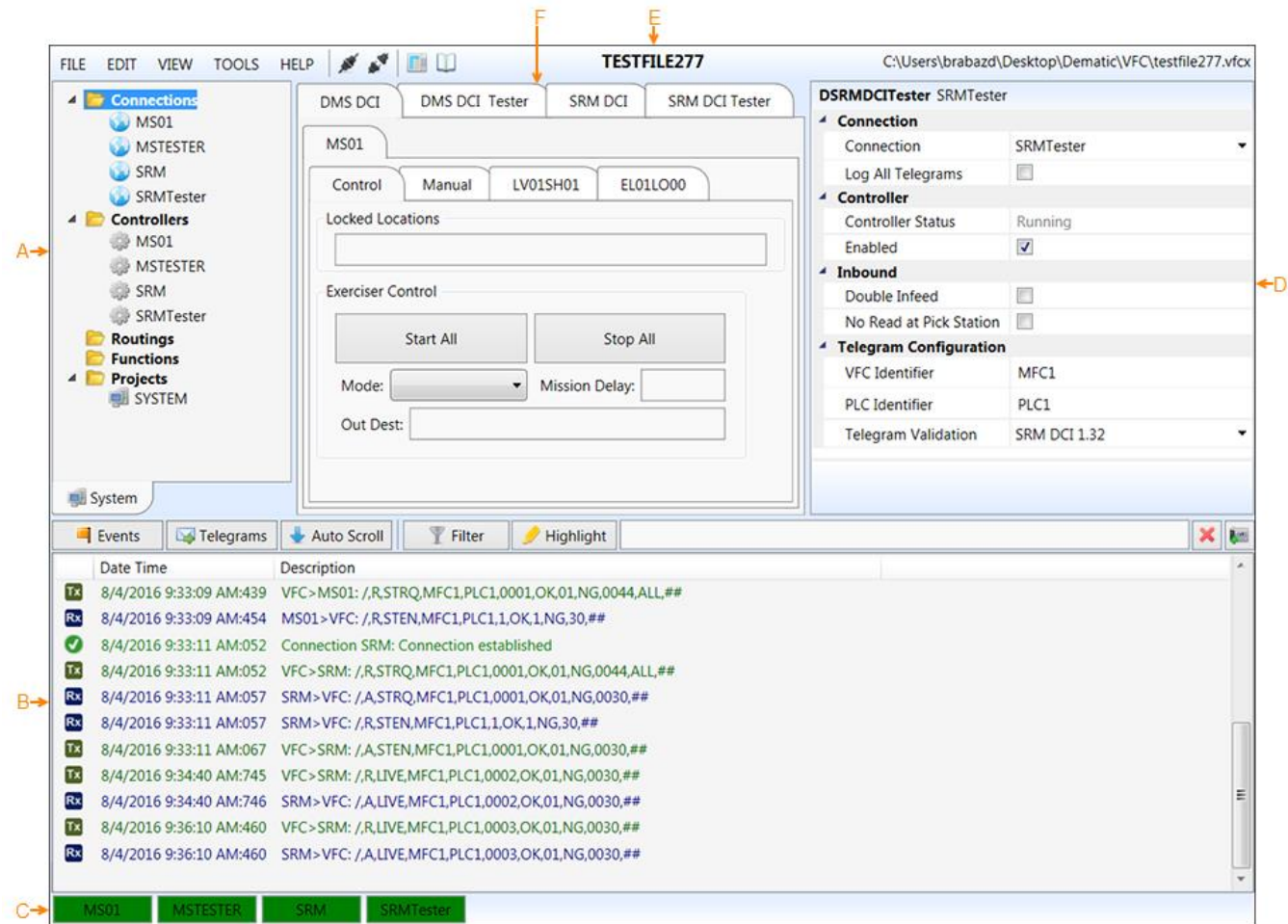


Table 1 VFC Navigation

Item	Description
A	<p>Project Tree - The project tree displays all components within the configuration:</p> <p>Connections link controllers and act as the interface to the equipment, emulation model, or PLC.</p> <p>Controllers contain the logic to control the associated equipment, or to react to a command, using standardized message protocols (for example, Dematic Communication Interface [DCI] TCP/IP).</p> <p>Routings are typically used for routing loads throughout conveyor systems.</p> <p>Functions are used to control a specific part of a controller function (for example, RapidPick).</p> <p>Projects are libraries of components, such as controllers and connections. Typically, the only project is the base VFC application project called "SYSTEM". You can add custom project controllers to VFC by using your own scripting. Once you have created your own scripting, right click on Projects and select Add Extension to add the script.</p>

