Application Manual
MMI-20076337, Rev AA
April 2022

Micro Motion™ 5700 Transmitters with a Marine Bunker Transfer Package

Certified Marine Bunker Measurement Solution

MICRO MOTION™

EMERSON™

Safety messages

Safety messages are provided throughout this manual to protect personnel and equipment. Read each safety message carefully before proceeding to the next step.

Safety and approval information

This Micro Motion product complies with all applicable European directives when properly installed in accordance with the instructions in this manual. Refer to the EU declaration of conformity for directives that apply to this product. The following are available: the EU declaration of conformity, with all applicable European directives, and the complete ATEX Installation Drawings and Instructions. In addition the IECEx Installation Instructions for installations outside of the European Union and the CSA Installation Instructions for installations in North America are available on the internet at www.emerson.com or through your local Micro Motion support center.

Information affixed to equipment that complies with the Pressure Equipment Directive, can be found on the internet at www.emerson.com. For hazardous installations in Europe, refer to standard EN 60079-14 if national standards do not apply.

Other information

Full product specifications can be found in the product data sheet. Troubleshooting information can be found in the configuration manual. Product data sheets and manuals are available from the Micro Motion web site at www.emerson.com.

Return policy

Follow Micro Motion procedures when returning equipment. These procedures ensure legal compliance with government transportation agencies and help provide a safe working environment for Micro Motion employees. Micro Motion will not accept your returned equipment if you fail to follow Micro Motion procedures.

Return procedures and forms are available on our web support site at www.emerson.com, or by phoning the Micro Motion Customer Service department.

Emerson Flow customer service

Email:

- Worldwide: flow.support@emerson.com
- Asia-Pacific: APflow.support@emerson.com

Telephone:

North and South America		Europe and Middle East		Asia Pacific	
United States	800 522 6277	U.K. and Ireland	0870 240 1978	Australia	800 158 727
Canada	+1 303 527 5200	The Netherlands	+31 (0) 70 413 6666	New Zealand	099 128 804
Mexico	+52 55 5809 5010	France	+33 (0) 800 917 901	India	800 440 1468
Argentina	+54 11 4809 2700	Germany	0800 182 5347	Pakistan	888 550 2682
Brazil	+55 15 3413 8000	Italy	+39 8008 77334	China	+86 21 2892 9000
Chile	+56 2 2928 4800	Central & Eastern	+41 (0) 41 7686 111	Japan	+81 3 5769 6803
Peru	+51 15190130	Russia/CIS	+7 495 995 9559	South Korea	+82 2 3438 4600
		Egypt	0800 000 0015	Singapore	+65 6 777 8211
		Oman	800 70101	Thailand	001 800 441 6426
		Qatar	431 0044	Malaysia	800 814 008
		Kuwait	663 299 01		
		South Africa	800 991 390		
		Saudi Arabia	800 844 9564		
		UAE	800 0444 0684		

Contents

Chapter 1 Before you begin 5
1.1 About this manual 5
1.2 Hazard messages 5
1.3 Related documents 6
Chapter 2 Overview of Marine Bunker Measurement Package 7
2.1 Measurement 7
2.2 OIML R117-1 compliance 7
2.3 System types and requirements for the Marine Bunker Transfer Package 8
Chapter 3 Install the 5700 with the Marine Bunker Transfer Package 9
3.1 Install the Profile/MID system 9
Chapter 4 Configure the system 13
4.1 Configure auxiliary devices 13
4.2 Configure basic flow meter parameters 13
4.3 Configure bunker ticket options 14
4.4 Configure the printer 19
Chapter 5 Operate the system 23
5.1 Transfer a bunker and print a ticket using the display 23
5.2 Print or reprint a bunker ticket using BunkerLink 23
5.3 View bunker transfer history 24
5.4 Print or export bunker transfer data 24
5.5 Contents of profile report 25
5.6 Contents of bunker ticket for Basic/MID and Profile/MID systems 30
5.7 Retrieve and reprint bunker tickets using the display 34
5.8 Bunker operations 34
5.9 Bunker variables 34
5.10 Maintain bunker transfer history 34

1 Before you begin

1.1 About this manual

This application manual provides information required to install and operate the 5700 transmitter with the Marine Bunker Transfer Package.

Use the transmitter display as the primary configuration and operation method. However, you can use ProLink™ III for most configuration and operation tasks. ProLink III also provides additional reporting and history features.

This manual assumes that users understand basic transmitter and sensor installation, configuration, and maintenance concepts and procedures.

Important
Use this application manual as your main guide for installation, configuration, and operation. You will be referred to other documentation for specific tasks and information.

1.2 Hazard messages

This document uses the following criteria for hazard messages based on ANSI standards Z535.6-2011 (R2017).

DANGER
Serious injury or death will occur if a hazardous situation is not avoided.

WARNING
Serious injury or death could occur if a hazardous situation is not avoided.

CAUTION
Minor or moderate injury will or could occur if a hazardous situation is not avoided.

NOTICE
Data loss, property damage, hardware damage, or software damage can occur if a situation is not avoided. There is no credible risk of physical injury.

Physical access

NOTICE
Unauthorized personnel can potentially cause significant damage and/or misconfiguration of end users' equipment. Protect against all intentional or unintentional unauthorized use.

Physical security is an important part of any security program and fundamental to protecting your system. Restrict physical access to protect users' assets. This is true for all systems used within the facility.

1.3 Related documents

You can find all product documentation on the product documentation DVD shipped with the product or at www.emerson.com.

See any of the following documents for more information:

- *Micro Motion 5700 Product Data Sheet*
- *Micro Motion 5700 Transmitters with Configurable Inputs and Outputs: Configuration and Use Manual*
- *Micro Motion 5700 Transmitters with Configurable Inputs and Outputs: Installation Manual*
- Sensor installation manual
- Vendor documentation for auxiliary devices

2 Overview of Marine Bunker Measurement Package

The Micro Motion Certified Marine Bunker Measurement Solution is a system that provides a complete solution for the measurement of marine fuel delivery. The system monitors aeration (entrained gas or entrained air), and supplies a bunker ticket with time and date, total amount transferred, and other relevant data.

2.1 Measurement

The Marine Bunker Transfer Package provides flow measurement data that complies with OIML R117-1 and MID 2004/22/EC Annex MI-005. If the appropriate security hardware is installed, the system has been accredited by a certified technician, and OIML/MID-approved procedures are followed, the bunker ticket can be used as a legal Weights & Measures document.

2.2 OIML R117-1 compliance

The Marine Bunker Transfer Package is designed to comply with measurement and operational requirements established by OIML. After the initial start up and certification, OIML R117-1 compliance includes four factors, or checks. For bunker transfer measurement data to meet OIML R117-1 requirements, the bunker transfer must pass all four checks.

The four checks are as follows:

MMQ	Minimum Measured Quantity (MMQ) defines the minimum measured quantity of fuel in a bunker transfer that is necessary to meet OIML/MID requirements. MMQ is used to ensure that the bunker is sized appropriately for the sensor and ensures that various factors related to starting and stopping flow do not have a significant effect on measurement accuracy. During initial system configuration, the service technician calculates and configures a site-specific value for MMQ. This value is typically not changed unless the piping is changed.
Aeration	Aeration refers to entrained gas or entrained air in the process fluid. Aeration Limit is a real-time diagnostic that monitors the potential measurement error due to aeration and other factors, and compares the real-time value to the maximum allowable measurement error as defined by MID 2004/22/EC Annex MI-005. Aeration Limit is expressed as a percentage of the MID limit. If the value of Aeration Limit at the end of the bunker transfer is below 100%, the bunker measurement passes the Max Aeration check. Aeration Limit is calculated continuously. During a bunker transfer, Aeration Limit can increase, decrease, or even exceed 100%.
Power	Power was continuous during the transfer (no power interrupt).
Bunker-critical alerts	If a bunker-critical alert occurs during a bunker transfer, the transfer fails the alert check and the measurement cannot be used to meet OIML/MID requirements. Not all alerts are bunker-critical. The following alerts are bunker-critical:

RAM Error (Core)	Security Breach
Mass Flow Overrange	Core Write Failure
Density OOR	Incorrect Board Type
Calibration Failure	Low Power
Sensor Temp Failure	Outputs to Fault
Sensor Case Temp Fail	Low Pickoff Sig
EEPROM Error	Data Loss Poss
RAM Error (Transmitter)	Power Reset Occurred
Cal Factors Missing	API Temp OOR
Incorrect Sensor Type	API Density OOR
Config DB Corrupt	Display Readback Fail
Program Corrupt (Core)	Display Comm Error
Sensor Comm. Fail	

If the bunker transfer fails one or more of these checks, the bunker transfer measurement data does not meet OIML R117-1 requirements and the ticket will show `Overall OIML R117-1: Fail`.

Note
Aeration Limit is always calculated and the four checks are always applied, whether or not an OIML/MID-compliant system was purchased and installed. If the system is not OIML/MID-compliant, there is no system performance traceability regardless of overall bunker pass/fail results.

2.3 System types and requirements for the Marine Bunker Transfer Package

The Marine Bunker Transfer Package can be set up in four different system types. Requirements depend on the type chosen during purchase.

Table 2-1: Marine Bunker Transfer Package system types

System type	Description
Basic system	Measures the bunker transfer and print bunker tickets only. The flow measurement and bunker tickets are not OIML/MID-approved.
Basic/MID system	Measures the bunker transfer and print bunker tickets only. The flow measurement and bunker tickets are OIML/MID-approved.
Profile system	Measures the bunker transfer and print bunker tickets and profile reports. The flow measurement and bunker tickets are not OIML/MID-approved. The profile report is not OIML/MID-approved.
Profile/MID system	Measures the bunker transfer and print bunker tickets and profile reports. The flow measurement and bunker tickets are OIML/MID-approved. The profile report is not OIML/MID-approved.

3 Install the 5700 with the Marine Bunker Transfer Package

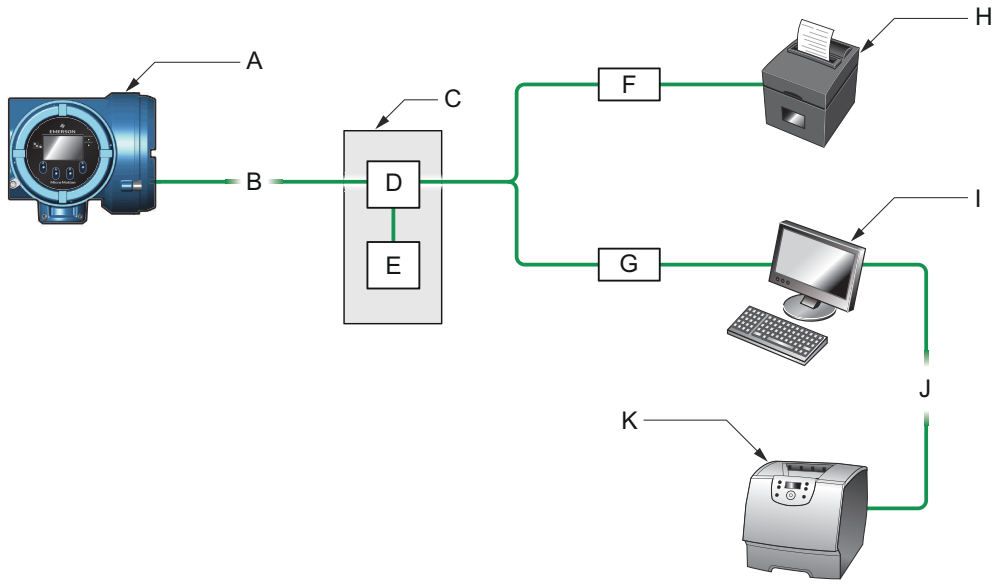
3.1 Install the Profile/MID system

This procedure provides installation instructions for a system that measures the bunker delivery and prints bunker tickets and profile reports. The bunker tickets are OIML/MID-approved. The profile reports are not OIML/MID-approved.

Prerequisites

- Verify that the sensor is correctly installed and ready for wiring.
- Verify that the auxiliary devices (level switches, pressure transmitter, and temperature transmitter) are correctly installed and ready for wiring to the 5700.

Figure 3-1: Schematic of Profile system

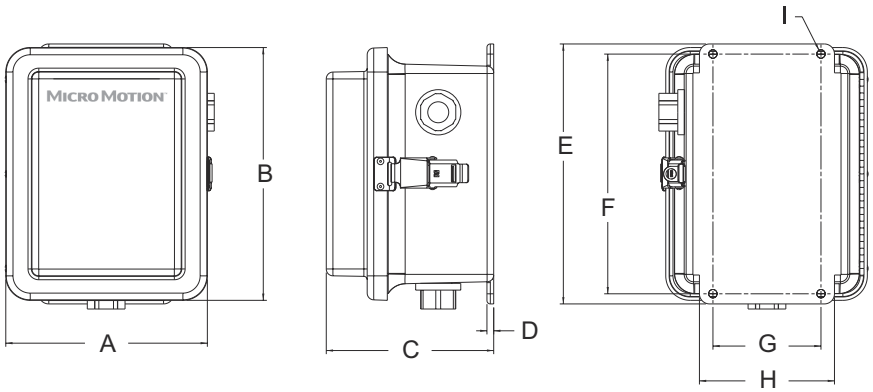


A. 5700 transmitter
B. RS-485
C. Printer interface component
D. Relay
E. Power supply for relay
F. RS-485 to RS-232 signal converter
G. RS-485 to USB signal converter
H. MID-approved ticket printer
I. PC with ProLink III/BunkerLink
J. Existing connection
K. Default printer

Procedure

1. Follow the instructions in the *Micro Motion 5700 Transmitters with Configurable Inputs and Outputs: Installation Manual* to perform the following installation tasks:
   a) Wire the pressure transmitter via HART to the transmitter.
   b) Mount the transmitter.
   c) Wire the transmitter to the sensor.
   d) Wire the transmitter's secondary mA Output and Frequency Output (if they will be used).
   e) Wire power to the transmitter.
   f) Ground the transmitter.
2. Mount the Printer Interface Component to any flat surface. See the following figure for mounting dimensions.