Table 1 VFC Navigation

Item	Description
B	<p>Message and Event Logger - The Message and Event Logger section displays a chronological list of telegram messages and events.</p> <p>Icons are displayed beside each message or event. For telegrams, a Tx icon refers to a transmitted message and an Rx icon refers to a received message. For events, a green check mark indicates a successful event, a yellow exclamation mark indicates a warning related to an event, a red X indicates a failure of some sort, and a blue "i" indicates an informative note. Check the Description column for further details about a message or event.</p> <p>Clicking on the Events or Telegrams buttons displays or hides those types of messages. Clicking the Auto Scroll button automatically scrolls to the next message in the logging window. If there are any error or warning messages, a blinking icon will display beside the Auto Scroll button along with the number of errors or warnings. A red X displays for errors and a yellow exclamation mark displays for warnings.</p> <p>Clicking on a message or event displays that message or event's content in a text field at the bottom of the screen. From here, you can copy any part of the message. If you paste the copied text into the text field beside the Highlight button you can do several things. If you click Filter, the messages and events will filter based on that criteria. If you click Highlight, matching text in the messages and events will highlight yellow.</p> <p>Clicking the Snap Shot of Messages button takes a snapshot of the message and event logger, and displays it in the main window. This is a helpful tool for investigating events that have recently occurred.</p> <p>Messages and events are also stored in a log file and can be accessed by clicking the Open Log File button on the menu bar. You can open multiple logs at once by selecting more than one log and clicking Open.</p>
C	<p>Connection Status - The bottom of the screen displays all available controller connections. The status of a connection is indicated by color: green for connected, red for disconnected, and yellow for a connection issue.</p>
D	<p>Properties Window - The Properties window displays a full list of properties for the selected component (connection, controller, and so on). Grayed out properties cannot be modified.</p>
E	<p>Menu Bar - The menu bar across the top of the screen provides standard menu functionality. The menu bar also displays the project name and the location of the open VFC file. Hover over an icon to learn more about its function.</p> <p>Click HELP for quick access to the Help content.</p>

Table 1 VFC Navigation

Item	Description
F	Main Window - The main window is the main workspace of VFC. Upon opening VFC, a tab for each controller is displayed. These tabs allow you to perform basic tasks such as manually creating messages. If you open other tools, such as Telegram Validation, they are displayed in the main window as well.

1.2 Setting Up VFC

Before you can start using VFC to simulate Warehouse Control System (WCS) messages, you must first set up the proper environment in VFC. This includes adding a connection, importing a telegram validation file, and adding a controller.

1.2.1 Adding a Connection

Connections link controllers and act as the interface to the equipment, emulation model, or PLC. To add a connection, perform the following steps:

Adding a Connection Complete

1. In VFC, create a new VFC file by selecting **File > New**, and giving your file a name. Save the file. The file name is displayed at the top of the screen.
2. To add a connection, right click **Connections** in the project tree and select **Add Connection**. The Add Connection dialog box is displayed.
3. Enter a connection name, type, and folder name. Typically, the type is DCI_TCPIP. Click **Add**. The connection is displayed in the project tree and connection parameters are displayed in the properties window on the right-hand side of the screen (as shown in the image to the right).
4. Enter the appropriate IP address (for your PLC or emulator) and port number. Typically, the IP address is 192.168.0.## and the port number is 2001.

Figure 2 Connection Properties

DCI TCP/IP test	
✦ Connection Mode	
Listen as Server	<input checked="" type="checkbox"/>
Auto Listen	<input checked="" type="checkbox"/>
✦ Connections	
IP Address	192.168.0.30
Port Number	2001
✦ Status	
Status	Listening

1.2.2 Importing a Telegram Validation File

The Telegram Validation tool allows you to set message parameters that ensure sent and received telegrams contain the necessary information. To import a telegram validation file, perform the following steps:

1. Navigate to the [VFC Telegram Validation](#) wiki page and download the current SRM telegram validation .xml file.
2. In VFC, click the Telegram Validation icon on the menu bar. The Telegram Validation tab is displayed.
3. Click the edit icon. Click **Import Template from XML** from the dropdown menu. A file browser is displayed.
4. Select the telegram validation file you downloaded in step 1. Click **Open**.

1.2.3 Adding a Controller

Controllers contain the logic to control the associated equipment, or to react to a command, using standardized message protocols. To add a controller, perform the following steps:

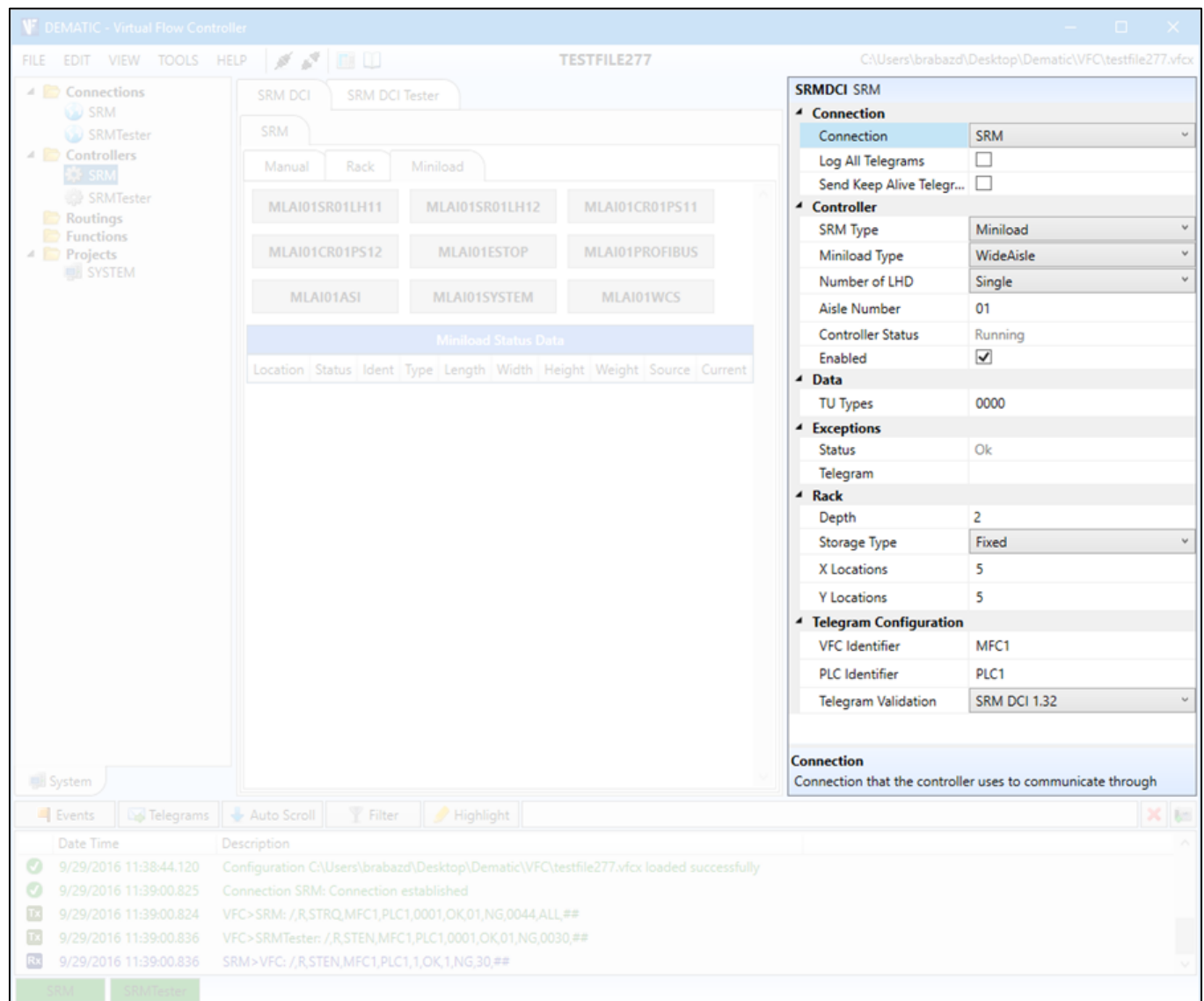
1. In VFC, right click **Controllers** in the project tree and select **Add Controller**. The Add Controller dialog box is displayed.
2. Enter a controller name, type, and folder name. Typically, the type is SRMDCI. To help you stay organized, use the same name and folder name as you used for your controller. Click **Add**. The controller is displayed in the project tree and controller parameters are displayed in the properties window on the right-hand side of the screen. A tab for your controller is displayed in the main window as well; this is where you'll do most of your work.

3. In the properties window, enter the appropriate parameters. Set the Connection parameter to the connection you created earlier. Set the telegram validation parameter to the telegram validation file you imported earlier. The following table describes the available controller parameters:

Section	Parameters
Connection	Set Connection to the associated SRM connection. Check the Log All Telegrams and Send Keep Alive Telegrams check boxes to log all telegrams and send heartbeat telegrams, respectively.
Controller	<p>SRM Type: Select either Miniload or Unitload from the dropdown menu.</p> <p>Miniload Type: Select either Narrow Aisle or Wide Aisle. (For ML-series SRMs only)</p> <p>Number of LHD: Configure either one or two LHDs per SRM by selecting Single or Double, respectively.</p> <p>Aisle Number: Enter the two-digit aisle number.</p> <p>Controller Status: Displays the current status of the controller.</p> <p>Enabled: Check this checkbox to enable the controller.</p>
Data	TU Types: Enter the four-character TU type identifiers. Separate multiple entries with a comma. TU types are documented on the Controls Emulation TU Types wiki page.
Exceptions	<p>Status: The current exception status. If there are no exceptions, the status will be "OK". If there is an exception, the exception type displays (for example, "BinOccupied").</p> <p>Telegram: If there is an exception, the exception telegram message is displayed.</p>
Rack	<p>Depth: The number of rack depths.</p> <p>Storage Type: Select a storage type from the dropdown menu. Fixed indicates one TU for one location. Dynamic builds from the upright and looks at millimeter distances from that point. Raster uses a raster table.</p> <p>X Locations: The number of locations along the X axis.</p> <p>Y Locations: The number of locations along the Y axis.</p>

Section	Parameters
Telegram Validation	<p>VFC Identifier: The VFC identifier for telegrams sent to and from the PLC.</p> <p>PLC Identifier: The PLC identifier for telegrams sent to and from VFC.</p> <p>Telegram Validation: The telegram standard type.</p>

Figure 3 Controller Parameters



- To enable your controller, check the **Enabled** checkbox in the properties window.

1.2.4 Connecting VFC to a PLC

Note: Before you connect VFC to your PLC you must have your PLC connected to the Demo3D emulator. For instructions on how to do so, see the *SRM Emulation* training course.

You can use VFC to simulate the WCS transport messages that are sent to and from your PLC. You can witness these transport messages being executed in the emulator.

To connect VFC to your PLC and to send transport missions to the PLC, perform the following steps in VFC:

1. Select your connection from the **Connections** section of the project tree. In the properties window for your connection, confirm that the IP address and port number are correct.
2. Select your controller from the **Controllers** section of the project tree. Ensure that the parameters are correct. The Connection parameter should be set to the connection you selected in step 1.
3. Click the **Connect All** icon to establish a connection. The connection status icon at the bottom of the screen turns green. VFC is now connected to your PLC.
4. On the **Manual** tab for your controller, you can now enter message parameters. Here's an example of the parameters you need to set to send a typical TUMI telegram:
 - Type: TUMI
 - For Source, Current, and Destination, click **Bin** beside each parameter. Enter the appropriate parameters and click **Update**.
 - Click **Send**. The transport unit mission message is sent to the PLC. The PLC tells the SRM to pick up the Transport Unit (TU) from the source location and move it to the destination location. If there are any errors (for example, the source bin empty or the destination bin already full), an error message is displayed on the HMI.

2 Messages

It's important to understand the types and components of messages that can be sent between WCS/VFC and controllers. This understanding will help you more efficiently design, test, and debug software. Let's look at the various message types, including possible responses, and then take a detailed look at exactly what information messages contain.

2.1 Message Types

To learn more about messages and naming conventions, see the *DCI Common* and *DCI Transport* specifications available on the [VFC Telegram Validation](#) wiki page.

The following sections explain the types of messages that can be sent or received by VFC.

2.1.1 TUMI

A TUMI (Transport Unit Mission) message is sent from WCS to the PLC. These messages are used to send a new transport mission to the PLC or to update an existing one.

The PLC will acknowledge this message with one of the following messages:

- TURP (Transport Unit Mission Report): An execution message of the transport order indicating whether the transport unit (TU) arrived at its destination. This message is only used for positive acknowledgment (that is, an event code of "OK").
- TUNO (Transport Unit Notification): A message that's used to send TU information during travel, or a message that's sent by the PLC due to a spontaneous event. This message is only used for positive acknowledgment (that is, an event code of "OK") and only if the TU has not reached its destination. This message is optional.
- TUEX (Transport Unit Exception): A message that's used for negative acknowledgment (that is, the event code is anything other than "OK") of a mission.
- TUDR (Transport Unit Destination Request): A message indicating the PLC requests a new destination from WCS if the TU has no destination.
- TULL (Transport Unit Location Left): A message indicating the TU has left an area.

2.1.2 TUMC

A TUMC (Transport Unit Mission Cancel) message indicates WCS has cancelled the transport order.

The PLC can respond with a TUCA message (Transport Unit Cancel), which is a positive or negative acknowledgment of the cancellation of the transport order.

2.1.3 MOMI

A MOMI (Move Mission) message is sent from WCS to move a vehicle to a specified position.

The PLC will respond with a MORP message (Move Report), which confirms the vehicle has executed its move mission.

2.1.4 STRQ

A STRQ (Status Request) message is sent from WCS to the PLC. These messages are used to request status information for a specific device, group of devices, or an entire system.

The PLC can respond with one of the following messages:

- STAT (Status): A message about availability of equipment.
- STMF (Status of Material Flow)
- STEN (End of Status): A messages indicating the end of a status sent only if requested from WCS.

2.1.5 LORQ

A LORQ (Location Data Request) message is used by WCS to request status information about a location from the PLC.

The PLC will respond with a TUNO (Transport Unit Notification) message, which is used to send TU information during travel, or is sent by the PLC due to a spontaneous event. This message is only used for positive acknowledgment (that is, an event code of "OK") and only if the TU has not reached its destination. This message is optional as long as it is not sent in an abnormal situation.

2.1.6 SETD

A SETD (Set Device) message sets a device to a given status. These messages are typically used by WCS to put a device into a defined status or to highlight a device within the PLC visualization.

2.1.7 SETT

A SETT (Set) message syncs the date and time between WCS and the PLC.

2.1.8 MFST

An MFST (Start Material Flow) message is used to start the material flow within the entire PLC area.

2.1.9 FTRQ

A FTRQ (Fault Text Request) message is a request for the text for a fault code. These messages can be sent manually by WCS or when a fault code is encountered for which no fault text exists within WCS.

The PLC will respond with a FTDF (Fault Text Definition) message, which reports the full text for the fault.

2.2 Components of a Message

Messages (also called telegrams) allow WCS and PLCs to talk to each other and ensure both are functioning as effectively as possible. VFC mimics WCS and can send the same types of messages to a PLC (either a simulated PLC or a real one).