Figure 3-2: Mounting dimensions for Printer Interface Component



A. Front view, width: 7.464 in (189.59 mm)
B. Front view, height: 9.360 in (237.74 mm)
C. Side view, width: 6.199 in (157.45 mm)
D. Mounting plate, width: 2 × 0.250 in (6.35 mm)
E. Back view, height: 9.625 in (244.48 mm)
F. Back view, space between mounting holes: 8.875 in (225.42 mm)
G. Back view, width: 4.000 in (101.60 mm)
H. Back view, space between mounting holes: 5.000 in (127.00 mm)
I. Back view, size of mounting holes: 4× ∅0.308 in (7.82 mm)

3. Set up one of the following options:
   - Option 1: Wire the level switch (or switches) to Discrete Input 1 and to power.
     When Discrete Input 1 is assigned to Start/Stop Totalizers during configuration, it will start totalizers when there is liquid in the pipeline, and stop totalizers when there is no liquid in the pipeline.
   - Option 2: Set up an integrity detection loop and wire it to Discrete Input 1.
     The integrity detection loop may be used to detect leaks, cable breakage, short circuits, and so on. You can use any preferred method or device.

4. Set up a HART loop that connects the primary mA Output to the external pressure transmitter and the external temperature transmitter.
5. Optional: Follow the instructions in the *Micro Motion 5700 Transmitters with Configurable Inputs and Outputs: Installation Manual* to perform the following installation tasks to wire Discrete Output 1 or Discrete Output 2 to signal devices such as lights or horns.

   Note
   A Discrete Output is needed to control the printer relay.

6. Install the ticket printer.
   a) Connect the printer to power according to the instructions in the vendor documentation.
   b) Set the DIP switches on the printer as shown in the following table.

      Note
      The DIP switches are on the bottom of the printer, under the DIP switch cover. Power down the printer before removing the DIP switch cover.

      Table 3-1: DIP switch settings for Epson TM-T88V printer

Switch bank	DIP switch settings		Printer communication parameters
DSW1	Switch 1-1	OFF	Baud: 38400 Parity: Even Data bits: 8 Stop bits: 1 Characters per second: 400 Buffer size: 1024
	Switch 1-2	OFF	
	Switch 1-3	OFF	
	Switch 1-4	OFF	
	Switch 1-5	ON	
	Switch 1-6	ON	
	Switch 1-7	ON	
	Switch 1-8	ON	
DSW2	Switch 2-1	OFF	
	Switches 2-2 through 2-8	As desired	

   c) Attach the adapter to the signal converter.
      An RS-485 to RS-232 signal converter and a DB9 to DB25 adapter were supplied with the system.
   d) Plug the adapter into the terminal block on the printer.
7. Wire the Printer Interface Component.
   a) Open the Printer Interface Component.
   b) Wire power to the relay power supply according to the instructions in the vendor documentation.
   c) Wire the relay to Discrete Output 1 or Discrete Output 2 on the transmitter.
   d) Wire one set of RS-485 terminals on the relay to the RS-485 terminals on the transmitter.

Table 3-2: RS-485 connections between transmitter and relay

RS-485 terminal	Relay terminals	5700 terminals
RS-485/A	Terminal 21	9
RS-485/B	Terminal 11	10

e) Wire one set of RS-485 terminals on the relay to the RS-485 terminals on the signal converter.

Table 3-3: RS-485 connections between signal converter and relay

RS-485 terminal	Relay terminals	Signal converter terminals
RS-485/A	24	Terminal 1
RS-485/B	14	Terminal 2

f) Close the Printer Interface Component.

8. Ensure that the PC is connected to the printer that you will use to print the profile report, and that this printer is defined as the default printer.

4 Configure the system

Tip
In most cases, these tasks will be performed by the service technician who performs the system startup.

4.1 Configure auxiliary devices

The pressure transmitter, temperature transmitter, level switches, and integrity detection devices (if present) must be configured for use by the 5700 transmitter. Perform the following steps using the transmitter display.

Procedure

1. At the pressure transmitter:
   a) Define a HART tag for polling.
   b) Set the pressure unit to the unit to be used by the transmitter.
2. At the temperature transmitter:
   a) Define a HART tag for polling.
   b) Set the temperature unit to the unit to be used by the transmitter.
3. When two level switches are used (upstream and downstream), put the status outputs in series as follows:
   Both switches need to see liquid for the transmitter to count.
   a) Set **Mode Switch** to **Wet On**.
   b) Set **Switching Time Delay** to 0.3 seconds.
4. Optional: If your installation includes an integrity detection loop, configure the integrity detection devices as required to report leakage, broken cables, short circuits, or other malfunction.

4.2 Configure basic flow meter parameters

Perform the following steps using the transmitter display.

Procedure

1. Configure security and language.
   a) Configure the maintenance and configuration passwords, and enable or disable them as desired.
   b) Configure the language used on the display.
   - Do not configure the Weights & Measures application.
   - Do not enable write-protection.
2. Configure system data and alarm severity.
3. Configure process variables as desired.
4. Configure sensor calibration data and sensor information for your sensor.

5. Configure Discrete Input 1 using one of the following options:

If	Then
If wired to a level switch or switches.	Configure Discrete Input 1 for use with the level switch or switches. a. Set **Discrete Input 1 Polarity** to Active Low. b. Assign Start/Stop Totalizers to Discrete Input 1. If the system is wired as recommended, totalizers will start when liquid is detected in the pipeline, and stop when no liquid is detected.
If an integrity detection loop is present in your installation.	Configure Discrete Input 1 for use in the integrity detection loop • Set **Discrete Input 1 Polarity** as required by the integrity device and the wiring. • Assign Integrity Breach to Discrete Input 1 The transmitter will post a Security Breach alert if a problem with flow or wiring is detected.

6. Configure polling for temperature.
   Set **External Tag** to the tag defined at the temperature device.
7. Configure polling for pressure.
   Set **External Tag** to the tag defined at the pressure device.
8. If Discrete Output 1 or Discrete Output 2 is wired to a relay to enable printing both bunker tickets and profile reports (Profile or Profile/MID systems), set the source variable to RS485 Dual Function.

4.3 Configure bunker ticket options

The bunker ticket contains a standard set of process and bunker data, and can be configured to include additional process and bunker data. You can print one, two, or three tickets automatically.

4.3.1 Configure bunker ticket options using the transmitter display

Procedure

1. Choose **Operations → Marine Bunkering → Format Ticket**.
2. Define **Header 1**, **Header 2**, **Header3**, **Header4**, and **Footer** as desired.
3. Choose **Item Display Options** and select the items to be printed on the ticket.

Important
Some options are enabled or disabled by default and may not be configurable. Mass Inventory is enabled by default.