Figure 4 Message Components

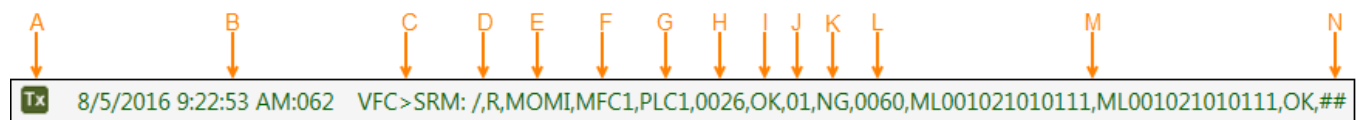


Table 2 Components of a Message

Item	Description
A	The Tx icon indicates that the message is a transfer message (that is, it has been transferred from WCS to the PLC). An Rx icon indicates the message has been received from the PLC.
B	The date and time the message was sent.
C	"VFC>SRM:" indicates the message is being sent from VFC to the controller (in this example, the controller is called "SRM"). The sender appears before the receiver regardless of whether the sender is the controller or VFC.
D	The "/" mark indicates the start of the message. This is byte 01. "R" is the second byte and identifies flow control. "R" indicates that acknowledgement is required, "A" indicates an acknowledgement flag, and "." indicates no acknowledgement is required.
E	Bytes 03 to 06 are the message type.
F	Bytes 07 to 10 are the sender (in this case, MFC1).
G	Bytes 11 to 14 are the receiver (in this case, PLC1).
H	Bytes 15 to 18 are the cycle number (in this case, 0026). This is a count of the number of messages sent, starting from 0001. This number is incremented by the sender for every new message. If a message is repeated, the number is not incremented.

Table 2 Components of a Message

Item	Description
I	Bytes 19 and 20 are the return value (in this case, OK). The following values can be returned: <ul style="list-style-type: none">■ OK: No error occurs■ MU: Message name is unknown. The message is not processed any further.■ SU: Sender ID is unknown. The message is not processed any further.■ RU: Receiver ID is unknown. The message is not processed any further.■ LE: The message length is too long or otherwise does not fit. The message is not processed any further.■ BF: Receive buffer capacity exhausted. The sender must buffer the message and repeat it until it can be accepted by the receiver. The waiting time between repetitions is 30 seconds.■ GE: General protocol error, which means any error that's not specified above. The message is not processed any further.
J	Bytes 21 and 22 indicate the number of blocks used in the message. You can pack multiple messages into a single message. The example says "01", which means there is a single message being sent.
K	Bytes 23 and 24 are the block type. "NG" indicates no logical grouping and is the default value. An "NG" message block type means each message body is kept separate and is not logically interlinked with the others. "LG" indicates a logical grouping of blocks and is used to process several messages together. The PLC sends "LG" message blocks automatically if more than one TU is handled simultaneously.
L	Bytes 25 to 28 indicate the length of the entire message in bytes (in this case, 0060).
M	This section is the actual message body. In the example, the message body includes a device identifier, a destination location, and an event code for the MOMI message. This data was set on the Manual tab for the controller.
N	The final two bytes are "##", which indicate the end of the message.

2.3 Sending Messages Manually

You can send custom messages to a destination PLC to perform specific tasks. This can be useful for testing specific scenarios such as load tests. To send a message manually, perform the following steps:

1. In the main window, select the appropriate controller.
2. Click the **Manual** tab.
3. To send a TU message, enter the necessary parameters in the **TU Messages** section. To send another type of message (such as MOMI, SETT, STRQ, and so on), enter the necessary parameters in the **Other Messages** section.
4. Click **Send**. You can confirm your message's successful transmission by viewing the Message and Event Logger. A Tx message should be displayed along with an Rx message, indicating the message was both transmitted and received as expected. If the message was not sent or received as expected, a warning message is displayed.

Figure 5 Controller Tab

The screenshot displays the 'Controller Tab' interface. At the top, there are four tabs: 'DMS DCI', 'DMS DCI Tester', 'SRM DCI', and 'SRM DCI Tester'. The 'SRM DCI' tab is selected. Below this, there are two sub-tabs: 'Rack' and 'Manual'. The 'Manual' sub-tab is active. The interface is divided into two main sections: 'TU Messages' on the left and 'Other Messages' on the right.

TU Messages Section:

- Type: TUMI (dropdown menu) [Send button]
- Source: ML001012990111 [Bin button]
- Current: ML001123010111 [Bin button]
- Destination: ML001021010111 [Bin button]
- TU Identifier: ML001021010111
- TU Type: 0000
- TU Length: 600
- TU Width: 400
- TU height: 350
- TU Weight: 200
- Event Code: OK
- Dynamics : 0100

Other Messages Section:

- Type: (dropdown menu) [Send button]
- Device Identifier: ML001021010111
- Destination Location: ML001021010111
- Location: ML001021010111
- Event Code: OK
- Forced Status:
- Date:
- Time:
- Fault Code: ok
- Language: ok

2.4 Tips and Tricks

Heartbeat messages (also called keep alive telegrams) are sent every 30 seconds between VFC and the PLC/controller. These messages can clog up your message logger, which can be annoying when you're trying to review or diagnose other messages. To turn these keep alive telegrams off, select the controller from the project tree and then uncheck the Send Keep Alive Telegrams check box in the Properties window.

You can resend a sent message by right clicking on the message in the Message and Event Logger and selecting **Resent Telegram**. This can be useful when performing unit level tests because it allows you to observe duplicate message scenarios.

3 Telegram Validation

The Telegram Validation tool allows users to set message parameters that ensure sent and received telegrams contain the necessary information. Message types can include header, tail, and telegram validation properties. These properties can be configured and linked to the applicable controllers. Each message must pass this validation prior to being processed or sent by the controller. This allows you to identify message errors quickly and speed up the testing and commissioning process.

To modify or manage telegram validations, click the Telegram Validation button on the menu bar.

Telegram validation templates can be found on the [Telegram Validation](#) wiki page. These templates can be good starting points when beginning a VFC project. To import or export a telegram validation template, click the pencil icon in the top right corner of the Telegram Validation tab and then select Import Template from XML or Export Template to XML.

If you want to create your own template, click New Template, enter a name for the new template, and then click Add. Templates are saved as XML files and can be modified at any time.

Note: Unlike most VFC tasks, you must save any modifications you make to telegram validation templates. After making your changes, click the Save Template button.

Figure 6 Telegram Validation Tab

DMS DCI
DMS DCI Tester
SRM DCI
SRM DCI Tester
Telegram Validation

Telegram Validation Template: SRM DCI 1.32
New Template
Save Template

DEFAULT

Ack Identifier: A
ASCII Padding: Right
ASCII Padding Char: .
NUMERIC Padding: Left
NUMERIC Padding Char: 0

HEADER

Name	Format	Length	Default	Type
Start	ASCII	1	/	Normal
Flow Control	ASCII	1		AckIdentifier
Name	ASCII	4		Identifier
Sender	ASCII	4		Normal
Receiver	ASCII	4		Normal
Cycle Number	NUMERIC	4		Normal
Return Code	ASCII	2		Normal
Number Of Blocks	NUMERIC	2		BodyQuantity
Type Of Blocks	ASCII	2		Normal
Length of Message	NUMERIC	4		Normal

TAIL

Name	Format	Length	Default	Type
End Of Message	ASCII	2	##	Normal

TELEGRAMS

TUMI
Transport Unit Mission
Repeat
Add
Copy
Delete

Name	Format	Length	Default	Type
Source Location	ASCII	14		Normal
Current Location	ASCII	14		Normal
Destination Location	ASCII	14		Normal

4 SRM Controllers

VFC includes several SRM-specific features to allow you to manage TU locations, cranes, and exceptions.

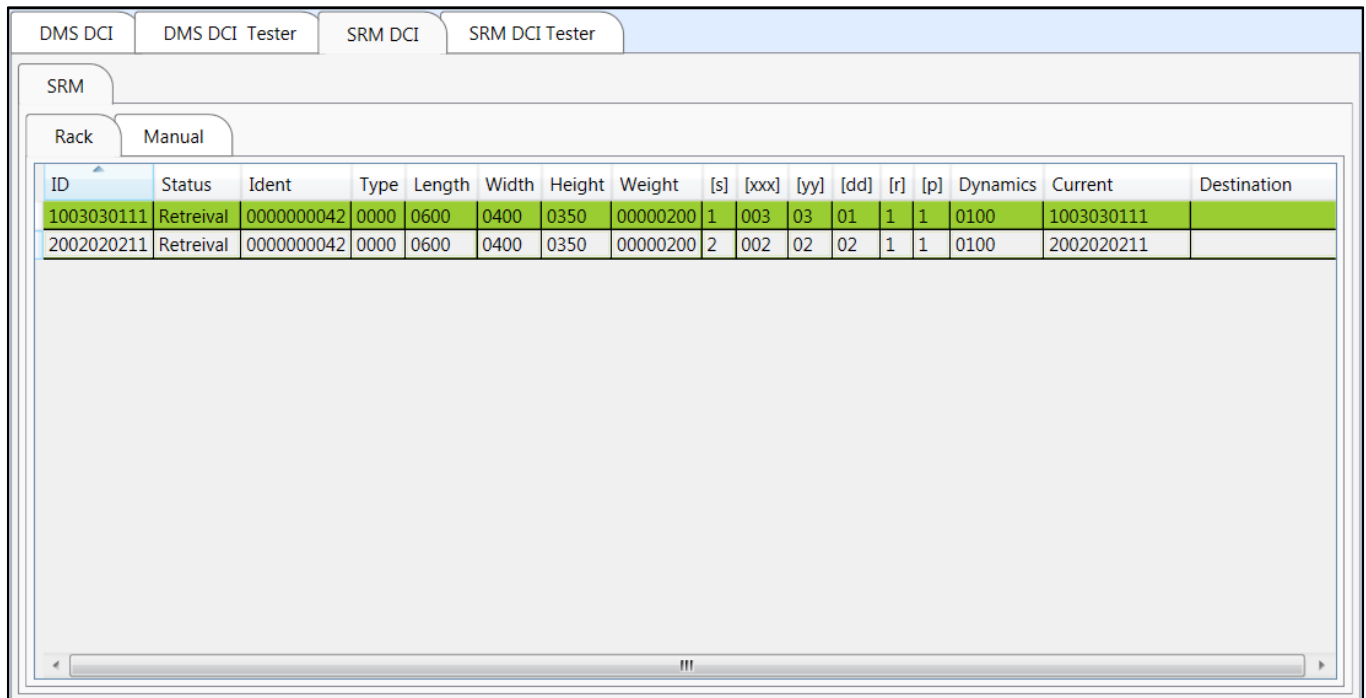
4.1 Racks

The Rack tab displays a list of all rack locations that TUs can be sent to or retrieved from. This is a helpful screen for gaining an understanding of the current status of your entire rack. You can modify rack locations so that they appear occupied, reserved, and so on.