Option	Description
Mass Inventory	Total mass of all bunkers transferred since the last inventory reset, plus the two forward inventories and the two reverse inventories. Labels and values depend on the setting of the Mass In Air option.
Average Temperature	Temperature of the process fluid, averaged across the entire bunker and expressed as a batch-weighted average with the configured volume unit used as the batch.
Average API Density	Average density of the bunker, at reference temperature.
Aeration Limit	Value of *Aeration Limit* at the end of the bunker transfer.
Bunker Result (1)	`Pass`: The bunker transfer passed all four OIML/MID checks. `Fail`: The bunker transfer failed one or more of the four OIML/MID checks.
Bunker Result Details	Individual results for the four OIML/MID checks: • MMQ check • Max Aeration check • Alert check • Power check These are printed only if Bunker Result = `Fail`.
Select using Mass In Air	OFF: The total and inventory values on the ticket represent “true mass”, or “mass in vacuum”. The following labels are used: • **Mass Total** • **Bunker Begin Fwd Inv** • **Bunker End Fwd Inv** • **Bunker Begin Rev Inv** • **Bunker End Rev Inv** ON: The total and inventory values on the ticket represent “mass in air”, and the Mass in Air conversion factor is printed on the ticket. The following labels are used: • **Mass in Air** • **Begin Fwd Inv Air** • **End Fwd Inv Air** • **Begin Rev Inv Air** • **End Rev Inv Air**
Gross Volume Total	Total volume of the bunker, calculated from the mass total and the average density of the bunker at process temperature. The mass total is based on both aerated and non-aerated flow. The average density is based on non-aerated flow.

Option	Description
	For this calculation, aerated flow is defined as any flow occurring while drive gain exceeds a preset limit or density exceeds preset limits.
Net Volume Total	Total volume of the bunker, calculated from the mass total and the average density of the bunker, corrected to 15 °C. The mass total is based on both aerated and non-aerated flow. The average density is based on non-aerated flow. For this calculation, aerated flow is defined as any flow occurring while drive gain exceeds a preset limit or density exceeds preset limits.
SPRING TC Parameters (to show SS648 parameters)	ON: All ticket data is printed as configured. OFF: The following items are not printed, whether or not they were configured: • "Approved Measurement" banner • Gross Volume Total • Net Volume Total • Average API Density • Average Temperature • Aeration Limit • Bunker Result • Bunker Result Details • MID Certificate Number • Measurement accuracy statement If SS648 Parameters is set to OFF, the bunker ticket cannot be used as a legal receipt.

4. Set **Number of Tickets** to the number of tickets to be printed by a single PRINT command.

   The default value is 3. The range is 1 to 3.

   On the first ticket, the word `Original` is printed at the bottom of the ticket. On the second and third tickets, the word `Copy` is printed at the bottom of the ticket.

4.3.2 Configure bunker ticket options using ProLink III

You can use the Marine Bunkering Transfer Package to configure the bunker ticket contents and printing options. The configuration parameters are stored in the transmitter and will overwrite the existing ticket configuration.

Prerequisites

To configure bunker ticket options, the transmitter must be unsecured.

Tip
These parameters are typically set during system start up and should not require changing.

Procedure

1. Connect from ProLink III to the transmitter.
   a) Start ProLink III.
   b) Select **Connection → Connect to Device**.
   c) Configure the communication parameters to match the transmitter.
   d) Set **Serial Port** to the PC port you are using for the connection.
   e) Set **Address** to the value configured for the transmitter. The default address is 1.
   f) Select **Connect**.
   If the connection is successful, the ***Marine Bunkering*** window is displayed.
2. Select the ***Configuration*** panel in the ***Marine Bunkering*** window.
3. In the ***Ticket Process Information*** group, select all items that you want to be included on the ticket.

Option	Description
Aeration Limit	Value of *Aeration Limit* at the end of the bunker transfer.
Bunker Result (1)	`Pass`: The bunker transfer passed all four OIML/MID checks. `Fail`: The bunker transfer failed one or more of the four OIML/MID checks.
Gross Volume Total	Total volume of the bunker, calculated from the mass total and the average density of the bunker at process temperature. The mass total is based on both aerated and non-aerated flow. The average density is based on non-aerated flow. For this calculation, aerated flow is defined as any flow occurring while drive gain exceeds a preset limit or density exceeds preset limits.
Mass Inventory	Total mass of all bunkers transferred since the last inventory reset, plus the two forward inventories and the two reverse inventories. Labels and values depend on the setting of the Mass In Air option.
Bunker Result Details	Individual results for the four OIML/MID checks: • MMQ check • Max Aeration check • Alarm check • Power check These are printed only if Bunker Result = `Fail`.
Net Volume Total	Total volume of the bunker, calculated from the mass total and the average density of the bunker, corrected to 15 °C. The mass total is based on both aerated and non-aerated flow. The average density is based on non-aerated flow. For this calculation, aerated flow is defined as any flow occurring while drive gain exceeds a preset limit or density exceeds preset limits.
Average Temperature	Temperature of the process fluid, averaged across the entire bunker and expressed as a batch-weighted average with the configured volume unit used as the batch.

Option	Description
Mass In Air	ON: The total and inventory values on the ticket represent “mass in air”, and the Mass in Air conversion factor is printed on the ticket. The following labels are used: • **Mass in Air** • **Begin Fwd Inv Air** • **End Fwd Inv Air** • **Begin Rev Inv Air** • **End Rev Inv Air** OFF: The total and inventory values on the ticket represent “true mass”, or “mass in vacuum”. The following labels are used: • **Mass Total** • **Bunker Begin Fwd Inv** • **Bunker End Fwd Inv** • **Bunker Begin Rev Inv** • **Bunker End Rev Inv**
Average API Density	Average density of the bunker, at reference temperature.
SS648 Parameters	ON: All ticket data is printed as configured. OFF: The following items are not printed, whether or not they were configured: • “Approved Measurement” banner • Gross Volume Total • Net Volume Total • Average API Density • Average Temperature • Aeration Limit • Bunker Result • Bunker Result Details • MID Certificate Number • Measurement accuracy statement If SS648 Parameters is set to OFF, the bunker ticket cannot be used as a legal receipt.

Note
Certain items are always included on the ticket, and cannot be disabled.

4. Configure headers, footers, and related parameters.

a) In the ***Header and Footer*** group, configure **Header Line 1**, **Header Line 2**, **Header3**, **Header4**, and **Footer** to the text to be printed on the ticket.

b) Set **Header Font Size** and **Footer Font Size** to the font height to be used on the ticket.

Tip
You can change the header parameters while the transmitter is secured. This allows you to use them for bunker-specific information if desired (for example, vessel name, purchaser name, and so on).

5. Set **Number of Tickets** to the number of tickets to be printed with one print command.

   The default value is 3. The range is 1 to 3.

   On the first ticket, the word *Original* is printed at the bottom of the ticket. On the second and third tickets, the word *Copy* is printed at the bottom of the ticket.

Tip
You can change the **Number of Tickets** setting while the transmitter is secured.

4.3.3 Mass in air

Micro Motion flow meters provide a "true mass" or "mass in vacuum" value for mass measurement. Weigh scales provide a "mass in air" value. Due to the buoyancy effect of the air around the object being weighed, the "mass in air" value is lower than the "mass in vacuum" value.

If Mass In Air is enabled, the transmitter will calculate the "mass in air" value, and print the "mass in air" total on the bunker ticket instead of the **Mass Total** ("mass in vacuum") value.

To calculate "mass in air", the transmitter multiplies the **Mass Total** value by the Mass in Air conversion factor: 0.998925. This constant is based on environmental conditions at sea level.

4.4 Configure the printer

Prerequisites

This procedure assumes that all variables and units of precision are already configured.

Verify that you have the correct software versions and licenses.

Software or license version	Where to look
ProLink III 4.1 or later	From ProLink III, **Help**
Transmitter software 2.0 or later	• From the display: **Menu** → **About** → **Versions** → **Transmitter Software** • From ProLink III, **Device Tools** → **About** → **Versions** → **Transmitter Software**

Procedure

1. Ensure that the transmitter is in unsecure mode in order to make the configuration changes for this procedure.
2. Configure OIML as the world area.
   For more information, see Table 4-3.

Display	**Menu → Configuration → Weights & Measures → World Area**
ProLink III	**Device Tools → Configuration → Weights & Measures → Regulatory Agency**

3. Select the approved variables you want shown on the ticket in the **Custody Transfer Approved** section. The variables you select will be marked by asterisks on the printed ticket.

Display	**Menu → Configuration → Weights & Measures → Approve Variables**
ProLink III	**Device Tools → Configuration → Transmitter Display → Display Variables**

4. Configure the printer parameters.

Display	**Menu → Configuration → Inputs/Outputs → Channel E → Printer → Printer Settings**
ProLink III	**Device Tools → Configuration → Printer and Tickets**

5. Secure and seal the transmitter.
   For more information, see the *Micro Motion 5700 Transmitters with Configurable Inputs and Outputs: Configuration and Use Manual*

4.4.1 Ticket and heading parameters

Table 4-1: Printer configurable parameters

Ticket parameters	Description
Printer Type	The following printer types are supported: • Epson TM88v — uses paper rolls and supports the Paper Out function. • Epson TMU-295 — uses paper slips and supports the Paper Out function. • Digitec 6610A — uses paper rolls and does not support the Paper Out function. This printer is not approved for OIML use. • Terminal Window — prints to a terminal window for debugging and testing. This option is not for legal trade. • Generic — does not support the Paper Out function.
Baud Rate	Refer to your printer documentation.
Parity	
Data Bits	
Stop Bits	
Characters/Sec	Configure the number of characters printed per second to influence printing speed. The range is 1 to 1000. The default value is dependent on the printer type selected.
Buffer Size	Configure the buffer size to influence printing speed. The range is 32 to 32768 characters. The default value is dependent on the printer type selected.
Paper Out Detection	Enables or disables automatic notification when the printer runs out of paper.

Table 4-2: Ticket configurable parameters

Ticket parameters	Description
Number of Transfer Tickets	The number of transfer (OIML) tickets printed when a print request is received. Use 1, 2, or 3. The default is 1.
Transfer BOL Start	Configure the starting ticket number for Bills of Lading (BOL).
Print with Non-Zero Flow	• Enabled — Tickets can be printed while the flow is occurring. — If a ticket is printed while flow is occurring, the flow rate and the banner "Not complete" are printed on the ticket, and the transfer continues. — If a ticket is printed under conditions of no flow and the ticket includes a transfer total, the transfer is completed, and the flow rate and the banner "Complete" are printed on the ticket. — If a ticket is printed under conditions of no flow and the ticket does not include a transfer total, the flow rate is printed on the ticket and the transfer is not completed. • Disabled — Tickets cannot be printed if there is any flow through the sensor. If a ticket is printed under conditions of no flow, and the ticket includes a transfer total, the transfer is completed, and the flow rate and the banner "Complete" are printed on the ticket. Default is Disabled.
Use Form Feed	Enables or disables an automatic page break after a ticket has been printed. Default is Disabled.
Alert Occurrence of Transfer Ticket	Enables or disables printing a banner, "Alarm occurred during the transfer", if an alarm occurs during transfer processing. Default is Disabled.

4.4.2 Ticket types

Tickets provide proof of what was purchased, as well as status summaries.

You can configure any of the following ticket types using varying methods.

Ticket configuration occurs in Channel E and requires a Channel E license.

Table 4-3: Ticket type descriptions

Ticket type	Description
Bunker ticket	Prints the current bunker transfer.
Bunker log ticket	Prints a ticket from the historical transfer log.

5 Operate the system

5.1 Transfer a bunker and print a ticket using the display

This procedure guides you through transferring a bunker and printing a bunker ticket using the transmitter display.

Prerequisites

- Verify that **Mass Flow Rate** is 0.0.
- Take appropriate precautions to ensure that flow occurs in only one direction during the bunker transfer. Small amounts of back flow due to valve action or other mechanical issues are insignificant, but larger amounts will affect measurement accuracy.
- During the bunker transfer, take appropriate steps to ensure that **Mass Flow Rate** does not hover around 0. Very low values for **Mass Flow Rate** can affect measurement accuracy. Low values for **Mass Flow Rate** at the beginning and end of the bunker transfer have insignificant effects.

Procedure

1. Select **Operations** → **Marine Bunkering**.
2. Start flow and totalizers.

   If you have installed and configured the system as recommended, totalizers will be started automatically when liquid is detected in the pipeline. If a transmitter power cycle has occurred, totalizing does not begin until system start up procedures are complete.
3. To end the bunker transfer:
   a) Stop flow.
   b) Press the **Print** button on the transmitter.

5.2 Print or reprint a bunker ticket using BunkerLink

You can print or reprint the bunker ticket for any bunker transfer in the BunkerLink database. You can use this function to recover from print failures.

Procedure

1. Connect BunkerLink to the transmitter.
2. Select the ***History*** panel in the ***Marine Bunkering*** window.
3. Select the desired transfer record from **Historical Transfer Log Index**.

   Transfer records are ordered by time stamp. Historical Transfer 0 is the most recent bunker transfer.
4. Click **Print Ticket** to print or reprint a ticket.

If the ticket has previously been printed, the new ticket will be a duplicate ticket and the “Duplicate Receipt” banner is automatically added to the ticket. If the ticket has not been previously printed, the banner is not added to the ticket.

Important

- The ticket will be printed with the current settings for **Header**, **Footer**, and **Number of Tickets**.
- The ticket will be printed according to the currently configured bunker ticket options (Bunker Result, Bunker Result Details, Mass In Air, etc.).

5.3 View bunker transfer history

You can view history data for all bunker transfers that are recorded in the BunkerLink database. The bunkering database can store data for up to five bunker transfers.

Prerequisites

The transmitter must be ready to accept a connection from BunkerLink. If you have trouble making the connection, ensure that communications have been configured for a Profile or Profile/MID system.