To add a rack location, perform the following steps:

1. In VFC, click the **Rack** tab and right click anywhere in the Rack table.
2. Click **Add Location**. The "Edit Rack Data" dialog box is displayed.
3. Enter the applicable rack location and TU parameters.
4. Click **Update**. The rack location's information is displayed in the Rack table.

Figure 7 Racks Tab



The screenshot shows the SRM Racks Tab interface. At the top, there are four tabs: DMS DCI, DMS DCI Tester, SRM DCI, and SRM DCI Tester. Below these, the SRM section is active, containing two sub-tabs: Rack and Manual. The Rack tab is selected, displaying a table with the following data:

ID	Status	Ident	Type	Length	Width	Height	Weight	[s]	[xxx]	[yy]	[dd]	[r]	[p]	Dynamics	Current	Destination
1003030111	Retreival	0000000042	0000	0600	0400	0350	00000200	1	003	03	01	1	1	0100	1003030111	
2002020211	Retreival	0000000042	0000	0600	0400	0350	00000200	2	002	02	02	1	1	0100	2002020211	

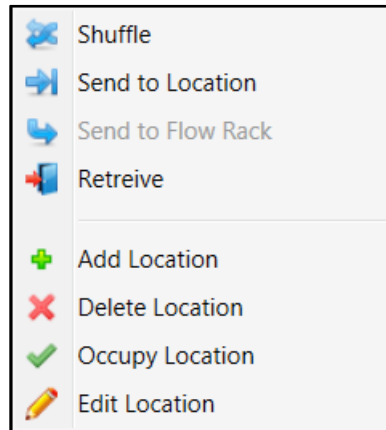
The following information is displayed for each rack location

- ID: The rack location identifying number. This number is determined by the parameters set on the "Edit Rack Data" dialog box.
- Status: The current status of the rack location. The status can be Blocked, Occupied, Reserved, Retrieval, Unknown, or Not Used.
- Ident: The TU identifying number. This is most commonly a bar code number and can be alphanumeric.
- Type: The TU type. For more information about TU types, see the [Controls Emulation TU Types](#) wiki page.
- Length: The TU length (in mm)
- Width: The TU width (in mm)
- Height: The TU height (in mm)
- Weight: The TU weight (in grams)
- [s]: The rack location side. That is, which side of the SRM the rack is on (01 for the left side and 02 for the right side).
- [xxx]: The rack location X-axis coordinate
- [yy]: The rack location Y-axis coordinate
- [dd]: The rack location depth
- [r]: The raster number
- [p]: The rack location position within the raster
- Dynamics: The velocity aggression
- Current: The current location of the TU. The TU could be on the rack, Pick Station (PS), Drop Station (DS), or SRM.
- Destination: The destination location of the TU

4.1.1 Working with Rack Locations

To begin working with rack locations, right click an entry in the Rack table.

Figure 8 Rack Location Actions



Depending on the location, the following actions might be available:

- **Shuffle:** Sends the TU to a random location in the same rack. Shuffling is typically done to access TUs stored behind other TUs, or for zone housekeeping. Additionally, when commissioning SRMs, shuffling can be helpful for exercising machines.
- **Send to Location:** Sends the TU to a specified rack location. You must enter the destination location details in the Rack Data menu that is displayed.
- **Send to Flow Rack:** Sends the TU to a flow rack to be gravity fed to a picking system.
- **Retrieve:** Sends the TU to a drop station.
- **Add Location:** Displays the "Edit Rack Data" dialog box and allows you to configure a new rack location.
- **Delete Location:** Deletes the selected location as soon as you click it. Be aware that there is no deletion confirmation.
- **Occupy Location:** Changes the rack location's status to *Occupied*.
- **Edit Location:** Displays the Edit Rack Data dialog box with the selected rack location's parameters already entered.

4.2 Cranes (Unitload or Miniload)

The Unitload or Miniload tab (depending on which SRM type you are working with) provides a visual representation of the devices and components that are running when your SRM is operational. This includes hardware such as PSs, DSs, and load handlers. It also includes software and connections such as the WCS, ASI, and PROFIBUS. This tab is a useful tool for quickly visualizing the current status of your SRM. Each component's name is displayed in a box that changes color depending on the status of that component. For more information on status colors, see section 4.2.2.

Figure 9 Cranes (Unitload or Miniload) Tab

Unitload Status Data									
Location	Status	Ident	Type	Length	Width	Height	Weight	Source	Current
ULAI01CR01PS11	Retreival	0000000070	0000	0600	0400	0250	00001000	ULAI01CR01PS11	ULAI01CR01PS11

4.2.1 Crane Properties

The crane properties panel allows you to add, modify, or delete the following components of your SRM controller configuration:

- Pick Stations:** Enable pick stations by checking the **PS Enabled** checkbox. Select either manual or automatic routing. Automatic automatically assign a destination pick station, whereas Manual requires you to manually assign a destination pick station. Select which side of the SRM the pick stations appear on. Finally, enter a default dynamic value for the pick stations (between 0 and 100). The PS Dynamic Default value is sent back to the SRM if no dynamic value is set for the TU.
- Drop Stations:** Enable drop stations by checking the **DS Enabled** checkbox. Select which side of the SRM the drop stations appear on.
- Ancillary:** Enable additional software or communication devices or systems that mimic common components of an SRM subsystem:
 - ESTOP: The safety emergency stop feature for the entire aisle
 - PROFIBUS: The fieldbus communication network
 - ASI: The Actuator Sensor Interface (AS-i) bit-oriented fieldbus communication interface
 - SYSTEM: Where applicable, any inputs from fire or air pressure warning systems for the building
 - WCS: The connection to the WCS
- Storage:** Set the storage rules and mode for your SRM. For more information, see section 4.2.3.