Procedure

1. Connect from BunkerLink to the transmitter.
   a) Start BunkerLink.
   b) Select **Connection** → **Connect to Device**.
   c) Configure the communication parameters to match the transmitter.
   d) Set **Serial Port** to the PC port you are using for the connection.
   e) Set **Address** to the value configured for the transmitter. The default address is 1.
   f) Select **Connect**.
   If the connection is successful, the ***Marine Bunkering*** window displays.
2. Select the ***History*** panel.
3. Select the desired transfer record from **Historical Transfer Log Index**.
   Transfer records are ordered by time stamp. Historical Transfer 0 is the most recent bunker transfer.
   The ***History*** panel is updated with data from the selected transfer record.
4. Optional: Select **Preview** or **Print** to preview or print the profile report for the currently selected bunker transfer.

5.4 Print or export bunker transfer data

You can print bunker transfer data from the current bunker transfer or from any bunker transfer in the BunkerLink database. You can export bunker transfer data to Unicode CSV (comma-separated values) files for use in other applications.

Procedure

- To print process data for the current bunker transfer:
  a) Ensure that BunkerLink is connected to the transmitter during the bunker transfer.
  b) Select the ***Monitor*** panel in the ***Marine Bunkering*** window.
  c) Select **Print Graph** (if the transfer is in progress) or **Print Report** (if the transfer is complete).

Tip
If you want to change the appearance of the graph before you print it, right-click anywhere on the graph and use the graphics toolbox that is provided. You can also use the graphics toolbox to save the graph as an image.

- To print a profile report for a bunker transfer in the bunkering database:
  a) Connect BunkerLink to the transmitter.
  b) Select the ***History*** panel in the ***Marine Bunkering*** window.
  c) Select the desired transfer record from **Historical Transfer Log Index**.
     Transfer records are ordered by time stamp. Historical Transfer 1 is the most recent bunker transfer.
  d) Select **Preview** to preview the profile report or to export the data to a CSV file.
  e) Select **Print Report** to print the profile report.

Restriction
You cannot use the ***History*** panel to print a profile report for the current bunker transfer while it is in progress. To print a profile report for the current bunker transfer, you must use the Marine Bunkering dashboard on the transmitter. When the transfer is complete, it is available from the History panel as Historical Transfer 0.

5.5 Contents of profile report

Table 5-1: Contents of profile report

Item	Description
`Header 1`	User-defined text
`Header 2`	User-defined text
`BOL Number`	Bill of Lading number, assigned automatically by the transmitter
`Reset Time`	Date and time that totals were reset, either by printing an original ticket or by pressing **Reset**
`Print Time`	Date and time that the original ticket was printed
`Bunker Begin Time`	Date and time that the transmitter started bunker measurement
`Bunker End Time`	Date and time that the transmitter stopped bunker measurement
`Mass in Air`	Total mass of bunker multiplied by the Mass in Air conversion factor
`Mass Total`	Total mass of bunker, as measured by transmitter
`Mass Inventory`	Total mass of all bunkers transferred since the last inventory reset
`Bunker Begin Forward Inventory`	Value of Mass Forward Inventory at the beginning of the bunker transfer
`Bunker End Forward Inventory`	Value of Mass Forward Inventory at the end of the bunker transfer
`Bunker Begin Reverse Inventory`	Value of Mass Reverse Inventory at the beginning of the bunker transfer

Table 5-1: Contents of profile report *(continued)*

Item	Description
`Bunker End Reverse Inventory`	Value of Mass Reverse Inventory at the end of the bunker transfer
`Gross Volume Total`	Total volume of the bunker, calculated from the mass total and the average density of the bunker at process temperature. The mass total is based on both aerated and non-aerated flow. The average density is based on non-aerated flow. For this calculation, aerated flow is defined as any flow occurring while drive gain exceeds a preset limit or density exceeds preset limits.
`Net Volume Total`	Total volume of the bunker, calculated from the mass total and the average density of the bunker, corrected to 15 °C. The mass total is based on both aerated and non-aerated flow. The average density is based on non-aerated flow. For this calculation, aerated flow is defined as any flow occurring while drive gain exceeds a preset limit or density exceeds preset limits.
`Average Temperature`	Average temperature of bunker, calculated as batch-weighted average with the configured volume unit used as the batch
`Average API Density`	Average density of the bunker, corrected to reference temperature
`Aeration Limit`	Value of *Aeration Limit* at the end of the bunker transfer • `Pass`: The value of *Aeration Limit* at the end of the transfer was within OIML/MID limits (higher than 100%) • `Fail`: The value of *Aeration Limit* at the end of the transfer was not within OIML/MID limits (lower or equal to 100%)
`Alarm Occurred`	• `Yes`: One or more bunker-critical alarms was posted during the bunker transfer • `No`: No bunker-critical alarm was posted during the bunker transfer
`Minimum Quantity`	• `Pass`: *Mass Total* ≥ MMQ (Minimum Measured Quantity) • `Fail`: *Mass Total* < MMQ
`No Power Interrupt`	• `Pass`: No power reset occurred during bunker transfer • `Fail`: Power reset occurred during bunker transfer
`Overall Bunker Results`	Represents the combined results of the four OIML/MID checks: • `Pass`: The bunker transfer measurement passed all four checks, and meets good-practice requirements. • `Fail`: The bunker transfer measurement failed one or more checks, and does not meet good-practice requirements.
`Meter Verification Test Results`	• `Pass`: The flow meter passed the most recent meter verification test. • `Fail`: The flow meter failed the most recent meter verification test. If the Meter Verification application is not present on the transmitter, this item is blank.
Bunker Profile graph	Line graph of *Mass Flow Rate*, *Average Density at Reference Temperature*, *Temperature*, and *Drive Gain* during the bunker transfer

Table 5-1: Contents of profile report *(continued)*

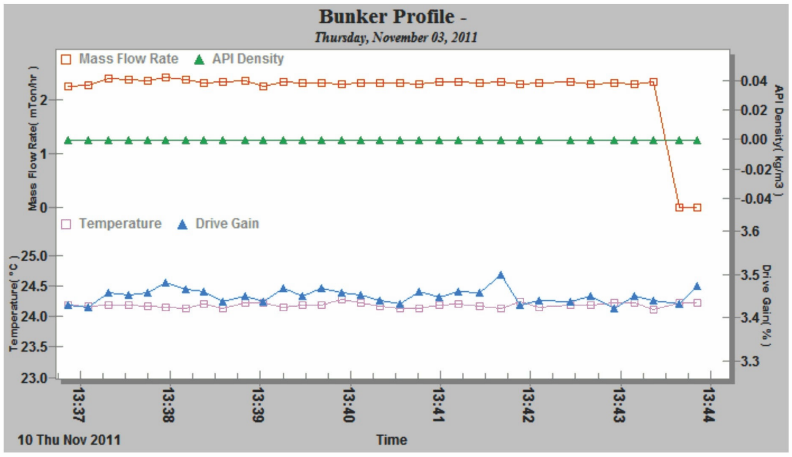
Item	Description
`MID Certificate #`	Certificate number for this Micro Motion system, obtained and configured during commissioning
`Mass in Air footer`	Statement of the Mass in Air conversion factor
`Footer`	User-defined text