- **SubController:** Enable the subcontroller by checking the **Enabled** checkbox.

Figure 10 Cranes Properties

SRMDCIMiniload Miniload	
▲ Pick Station	
PS Enabled	<input type="checkbox"/>
PS Routing	Auto ▾
PS Side	Left ▾
PS Dynamic Default	0100
▲ Drop Station	
DS Enabled	<input type="checkbox"/>
DS Side	Left ▾
▲ Ancillary	
ESTOP	<input type="checkbox"/>
PROFIBUS	<input type="checkbox"/>
ASI	<input type="checkbox"/>
SYSTEM	<input type="checkbox"/>
WCS	<input type="checkbox"/>
▲ Storage	
Mode	Single ▾
Rule 1	Random ▾
Rule 2	Any ▾
▲ SubController	
Controller Status	Disabled
Enabled	<input checked="" type="checkbox"/>

4.2.2 Status Telegrams

Status telegrams send messages to change the status of a device or larger subsystem. For example, sending an AU (automatic) telegram to a load handler changes that load handler's status to automatic operation mode on the Unitload or Miniload tab. The following status telegrams can be sent to VFC to alter the status of devices, components, or subsystems:

Table 3 Status Telegrams

Status Code	Description	Status Color
AU	Automatic operation mode without any fault	Green
MA	Manual operation mode without any fault	Orange

Table 3 Status Telegrams

Status Code	Description	Status Color
FL	Short term fault	Red
OF	Long term not available (off or long term fault)	Yellow
..	No operation mode	White

4.2.3 Storage Rules

Storage modes and rules determine how TUs are stored and retrieved. These parameters are set in the properties window when the Unitload or Miniload tab is selected.

Storage Modes

- **Single:** Each load is stored in a different X location. This means two loads can be arranged on the PS, DS, or LHD to be delivered both on the left side, both on the right side, or one on each side provided that the loads do not need to cross each other.
- **Paired:** (Applicable to wide aisles only) loads on the same LHD are stored in the same X location either on the left or right side. Loads must be in the correct order based on their destination depths.
- **Mixed:** (Applicable to wide aisles only) sometimes uses a single storage mode and sometimes a paired mode.

Storage Rule 1

- **Random:** The location is selected at random
- **Front:** The free location nearest to X = 1 is selected

Storage Rule 2

- **Any:** Any free location is allowed
- **Not Visited:** A location that has not been previously visited is selected

4.3 Handling Exceptions

When an exception message is sent, the exception is displayed on the Rack tab. You can perform the following actions to handle exceptions:

- **Modify:** Modifies the transport mission and sends a TUMI telegram.

- **Retry:** Retries the same transport mission that caused the exception and sends a TUMI telegram.
- **Cancel:** Cancels the exception. No message is sent.

Figure 11 Handling Exceptions

The screenshot shows the SRM DCI Tester interface. At the top, there are tabs for 'SRM DCI' and 'SRM DCI Tester'. Below these, there are tabs for 'SRM', 'Manual', 'Rack', and 'Miniload'. The 'Miniload' tab is currently selected. Under the 'Miniload' tab, there is an 'Exception Handling' section with three buttons: 'Modify', 'Retry', and 'Cancel'. Below these buttons is a purple bar with the text 'Bin Occupied'. At the bottom of the interface is a table with 15 columns: ID, Status, Ident, Type, Length, Width, Height, Weight, [s], [xxx], [yy], [dd], [r], [p], and Dynamics. The table contains 10 rows of data, with some rows highlighted in green and others in yellow.

ID	Status	Ident	Type	Length	Width	Height	Weight	[s]	[xxx]	[yy]	[dd]	[r]	[p]	Dynamics
1010001	Occupied	0000000080	EP01	0600	0400	0350	00000200	1	000	00	00	0	0	0001
1005010211	Occupied	0000000082	0000	0600	0400	0250	00001000	1	005	01	02	1	1	0001
1002050111	Retreival	0000000073	0000	0600	0400	0250	00001000	1	002	05	01	1	1	0000
1004050211	Retreival	0000000078	0000	0600	0400	0250	00001000	1	004	05	02	1	1	0000
1001010111	Retreival	0000000078	0000	0600	0400	0250	00001000	1	001	01	01	1	1	0000
2001010111	Reserved	0000000078	0000	0600	0400	0250	00001000	2	001	01	01	1	1	0000
2002050211	Retreival	0000000073	0000	0600	0400	0250	00001000	2	002	05	02	1	1	0000
1004040211	Reserved	0000000073	0000	0600	0400	0250	00001000	1	004	04	02	1	1	0000
1003040211	Reserved	0000000073	0000	0600	0400	0250	00001000	1	003	04	02	1	1	0000