5.5.1 Sample profile reports

Figure 5-1: Sample profile report for Profile systems

Bunker Delivery Verification
Micro Motion Inc., Business Unit of Emerson
FUEL OIL
v8.10

BOL Number: 257
Reset Time: 19-Jan-12 15:07:37
Print Time: 19-Jan-12 15:11:36
Bunker Begin Time: 19-Jan-12 15:11:08
Bunker End Time: 19-Jan-12 15:11:28
Mass In Vacuum: 24.15430 mTon
Mass In Air: 24.12833 mTon
Mass Total: 24.15430 mTon
Mass Inventory: 79.06028 mTon
Bunker Begin Forward Mass Inventory: 54.82288 mTon
Bunker End Forward Mass Inventory: 78.97719 mTon
Bunker Begin Reverse Mass Inventory: 0.00007 mTon
Bunker End Reverse Mass Inventory: 0.00007 mTon
Gross Volume Total: 0.00000 m3
Net Volume Total: 86.62148 m3
Average Temperature: NAN °C
Average API Density: NAN kg/m3
Aeration Limit: 71.42857% Pass
Alarms Occurred: None
Minimum Quantity: Pass
No Power Interrupt: Pass
Overall Bunker Results: Pass With High Aeration
Meter Verification Test Results: Fail

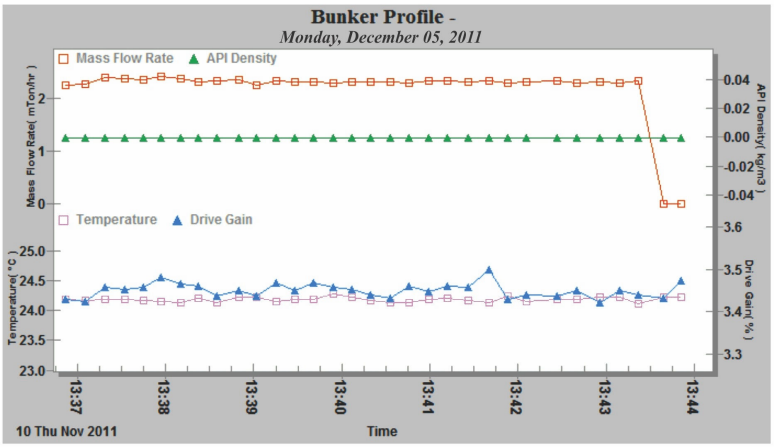


To convert mass to mass in air, multiply by 0.998925.

Figure 5-2: Sample profile report for Profile/MID systems

Bunker Delivery Verification
Micro Motion Inc., Business Unit of Emerson
FUEL OIL
v8.10

BOL Number: 256
Reset Time: 19-Jan-12 15:06:00
Print Time: 19-Jan-12 15:07:22
Bunker Begin Time: 19-Jan-12 15:06:47
Bunker End Time: 19-Jan-12 15:07:00
Mass In Vacuum: 14.62141 mTon
Mass In Air: 14.60569 mTon
Mass Total: 14.62141 mTon
Mass Inventory: 54.90598 mTon
Bunker Begin Forward Mass Inventory: 40.20147 mTon
Bunker End Forward Mass Inventory: 54.82288 mTon
Bunker Begin Reverse Mass Inventory: 0.00007 mTon
Bunker End Reverse Mass Inventory: 0.00007 mTon
Gross Volume Total: 0.00000 m3
Net Volume Total: 62.46829 m3
Average Temperature: NAN °C
Average API Density: NAN kg/m3
Aeration Limit: 71.42857% Pass
Alarms Occurred: None
Minimum Quantity: Pass
No Power Interrupt: Pass
Overall Bunker Results: Pass With High Aeration
Accuracy within 1%
Meter Verification Test Results: Fail



MID Certificate #:T1215
To convert mass to mass in air, multiply by 0.998925.

5.6 Contents of bunker ticket for Basic/MID and Profile/MID systems

Note
Some items are optional and are printed only if selected during ticket configuration.

Table 5-2: Contents of bunker ticket for Basic/MID and Profile/MID systems

Ticket item	Description
`*Approved Measurement*`	Banner printed at top and bottom of ticket if **Overall Bunker** = `Pass`
`Micro Motion Inc, Business Unit of Emerson`	Banner printed at top of ticket
`Header 1`	User-defined text
`Header 2`	User-defined text
`Transmitter Tag Name`	User-configured string
`System ID`	HART software tag configured in the transmitter
`BOL Number`	Bill of Lading number, assigned automatically by the transmitter
`Reset Time`	Date and time that totals were reset, either by printing an original ticket or by pressing **Reset**
`Print Time`	Date and time that the original ticket was printed
`Bunker Begin Time`	Date and time that the transmitter started bunker measurement (last flow)
`Bunker End Time`	Date and time that the transmitter stopped bunker measurement (first flow)
`Mass Total`	Total mass of bunker, as measured by transmitter
`Mass in Air`	Total mass of bunker multiplied by the Mass in Air conversion factor
`Mass Inventory`	Total mass of all bunkers transferred since the last inventory reset
`Bunker Begin Forward Inventory`	Value of Mass Forward Inventory at the beginning of the bunker transfer
`Bunker End Forward Inventory`	Value of Mass Forward Inventory at the end of the bunker transfer
`Bunker Begin Reverse Inventory`	Value of Mass Reverse Inventory at the beginning of the bunker transfer
`Bunker End Reverse Inventory`	Value of Mass Reverse Inventory at the end of the bunker transfer
`Begin Forward Inventory Air`	Value of Mass Forward Inventory at the beginning of the bunker transfer, multiplied by the Mass in Air conversion factor
`End Forward Inventory Air`	Value of Mass Forward Inventory at the end of the bunker transfer, multiplied by the Mass in Air conversion factor
`Begin Reverse Inventory Air`	Value of Mass Reverse Inventory at the beginning of the bunker transfer, multiplied by the Mass in Air conversion factor

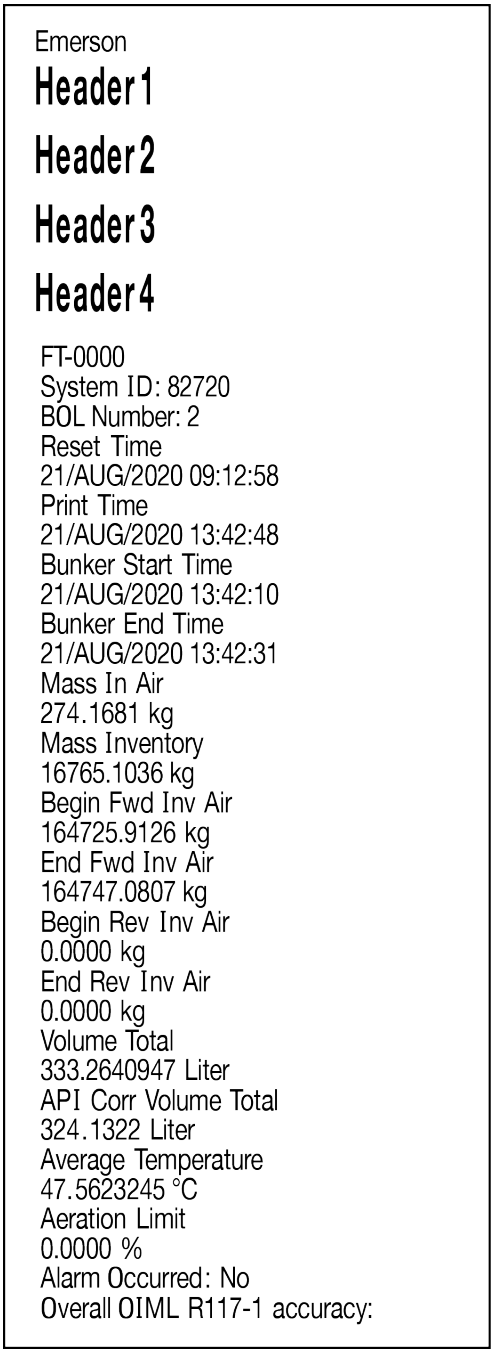
Table 5-2: Contents of bunker ticket for Basic/MID and Profile/MID systems *(continued)*

Ticket item	Description
`End Reverse Inventory Air`	Value of Mass Reverse Inventory at the end of the bunker transfer, multiplied by the Mass in Air conversion factor
`Gross Volume Total`	Total volume of the bunker, calculated from the mass total and the average density of the bunker at process temperature. The mass total is based on both aerated and non-aerated flow. The average density is based on non-aerated flow. For this calculation, aerated flow is defined as any flow occurring while drive gain exceeds a preset limit or density exceeds preset limits.
`Net Volume Total`	Total volume of the bunker, calculated from the mass total and the average density of the bunker, corrected to 15 °C. The mass total is based on both aerated and non-aerated flow. The average density is based on non-aerated flow. For this calculation, aerated flow is defined as any flow occurring while drive gain exceeds a preset limit or density exceeds preset limits.
`Average Temperature`	Average temperature of bunker, calculated as batch-weighted average with the configured volume unit used as the batch
`Average API Density`	Average density of the bunker, corrected to reference temperature
`Aeration Limit`	Value of *Aeration Limit* at the end of the bunker transfer
`Alarm Occurred`	• `Yes`: One or more bunker-critical alarms was posted during the bunker transfer • `No`: No bunker-critical alarm was posted during the bunker transfer
`Aeration Limit`	• `Pass`: The value of *Aeration Limit* at the end of the transfer was within OIML/MID limits • `Fail`: The value of *Aeration Limit* at the end of the transfer was not within OIML/MID limits
`Minimum Quantity`	• `Pass`: *Mass Total* ≥ MMQ (Minimum Measured Quantity) • `Fail`: *Mass Total* < MMQ
`No Power Interrupt`	• `Pass`: No power reset occurred during bunker transfer • `Fail`: Power reset occurred during bunker transfer
`Overall OIML R117-1 Accuracy`	Represents the combined results of the four OIML/MID checks: • `Pass`: The bunker transfer measurement passed all four checks, and meets OIML/MID requirements (the value is lower or equal to 100%) • `Fail`: The bunker transfer measurement failed one or more checks, and does not meet OIML/MID requirements (the value is higher than 100%)
`"Accuracy within x.x%`	Statement of measurement accuracy for the bunker transfer
`MID Certificate #`	Certificate number for this Micro Motion system, obtained and configured during commissioning
`Mass in Air footer`	Statement of the Mass in Air conversion factor
`IMPORTANT: Attach this ticket to BDN Report`	Banner printed at bottom of ticket

Table 5-2: Contents of bunker ticket for Basic/MID and Profile/MID systems *(continued)*

Ticket item	Description
`Footer`	User-defined text
`Original`	Printed automatically on the first printed ticket
`Copy`	Printed automatically on the second or third ticket
`Duplicate Receipt`	Printed automatically on all duplicate (reprinted) tickets
`SECURITY BREACH` `Not A Legal Receipt`	Banner printed at bottom of ticket if a security breach occurred during the transfer

5.6.1 Sample bunker ticket



Emerson

Header 1

Header 2

Header 3

Header 4

FT-0000
System ID: 82720
BOL Number: 2
Reset Time
21/AUG/2020 09:12:58
Print Time
21/AUG/2020 13:42:48
Bunker Start Time
21/AUG/2020 13:42:10
Bunker End Time
21/AUG/2020 13:42:31
Mass In Air
274.1681 kg
Mass Inventory
16765.1036 kg
Begin Fwd Inv Air
164725.9126 kg
End Fwd Inv Air
164747.0807 kg
Begin Rev Inv Air
0.0000 kg
End Rev Inv Air
0.0000 kg
Volume Total
333.2640947 Liter
API Corr Volume Total
324.1322 Liter
Average Temperature
47.5623245 °C
Aeration Limit
0.0000 %
Alarm Occurred: No
Overall OIML R117-1 accuracy:

5.7 Retrieve and reprint bunker tickets using the display

Ticket data for the twenty previous bunker transfers is stored on the transmitter. You can retrieve the data for viewing, and you can print duplicate tickets. You can also use this function to recover from print failures.

Procedure

1. Select **Operations → Marine Bunkering → Print Ticket Log**.
   Up to twenty tickets are listed by BOL number. The most recent is listed first. For each ticket:
   - `(P)`: The ticket has been printed successfully.
   - `(F)`: The ticket has not been printed successfully.
2. Select a ticket.
3. Use the **Up Arrow** and **Down Arrow** buttons to view all ticket data.

5.8 Bunker operations

Mass Flow Rate	The current value of the process variable.
Mass Total	The current value of the process variable measured since the last time the totals were reset. (Totals are reset automatically when an original ticket is printed or the **Reset** button is pressed.)
Aeration Present	The transfer has aeration.
Average API Density	Current value of the process variable.
Mass in Air Factor	The current conversion factor.

5.9 Bunker variables

Percent Aeration	The current value of the process variable.
Temperature	The current value of the process variable.
Drive Gain	The current value of the process variable.
Flow Zero	The current value of the process variable.

5.10 Maintain bunker transfer history

You can keep bunkering transfer data as long as required by storing it outside the BunkerLink database.

The BunkerLink database can store data for up to five bunker transfers. When the database is full, the oldest bunker transfer will be overwritten.

Tip
Be sure to store any required data externally before the bunker transfer is overwritten.

Procedure

- To keep the profile report data in both TIF format and HTML format, print the profile report.

A graphics file in TIF format will be created and saved in the location you specify. Additionally, a set of HTML files is automatically generated and saved on your PC in a folder named **Reports**. **Reports** is located in the BunkerLink installation folder. You can view the report by opening the HTML file in a browser.

- To store the corresponding trend data, export the data for the transfer to a CSV file. To do this, preview the profile report and select **Export to CSV**.

MMI-20076337
Rev. AA
2022

For more information: **www.emerson.com**

MICRO MOTION™

EMERSON™